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AUTOMOTIVE CONTROL MECHANISM

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2 Sheets-Sheet 1

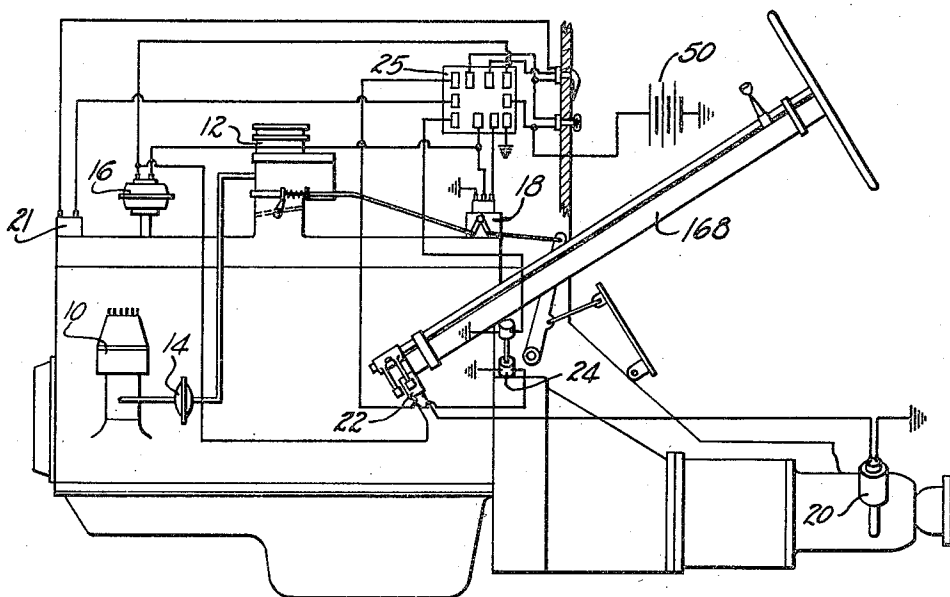


FIG. 1

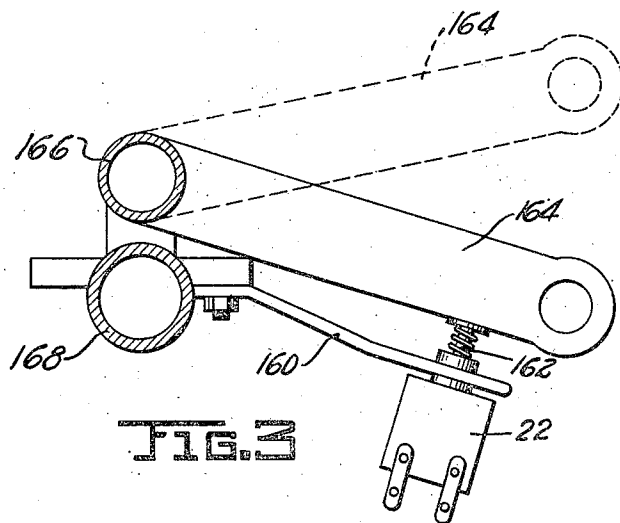


FIG. 3

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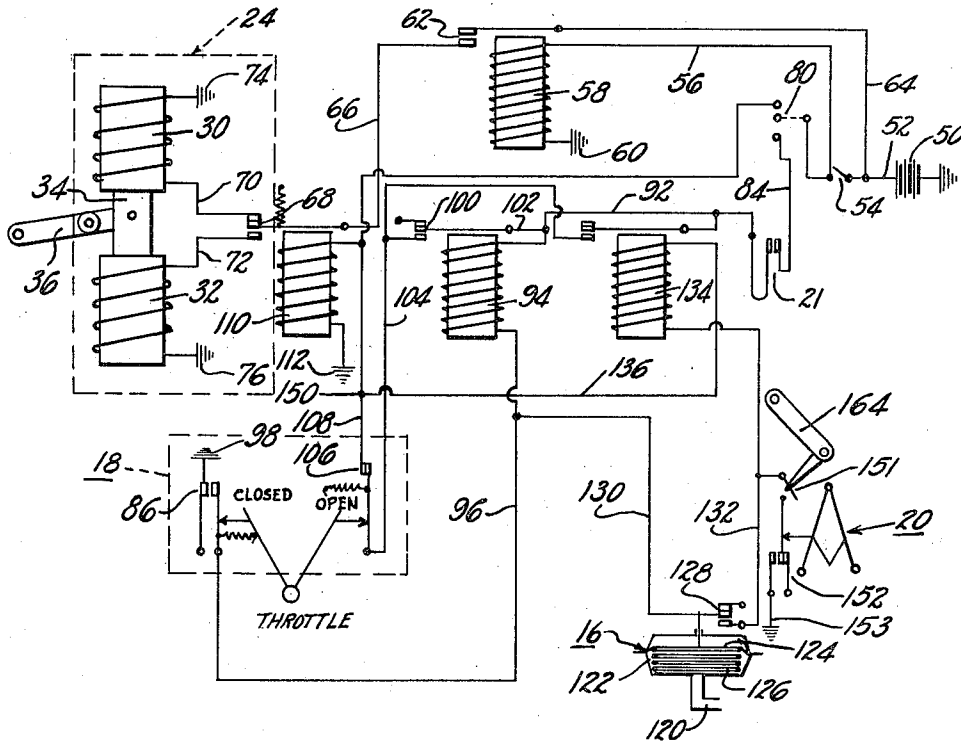


FIG. 2

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## AUTOMOTIVE CONTROL MECHANISM

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Application July 17, 1950, Serial No. 174,289

8 Claims. (Cl. 74-472)

The present invention relates to internal combustion engines, and more particularly to a multiple cylinder internal combustion engine in which less than the full number of cylinders may be used to deliver power during certain stages of engine operation.

One of the principal objects of the present invention is to provide in a multiple cylinder internal combustion engine a mechanism for rendering a portion of the cylinders inoperable during certain stages of engine operation and for rendering said cylinders operable for other stages of engine operation.

Another object of the invention is to provide a multiple cylinder internal combustion engine wherein less than the full number of cylinders may be employed during idling and cruising and the full number of cylinders employed for starting and high power output, and during the warming-up period of the engine.

Another object of the invention is to provide a control mechanism for a vehicle engine of the aforesaid type which may render a portion of the cylinders inoperative during idling and cruising and which provides the full number of cylinders for starting, warm-up, and high power output and while the vehicle is in any of the lower gears.

Another object of the invention is to provide an internal combustion engine which gives high economy for low power engine output.

Additional objects and advantages will appear from the following description and accompanying drawings, wherein one specific embodiment of my invention is disclosed. The control mechanism comprising the subject matter of the present invention is not limited to the embodiment disclosed herein nor to any particular type of internal combustion engine, but is understood to be generally adaptable to vehicles having multiple cylinder engines and a gear selecting mechanism, whether manual or automatic. The invention contemplates a control which will render the valves for a portion of the cylinders inoperable and consequently render said cylinders inoperable, except during starting, warm-up, and high power output and while the vehicle is operating in certain gear selections, such as in first and second gears at part and wide open throttle operations.

In the drawings, Figure 1 is a side elevation of a multiple cylinder internal combustion engine showing schematically the several elements comprising the present invention, the position of some of said elements being rearranged to more advantageously show the functional relationship thereof;

Figure 2 is a diagram of the electrical control system of the present invention; and

Figure 3 is an enlarged view of a portion of the gear shift mechanism of a vehicle showing a control switch actuated thereby.

