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(54) HEATING AND VENTILATING APPARATUS FOR MOTOR VEHICLES

(54) APPAREIL DE VENTILATION ET DE CHAUFFAGE POUR VEHICULES A MOTEUR

(57) **Abstract:**

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BE IT KNOWN that HOWARD J. FINDLEY, a citizen of the United States of America, residing in Chardon, Ohio, U.S.A., Engineer, having made an invention entitled

HEATING AND VENTILATING APPARATUS FOR MOTOR VEHICLES

the following is a full, clear and exact disclosure of the nature of the said invention and of the best mode of realizing the advantages thereof.

This invention relates to heating and ventilating automotive vehicles in general, and more particularly, provides for heating and ventilating the passenger compartment of a vehicle by the use of suitably located heat-exchange apparatus adapted to use waste heat from the vehicle engine and embodying a blower which delivers an adequate volume of air into the compartment and is driven from the engine at a speed which is economical and satisfactory for this purpose.

Heretofore it has been common practice to drive the air impelling means of a vehicle compartment heat-exchanger by means of an electric motor which was energized from the vehicle electrical system. With the advent of present day vehicles having numerous electrical accessories all operated from the vehicle electrical system the drain upon the battery has become prohibitive. The present limited output generator has not been increased in size and capacity due to the disproportionate expense involved for the small increase in electrical output.

Concurrently with these developments vehicle manufacturers have become conscious of the possibilities of greatly increased output of such air conditioning means for tempering the air of the entire vehicle, not just spot heating; and especially with larger air impellers of substantially noiseless operating

characteristics. One solution of this problem has been to remove the generally increasing bulk of the air conditioning means from the area of the vehicle compartment adjacent the passengers feet to a position beneath the vehicle seat. Another proposed arrangement is to locate the heat-exchange apparatus in the vehicle engine compartment. The shifting of such heat-exchangers out of the passengers way and into the engine compartment has naturally suggested use of the vehicle engine as the prime mover for a power take-off means from which to operate such accessories. The present invention accordingly provides an efficient means for operation of such equipment at increased output, in a generally noiseless manner, and at a substantially constant speed above a predetermined vehicle engine speed.

The present invention further provides vehicle compartment heat-exchange apparatus embodying a blower and a magnetic or eddy-current coupling for operably connecting the blower with the power take-off of the variable speed vehicle engine. The coupling operates with continuous slippage between its input and output members such that although its input member which is connected with the power take-off of the engine operates at variable speeds, its output member which is connected with the air impeller operates at a substantially constant speed for all engine speeds above a predetermined value.

In the drawing like parts are denoted by corresponding reference characters throughout, and in which:

Fig. 1 is a sectional plan view illustrating one embodiment of heating and ventilating apparatus of this kind in which the heat-exchanger and blower are located in the engine compartment and the latter is driven from the vehicle engine by a power take-off means comprising a coupling having a variable input speed and producing a substantially constant output speed

Fig. 2 is a partial side elevation, with portions in section, showing a motor vehicle equipped with similar apparatus in which the heat-exchanger is located in the passenger compartment.

Fig. 3 is a detached sectional view taken through the magnetic coupling.

Fig. 4 is a view, partly in section and somewhat diagrammatic in form, showing means for controlling the blower intake and the energization of the coupling.

Fig. 5 is a partial side elevation, with portions in section showing, showing another embodiment of the apparatus in which the heat-exchanger and blower are located in the engine compartment; and

Fig. 6 is a partial side view, on a larger scale, further illustrating the means for controlling the delivery of air into the passenger compartment by the apparatus of Fig. 5.

Now having reference to Fig. 1 of the drawings there is shown in broken lines in the background, in surrounding relation to a vehicle body heating and ventilating apparatus, a front portion of a vehicle 1 having a dash board 2, the usual vehicle radiator 3 for circulating cooling liquid to the vehicle engine 4, and the vehicle engine-driven fan shaft 4a. An air blower 6 of the radial delivery type enclosed in a housing 7 has an air inlet 8, and in this case is actuated from the engine-driven fan shaft or power take-off 4a by a separate belt and pulley, as shown, through the intermediary of a pulley 15 fixed

to a shaft 16 of a variable input speed coupling with a substantially constant output speed, generally designated 17, and to be hereinafter described.

A heat-exchanger casing 20 has an outer wall which diverts air, received from the peripheral air discharge of the blower 6 into the casing inlet, through one portion of a heat-exchanger or core 21 transversely disposed therein, and conducts air out of the casing, through another portion of the core divided from the casing air inlet, by a partition wall 22. With this arrangement of a single heat-exchanger all portions thereof are efficiently utilized by providing two passes therethrough. The heat-exchange medium, of course, being first introduced to the core section adjacent the casing air outlet for mildly raising the air temperature passed therethrough and causing the least drop in the temperature of the heat-exchange medium, while the air entering the casing is rapidly changed in temperature by the slightly dissipated or expended heat-exchange medium flowing reversely through the core from the inlet conduit 12, connected to the vehicle engine 4, to the outlet conduit 13 connected with the vehicle radiator 3.

An air silencer 23 has an air inlet, for receiving air flowing from the outlet of the heat-exchanger casing 20, and an outlet connected to an air conveying means 24 which is projected through the vehicle dash 2 into the passenger compartment where it is terminated in diverging spouts 25 and 26 for distribution of tempered air to selected locations, for example compartment heating and windshield defrosting. Valve 27, and control means 28 which may be extended to within convenient reach of the vehicle operator, is disposed in the air conveying means 24 to throttle or shut-off the tempered air supply. When the shut-off valve means 27 is closed, valve means 29 in the outer wall of the

heat-exchanger casing 47 is suitably spring loaded to relieve excess pressures thereby produced in the casing to a predetermined safe maximum and thereafter to automatically dump excess air to the atmosphere.

