April 3, 1945. A. J. KUHN ET AL 2,372,835

ENGINE STARTING SYSTEM

Filed July 14, 1941 3 Sheets-Sheet 1

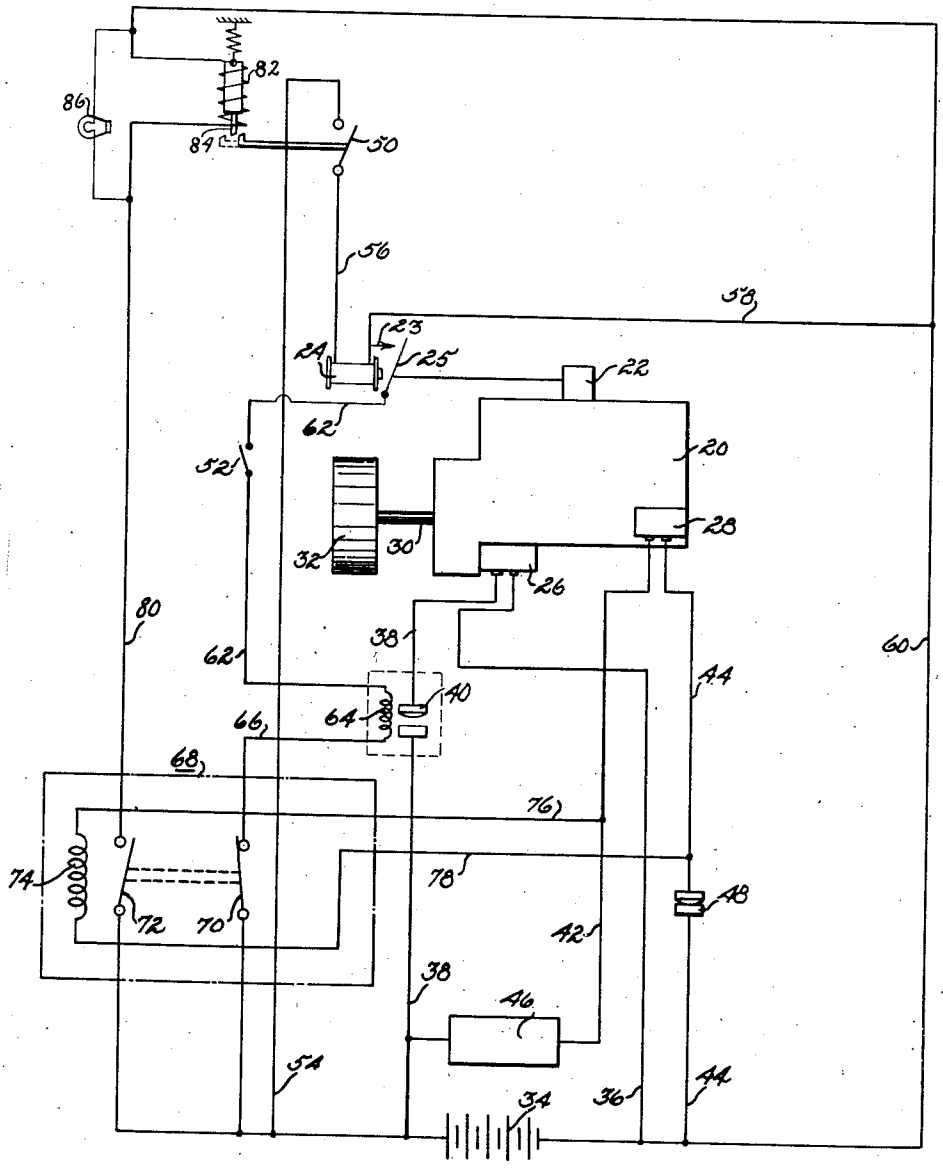


Fig. 1

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ENGINE STARTING SYSTEM

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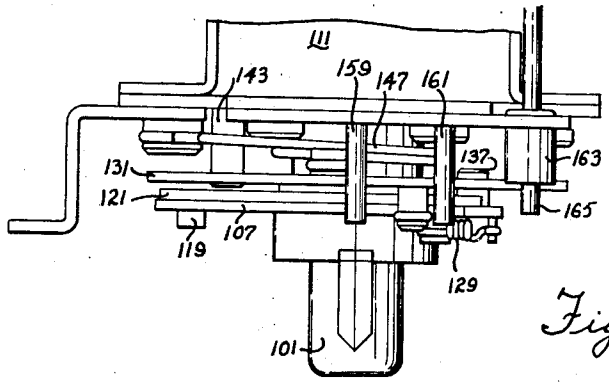


