

Dec. 17, 1940.

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2,225,071

HEAT TRANSFER DEVICE

Filed July 15, 1937

2 Sheets-Sheet 1

Fig. 1

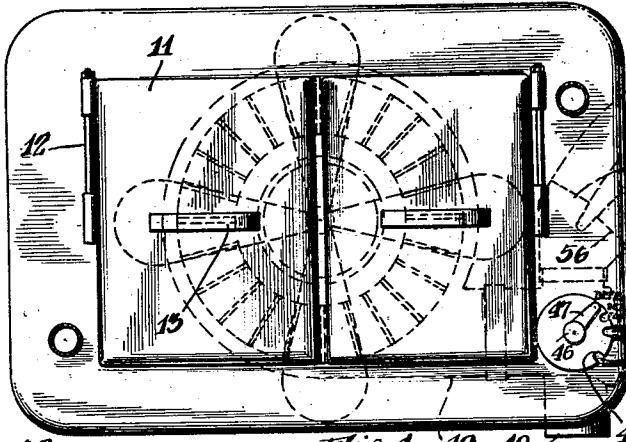


Fig. 2

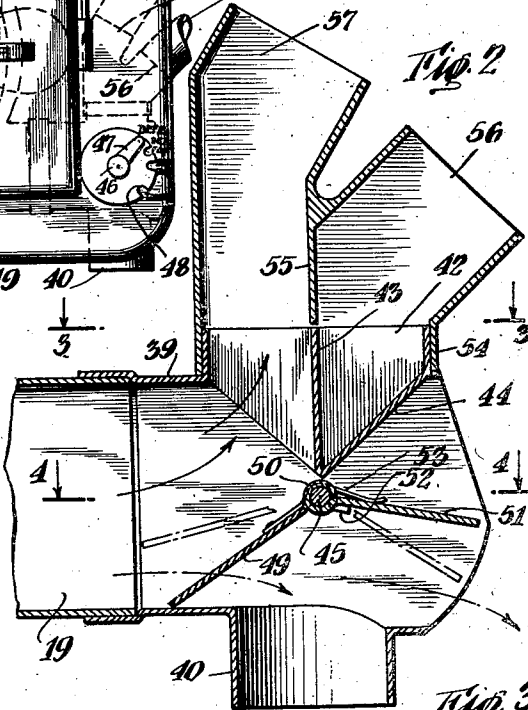


Fig. 4

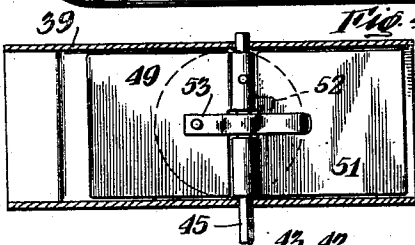


Fig. 5