The coupling generally designated 17, driven by the pulley 16 from the engine-driven fan shaft 4a, has an input shaft 30 which is driven at variable speeds occasioned by operative demands of the vehicle engine. The input shaft 30 is suitably journalled within the housing 31 and its frame work 32, and includes a similar axially disposed and journalled output or driven shaft 33 leaving the input shaft 30 freely rotatable with respect to the mechanically uncoupled driven shaft 33. Shaft members 30 and 33 each have an annular disc or ring 34 and 35, respectively concentrically fixed thereon and axially spaced with respect to each other. The air space between the members 34 and 35 is maintained while the coupling is energized so that slippage between these members can take place during the transmission of torque by the coupling. A coil 36 is concentrically disposed around the shaft within one of the ring members for producing a magnetic flux. Energy for the coil is supplied from the vehicle battery generally designated 37. The current supply means for the coil 36 may include a suitable slip-ring and brush arrangement indicated at 38 in the drawing. A resistance rheostat 40 in the power line may be used to govern the amount of current energizing the coil. Alternatively, a thermostatically controlled switch and valve may be used for summer ventilation by the use of the fan only with the water to the heat-exchanger shut off.

In the coupling construction just enumerated it will be apparent that the input shaft 30 driven from the engine-driven fan shaft 4a will be subjected to various speeds depending upon the operative demands of the vehicle engine while the output or driven shaft 33 of the coupling may be driven at a selective

substantially constant speed above idling speeds of the vehicle engine. That is to say, only sufficient electric energy is supplied to the magnetic coil by the rheostat 40 to provide a magnetic field which will carry only a certain load. A suitable fan speed for operation of the heat-exchanger has been selected and above the desired speed the coupling will start to slip.

In operation the current consumption of the magnetic coil is relatively small compared to an electric motor of comparable operating characteristics. It has been found from tests conducted on this substantially constant speed coupling that at speeds of approximately 600-1200 R.P.M. for the engine driven shaft that the output or fan side of the coupling will be driven at approximately like speeds of 600-1200 R.P.M., however, from 1200 R.P.M. to 2500 and up to 3700 R.P.M. engine speeds the output speed of the coupling is only 1300-1450 R.P.M.

From the foregoing disclosures it will now be apparent that there has been revealed a novel engine driven heating and ventilating apparatus having a fan drive therefor with a variable input speed and a substantially constant output speed.

Fig. 2 of the drawings shows a modified form of the heating and ventilating apparatus embodied in an automobile 50, the latter having a passenger compartment 51 and an engine compartment 52 which is separated from the passenger compartment by the usual dashboard 53. The passenger compartment is provided with the usual floor 54, seat 55, windshield 56 and instrument panel 57. A variable speed driving engine or motor 58 is located in the engine compartment 52 and is operated by means of the usual controls located in the passenger compartment 51 including one or more pedals 59. The engine 58 is here shown as a liquid-cooled engine and is provided at the forward end thereof with a conventional cooling radiator 60. The engine can be a reciprocating or

rotary internal combustion engine or could be an internal combustion turbine.

The means for heating and ventilating the passenger compartment 51 comprises in general an air heater 62, a blower 63, and a silencer 64 which also serves as an air delivery means or conduit connecting the blower with the air heater. As here shown, the air heater 62 may be (though not necessarily) located in the passenger compartment 51. The engine 58 is provided at its forward end with a power take-off means 65 which includes a pulley 66. The blower 63 is located under the hood 67, that is, in the engine compartment and preferably immediately adjacent the power take-off 65.

The air heater 62 is of the kind embodying a core 68 having numerous passages for the air to be heated and which core is connected with the cooling system of the engine 58 by supply and return conduits 69 so as to receive heated liquid therefrom. Shut-off valves 70 located in the conduits 69 can be closed to isolate the core 68 from the engine cooling system so that unheated air can be supplied to the compartment 51 when this is desirable. The heater 62 also includes a suitable housing 71 in which the core 68 is located and which contains a plenum chamber 72 having an air inlet 73 with which the delivery means or silencer 64 is connected. On the side of the core opposite the plenum chamber the housing 71 is provided with a delivery opening 74 through which the air is delivered into the compartment 51 after passage through the core. A movable door 75 associated with the delivery opening 74 can be manually shifted to open or closed position, or to a partially open position, for regulating the amount of air delivered through the heater into the compartment 51.

The air heater 62 may also include a defrosting outlet or connection 76 for supplying air to one or more delivery nozzles

77 which are located adjacent the base of the windshield 56 and direct air against the inside of the latter. A manually operable valve 78 located in the defrosting connection 76 enables the operator to control the delivery of air through such connection for windshield defrosting purposes. The door 75 is moved to its closed position when the delivery of the maximum amount of air through the defrosting connection 76 is desired. The housing 71 of the heater may have a second door 75a thereon which can be moved to an open position for discharging unheated air into the compartment 51 from the plenum chamber 72.

The blower 63 may be of the centrifugal type having a housing 80 provided with a fresh air intake 81 and an outlet 82 connected with the air delivery means or silencer 64. The blower also includes a suitable impeller 83 which is rotatable in the housing 80 for drawing fresh air in through the intake 81 and forcing such air through the delivery means 64 and air heater 62 into the passenger compartment 51. The impeller 83 is mounted on a shaft 84 to which it is pinned or otherwise secured and may include an inwardly dished hub or body portion 85 to which further reference will presently be made. The intake 81 of the blower 63 extends forwardly of the radiator 60 of the engine cooling system, as shown in Fig. 2, so that unheated fresh air can be obtained. The intake preferably includes an air scoop 86 at its forward end and which is provided with a suitable filter 87 for preventing the entry of dust, insects and other foreign matter.

An important feature of the present invention is the use of driving means for the blower 63 which enables the latter to be operated from the power take-off 65 of the engine 58 in a manner such that the blower will be driven at a substantially constant speed for all engine speeds coming within the usual driving range extending from idling speed to a vehicle speed on

the order of ninety or a hundred miles per hour. The use of a blower driven from the engine 58 makes it possible to deliver a large volume of air to the compartment 51 without placing a large drain on the storage battery or electrical system of the vehicle 50. This relatively large volume of air thus obtainable serves to cool and condition the passenger compartment while the vehicle is being operated in summer weather, at which time the valves 70 are closed to disconnect the core 68 of the air heater from the engine cooling system. During cold weather this large volume of air is heated by the core 68 and also serves to create a super-atmospheric pressure in the passenger compartment so as to prevent uncomfortable drafts which would otherwise result from infiltration of cold air through various cracks and crevices.

