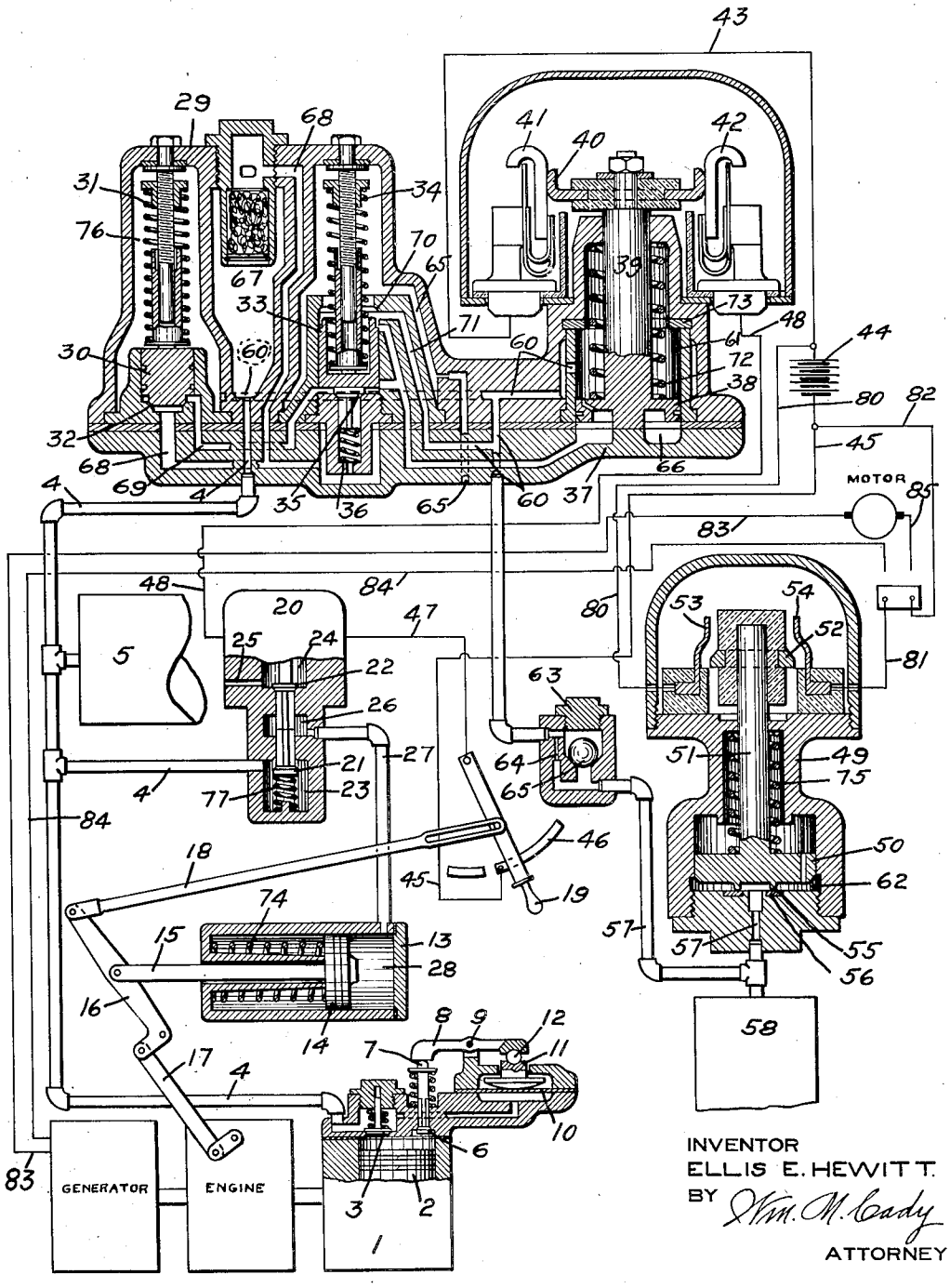
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COMPRESSOR CONTROL DEVICE

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COMPRESSOR CONTROL DEVICE.

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This invention relates to vehicles of the type in which an internal combustion or oil engine is employed for driving a generator for supplying an electric current to the vehicle propelling motor and for driving a fluid compressor to supply fluid under pressure to the fluid pressure brake system. In this type of vehicle, with the controller for the motor circuit in power "on" position, the speed of the vehicle depends upon the speed of the engine, that is to say, if it is desired to increase or decrease the speed of the vehicle, the speed of the engine is increased or decreased, as the case may be, and will thus effect an increase or decrease in the supply of electric current from the generator to the vehicle propelling motor and the motor will operate to propel the vehicle in accordance with the current supplied.