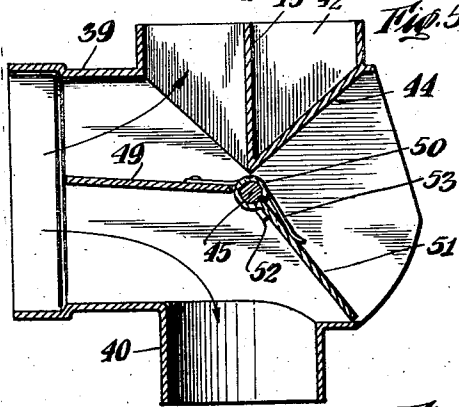


Fig. 6

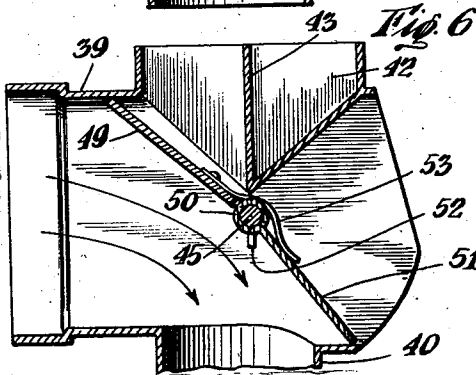
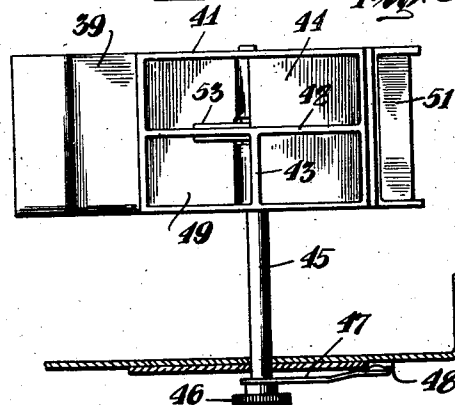


Fig. 3



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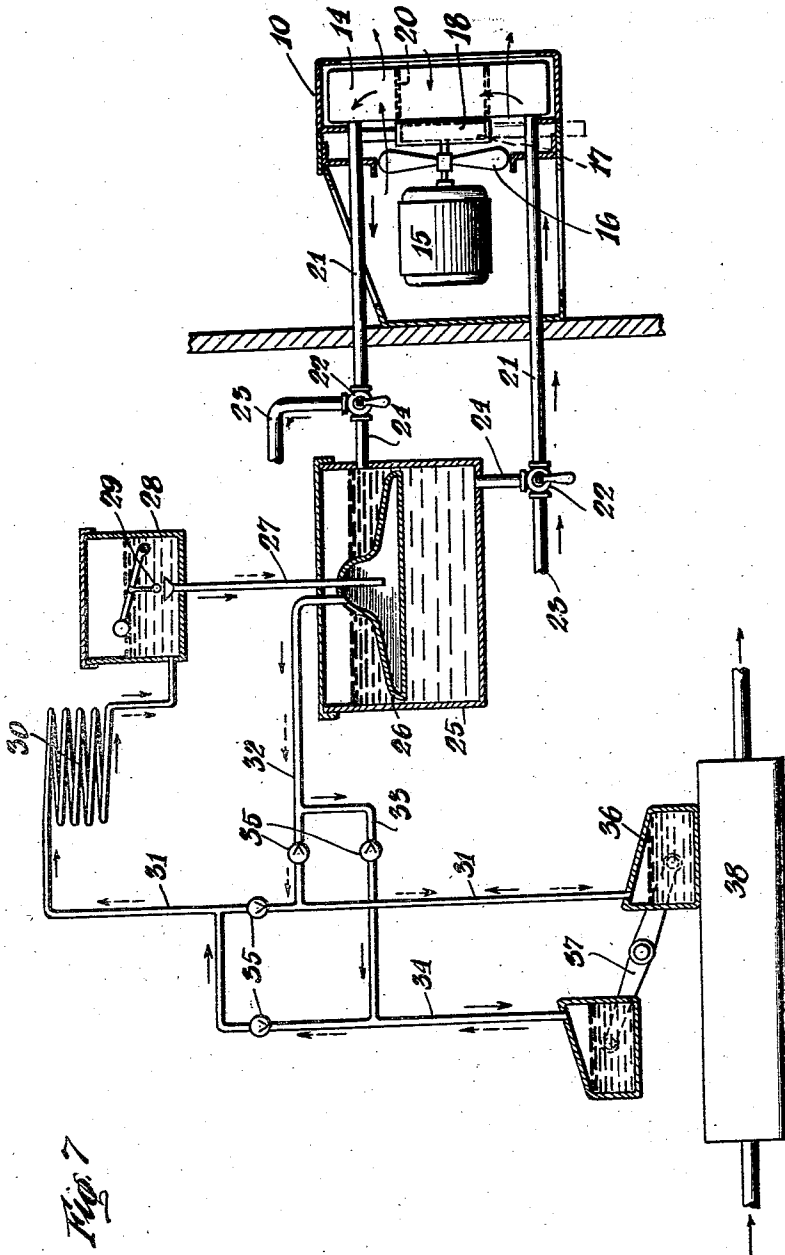
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HEAT TRANSFER DEVICE