For reasons previously explained herein, it is desirable that the blower 63 be capable of operation at speeds which will insure the delivery of the desired volume of air to the compartment 51 for all ordinary conditions of operation of the vehicle 50, without requiring the blower to be driven at excessive speeds at times when the vehicle is being operated at relatively high speeds. To this the driving means for the blower 63 includes a constant speed coupling 89, that is to say, a coupling which is capable of operating with slippage. The coupling 89 is preferably a magnetic coupling of a suitable type and construction, such as the eddy-current coupling shown in Fig. 3. This coupling comprises a housing 90 of magnetic material and a rotor 91 of magnetic material disposed in such housing and carrying a magnetizing coil or winding 92.

The housing 90 of this magnetic coupling is rotatable on the shaft 84 and is connected with the power take-off means 65 so as to be continuously driven by the latter during operation of the vehicle engine 58. Any suitable torque-transmitting means

can be used for connecting the coupling 89 with the power take-off so as to provide the desired ratio, such as the endless belt 66a which extends around the pulley 66 of the power take-off and around a pulley 93 carried by the housing 90 of the coupling. The rotor 91 is pinned or otherwise connected to the shaft 84. Slip rings 94 and 95 carried by the shaft 84 cooperate with brushes 96 and 97 and are connected with the coil 92 to enable the latter to be electrically energized as will be presently explained. The magnetic coupling 89 can be located at any suitable point where it will be capable of accomplishing its intended function and, as here shown, can be housed or partially housed in the cup-shaped hub or body portion 85 of the impeller 83 of the blower.

A control means is provided for controlling the volume of air supplied to the compartment 51 and includes a valve 99 located in the intake 81 of the blower 63 and a rheostat 100, or equivalent device, for varying the energization of the magnetic coupling 89. The valve 99 is pivotally mounted in the intake 81 so as to be biased toward its open position by a tension spring 101. A control device 102 mounted on the instrument panel 57 has a manually operable control knob 103 which is readily accessible in the passenger compartment 51 and is movable from an initial position A to a plurality of different positions B, C and D.

This control device includes the rheostat 100 and a pull-rod 104 carrying a contact 105 which cooperates with the resistor 100a of the rheostat and is connected with the brush 96 by the conductor 106. The inner end 104a of the pull-rod forms a stop for the outer or free end 107a of a flexible cable or Bowden wire 107 which is connected with an actuating arm 108 of the air intake valve 99. The tension spring 101 opens the valve 99 to the extent that outward movement of the flexible cable 107 is permitted by the inner end of the pull-rod 104. As shown in Fig. 4 the rheostat 100 is connected with an available current source, such as the storage battery 109 of the vehicle, through a key-controlled switch S which may also be the ignition switch. The brush 97

of the energizing circuit for the coil 92 may be grounded or otherwise connected with the current source 109.

From the foregoing detailed description of the heating and ventilating apparatus shown in Fig. 2 and the control means therefor, it will be seen that whenever the engine 58 is operating, power will be available for driving the blower 63 to supply air to the compartment 51. The amount of air which is desired to be delivered to the compartment 51 can be varied by adjusting the extent of opening of the valve 99 and the energization of the magnetic coupling by moving the control knob 103 to its different positions.

When the knob 103 is in its initial position A the air inlet valve 99 is closed and the coupling 89 is deenergized and at this time the blower 63 is not being driven and no air at all will be delivered to the vehicle compartment 51. When the knob is moved to its first position B the valve 99 is opened, or partially opened, by the spring 101 but the contact 105 is still disengaged from the resistor 100a so that the coupling 89 is deenergized and the blower is still not being driven. If at this time the vehicle is traveling at a relatively high speed its forward motion will cause air to be delivered through the heating and ventilating apparatus to the vehicle compartment 51.

When the knob 103 is moved to its position C the intake valve 99 remains fully opened and the contact 105 will engage the resistor 100a to cause a partial energization of the coupling 109 and at this time the blower 63 will be driven at a reduced speed. When the knob is moved to its position D the coupling is fully energized and the blower is then driven at a relatively higher speed. By providing additional positions for the control knob 83 the speed of the blower can be varied by more than the two steps described above.

It is important to understand in connection with the operation of my improved apparatus, that the slippage which occurs

between the outer and inner members 90 and 91 of the magnetic coupling 89 is such that the blower 63 will be driven at a substantially constant speed for all speeds of the engine 58 which lie within the usual driving range above idling speed. This substantially constant operating speed for the blower is a selected speed which is dependent upon the extent of energization of the magnetic coupling as determined by the position to which the control knob 103 is moved. As explained above, the coupling is deenergized for positions A and B of the knob 103 and at this time the slippage is substantially one hundred percent. For knob position C the slippage is such as to give the above-mentioned selected relatively low constant speed for the blower 63 and for knob position C the slippage is such as to give the above-mentioned selected relatively high constant speed for the blower.

The delivery means 64 connecting the air heater 62 with the blower 63 also serves as a silencer as mentioned above. This device comprises a housing or conduit 64a having a sleeve or liner 64b of fibrous, cellular or porous sound-absorbing material retained therein. During the passage of air through the housing 64a the material 64b absorbs objectionable noises from the air stream.

The modified form of heating and ventilating apparatus shown in Figs. 5 and 6 will be described next. In certain respects the apparatus of Fig. 5 is similar to the apparatus of Fig. 1 and in certain other respects is similar to the apparatus of Fig. 2. The apparatus of Fig. 5 is shown applied to an automobile 110 having a passenger compartment 111, and an engine compartment 112 lying under the forwardly extending hood 112a and separated from the passenger compartment by the usual dash-board 113. The passenger compartment 111 includes the usual windshield 114, instrument panel 115 and floor 116. A variable speed vehicle driving engine or motor 117 is located in the engine compartment 112

and is controlled from the passenger compartment 111 by the usual controls which include one or more pedals 118. The engine 117 is here shown as a liquid-cooled engine having a cooling system which includes a conventional radiator 119 located in the forward end of the engine compartment. The engine is also provided at the forward end thereof with power take-off means 120 which includes a pulley 121.

As shown in the drawings the heating and ventilating apparatus of Fig. 5 comprises an air impelling means or blower 124 and an air heater 125 both of which are located in the engine compartment, and main and auxiliary air discharge conduits 126 and 127 for delivering air into the passenger compartment 111. A substantially constant speed coupling 122 which is identical with the magnetic coupling 62 shown in Figs. 3 and 4 and above described, enables the blower to be driven from the vehicle engine 117 at a substantially constant speed for all engine speeds coming within the usual driving range which extends from idling speed to a top vehicle speed on the order of ninety or a hundred miles per hour. As will be explained more fully hereinafter, the conduit 126 provides a discharge means through which air can be delivered to the passenger compartment from the blower 124 in either a heated or unheated state and the auxiliary conduit 127 provides a by-pass means through which unheated air can be delivered to the passenger compartment while heated air is being delivered thereto through the main conduit 126.

