

Aug. 24, 1948.

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2,447,723

THERMOSTATIC AIR CIRCULATION CONTROL

2 Sheets-Sheet 1

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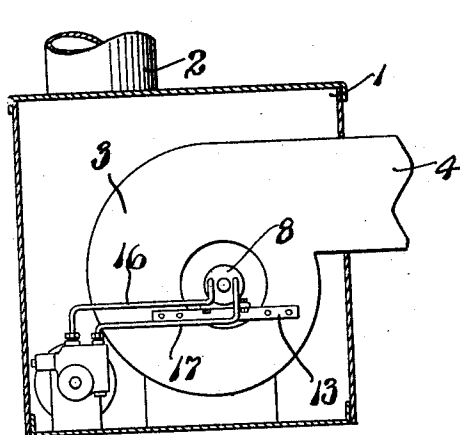


FIG. 1.

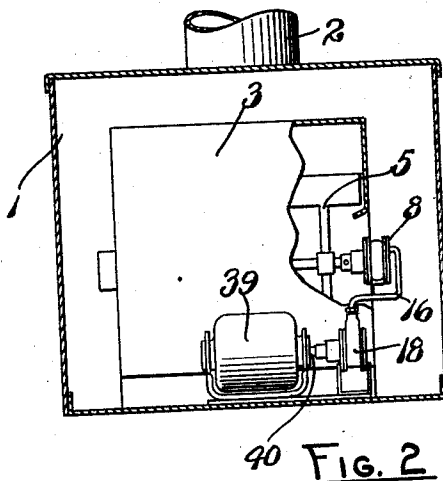


FIG. 2.

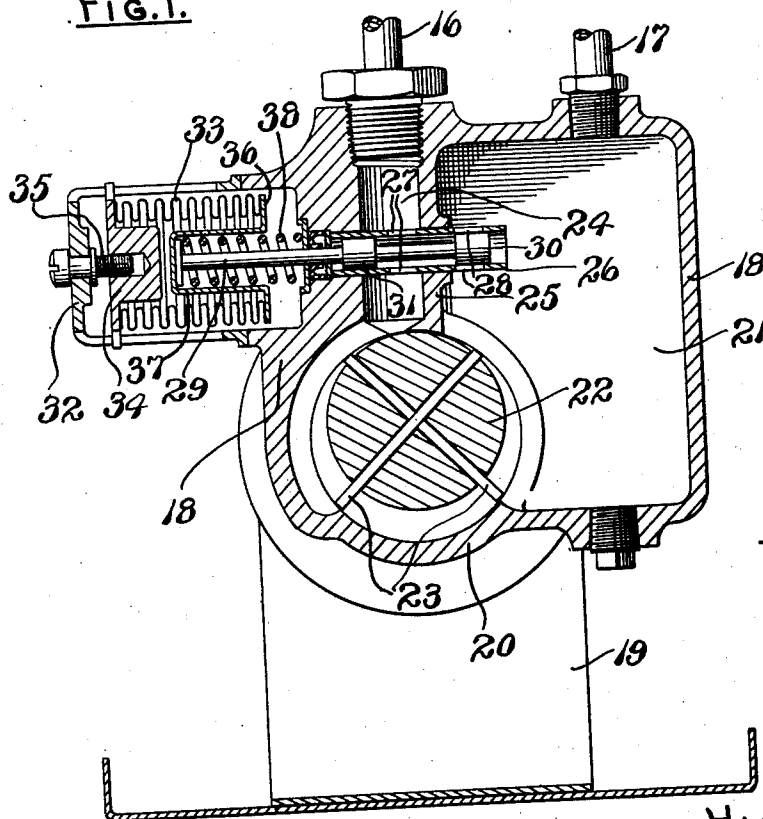


FIG. 3.