Filed July 15, 1937

2 Sheets-Sheet 2



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## UNITED STATES PATENT OFFICE

2,225,071

## HEAT TRANSFER DEVICE

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Application July 15, 1937, Serial No. 153,743

4 Claims. (Cl. 237—1)

This invention relates to a structurally and functionally improved control or valve capable of use in numerous different associations, but primarily intended to be employed in connection with a heat-exchange unit, and especially a heater of the automobile type.

Still another object is that of furnishing an apparatus of this character which will embody relatively few and individually rugged parts, capable of quantity manufacture and assemblage by comparatively unskilled labor, so that the entire apparatus may be marketed for a nominal figure. Moreover, an apparatus provided in accordance with the teachings of this invention will function over long periods of time with freedom from all difficulties and at minimum expense.

With these and other objects in mind, reference is had to the attached sheets of drawings, illustrating practical embodiments of the invention and in which

Fig. 1 is a face view of a heat exchange or transfer device and showing an improved control in association therewith;

Fig. 2 is a sectional side view of such control; Figs. 3 and 4 are sectional plan views, taken along the lines 3—3 and 4—4 respectively, and in the direction of the arrows of Fig. 2;

Figs. 5 and 6 are views similar to Fig. 2, but showing the parts adjusted to a different position, and

Fig. 7 is a diagrammatic view showing the layout of apparatus and particularly the method of connecting the primary heat transfer device to the operating mechanism;

Referring first to Fig. 7, it will be understood that the present invention has been illustrated in a layout such as would conveniently exist in a more or less conventional motor vehicle. The structure illustrated in Fig. 7 forms the subject-matter of a separate application which has been patented in United States Patent No. 2,148,571 issued February 28, 1939. Therefore, except insofar as the disclosure in Fig. 7 is necessary for an understanding of the present subject matter, it may be disregarded. Considering this figure in conjunction with Fig. 1, the numeral 10 indicates a casing with which any desirable type of control panels 11 may be associated as, for example, by hinges 12. These hinges may be of such type as will maintain the panels in any position to which they have been adjusted by handles 13 or otherwise. Conveniently adjacent the forward end of casing 10 is a core 14. To the rear of this core a motor 15 is positioned and serves to drive

through its shaft a fan 16 and blower wheel 17. The latter is arranged within a casing 18 from which a duct 19 extends. The core 14 of course includes headers between which there is interposed a heat transfer structure of a honeycomb, tube, or any other convenient type. This has not been shown in detail because it is well known in the art and to do so would amount to mere surplusage.

Suffice it to say that as illustrated the blower wheel will suck air through the central portion of core 14 and discharge such air through duct 19, while fan 16 will blow air outwardly through the core, such air being conveniently controlled by the panels 11. In case a cellular type of core is employed, all areas of the same are transversely segregated by the cells which, in effect, provide partitions. If, however, a tube or similar type of core is employed, then partition members 20 indicated in dotted lines in Fig. 7 may be utilized to prevent conflict between the opposing air flows, as induced by the fan and blower wheel.

At this time it is to be understood that the heat transfer device, as heretofore described, is merely provided for the purpose of depicting operative and complete combination of mechanism. Many other types of units could be properly employed. All of these, however, would have the same general characteristics, including a motor, air impeller, heat transfer core and probably casing and control panels. They might, or might not include the blower wheel and the mechanism associated therewith, although it is preferred, in a complete apparatus, that a structure be employed such that an air flow distinct from that directly discharged by the fan be provided for.

In any event, however, there extends from the core tubes 21 which, as shown in Fig. 1, are preferably connected adjacent opposite corners of the core headers so that the benefit of thermo-siphon action may be had. These tubes are connected by valves 22 to further tubes 23 coupled, for example, to the cooling system of an internal combustion motor so that heated fluid from the latter may flow through the core, thus heating the latter. The details of such connection are also well known to those skilled in the art and therefore also will not be described herein.