The blower 124 comprises a housing 128 having an intake 129 for cold or fresh air extending forwardly of the radiator 119 and an impeller mounted for rotation in such housing so as to draw air in through the intake 129 and discharge the same through the nozzle or outlet 131. The intake 129 preferably includes a forwardly opening scoop 132 having a screen or filter 133 therein for excluding dust, insects and other foreign matter. The blower

124 also includes an impeller similar to the impeller 83 of Fig. 4.

The air heater 125 comprises a housing 138 which is connected with the outlet 131 of the blower 124 and a core 139 located in such housing and connected with the engine cooling system by means of supply and return conduits 140 and 141. A shut-off valve 142 located in the supply conduit 140 permits the core 139 to be isolated from the engine cooling system so that unheated air can be delivered through the heater 125 and main conduit 126 to the passenger compartment 111 whenever this is desirable, such as during operation of the vehicle in the summer season. The conduit 126 preferably embodies a silencer for removing undesirable noises from the air being delivered to the compartment 111. For this purpose the conduit 126 is provided with a lining or sleeve 143 of a fibrous, cellular or porous sound-absorbing material.

The auxiliary conduit or by-pass means 127 connects the blower outlet 131 with the passenger compartment 111 so that air can be by-passed around the core 139 of the air heater 125 and can be supplied to the passenger compartment in an unheated condition. It is frequently desirable to supply air to the passenger compartment in an unheated condition at the same time that heated air is being supplied through the core 139 and the main discharge conduit 126. Such unheated air is desired mainly for defogging the windshield 114 but can also be supplied to the passenger compartment for regulating the temperature therein. To enable such unheated air to be discharged against or across the windshield 114, the instrument panel 115 is provided with one or more openings or nozzles 145 located adjacent the base of the windshield and connected with the delivery end of the by-pass conduit 127 by means of one or more flexible conduits 146.

It is also desirable at times to supply heated air to the windshield for defrosting purposes and, to permit this to be done, a passage or conduit 147 is provided interconnecting the

delivery ends of the main and auxiliary conduits 126 and 127. The interconnection 147 also permits unheated air from the by-pass means 127 to be discharged through the delivery end 126a of the main conduit 126 for mixing with the heated air being supplied through the latter. The delivery of air through the main and auxiliary conduits 126 and 127 can be controlled by means of valves 148 and 149 located therein and adapted to be moved to different positions by corresponding control members 150 and 151 located on the instrument panel 115 and connected with the respective valves by suitable linkage preferably in the form of flexible actuating members or shafts 152 and 153.

When the control member 150 is in its full line position, as shown in Fig. 6, the valve 148 is in a position closing the delivery outlet of the main conduit 126 so as to divert all of the air upwardly through the connection 147 for delivery to the windshield clearing nozzles 145. When the control member 150 is withdrawn to the position 150a the valve 148 occupies the broken line position 148a in which the connection 147 is closed and all of the air being supplied through the main conduit 126 is discharged directly into the passenger compartment through the delivery end 126a. When the control member 150 is moved to a position between its full line position and the position 150a, the valve 148 will occupy a corresponding intermediate position in which unheated air from the auxiliary conduit 127 can be supplied through the connection 147 for mixing with the heated air being delivered through the main conduit 126, or some of the heated air from the main conduit 126 can be diverted upwardly through the connection 147 depending upon the position of the valve 149.

The valve 149 which controls the by-pass conduit 127 is movable from its initial full line position (see Fig. 6) in which the by-pass conduit is completely closed to a plurality of successive positions 149a, 149b and 149c. The closed position 149

corresponds with the full line position of the control member 151 and the positions 149a, 149b and 149c correspond respectively with the positions 151a, 151b and 151c of this control member. When the valve 149 occupies the position 149b all of the unheated air delivered through the by-pass conduit 127 is supplied to the windshield clearing nozzles 145. When the valve 149 occupies the position 149c all of the unheated air supplied by the by-pass conduit 127 is diverted downwardly through the connection 147 into the main conduit 126 for mixing with the heated air being supplied through the latter. When the valve 149 occupies the position 149a it is in a partially open state and the character of the air then supplied to the windshield will depend upon the position of the valve 148. If the valve 148 is in its lower or closed position heated air will be directed upwardly through the connection 147 and the air then supplied to the windshield will be a mixture of unheated air from the by-pass conduit 127 and heated air from the main conduit 126. If the valve 148 occupies the position 148a while the valve 149 is in this partially open position 149a, a reduced volume of unheated air will then be supplied to the windshield. If the valve 148 occupies an intermediate position the air then supplied to the windshield will be a mixture of unheated air from the by-pass conduit 127 and heated air from the main conduit 126.

As mentioned above the driving means for the blower 124 includes the substantially constant speed coupling 122. The housing of this coupling carries a pulley 157. This coupling connects the blower 124 with the engine shaft 120 by the use of any suitable torque-transmitting means such as the endless belt 155 which extends around the pulleys 121 and 157, the latter being of a size to provide an appropriate ratio.

The intake 129 for the blower 124 is provided with a control valve 174 which is biased toward an open position by a

tension spring 175 in the same manner as the intake valve 99 of the apparatus of Figs. 2 and 4. A control knob 172 located on the instrument panel 115 is connected with the valve 174 by the flexible wire 176. The knob 172 also controls the energization of the magnetic coupling 122. The actuation of the valve 174 and the energization of the coupling 122 are effected in the same way and for the same purposes as described in detail above for the valve 99 and the magnetic coupling 89 in connection with the apparatus of Fig. 2 and the control means illustrated in Fig. 4.

As mentioned above, the conduit 140 through which heated liquid is supplied to the core 139 from the cooling system of the engine 117 contains a shut-off valve 142. It is desirable to be able to actuate this shut-off valve from the passenger compartment 111 and, for this purpose, a control member 178 is provided on the instrument panel 115 and which is connected with the shut-off valve by a flexible wire 179. The control member 178 permits the valve 142 to be opened or closed from the passenger compartment 111 so that either heated or unheated air can be supplied through the main conduit 126 as above explained.