Fig. 2

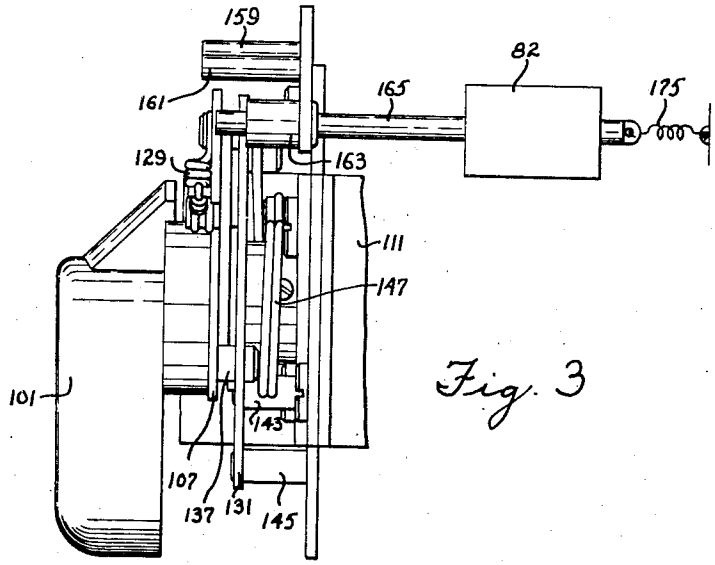


Fig. 3

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Filed July 14, 1941 3 Sheets-Sheet 3