When a vehicle, equipped with my invention, is standing at a stop or descending a grade, the engine is not stopped but continues to operate at the usual slow idling speed, so that the rate at which fluid is compressed by the compressor is reduced below that obtained at the average running speed. In order to increase the output of the compressor, I provide means for automatically accelerating the engine and consequently the compressor under conditions where the engine is idling and the pressure of fluid compressed by the compressor is below a predetermined degree.

With the engine running at idling speed, the electric generator will be driven at a correspondingly slow speed, so that the current generated by the generator will be of low voltage. When the engine is accelerated above idling speed to increase the output of the compressor, the speed of the generator is correspondingly increased, with the result, that the current generated by the generator will be of high voltage, and if the motor propelling or generator circuit should be closed while the engine is running at increased speed and the controller in power "on" position, this current would be suddenly imposed upon the propelling motor, and due to its high voltage, might damage the motor to such an extent as to render it inoperative.

To effect the automatic control of the propelling motor or generator circuit, a control circuit of the usual type may be employed.

The principal object of my invention is to provide means automatically operative for preventing an electric current of high voltage from being suddenly imposed upon the vehicle propelling motor when the speed of the engine is suddenly increased.

Another and more specific object of my invention is to provide means for automatically increasing the speed of the engine above idling speed, to increase the output of the compressor and to provide means automatically operative for maintaining the motor control and motor circuits open until after the fluid compressed by the compressor has been increased to a predetermined degree and the speed of the engine has been reduced to substantially idling speed.

Other objects and advantages will appear from the following more detailed description.

In the accompanying drawing, the single figure is a diagrammatic view, principally in section, of a fluid compressing and electric circuit control apparatus embodying my invention.

In the accompanying drawing an internal combustion or oil engine has been shown, in diagrammatic form, which may be mounted on a vehicle in any desired manner and which is adapted to drive an electric generator for supplying current to operate the vehicle propelling motor and is also adapted to drive a fluid compressor 1.

The compressor 1 has the usual compressing piston 2 and a discharge valve 3, past which, fluid compressed by the compressor is supplied, through pipe 4, to a main or storage reservoir 5.

Associated with the compressor is an unloading valve 6, which when open, permits the compressor piston to reciprocate without compressing fluid into the reservoir 5. The valve 6 is provided with a stem 7 which projects out of the compressor casing and is engaged by the end of the lever 8 fulcrumed on a pin 9. The other end of the lever 8 is adapted to be operated by a flexible diaphragm 10, a follower 11 engaging the diaphragm, and a ball 12 being interposed between the follower and the adjacent end of the lever.

For the purpose of operating the usual throttle valve device, with which the engine may be equipped, a piston device 13 is provided comprising a cylinder containing a piston 14 having a stem 15 which extends through an opening in one end of the cylinder, and at

its outer end is pivotally connected with one arm of a fulcrumed lever 16, another arm of the lever 16 being operatively connected with the throttle valve device by a connection 17. One end of an operating rod 18 is pivotally connected to the arm of the lever 16 to which the stem 15 is connected. The other end of the rod 18 is pivotally and slidably connected with a manually operable and pivotally mounted throttle lever 19, the connection between the lever 19 and the rod 18 permitting longitudinal movement of the rod relative to the lever when the lever 16 is operated by the piston device 13.

Associated with the piston device 13, is a magnet valve device having a magnet portion 20 adapted to control the operation of double beat valves 21 and 22. The valve 21 is contained in a chamber 23 which is connected to the reservoir 5 by the pipe 4, and the valve 22 is contained in a chamber 24 which is connected to atmosphere through an atmospheric passage 25. A chamber 26, intermediate the valves 21 and 22, is connected, by a pipe 27, with the piston chamber 28 at one side of the piston 14 of the piston device 13.

A governor device 29 is provided comprising a casing containing a cut-out piston 30, subject to the pressure of a coil spring 31, and carrying a valve 32, and also containing a cut-in piston valve 33 subject to the pressure of a coil spring 34 and cooperating with a valve 35 subject to the pressure of a coil spring 36. The reservoir 5 is connected to the governor device 29 by the pipe and passage 4.

Associated with the governor device 29 is an electrical switch device 37 comprising a cylinder containing a piston 38 having a stem 39 which projects through the casing and has secured to its outer end portion, an electrical contact member 40 which is adapted to be moved into and out of electrical engagement with stationary terminal contacts 41 and 42. The terminal contact 41 is connected by a wire 43 with one terminal of a battery 44 or other source of electric current, the other terminal of the battery being connected, by a wire 45, with a terminal contact 46 in the form of a quadrant with which the throttle lever 19, in its engine idling position, is adapted to contact. This lever 19 is connected, by a wire 47, with one terminal of the magnet 20 of the magnet valve device, the other terminal of the magnet being connected, by a wire 48, with the terminal contact 42 of the switch device 37.