The present invention may be readily understood by referring to the accompanying drawings in which Figure 1 shows a multiple cylinder internal combustion engine in combination with the present engine control mechanism wherein numeral 10 designates a conventional spark

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distributor, 12 a carburetor, 14 a spark advance mechanism, 16 a vacuum actuated switch for the split engine control, 18 an accelerating pedal actuated switch for said control, 20 a speed responsive switch for said control, 21 a thermostatic switch, 22 a switch assembly actuated by the gear shift mechanism, and 24 a solenoid mechanism for controlling the operation of a portion of the cylinders in response to the aforementioned control switches. The several switches are connected by leads to relays in box 25 which in turn controls solenoid mechanism 24. With the exception of the mechanism for rendering a portion of the cylinders inoperable and the control system for said mechanism, the present engine is a conventional multiple cylinder internal combustion engine. The one shown in Figure 1 is a standard six cylinder L head motor with poppet-type valves. Of the six cylinders, three are part time operating cylinders.

For convenience in description throughout the specification and in the appended claims, the cylinders which remain in operation the entire time that the engine is running will be referred to as the "normal" cylinders and the cylinders which are operable only during starting, warm-up, and high power output will be referred to as the "power" cylinders. In the engine shown in the drawings, the normal cylinders are the front three and the power cylinders are the rear three, although any other suitable arrangement of the power and the normal cylinders may be used, as for example the cylinders of the two sets may be alternated. The running of the engine on all six cylinders will be referred to as "standard engine operation" and the running of the engine on only the three front cylinders will be referred to as "split engine operation."

The tappets or valve lifters, the carburetor, and the spark advance mechanism are shown and described in detail and claimed either alone or in combination with the engine and control mechanism in my copending application Serial No. 751,282 filed on May 29, 1947, now Patent No. 2,652,038, dated September 15, 1953. These elements therefore will not be described in detail herein.

The tappet mechanism of the power cylinders is directly controlled by two solenoids 30 and 32 shown schematically in Figure 2, arranged diametrically opposite to one another and connected by a reciprocable rod 34. The central portion of rod 34 is connected to the tappet mechanism by a linkage partially shown as numeral 36; further details of the linkage are shown in my above mentioned copending application. Movement of the rod 34 downwardly by solenoid 32 renders a portion of the cylinders inoperative for split engine operation and movement of the rod upwardly by solenoid 30 returns the engine to standard operation.

Figure 2 shows a circuit plan of an arrangement for shifting the operation between split and standard engine throughout the operating range of the engine. The main circuit for energizing the two solenoids 30 and 32 of the tappet control mechanism (not shown) includes a grounded storage battery 50 from which the current flows through lead 52 to ignition switch 54, thence through lead 56 to the winding of relay 58 to ground 60. Completion of this circuit by closing the ignition switch in the conventional manner energizes relay 58 which closes switch 62 and completes a second circuit consisting of battery 50, lead 64, switch 62, lead 66, double switch 68, thence either lead 70 or 72, solenoid 30 or 32, and the respective grounds therefor 74 and 76. The particular solenoid energized depends upon the energization of one or more of the cooperating control circuits to be presently described.

In the control circuit for the main solenoid actuating circuit there are seven separate control elements which cooperate with one or more of the remaining control elements to shift the engine between standard and split engine operation. The mechanism for shifting the operation

between standard and split engine may be manually controlled by the operation of switch 80 which when in the position shown is open and renders the remaining control elements inoperative and prevents the solenoids from shifting to split engine or if on split engine, causes said mechanism to shift to standard engine. When the upper contact of switch 80 is closed, the engine is at all times in split operation and when lower contact is closed, the operation is automatically controlled and will shift between split and standard, as required.

In order to prevent the engine from shifting to split operation before the motor has reached normal operating temperatures, a thermostatically controlled switch 21 is placed in lead 84 through which the current flows to the remaining control elements for shifting the engine to split operation. As the engine becomes warm, switch 21 closes and remains closed as long as the temperature of the engine remains above a predetermined point. The thermostatically controlled switch 21 is preferably located on the cylinder head or in a conduit carrying water from the jacket around the combustion chambers and is of the snap-acting type which has a differential between off and on positions, i. e. for example, a temperature of 130° F. is required to close the switch and a temperature of 120° is required to open the switch. It is seen that this thermostatically controlled switch prevents the engine from shifting to split engine operation while the engine is cold and thus prevents an undue load from being placed on the normal cylinders.