From the foregoing description of the apparatus shown in Figs. 5 and 6 of the drawings it will now be readily understood that this invention provides improved vehicle heating and ventilating apparatus in which the blower and air heater are located in the engine compartment and in which control means operable from the passenger compartment makes it possible to vary the volume and condition of the air which is delivered to the passenger compartment. It will be seen also that since the blower is driven from a power take-off of the vehicle engine through a magnetic coupling which operates with slippage, the speed of the blower can be selected in accordance with the volume of air desired to be delivered to the passenger compartment and such selected

speed will be a substantially constant speed. It will be seen moreover that the improved apparatus provides for the delivery of air in either a heated or unheated condition to the windshield for defrosting or defogging purposes, and also that the system will operate in an efficient manner without placing any substantial load or drain on the battery or electrical system of the vehicle.

Having regard to the foregoing disclosure, the patent of which this specification forms part confers, subject to the conditions prescribed in the Patent Act, 1935, the exclusive right, privilege and liberty of making, constructing, using and vending to others to be used, the invention as defined in claims submitted by the patentee as follows:

1. In heating and ventilating apparatus for a vehicle having a passenger compartment and a variable speed driving engine provided with a power take-off, a heat-exchange device adapted to receive heat from said engine and having air delivery means connected with said compartment, an air impelling means connected with said heat-exchange device and operable to cause a flow of air through the latter and through said delivery means to said compartment, means operably connecting said impelling means with said power take-off including a magnetic coupling, and means for energizing said magnetic coupling, said coupling being operable with slippage such that said impelling means will be driven at a substantially constant speed for all operating speeds of the engine above a predetermined value and the volume of air delivered to said compartment by the impelling means will be substantially unaffected by variations in the operating speed of the engine above said predetermined value.

2. In heating and ventilating apparatus for a vehicle having a passenger compartment and a variable speed driving engine provided with a power take-off, a heat-exchange device adapted to receive heat from said engine and having air delivery means connected with said compartment, an air impelling means connected with said heat-exchange device and operable to cause a flow of air through the latter and through said delivery means to said compartment, a magnetic coupling having a variable speed input member connected with said power take-off and a substantially constant speed output member connected with said impelling means, and means for energizing said magnetic coupling, said coupling being operable with slippage such that said impelling means will be driven at a substantially constant speed for all operating speeds of the engine above a predetermined value and the volume of air delivered to said compartment by the impelling means will be substantially unaffected by variations in the operating speed of the engine above said predetermined value.

3. In heating and ventilating apparatus for a vehicle having a passenger compartment and a variable speed driving engine provided with a power take-off, a heat-exchange device adapted to receive heat from said engine and having air delivery means connected with said compartment, an air impelling means connected with said heat-exchange device and operable to cause a flow of air through the latter and through said delivery means to said compartment, means operably connecting said impelling means with said power take-off including a magnetic coupling operable with slippage such that said impelling means will be driven at a selected substantially constant speed for all operating speeds of the engine above a predetermined value and the volume of air delivered to said compartment by the impelling means will be substantially unaffected by variations in the operating speed of the engine above said predetermined value, and a circuit for energizing said magnetic coupling and including variable means for obtaining an energization of the coupling corresponding with said selected substantially constant speed.

4. In heating and ventilating apparatus for a vehicle having a passenger compartment and an engine compartment containing a liquid-cooled variable speed driving engine, said engine being provided with a power take-off and a liquid-containing cooling radiator, a heat-exchange device having a core which is connected with said engine and radiator for a circulation of heated liquid and also having air delivery means connected with said passenger compartment, an air impelling means connected with said heat-exchange device and operable to cause a flow of air through the latter and through said delivery means to said passenger compartment, means operably connecting said impelling means with said power take-off including a magnetic coupling, and means for energizing said magnetic coupling, said coupling being operable with slippage such that said impelling means will be driven at a substantially constant speed for all operating speeds of the engine above a predetermined value and the volume of air delivered to said passenger compartment by the impelling means will be substantially unaffected by variations in the operating speed of the engine above said predetermined value.

5. In heating and ventilating apparatus for a vehicle having a passenger compartment and a variable speed driving engine provided with a power take-off, a heat-exchange device adapted to receive heat from said engine and having air delivery means connected with said compartment, an air impelling means connected with said heat-exchange device and operable to cause a flow of air through the latter and through said delivery means to said compartment, means operably connecting said air impelling means with said power take-off including a magnetic coupling, means for energizing said magnetic coupling, said coupling being operable with slippage such that said impelling means will be driven at a substantially constant speed for all operating speeds of the engine above a predetermined value and the volume of air delivered to said compartment by the impelling means will be substantially unaffected by variations in the operating speed of the engine above said predetermined value, and valve means for controlling the delivery of air to said passenger compartment from said heat-exchange device.

6. In heating and ventilating apparatus for a vehicle having a passenger compartment and an engine compartment containing a liquid-cooled variable speed driving engine, said engine being provided with a power take-off at one end thereof and a liquid-containing cooling radiator adjacent said power take-off, a heat-exchange device located immediately adjacent said radiator and having a core which is connected with said engine and radiator for a circulation of heated liquid, an air delivery conduit connecting said heat-exchange device with said passenger compartment, an air impelling means located immediately adjacent said one end of the engine and connected with said heat-exchange device and operable to cause a flow of air through the latter and through said conduit to said passenger compartment, means operably connecting said impelling means with said power take-off including a magnetic coupling, and means for energizing said magnetic coupling, said coupling being operable with slippage such that said impelling means will be driven at a substantially constant speed for all operating speeds of the engine above a predetermined value and the volume of air delivered to said passenger compartment by the impelling means will be substantially unaffected by variations in the operating speed of the engine above said predetermined value.

7. In heating and ventilating apparatus for a vehicle having a passenger compartment, an engine compartment and a liquid-cooled engine in the latter compartment provided with a power take-off, an air heater located in the engine compartment and having a core and an air discharge means leading to said passenger compartment, means connecting said core with said engine to receive heated liquid therefrom and including a shut-off valve, a blower provided with a fresh air intake and connected with said air heater for the delivery of air to said passenger compartment through said core and discharge means, a magnetic coupling connecting said blower with said power take-off, said coupling being operable with slippage so as to drive said blower at a selected substantially constant speed for all engine speeds above a predetermined value, control means located in said passenger compartment and operably connected with said coupling including electrical means for varying the energization of the coupling to enable the selection of said substantially constant speed for the blower, and control means located in said passenger compartment and operably connected with said shut-off valve for controlling the supply of heated liquid to said core.