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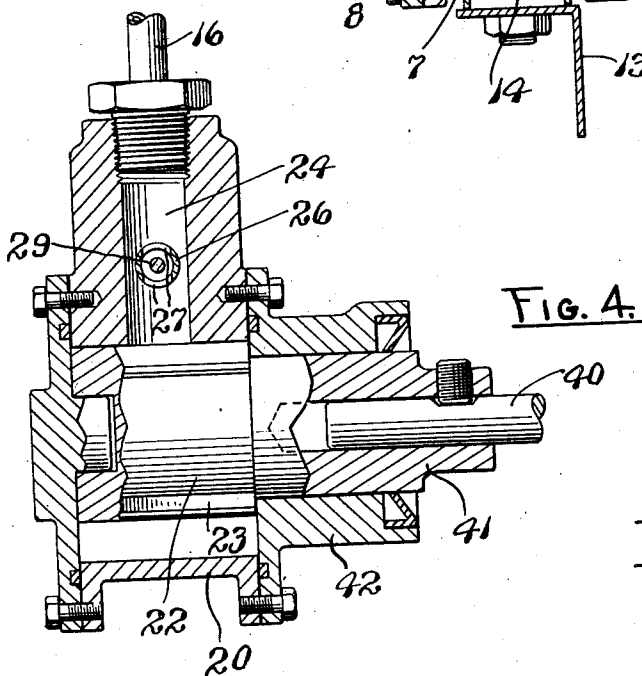
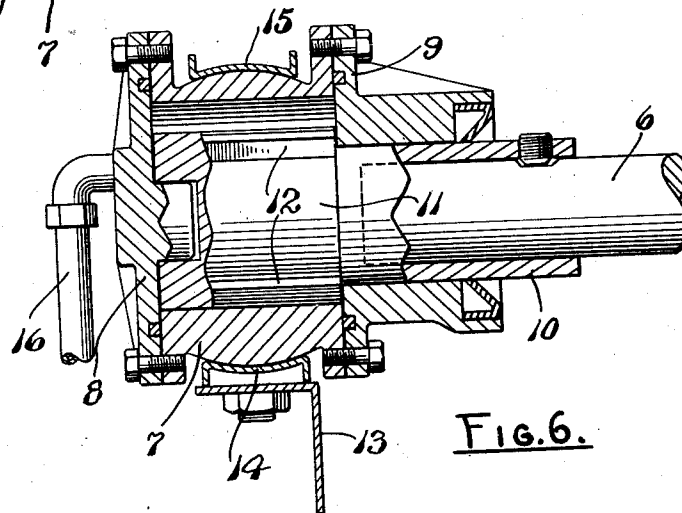
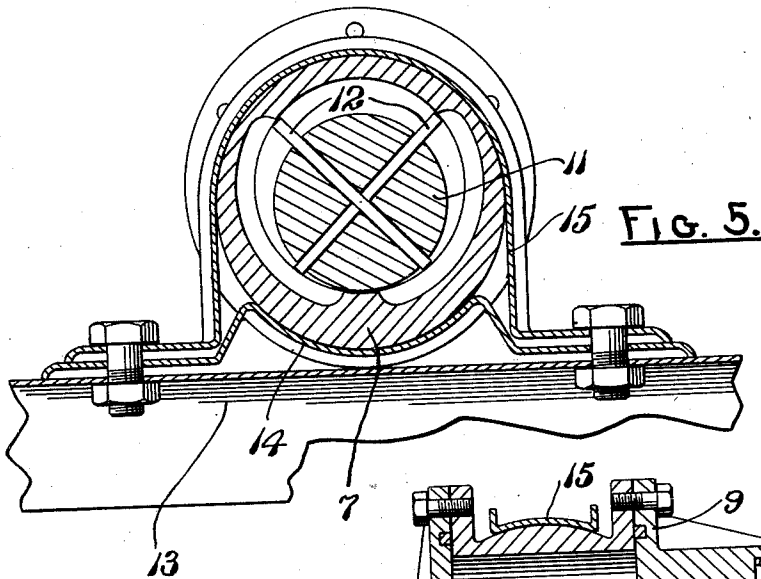
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2 Sheets-Sheet 2



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THERMOSTATIC AIR CIRCULATION
CONTROL

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7 Claims. (Cl. 230-11)