While the engine is idling, i. e. when the throttle valve is in closed or substantially closed position, it is preferable to operate on split engine unless the engine is cold, as explained in the preceding paragraph. A switch 86 is actuated by the closing movement of the throttle valve to close the circuit consisting of battery 50, switches 54 and 80, lead 84, switch 21, lead 92, relay 94, lead 96 and ground 98. When this circuit is closed, relay 94 becomes energized and closes switch 100 so that the current flows through leads 102 and 104, switch 106, lead 108 and relay 110 to ground 112, energizes relay 110, and completes the main circuit to solenoid 32, thus shifting the engine to split operation. While the throttle valve is closed or nearly closed, the intake manifold vacuum is relatively high. This lower pressure is transmitted through conduit 120 to chamber 122 of unit 16 and moves diaphragm 124 downwardly in opposition to spring 126, closing switch 128. The closing of switch 128 completes the circuit consisting of battery 50, switches 54 and 80, lead 84, switch 21, lead 92, relay 94, lead 130, switch 128, lead 132, relay 134, lead 136, relay 110, and ground 112, though preferably this circuit alone cannot energize relay 110 to cause split engine operation. One way of accomplishing this is to provide relays at 94, 110 and 134 which have electrical characteristics such that the voltage required to operate two or more in series would be greater than the maximum line potential of the circuit. By this arrangement, switch 128 would be unable to energize the circuit for split engine operation unless either the speed or throttle controlled switches were also closed.

The operation of the solenoids 30 and 32 is also controlled by vehicle or engine speed. The speed controlled switch device 20 for sensing vehicle speed is preferably regulated by a fly-ball governor driven from the drive shaft through the speedometer cable. During operation, when the vehicle reaches a predetermined speed, switch 152 closes, thus closing the circuit beginning with the connection 150 and consisting of lead 136, relay 134, lead 132, switches 151, 152 and ground 153. This circuit will not energize relay 134, however, unless the circuit controlled by switch 86 or the circuit controlled by switch 128 is first closed since the current for the circuit controlled by switch 152 flows from the circuit for energizing relay 110. After switch 152 has been closed by the governor while either switch 86 or 128 is closed, relay 110 for maintaining the engine on split operation

remains energized until switches 86 and 152 have been opened or until switch 106 has been opened, the latter switch being opened by overtravel of the throttle valve lever. The circuit for energizing relay 110 thereafter remains open and the engine remains on standard operation until the throttle valve is moved to closed position, closing switch 86, or until the manifold vacuum becomes sufficiently high to close switch 128 after a predetermined speed has been reached closing switch 152. When the engine is on split operation with the throttle valve open, though not in the overtravel position, the engine remains on split operation as long as the vehicle speed remains above a certain predetermined value independent of manifold vacuum. When the speed decreases to a point below the predetermined rate, switch 152 is opened and relay 110 is de-energized and the engine shifted to standard operation. The return of the speed to a point above a predetermined rate, however, does not again energize relay 110 unless either switch 86 or 128 has been closed.

Switch assembly 22 includes switch element 151, which is controlled by the gear shift mechanism of the vehicle, prevents the control mechanism from shifting the operation to split engine regardless of speed attained by the engine during certain gear selections, such as low and second gear. This switch is mounted on a bracket 160 (Figure 3) and is provided with a stem 162 which is actuated by an arm 164 of the gear shift mechanism, said arm being shown in the position occupied when the vehicle is operating in one of the lower gears. The broken line indicates the position of said arm when the vehicle is operating in high gear. Arm 164 is connected to manually actuated shaft 166 which is mounted in the conventional manner on the steering column 168 of the vehicle. Opening of switch 151 by arm 164 (downward movement of said arm) as the vehicle is shifted into one of the lower gears prevents split engine operation, except during idling, since, as pointed out previously, the voltage required to operate relays 94, 110 and 134 in series, as shown, is greater than the maximum line potential of the circuit controlled by the vacuum actuated switch so that without the circuit controlled by the speed controlled switch 152 the vacuum actuated switch cannot operate the split engine control.