Associated with the governor device 29 is an electrical switch device 49 adapted to control a control circuit for effecting the opening and closing of the electric circuit through which current flows from the generator to the vehicle propelling motor. The switch device 49 may comprise a cylinder containing a piston 50 having a stem 51 which projects through a wall of the cylinder, and to the outer end of the stem there is secured a contact member in the form of a ring 52, which is adapted to be moved, by the stem, into electrical contact with contact terminals 53 and 54 of the control circuit. The contact terminal 53 is connected, by a wire 80, with the wire 43 leading to one terminal of the battery 44 and the contact 54 is connected, by a wire 81, to the usual means (not shown) for effecting the control of the motor circuit, another terminal of said means being connected, by a wire 82, with the wire 80 leading to one terminal of the battery 44. The motor circuit comprises a wire 83 which is connected to one terminal of the electric generator and to one terminal of the vehicle propelling motor and also comprises a wire 84 which is connected with the other terminal of the generator and with the usual control means hereinbefore mentioned. The other terminal of the motor is connected, by a wire 85, with the control means. The usual control means mentioned are interposed between the motor circuit and the control circuit and are for the purpose of controlling the motor circuit through the operation of the control circuit.

It will here be noted that instead of interposing the switch device 49 in the control circuit, it may be interposed in the motor circuit so that when it is operated it will directly control this circuit.

The piston 50 of this switch device 49 is provided with a seat ring 55 which is adapted to seat on a washer 56. Leading from the small seated area of this piston is a pipe and passage 57, which pipe is connected to a volume reservoir 58 and to a passage 60 in the governor device and the switch device 37, said passage leading through a port 60 to a chamber 61 at one side of the piston 38, when said piston is in the position shown in the drawing. Between the chamber 61 of the switch device 37 and the piston chamber 62, at one side of the piston 50 of the switch device 49, there is interposed, in the pipe 57, a ball check valve device 63, having a restricted passage 64 through which fluid under pressure is adapted to flow from the chamber 61 to the volume reservoir 58 and piston chamber 62, the fluid under pressure by-passing the ball check valve 65.

In operation, with the throttle lever 19 in idling position, and the pressure of the fluid in the reservoir 5 reduced to a predetermined degree, the several parts of the invention will move to the positions shown in the drawing, in which positions, the circuit from the generator to the propelling motor and the control circuit will be open. The circuit for controlling the operation of the throttle mechanism will be closed, and current flowing through this circuit energizes the magnet 20 of the magnet valve device, causing the valve 22 of this device to seat and the valve 21 to unseat, so that, fluid under pressure from the

reservoir 5 will flow from the valve chamber 23 of the magnet valve device, which is connected to the reservoir 5 by the pipe 4, and from the chamber 23 flows past the valve 21 to chamber 26 and from thence to the piston chamber 28 at one side of the piston 14 of the piston device 13, causing said piston and stem 15 to be moved outwardly, operating the lever 16 and connection 17 to cause the operation of the throttle valve device to accelerate the engine from its idling speed. As the speed of the engine is increased over its idling speed, the operating speed of the compressor is correspondingly increased, which increases the output of the compressor. The speed of the generator is also correspondingly increased, which results in the generation of an electric current of high voltage which cannot be imposed upon the driving motor due to the motor circuit and control circuit being open.

Fluid under pressure from the reservoir 5 flows to the governor 29 through pipe and passage 4, chamber 67 and passage 68 to the face of the cut-out valve 32, and when the pressure of the fluid compressed by the compressor has been increased to a predetermined degree, which is sufficient to overcome the pressure of the spring 31, the piston 30 will move upwardly and unseat the valve 32, so that fluid under pressure will flow, by way of a passage 69, to the face of the cut-in valve piston 33 and cause it to move upwardly against the pressure of the spring 34. The valve 35, due to the pressure of the spring 36, moves upwardly with the valve piston 33 and unseats, so that fluid under pressure from the passage 68 flows past the open valve 35 to the face of the piston 33. The valve piston 33, when it is in its upper position, seats on a valve seat 70, thus closing communication of the chambers 61 and 66 of the switch device 37, with the atmospheric passage 65, through passages 60 and 71 respectively. Fluid under pressure now flowing through passage 71 to the piston chamber 66 causes the piston 38 to move upwardly against the pressure of a spring 72 until the upper face of the piston seats on an annular shoulder 73, at which time the contact 40, mounted on the piston stem 39, will have been moved out of engagement with the contacts 41 and 42, thus opening the circuit to the magnet valve device, and causing the magnet 20 to be deenergized. When the magnet is deenergized, the pressure of a spring 77 acting on the double beat valve will cause the valve 21 to seat, closing communication of the main reservoir with the piston chamber 28 of the throttle operating piston device 13, and cause the valve 22 to unseat, thus venting the chamber 28 to the atmosphere through pipe 27, chambers 26 and 24, and atmospheric passage 25. When the chamber 28 is thus vented, the pressure of a spring 74 will cause the piston 14 to move inwardly and thus rotate the lever 16 a sufficient amount to operate the engine throttle valve device to decrease the speed of the engine to its idling speed.