It is to be understood that valves 22 are of such type that they may optionally couple tubes 21 to tubes 23 or tubes 24. Such valves may also function to completely isolate tubes 21 from tubes 23 or 24, so as to preclude circulation of fluid through the core. Tubes 24 are connected adjacent the upper and lower ends of a tank 25 con-

taining a brine or similar solution. Within this tank an evaporator 26 is disposed. A conduit 27 extends from the evaporator to a chamber 28 within which a float controlled valve 29 is arranged for the purpose of governing the height of the liquid within the same. A condenser 30 is coupled to chamber 28 and this condenser should be so disposed that cooling fluid may circulate in contact therewith. In the case of a motor vehicle, the condenser may be conveniently arranged in the slip stream of the fan which is associated with the radiator of such vehicle. A tube 31 is connected to the condenser 30 and a branch 32 extends from the evaporator and is connected to such tube 31. A further branch 33 extends from branch 32 and is connected to a tube 34 also having connection with tube 31. Check valves 35 are interposed in branch 33 and between the point of coupling of the latter with branch 32 and the connection of such branch 32 with tube 31. Moreover, above the latter point of connection a further check valve is disposed in tube 31 and tube 34 has a final check valve interposed within its body between the points at which it connects with branch 33 and tube 31. These check valves are all arranged to act in the manner indicated and tubes 31 and 34 are coupled to silica gel adsorbers 36 conveniently coupled to each other by a shifting lever 37. Of course tubes 31 and 34 at least adjacent their outer ends must incorporate a structure such that the adsorbers may be shifted. Such structure may take numerous desired forms and has therefore not been illustrated in detail. One suggested form is that of armored flexible tubing to be provided adjacent the lower ends of tubes 31 and 34.

In any event the adsorbers may be brought in contact with a source of heat as, for example, the exhaust manifold 38. With a refrigerant such as SO<sub>2</sub> (sulphur dioxide), it is obvious that with the parts in the position shown in Fig. 7, the cycle of operation will be similar to that indicated by the full line arrows. In other words, the vaporized refrigerant will move up tube 31, past the check valve arranged in such tube, and through condenser 30. It being thus converted into a fluid, it will flow into chamber 28 and under the control of valve 29 will flow into the evaporator 26. Thence it will flow through branch 32 and thence to branch 33 and so to the left hand adsorber as viewed in Fig. 7. After the right hand adsorber has been more or less completely discharged, it will be obvious that the left hand adsorber will be charged. Thereupon, by simple shifting lever 37 the operator will cause a flow similar to that just described, but in which the cycle will be as indicated by the fragmentary arrows.

Under these circumstances it will be apparent that the fluid within tank 25 will be cooled and if the valves 22 are properly set, this fluid, or its functional equivalent, will flow through core 14. Such flow may conveniently occur incident to the thermo-siphon circulation provided by the coupling of tubes 24 to tank 25. Of course, if a pump should prove desirable, such an element may readily be interposed in this line to thus accelerate the circulation of cooling fluid.

Thus it is apparent that if the valves 22 are properly set, the dry bulb temperature of core 14 may be efficiently lowered and that by a layout of mechanism such as that presently proposed a constantly functioning system is presented. Again, by properly setting the valves 22, the core may be coupled to a source of heated fluid, thus raising its dry bulb temperature. In

either event, the air circulated through the core by the impellers 16 and/or 17 will properly heat or cool the space with which the core is in communication or within which it is disposed.