Some of the controls included in the present system are optional and may be omitted in some installations without seriously affecting the operation and control of the engine. For example, the speed controlled switch 152 could be omitted and the lead connecting lead 132 to said switch merely grounded. With this arrangement, closing of either switch 86 or 128 would shift the engine to split operation unless switch 151 were open. Further modifications of the control system are possible without causing any substantial overall change in the operation of the present engine.

Although only one embodiment of the invention has been illustrated and described, various changes in the form and relative arrangements of the parts may be made to suit requirements.

I claim:

1. For use in connection with an internal combustion engine having a plurality of cylinders and a gear selecting mechanism: a control mechanism for rendering a portion of said cylinders inoperative comprising means responsive to speed for activating said control mechanism and means operatively connected with said first named means and responsive to movement of said gear selecting mechanism to a predetermined position for rendering said speed responsive means ineffective.

2. For use in connection with an internal combustion engine having a plurality of cylinders and a gear selecting mechanism movable to select at least low and second gear operation: a control mechanism for rendering a portion of said cylinders inoperative comprising means responsive to speed for activating said control mechanism

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and means operatively connected to said first named means actuable by movement of said gear selecting position to low and second gear positions for rendering said speed responsive means ineffective.

3. For use in connection with an internal combustion engine having a plurality of cylinders and a gear selecting mechanism: an electrical control mechanism for rendering a portion of said cylinders inoperative comprising a circuit for said control mechanism, means for energizing said circuit and a switch in said circuit actuable by movement of said gear selecting mechanism to certain predetermined positions to render said means ineffective.

4. For use in connection with an internal combustion engine having a plurality of cylinders and a gear selecting mechanism: an electrical control mechanism for rendering a portion of said cylinders inoperative comprising a circuit for said control mechanism, a switch in said circuit adapted to be closed in response to a predetermined manifold vacuum, and a second switch in said circuit adapted to be selectively opened and closed in response to movement of said gear selecting mechanism to certain predetermined positions, said circuit adapted to be energized when both of said switches are closed.

5. For use in connection with an internal combustion engine having a plurality of cylinders, a throttle and a gear selecting mechanism: a control mechanism for rendering a portion of said cylinders inoperative comprising first means responsive to manifold vacuum; second means operatively connected to said first means and responsive to throttle movement; and third means operatively connected to said first and second means and responsive to movement of said gear selecting mechanism, said first means adapted to coact alternatively with said second and third means to activate said control mechanism.

6. For use in connection with a vehicle mounted internal combustion engine having a plurality of cylinders and a gear selecting mechanism: a control mechanism for rendering a portion of said cylinders inoperative comprising first means responsive to manifold vacuum; second means operatively connected to said first means and responsive to vehicle speed, said first and second means

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adapted to coact to actuate said control mechanism; and third means operatively connected to one of said previously mentioned means and actuable by movement of said gear selecting mechanism to certain predetermined positions to render said means ineffective to actuate said control mechanism.

7. In a system for controlling a vehicle mounted internal combustion engine having a plurality of cylinders and a gear selecting mechanism: a control mechanism actuable to render a portion of said cylinders inoperative; means responsive to vehicle speed for actuating said mechanism; and means operatively connected to said first named means and responsive to movement of said gear selecting mechanism to certain predetermined positions for rendering said first named means ineffective to actuate said mechanism.

8. A system for controlling a vehicle mounted internal combustion engine having a plurality of cylinders and a gear selecting mechanism comprising: an electrical control energizable to render a portion of said cylinders inoperative; a circuit for said control mechanism; a first switch in said circuit responsive to engine temperature; a second switch in said circuit responsive to throttle movement; a third switch in said circuit responsive to vehicle speed; and a fourth switch in said circuit responsive to movement of said gear selecting mechanism to certain predetermined positions, said first switch adapted to coact with either said second switch or said third and fourth switches to energize said control mechanism.

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