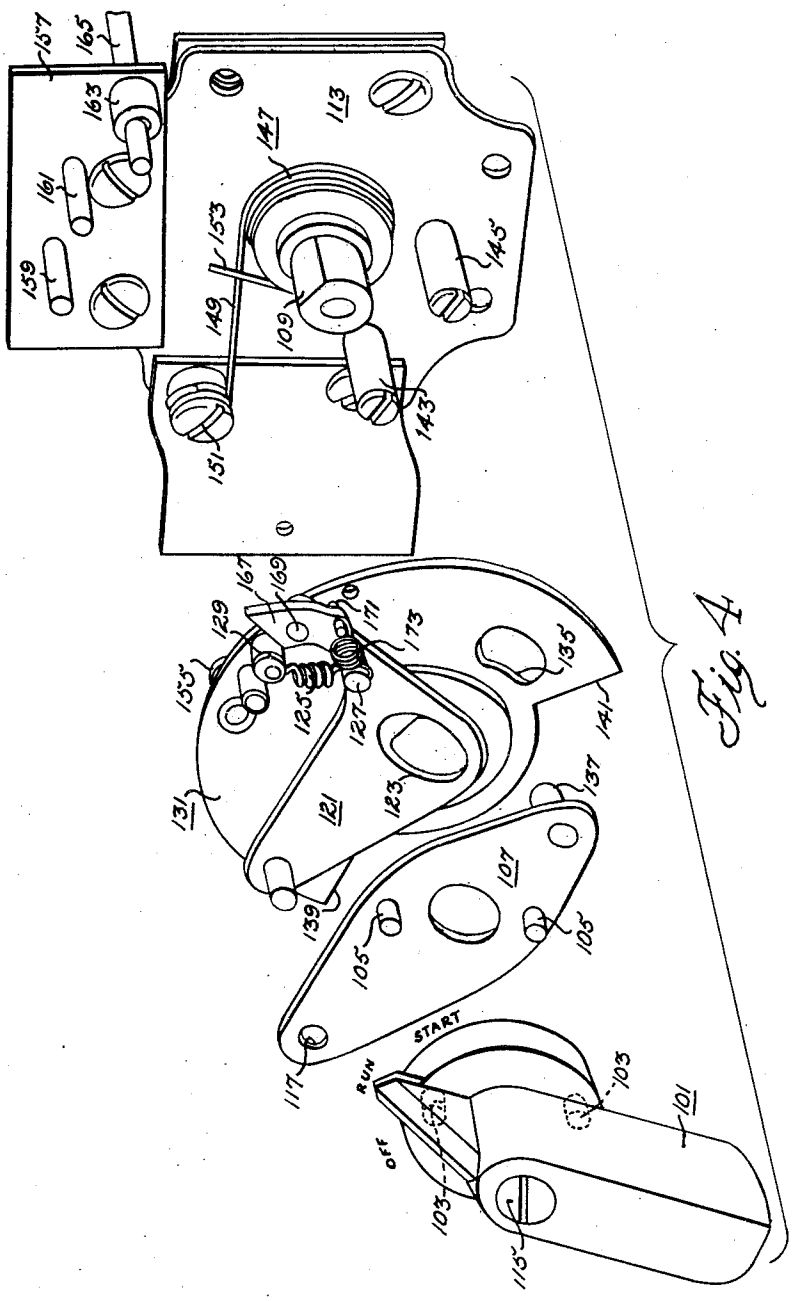


Fig. 4

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UNITED STATES PATENT OFFICE

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ENGINE STARTING SYSTEM

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Application July 14, 1941, Serial No. 402,442

6 Claims. (Cl. 290—36)

This invention relates to controls for internal combustion engines which may be used in connection with refrigerating apparatus and other apparatus.

Where internal combustion engines are placed where their operation can neither be seen, heard, or felt, an operator may attempt to start the engine when it is already in operation or the engine may stop or fail to start without the operator being aware of it.

It is an object of our invention to provide a control for internal combustion engines which allows a return to a clearly visible off position when the engine stops or fails to start.

It is another object of our invention to provide a starting and run control for internal combustion engines which requires manipulation to move to and to be retained in the starting position but which is automatically returned to the running position when released and which is automatically returned to a clearly visible off position when the engine stops or fails to start.

It is a further object of our invention to provide such a control with means so that it can be manually returned to off position when it is desired to stop the engine.

To attain these objects we have provided a control with a latch and a magnetic detent for retaining the latch in the running position as long as the engine is in operation. The handle and switch mechanism is provided with a spring for returning the mechanism to the off position when it is unlatched. The handle is turned to an extreme position for starting, and when released the handle returns either to run position or to the off position depending on whether the engine has started or failed to start. The handle is directly connected to a switch mechanism which in the extreme position causes the closing of contacts for starting the engine and keeping it in operation while in the run position only the contacts for keeping the engine is operation are closed and the starting contacts are opened.

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 the present invention is clearly shown.

In the drawings:

Fig. 1 is a wiring diagram showing one form of electrical system for carrying out our invention;

Fig. 2 is a top view of the switch operating mechanism;

Fig. 3 is a side view of the switch operating mechanism; and

Fig. 4 is an exploded perspective view of the switch operating mechanism.

Referring now to the drawings and more particularly to Fig. 1, there is shown diagrammatically as a representative of one form of internal combustion engine, a Diesel engine 20 provided with a fuel throttle 22 having an electromagnet operating control 24 which when energized opens the throttle to allow fuel to flow to the engine. The Diesel engine 20 is also provided with a starting motor 26 and a generator 28. It is shown directly connected by the shaft 30 to some sort of a load, such as an electrical generator or a refrigerator compressor 32.

A battery 34 is connected by the conductors 36 and 38 under the control of the electromagnetically operated starting contacts 40 with the starting motor 26. The battery 34 is kept charged by the generator 28 through the conductors 42 and 44 under the control of a suitable type of charging control 46 and a reverse current relay 48. To start the engine, the control handle 101 (see Fig. 4) is turned to the starting position in which the running cam switch 50 as well as the starting cam switch 52 are moved to closed position. This causes current from the battery 34 to flow through the conductor 54 to the switch 50 and through the conductor 56 to the electromagnetic throttle control 24 and through the conductors 58 and 60 to the other side of the battery 34. The energization of the electromagnet operating control 24 not only opens the throttle but it also closes the contacts 23 and 25 to cause current to flow from the conductor 58 to the starting cam switch 52 and through the conductor 62 to the electromagnetic coil 64 to close the contacts of the electromagnetic starting switch 40. This causes the starter motor 26 to turn over the engine 20.