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The present invention relates to a control of the motor of an air fan or blower, for varying the speed of rotation of the motor and, therefore, of the fan, governed by the temperature of the air which is being forced by the fan out of the fan or blower housing. A constant speed electric motor is the prime mover preferably, in connection with this invention, and is used to drive a hydraulic pump, the liquid pumped thereby being carried to a hydraulic motor, the speed of rotation of which is in proportion to the quantity or amount of liquid which is pumped to it. With my invention, the flow of liquid pumped from the hydraulic pump to the fan connected hydraulic motor is automatically varied and is controlled by thermostatic means which is utilized to govern the area of passage of the liquid pumped by the pump, so that the liquid going from the pump to the motor is greater or less in accordance with the greater or less area of the passage therefor. In combination and association therewith, means are provided for a return to the liquid supply of such liquid pumped by the pump, which can not pass to the motor.

The invention is utilized in conjunction with the forcing or blowing, by a fan blower, of air of a raised temperature to a room or rooms of a house or building, the driving speed of the fan being decreased the higher the temperature of the air circulated or forced to a room or rooms to be heated, and increased when the temperature of the air is lowered.

It is a primary object and purpose of the present invention to provide a very effective, practical and serviceable unit for automatically achieving the variable operation of a blower fan from a constant speed driving motor, and dispense with expensive rheostat controls for an electric motor and also eliminate any necessity of using special fan constructions which may be adjusted, usually manually, to serve different conditions of service.

An understanding of the invention may be had from the following description taken in connection with the accompanying drawings, in which—

Fig. 1 is a side elevation, partly in section, of the thermostatic control installation of my invention.

Fig. 2 is a similar view at right angles to Fig. 1, showing an end elevation of the blower housing.

Fig. 3 is a vertical section through the hydraulic pump and the mechanism used to thermostatically control its working liquid passage therefrom.

Fig. 4 is a fragmentary vertical section through the pipe at right angles to the section shown in Fig. 3.

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Fig. 5 is a transverse vertical section through the hydraulic motor operated from the pump, and

Fig. 6 is a longitudinal vertical section there-through.

Like reference characters refer to like parts in the different figures of the drawing.

Within an closed compartment 1, the air which is to be placed under forced circulation by the blower fan is entered through an inlet pipe or conduit 2. The blower fan housing 3 has an outlet 4 extending from the compartment and within the housing any conventional form of rotatable fan blower 5 is mounted being shown mounted for rotation about a horizontal axis, at one end upon a bearing at a side of the housing 3 and at the other side having a shaft 6 which is directly connected with the rotor of a hydraulic motor.

The hydraulic motor (Fig. 6) comprises a casing 7 open at both ends and closed at its ends by end plates 8 and 9, the latter having a relatively extended bearing for a sleeve 10 extending from the rotor 11 of the motor which is eccentrically mounted within the cylindrical chamber within the housing 7. The shaft 6 extends into the sleeve 10 (Fig. 6) and may be keyed or connected as shown by a set screw. The rotor 11 is of the conventional type used in hydraulic motors carrying diametrically mounted movable vanes 12. The detail of the hydraulic motor need not be entered into as such type of motor is well known.

The motor is preferably mounted upon an angle bar support 13 secured at a side of the blower housing 3, utilizing two clamping brackets or bands 14 and 15, one passing underneath the casing 7 and the other over it and both secured to the support 13 by bolts as shown in Fig. 5.

The motor is supplied with inlet and outlet pipes or conduits 16 and 17 connected with the interior chamber. The liquid under pressure for driving the rotor 11 is supplied through the inlet pipe 16 and the exhaust or return of the liquid is through the pipe 17. Both of said pipes are connected at their opposite ends with the housing or casing 18 of a hydraulic pump which is preferably supported by supporting standards 19 which may rest upon the floor of the compartment 1.

The housing or casing 18 of the pump has a cylindrical recess bounded by cylindrical walls 20 adjoining and associated with which is a liquid supply chamber 21 (Fig. 3) for supplying liquid to the pump. The return of the exhaust liquid from the hydraulic motor previously described is to the chamber 21 as shown in Fig. 3. The rotor 22 of the hydraulic pump is of cylindrical form

eccentrically located in the cylinder 20 and having the diametrically positioned vanes 23 of usual construction.