8. In heating and ventilating apparatus for a vehicle having a passenger compartment, an engine compartment and a liquid -cooled engine in the latter compartment provided with a power take-off, an air heater located in the engine compartment and having a core and an air discharge means leading to said passenger compartment, means connecting said core with said engine to receive heated liquid therefrom, a blower provided with a fresh air intake and connected with said air heater for the delivery of air to said passenger compartment through said core and discharge means, a substantially constant speed coupling for driving said blower from said power take-off, said coupling being operable with slippage such that the blower will be driven at a substantially constant speed for all engine speeds above a predetermined value, by-pass means extending around the core of said air heater for delivering unheated air to the passenger compartment from said blower, valve means for said discharge means and said by-pass means, and control means located in said passenger compartment and operably connected with said valve means for controlling the volume of air being supplied to the passenger compartment.

9. In heating and ventilating apparatus for a vehicle having a passenger compartment provided with a windshield, an engine compartment and an engine in the latter compartment provided with a power take-off and a liquid cooling system, an air heater located in the engine compartment and having a core connected with said cooling system and an air discharge means leading to said passenger compartment, a blower provided with a cold air intake and connected with said heater for the delivery of air to said passenger compartment through said core and discharge means, a substantially constant speed coupling for driving said blower from said power take-off, said coupling being operable with slippage such that the blower will be driven at a substantially constant speed for all engine speeds above a predetermined value, by-pass means extending around the core of said air heater for delivering unheated air from said blower into said passenger compartment at a point adjacent said windshield, valves for said air discharge means and said by-pass means, and control means in said passenger compartment and operably connected with said valves to actuate the same.

10. In heating and ventilating apparatus for a vehicle having a passenger compartment provided with a windshield, an engine compartment and an engine in the latter compartment provided with a power take-off and a liquid cooling system, an air heater located in the engine compartment and having a core connected with said cooling system and an air discharge means leading to said passenger compartment, a blower provided with a cold air intake and connected with said heater for the delivery of air to said passenger compartment through said core and discharge means, a substantially constant speed coupling for driving said blower from said power take-off, said coupling being operable with slippage such that the blower will be driven at a substantially constant speed for all engine speeds above a predetermined value, by-pass means extending around the core of said air heater for delivering unheated air from said blower to said passenger compartment at a point adjacent said windshield, valves for said air discharge means and said by-pass means, control means in said passenger compartment and operably connected with said valves to actuate the same, and means interconnecting said air discharge means and said by-pass means for diverting air therebetween.

11. In heating and ventilating apparatus for a vehicle having a passenger compartment, an engine compartment and a liquid-cooled engine in the latter compartment provided with a power take-off, an air heater having a core and an air discharge means opening into said passenger compartment, means connecting said core with said engine to receive heated liquid therefrom, a blower provided with a fresh air intake and connected with said air heater for the delivery of air to said passenger compartment through said core and discharge means, a substantially constant speed electromagnetic coupling for driving said blower from said power take-off, a circuit for energizing the coupling, said coupling being operable with slippage such that the blower will be driven at a substantially constant speed for all operating speeds of the engine above a predetermined value, an electric control device in said circuit for varying the energization of said coupling, an actuating member located in said passenger compartment and operably connected with said electric control device, a by-pass extending around said core for delivering unheated air to the passenger compartment from said blower, a valve controlling said by-pass, a valve controlling said air discharge means, and other actuating members located in said passenger compartment and connected with the valves of said air discharge means and by-pass.

12. In heating and ventilating apparatus for a vehicle having a passenger compartment, an engine compartment and a liquid-cooled engine in the latter compartment provided with a power take-off, an air heater having a core and an air discharge means opening into said passenger compartment, means connecting said core with said engine to receive heated liquid therefrom, a blower provided with a fresh air intake and connected with said air heater for the delivery of air to said passenger compartment through said core and discharge means, a substantially constant speed electromagnetic coupling for driving said blower from said power take-off, a circuit for energizing the coupling, said coupling being operable with slippage such that the blower will be driven at a substantially constant speed for all operating speeds of the engine above a predetermined value, an electric control device in said circuit for varying the energization of said coupling, an actuating member located in said passenger compartment and operably connected with said electric control device, a control valve in said fresh air intake, means connecting said valve with said actuating member so as to cause actuation of the valve simultaneously with the actuation of said electric control device, a by-pass extending around said core for delivering unheated air to the passenger compartment from said blower, a valve controlling said by-pass, a valve controlling said air discharge means, and other actuating members located in said passenger compartment and connected with the valves of said air discharge means and by-pass.

13. In heating and ventilating apparatus for a vehicle having a passenger compartment, an engine compartment and a liquid-cooled engine in the latter compartment provided with a power take-off, an air heater having a core and an air discharge means opening into said passenger compartment, means connecting said core with said engine to receive heated liquid therefrom, a blower provided with a fresh air intake and connected with said air heater for the delivery of air to said passenger compartment through said core and discharge means, a substantially constant speed electromagnetic coupling for driving said blower from said power take-off, a circuit for energizing the coupling, said coupling being operable with slippage such that the blower will be driven at a substantially constant speed for all operating speeds of the engine above a predetermined value, an electric control device in said circuit for varying the energization of said coupling, an actuating member located in said passenger compartment and operably connected with said electric control device, a control valve in said fresh air intake means connecting said valve with said actuating member so as to cause actuation of the valve simultaneously with the actuation of said electric control device, valve means controlling the supply of heated liquid to said core, a second actuating member located in said passenger compartment and operably connected with said valve means, a by-pass extending around said core for delivering unheated air to the passenger compartment from said blower, a valve controlling said by-pass, a valve controlling said air discharge means, and other actuating members located in said passenger compartment and connected with the valves of said air discharge means and by-pass.