When the upper face of the piston 38, of switch device 37, is seated on the shoulder 73, the piston will have been moved above the port 60 which opens into the chamber 61, so that fluid under pressure flows through this port and passage 60, pipe 57, the restricted passage 34 in the check valve device 63 and through pipe 57 to the reservoir 58 and piston chamber 62 of the switch device 49. The restriction in the passage 64 is of such a size as to govern the rate of flow of fluid under pressure therethrough to the reservoir 58 and chamber 62, and the reservoir is of such size that there will be a delay period between the moving of the contact 40 of the switch device 37 out of contact with the contact terminals 41 and 42, and the build-up of sufficient pressure in the reservoir 58 and piston chamber 62 of the switch device 49, to cause the piston 50 to move upwardly, against the pressure of a spring 75, a sufficient distance that the contact ring 52 will engage the contacts 53 and 54 to close the control circuit. It will thus be seen that when the engine is operating at high speed and the pressure in the reservoir is increased to a predetermined degree, the switch device 37 will be operated to open the throttle circuit and cause the throttle valve device to operate to its decelerating position before the switch device 49 operates to close the control circuit to render said circuit operative for controlling the motor circuit. The delay period between the opening of the throttle controlling circuit and the closing of the control circuit is of such duration as to permit the speed of the engine, after the throttle valve device has been moved to decelerating position, to gradually decrease to idling speed before the control circuit is closed.

Fluid under pressure in the passage 60 also flows to a chamber 76 at one side of the cut-out piston 30 of the governor device, and when the pressures on both sides of this piston equalize, the pressure of the spring 31 acting on the piston will seat the valve 32.

The several parts of the invention will now be maintained in the positions just described until the pressure of the fluid in the reservoir 5 has been reduced to a predetermined degree. The pressure of the spring 34 will then cause the cut-in piston 33 to move downwardly, moving the valve 35 to its seated position, so that further flow of fluid under pressure to the passage 71 is cut off. When the piston 33 is thus moved, the upper portion thereof is unseated from its seat 70. Fluid under pressure in the piston chamber 66 of the switch device 37 is now vented to the atmosphere, by way of passage 71 and atmospheric passage 65. At the same time, fluid under pressure in the piston chamber

62 of the switch device 49 and in the reservoir 58 is vented to the atmosphere, through pipe 57, past the ball check 65, through passage 60 and atmospheric passage 65. The pressure of the springs 72 and 75 will now cause the pistons 38 and 50, respectively, to move downwardly to the positions shown in the drawing, and the speed of the engine will then be increased in the manner as hereinbefore described. The pistons 38 and 50 operate in such a manner that the control circuit is opened before the speed of the engine is increased sufficiently to cause the generator to generate a high voltage current. As it requires a little time to accelerate the engine, both of the switch devices may operate simultaneously without danger of imposing a high voltage current on the propelling motor, but if desired, the switch device 49 may be made to operate to open the control circuit before the switch device 37 is caused to operate to close the circuit for the operation of the engine throttle. To accomplish this, the capacity of the spring 75 may be increased sufficiently to cause the piston 50 to be moved downwardly before the piston 38 is moved.

While one illustrative embodiment of the invention has been described in detail, it is not my intention to limit its scope to that embodiment or otherwise than by the terms of the appended claims.

Having now described my invention, what I claim as new and desire to secure by Letters Patent, is:—

1. The combination with an engine driven compressor and electric generator and a circuit through which current generated by the generator may flow, of means subject to the pressure of fluid compressed by the compressor for automatically controlling the acceleration and deceleration of said engine, and means subject to the pressure of fluid compressed by said compressor for effecting the control of said circuit in accordance with the speed of the engine.