The outlet of liquid forced or pumped outwardly is through an outlet passage 24 in communication with the pipe 16, which is connected to the inlet of the hydraulic motor.

A cylindrical sleeve 26 is mounted across and extends at its inner end beyond the inner side of the sleeve 25, extending across the vertical outlet passage 24 and, as shown in Fig. 4, the exterior diameter of the sleeve or cylinder 26 is less than the interior diameter of the passage 24. In said cylinder 26 two pairs of openings 27 and 28 are cut in its upper and lower sides. The openings 27 are made through the cylinder 26 within the passage at 24, while the openings 28 are at the inner end portion of the cylinder 26 and beyond the adjacent side of the sleeve 25, or in the chamber 21.

A piston rod 29 is equipped with two spaced pistons 30 and 31 as shown in Fig. 3, and extends through the outer end of the cylinder 26. The pistons 30 and 31 are so located within the cylinder 26 with respect to the openings 27 and 28 therein that, when located as shown in Fig. 3, with the openings 28 covered by the piston 30, the openings at 27 are open to their full extent, in which case all of the liquid pumped by the rotary pump will pass to and through the pipe 16, passing through the vertically aligned passage 27 and at opposite sides of the cylinder 26. But with the piston rod 29 and the pistons 30 and 31 thereon moved to the right the openings at 28 will be uncovered more or less, depending upon the extent of movement, and the passage through the vertically aligned openings 27 will be reduced to a greater or less extent, and there will be provided a passage of liquid from the pump through the lower opening 29 and thence to the lower opening 28 so that a part of the liquid taken from the chamber 21 will be returned to such chamber without passing through the liquid circuit of pipe 16, the fan driving motor and return pipe 17. When such flow of liquid is thus lessened, the hydraulic motor connected with the fan blower will receive only a part of the pump output and its speed of rotation will be correspondingly reduced.

An open frame housing 32 is connected at one side of the casing or housing 18, its horizontal axis being coincident with the axis of the piston rod 29, within this housing an expansible and contractable thermostatic element is located, including a flexible metallic bellows 33 sealed and closed at its outer end by a closure plate 34 which may be adjusted with respect to the outer end of the housing 32 by the adjusting screw 35 as shown. The other end of the expansible and contractable bellows is closed and sealed by a plate 36 the central portion of which has a relatively deep cylindrical recess 37 therein against the bottom of which a head at the outer end of the piston rod 29 is seated. A coiled compression spring 38 at its outer end bears against the head at the outer end of the rod 29, and at its opposite end against the housing or casing 18.

The position of the pistons 30 and 31 is therefore governed by the thermostatically expanding and contracting bellows element, sometimes known as a Siphon, which elongates with increases in temperature and contracts with decreases in temperature due to the expansion and contraction of the gaseous material which is sealed within such thermostatic Siphon element.

Such thermostatic bellows is old and well known and has been used in many relations. Thus when the temperature of the air supplied through the pipe 2 to the chamber 1 is high, causing the thermostatic bellows to expand and elongate, the openings at 27 will be closed in effective passage areas by the piston 31 in accordance with the degree or extent of expansion of the thermostatic bellows, with a corresponding curtailment or diminution of the flow of liquid pumped by the hydraulic pump to the fan driving hydraulic motor; and when the temperature of the air supplied to the pipe 2 is lowered the effective passage openings 27 will be increased and the fan driving motor will be correspondingly stepped up in its speed of rotation, so that with varying quantities of air circulated by the fan blower the quantity of heat measured in thermal units supplied may be rendered substantially constant.

The hydraulic pump is driven by an electric motor 39, the shaft 40 of which is connected with an extension 41 to the rotor 22 of the pump. The pump chamber is closed by end plates one of which has a relatively long bearing extension 42 in which said rotor extension 41 is rotatably mounted (Fig. 4).