14. In heating and ventilating apparatus for a vehicle having a passenger compartment provided with a windshield, an engine compartment and an engine in the latter compartment provided with a power take-off and a liquid cooling system, an air heater having a core and an air discharge means opening into said passenger compartment, means connecting said core with said engine to receive heated liquid therefrom, a blower provided with a fresh air intake and connected with said air heater for the delivery of air to said passenger compartment through said core and air discharge means, a substantially constant speed electromagnetic coupling for driving said blower from said power take-off, a circuit for energizing the coupling, said coupling being operable with slippage such that the blower will be driven at a substantially constant speed for all operating needs of the engine above a predetermined value, an electric control device in said circuit for varying the energization of said coupling, an actuating member located in said passenger compartment and operably connected with said electric control device, a control valve in said fresh air intake, means connecting said valve with said actuating member so as to cause actuation of the valve simultaneously with the actuation of said electric control device, a by-pass extending around said core for delivering unheated air from said blower to the passenger compartment at a point adjacent said windshield, a valve controlling said by-pass, a valve controlling said air discharge means, other actuating members located in said passenger compartment and connected with the valves of said air discharge means and by-pass, and means interconnecting said air discharge means and by-pass for diverting air therebetween.

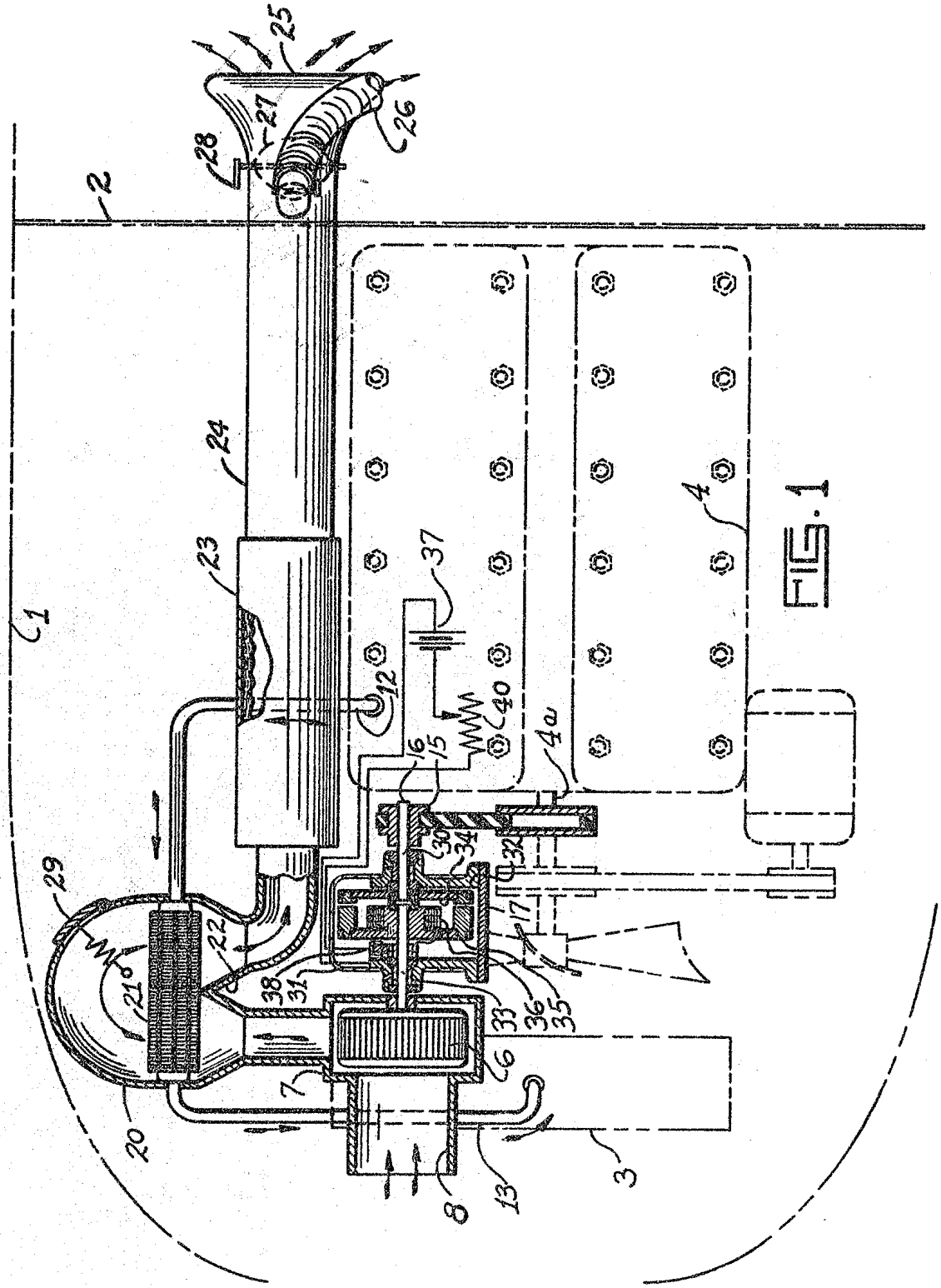

FIG. 1

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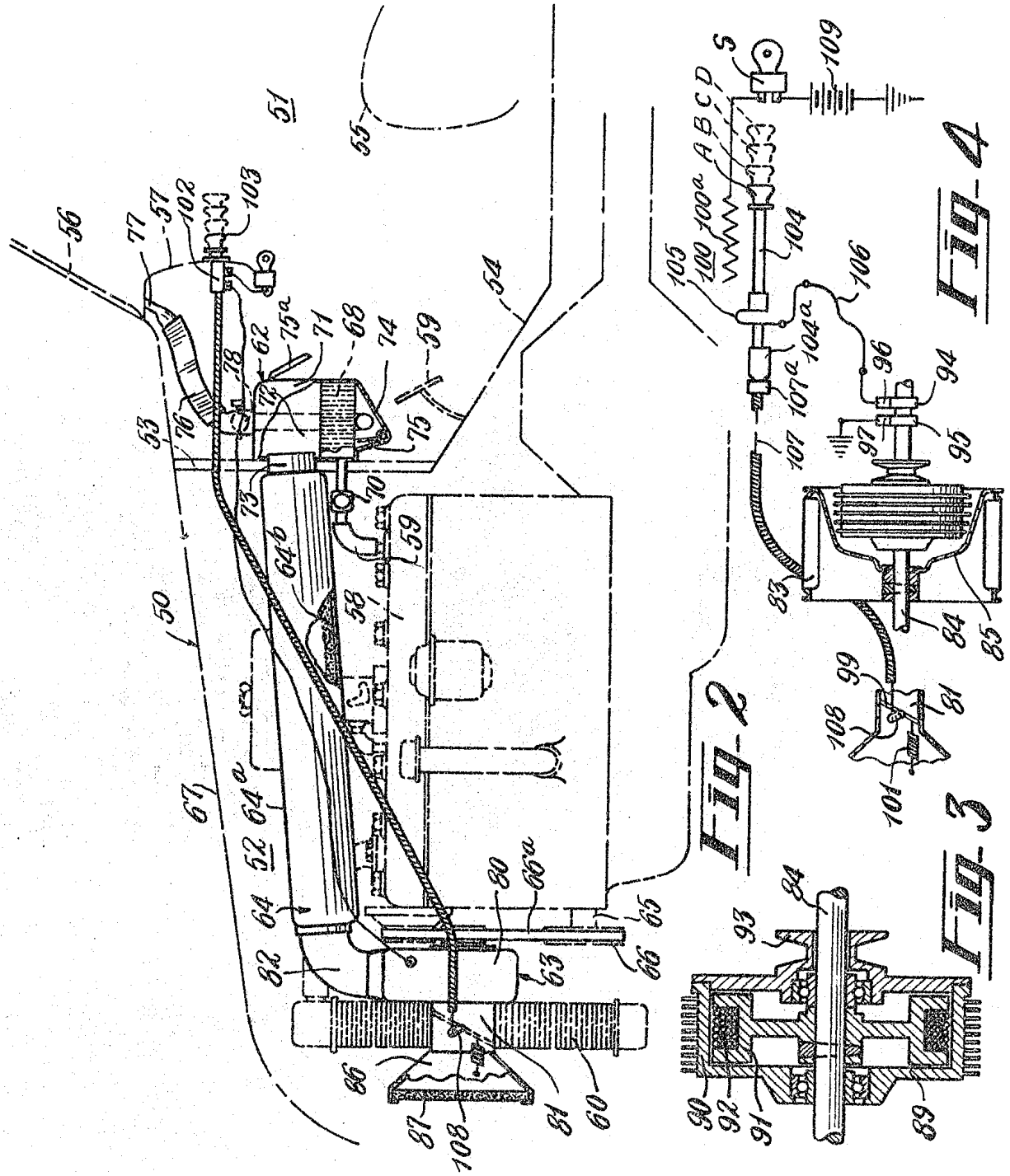
Certified to be the drawings referred to in the specification hereunto annexed.

Ottawa, Ontario, Canada, June 30th, 19 45.



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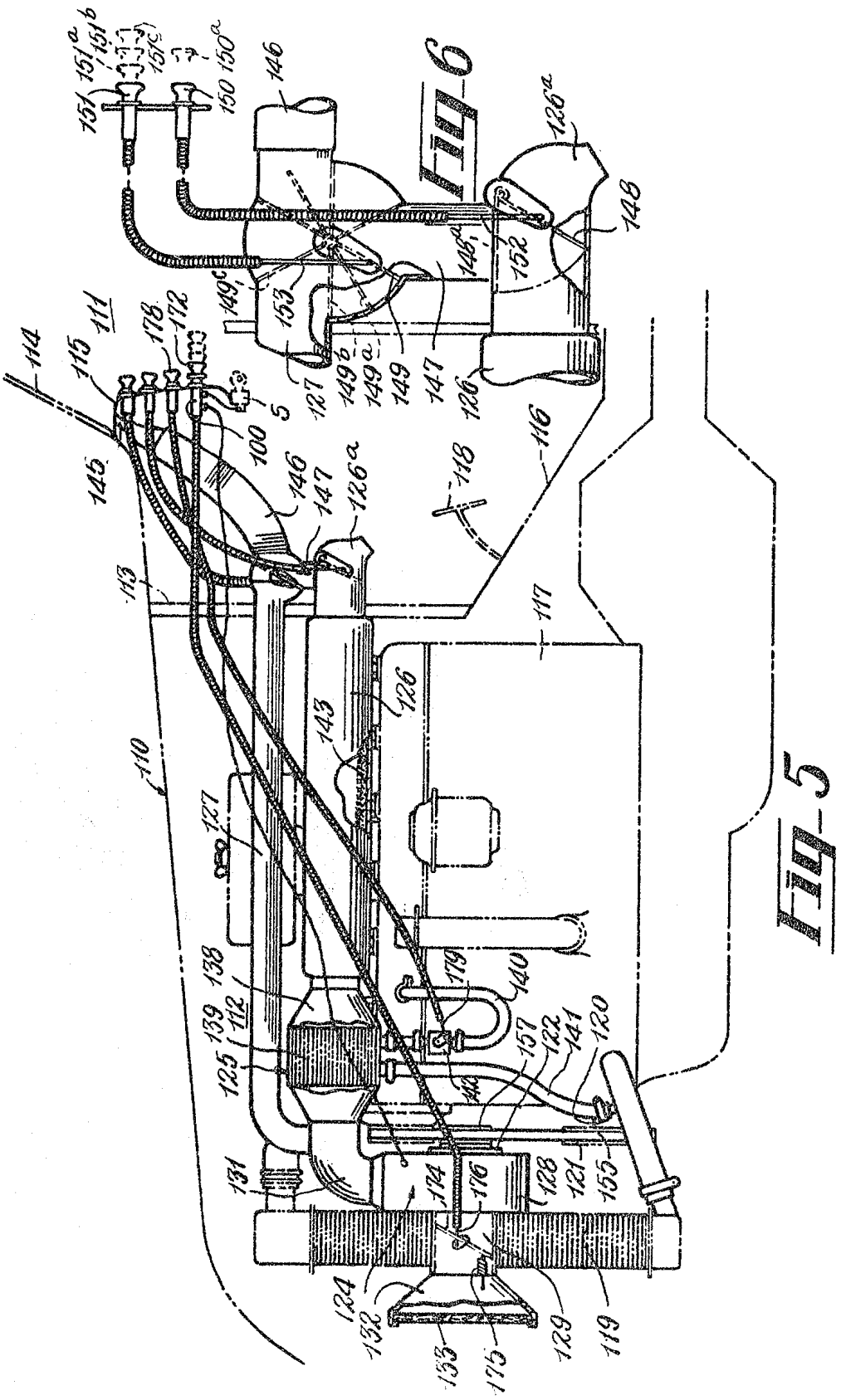

Fig. 5

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