From the coil 64 the current flows through the conductor 66 to an electromagnetic switch means 68 which includes a normally closed switch 70 and a normally open switch 72. Both the switches 70 and 72 are connected to the same side of the battery 34. The electromagnetic operating coil 74 of the switch 68 is connected by the conductors 76 and 78 across the conductors 42 and 44 so that it will be energized by the generator 28. When the operation of the Diesel engine 20 approaches a stable running speed sufficient current will be generated by the generator 28 to cause the coil 74 to open the switch 70 and close the switch 72. The opening of the switch 70 will

deenergize the coil 64 and cause the opening of the contacts 40 to stop the starting motor 26.

The closing of the switch 72 will allow current from the battery to flow through the conductor 80 to the operating coil 82 of a magnetic detent 84 shown diagrammatically for the purpose of holding the switch 50 in closed position as long as it is desired to operate the engine 20. A signal light 86 is connected in parallel with the coil 82 to indicate to the operator that the engine has started and is in operation. The operator then can release the switch and allow it to move to the running position where it will be retained by the magnetic detent 84.

Referring now more particularly to Figs. 2 to 4 which show the actual switch operating mechanism, there is shown a handle 101, shown in the off position but which may be moved either to the run or start position in a clockwise direction and an emergency position in a counterclockwise direction. In the emergency position additional contacts, not shown, are energized to cause the operation of certain apparatus when the engine cannot be operated. To start the engine the handle 101 is moved to the starting position until the light 86 is lighted after which it is allowed to return to the run position where it will remain unless the engine 20 stops or fails to start for some reason, or unless the handle is moved to the off position to manually stop the engine. The handle 101 is provided with a pair of holes 103 which engage the pins 105 projecting from a plate 107 which is rotatably mounted upon a shaft 109. This shaft 109 projects forwardly from a switch box 111 which is carried by the frame member 113. The handle 101 is rotatably mounted upon a screw 115 threaded into the front end of the shaft 109. The shaft 109 operates the switches 50 and 52 which are located within the switch box 111 along with other switches for controlling the other mechanism.

The plate 107 is provided with an aperture 117 which receives a pin 119 projecting from the end of a right angled piece 121 provided with a slot 123 for receiving the shaft 109. Plate 121 is pulled upwardly by a spring 125 which extends from a spring stud 127 on the member 121 to a spring stud 129 on a semi-circular plate 131 which is fixed by a set-screw to the shaft 109. Also the semi-circular member 131 is provided with a slot 135 which receives the pin 137 projecting from the rear face of the plate 107 and allows a limited relative movement between the plate 107 and the semi-circular member 131 for lowering the plate 121 by the downward movement of the pin 119 when the handle 101 is turned counterclockwise. The semi-circular member 131 is provided with the shoulders 139 and 141 located upon opposite sides of a pair of pins 143 and 145 which project from the frame member 113.

A spring 147 has a coiled portion about the shaft 109 with an arm 149 fastened to the stud 151 and with an arm 153 fastened to a spring stud 155 projecting from the rear face of the semi-circular member 131. This spring 147 tends to turn the semi-circular member 131 as well as the plate members 107 and 121 and also the handle 101 in a counterclockwise direction. The frame member 113 is provided with an upper plate 157 from which projects the stationary pins 159 and 161. The plate 157 also carries a bushing 163 through which extends the pin 165 of the electromagnetic detent 84. The pins 159 and 161 as well as the pin 165 when energized extend over the edges of the plate members 107 and 121 as well as the semi-circular member 131.

The right angled plate member 121 carries at its upper end a pawl 167 which is pivoted upon a pin 169 in the form of a rivet projecting from the right angled plate member 121. This pawl 167 is normally urged in a clockwise direction with its stop pin 171 against the edge of the plate member 121 by a light coil spring 173 which extends from the pin 171 to the spring stud 127. When the handle 101 is in the off position this pawl 167 rests against the right side of the pin 161 as viewed in Fig. 4.