With the construction described varying quantities of air supplied to heat desired spaces in the way of rooms, houses or buildings, with the supplying substantially of an even and constant quantity measured in units of heat despite temperatures of the air which carries the heat may be obtained; using a constant speed driving motor for the unit to drive a hydraulic pump at a constant speed, but with a control of the liquid pumped by the pump to carry varying quantities thereof to the hydraulic motor connected with and driving the fan blower. Such control is thermostatically operated in conjunction with the temperature of the air which is to be circulated by the fan blower, said fan blower being driven at less speed with air of higher temperatures and at greater speeds with air at lower relative temperatures.

The construction is compact, easily manufactured and assembled, is adjustable for substantially all working conditions met with, is relatively economical to produce, and in general has proven very satisfactory.

The invention is defined in the appended claims and is to be considered comprehensive of all forms of structure coming within their scope.

I claim:

1. In a construction as described, a rotatably mounted fan, a hydraulic motor for driving said fan, a hydraulic pump for driving said motor, a continuous speed motor for driving the pump at a continuous speed, and valve means interposed between said pump and the fan driving motor for controlling the passage of hydraulic fluid from the pump to said motor, combined with temperature actuated means for automatically controlling said valve means in accordance with the temperatures to which said temperature sensitive means is exposed.

2. The elements of claim 1 in which said valve means acts to by-pass liquid from the outlet to the inlet side of said pump.

3. In a structure as described, an enclosed compartment having an inlet for the conducting of air at varying temperatures therein, a blower housing in the compartment having an outlet extending through a wall of and away from said compartment, a rotatable fan mounted within said housing, a hydraulic motor for driving the

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fan, a hydraulic pump, a constant speed motor for driving said pump, conduit means having a continuous passage between the pump and said hydraulic motor for conducting pumped liquid to said motor, means for returning the liquid from hydraulic motor to said pump, movable valve means for opening or partially closing the passage in said conduit means from the pump to the hydraulic motor for varying the speed of the hydraulic motor in relation to a constant speed of rotation of said pump, and temperature sensitive expanding and contracting means operatively connected with said valve means to move the valve toward or to open position on contraction of said temperature sensitive means, and in the opposite direction to partially reduce the quantity of liquid pumped by said pump to the hydraulic motor, the degree of reducing said liquid flow increasing upon increases of temperature of air supplied to said compartment and to which air said temperature sensitive means is exposed.

4. A construction as defined in claim 3, said valve means including a cylindrical sleeve extending across the passage in said conduit means between said pump and hydraulic motor, the sleeve having an exterior diameter less than the interior diameter of the passage, and said sleeve having opposed openings through its sides within the said passage, a piston rod extending between said temperature sensitive expanding and contracting means into said cylindrical sleeve, and a piston within the sleeve on said rod adapted to be moved between positions in which said openings through the sleeve are wholly uncovered or partially covered by said piston.

5. In a construction as described, a blower housing having air inlet and outlet, a fan blower mounted for rotation within the housing, a hydraulic motor connected to said fan for rotatably driving it, a hydraulic pump for driving said pump said hydraulic pump including a housing with an outlet thereto having a passage for the flow of liquid pumped for said pump, a cylindrical sleeve

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positioned across said passage and carried between pump housing, said sleeve having opposed openings through its sides spaced from each other in the direction of said passage, a piston rod extending into one end of the sleeve, a piston of said rod within the sleeve, an expanding and contracting thermostatic bellows adapted to be held in a fixed position at one end relative to said sleeve, the other end being movable towards or away from said sleeve upon increases or decreases of the temperatures to which the bellows is exposed, the outer end of said piston rod bearing against said movable end of the bellows, a compression spring between the bellows and the pump housing, and a conducting pipe between said hydraulic motor and the pump housing in conjunction with the outlet passage from said pump.

6. A construction as defined in claim 5, and means for adjustably mounting the outer end of said bellows for adjustment towards or away from said pump housing and for holding it fixed in any position to which adjusted.

7. A construction as defined in claim 5, said pump housing including walls surrounding an oil supply chamber, a return pipe leading from the hydraulic motor to said chamber, said sleeve extending at its inner end into said chamber, and said sleeve having additional openings at opposite sides within the chamber, and a second piston on said piston rod located distances apart greater than the spaces between the openings in the sides of said sleeve from each other.

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