2. The combination with an engine driven compressor and electric generator and a circuit through which current generated by the generator may flow, of means subject to the pressure of fluid compressed by the compressor for automatically controlling the acceleration and deceleration of said engine, and means separate from the first mentioned means subject to the pressure of fluid compressed by the compressor for effecting the control of said circuit in accordance with the speed of the engine.

3. The combination with an engine driven compressor and electric generator and a circuit through which current generated by the generator may flow, of means subject to the pressure of fluid compressed by the compressor for automatically controlling the acceleration and deceleration of said engine, and means separate from the first mentioned means subject to the pressure of fluid compressed by the compressor for rendering said circuit inoperative as said engine is automatically accelerated.

4. The combination with an engine driven compressor and electric generator and a circuit through which current generated by the generator may flow, of means subject to the pressure of fluid compressed by the compressor for automatically controlling the acceleration and deceleration of said engine, and means separate from the first mentioned means subject to the pressure of fluid compressed by the compressor for rendering said circuit operative after said engine has been automatically decelerated to substantially idling speed.

5. The combination with an engine driven compressor and electric generator and a circuit through which current generated by said generator may flow, of a circuit for effecting the acceleration and deceleration of the engine, means subject to the pressure of fluid compressed by the compressor for controlling said circuit, a control circuit for effecting the control of the generator circuit, and means separate from the first mentioned means operative by fluid compressed by the compressor for controlling said control circuit.

6. The combination with an engine driven compressor and electric generator and a circuit through which current generated by said generator may flow, of means operative automatically for effecting the deceleration of said engine when the pressure of fluid compressed by the compressor has been increased to a predetermined degree, and means separate from the first mentioned means operative after said engine has decelerated to idling speed to render the generator circuit operative.

7. The combination with an engine driven compressor and electric generator and a circuit through which current generated by said generator may flow, of means operative automatically for effecting the deceleration of said engine when the pressure of fluid compressed by the compressor has been increased to a predetermined degree, pressure sensitive means operative automatically for rendering the generator circuit operative, and means for causing a predetermined time period to elapse between the decelerating of the engine and the rendering of the generator circuit operative.

8. The combination with an engine driven compressor and electric generator and a circuit through which current generated by the generator may flow, of a throttle circuit for automatically effecting the acceleration and deceleration of the engine, a switch device operative to open said throttle circuit to effect the deceleration of said engine when the pressure of fluid compressed by the com-

pressor is increased to a predetermined degree, and a switch device operative to render the generator circuit operative at a predetermined time after the opening of said throttle circuit.

9. The combination with an engine driven compressor and electric generator and a circuit through which current generated by the generator may flow, of a throttle circuit for automatically effecting the acceleration and deceleration of the engine, a switch device operative to open said throttle circuit to effect the deceleration of said engine when the pressure of fluid compressed by the compressor is increased to a predetermined degree, pressure sensitive means operative to render the generator circuit operative after the opening of said throttle circuit, and means for timing the operation of said pressure sensitive means.

10. The combination with an engine driven compressor and electric generator and a circuit through which current generated by the generator may flow, of a throttle circuit for automatically effecting the acceleration and deceleration of the engine, a switch device operative to open said throttle circuit to effect the deceleration of said engine when the pressure of fluid compressed by the compressor is increased to a predetermined degree, means subject to the pressure of fluid compressed by the compressor for rendering the generator circuit operative, and means for regulating the flow of fluid to the second mentioned means to cause a predetermined time period to elapse between the opening of the throttle circuit and the rendering of the generator circuit operative.

11. The combination with an engine driven compressor and electric generator and a circuit through which current generated by the generator may flow, of a throttle circuit for automatically effecting the acceleration and deceleration of the engine, a switch device operative to open said throttle circuit to effect the deceleration of said engine when the pressure of fluid compressed by the compressor is increased to a predetermined degree, means subject to the pressure of fluid compressed by the compressor for rendering the generator circuit operative, and means for regulating the flow of fluid to the second mentioned means to cause a predetermined time period to elapse between the opening of the throttle circuit and the operation of the second mentioned means.

12. The combination with an engine driven compressor and electric generator and a circuit through which current generated by the generator may flow, of a throttle circuit for automatically effecting the acceleration and deceleration of the engine, a switch device operative to open said throttle circuit to effect the deceleration of said engine when the pressure of fluid compressed by the compressor is increased to a predetermined degree, a switch device operative for rendering said generator circuit operative, and means interposed between said switch devices for delaying the operation of the second mentioned switch device for a predetermined period of time after the operation of the first mentioned switch device.

In testimony whereof I have hereunto set my hand.

ELLIS E. HEWITT.