When it is desired to start the Diesel engine the handle 101 is turned until the shoulder 141 upon the plate member 131 engages the pin 145. The handle 101 is held in this position until the light 86 lights up, at which time the solenoid 82 is energized to project the pin 165 of the detent 84 into the position where it projects from the stud as far as the pins 159 and 161 project. This places the end of the pin 165 in the path of the pawl 167 so that when the handle 101 is released following the lighting of the light 86 it, together with the switch mechanism, will be held in their run position by the engagement of the pawl 167 with the detent 165. Should the engine stop for any cause, the solenoid 82 will be deenergized and the return spring 175 of the detent 84 will cause the pin 165 to be withdrawn to allow the handle and the remainder of the switch mechanism to return automatically to the off position. This will also extinguish light 86.

Should it be desired to stop the engine at any time while the pawl 167 is held by the pin 165 it is only necessary to manually turn the handle to the off position and this will cause the pin 119 to pull down the plate 121 within the limits of the slot 123 thereby retracting the pawl 167 which is in engagement with the pin 165. In this way the handle is turned to the off position. A similar manipulation allows the handle to be turned to the emergency position and in doing so the pawl 167 is again depressed by the pin 119 and it is stopped when it reaches the pin 159. The stopping at this point is insured by the shoulder 139 which comes into engagement with the pin 143.

Thus the handle will move automatically under the tension of the spring 147 when it is released from the starting position and will stop against the detent pin 165 in the run position when the engine is in operation, otherwise it will move to the stop position. Likewise it can be manually moved from the running position to the stop position and also from the stop position to the emergency position and returned. In this way we have provided a suitable control for a remotely located internal combustion engine wherein the operator always has a readily visible means for ascertaining when the engine is in operation and in which the switch automatically turns to off when the engine stops or fails to start.

While the form of embodiment of the invention as herein described, 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. In a system for controlling an internal combustion engine, a movable control means having one position effective to stop the engine, a second position effective to start the engine, and a third position for normal operation of the engine located between said one position and said second

position, yielding means for constantly urging said control means into said one position, movable stop means for stopping the control means in the third position when it is allowed to move from the second position toward said one position, and means for rendering said stop means ineffective when the engine does not attain a predetermined minimum speed and effective when the engine does attain the minimum speed.

2. In a system for controlling an internal combustion engine, a movable control means having one position effective to stop the engine, a second position effective to start the engine, and a third position for normal operation of the engine; yielding means for urging said control means into said one position, holding means effective when the engine attains a predetermined minimum operating speed for holding said control means in said third position, and means operated by said movable control means when it is forcibly moved for overcoming said holding means.

3. In a system for controlling an internal combustion engine, a movable control member having one position effective to stop the engine, a second position effective to start the engine, and a third position for normal operation of the engine; yielding means for urging said control member into said one position, said internal combustion engine being provided with a starter and a generator, a switch means operated by said control member and rendered effective by said control member when in the second and third positions for conditioning the engine for operation, a second switch means operated by said control member and rendered effective by said control member when in the second position for energizing the starter to start the engine, and means controlled by the current produced by the generator for preventing the yielding means from returning the control member to the one position from the third position.

4. In combination, an internal combustion engine, a movable control member having three control positions, means rendered effective when said control member is in a first position for stopping the engine, means rendered effective when said control member is in the second position for starting the engine, means rendered effective when said control member is in the third position for maintaining the engine in normal operation, yielding means for urging said control member into said first position, and holding means rendered effective when the engine attains a predetermined minimum operating speed for holding the control member in said third position.

5. In combination, an internal combustion engine, a movable control member having three control positions, means rendered effective when said control member is in a first position for stopping the engine, means rendered effective when said control member is in the second position for starting the engine, means rendered effective when said control member is in the third position for maintaining the engine in normal operation, yielding means for urging said control member into said first position, said third position being located between said first and second positions, a movable stop means for stopping the control member in the third position when the control member is allowed to move from the second toward the first position, and means for rendering said stop means ineffective when the engine does not attain a predetermined minimum speed and effective when the engine does attain a minimum speed.

6. In combination, an internal combustion engine, a movable control member having three control positions, means rendered effective when said control member is in a first position for stopping the engine, means rendered effective when said control member is in the second position for starting the engine, means rendered effective when said control member is in the third position for maintaining the engine in normal operation, yielding means for urging said control member into said first position, holding means rendered effective when the engine attains a predetermined minimum operating speed for holding the control member in said third position, and means operated by the movable control member when it is forcibly moved for overcoming said holding means.

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