As afore brought out, it is preferred that whatever the type of unit employed, at 10 to 20 inclusive, a separate flow distinct from the ordinary flow of air, be provided for, as for example by the blower wheel 17. Regardless of how this flow is created, a duct such as 19 will receive this distinct flow. Under ordinary conditions of installations, the flow through this duct or its equivalent, should, at the will of the operator, be capable of being directed, for example, to a surface to be defrosted; to such surface and a locality which is to be especially warmed; again, to such surface and, for example, in the form of a concentrated flow to a remote portion of the space which is generally being warmed, or entirely to the remote portion of such space for the purpose of cooling or warming. In the case of a motor vehicle, the surface may, for example, be the windshield, the area to be especially warmed may be adjacent the feet of the driver, and the relatively remote locality may, for example, be in the rear compartment of the tonneau.

A control conveniently achieving this purpose and which may be employed quite independently of the layout of apparatus shown in Fig. 7, has been particularly illustrated in Figs. 2 to 6, inclusive. In these views the numeral 19 indicates the duct afore noted and to which a control body is coupled, including a passage 39 to be coupled to duct 19. Extending from the base of the body is an outlet 40 and no cover portion extends between the far side edges of the side walls providing such body. Accordingly, at this point an opening is also provided through which air may flow. Adjacent its upper end the body has discharge openings defined by a flange 41, and central and transverse partitions 42 and 43 respectively. Moreover, it is to be noted that while the transverse partition 43 extends between one side face of the flange 41 and the central partition 42, it is preferable that no such partition be provided between the opposite face of the center partition 42 and the opposite side flange portion 41. Instead, an inclined partition 44 is provided. This partition extends for example to a point centrally of the body of the control. Adjacent this point a shaft 45 is rotatably mounted and this shaft projects beyond the body and for example through the casing 10 in the manner indicated in Fig. 1. At its outer end, the shaft may be provided with a manipulating knob 46 and a spring detent 47 riding within a series of notches 48 and serving to maintain the shaft in any position to which it has been adjusted. Affixed to shaft 45 is a flap 49. Rotatably encircling the shaft is the hub portion 50 of a flap 51. A stop member 52 is formed integral with, or fixed with respect to shaft 45 and flap 49. This stop member may bear against one face of flap 51 after flap 49 has been swung to a position to accomplish this. Also conveniently secured to flap 49 is a spring 53 which bears against that face of flap 51 which is opposite to the one engaged by stop 52.

It follows that with the parts in the position shown in Fig. 2, all air discharged by duct 19 will be diverted by flap 49 into the passage defined by partitions 42 and 44 and flange 41, as well as the opening defined by flange 41 and partitions 42 and 43. If now shaft 45 is turned so that detent 47 engages the next notch, spring 53

will maintain flap 51 in contact with stop 52 so as flap 49 elevates to the position indicated in dash lines in Fig. 2, flap 51 will lower to its similarly indicated position. Under these circumstances air will flow upwardly through the aforementioned openings defined by partitions 42, 43 and 44, and flange 41, and will also flow between the edges of the side and top walls of the control body. These may extend towards the feet of the passenger or driver and this air will be accordingly directed. It will not tend to flow through the collar or outlet 40 because of the disposition of flaps 49 and 51 and/or the fact that collar 40 is to be connected to a conduit (not shown) which will naturally offer a certain amount of resistance to flow. If now shaft 45 is turned so that the detent 47 engages a further notch, the air discharged by duct 19 will flow in the manner indicated in Fig. 5. Under these circumstances air will still discharge through the upper openings (assembly 41 to 44 inclusive), but may not flow between the spaced right hand edges of the body as viewed in the various figures under consideration. This will be because flap 51 will now be in the position shown in Fig. 5 and will obstruct such flow. Instead, the air flowing under flap 49 will be diverted under collar 40. Flap 51 has now reached its one extreme of movement, but due to the "loose" coupling between it and shaft 45, the latter may still be turned to cause a shifting of flap 49 from the position shown in Fig. 5 to that shown in Fig. 6. Under these circumstances, warm or cool air discharged by duct 19 will be bodily diverted through collar 40.

There may be secured to the flange 41 a fitting such as has been especially shown in Figs. 1 and 2. This includes a portion 54 conveniently encircling flange 41 and a central partition 55 defining a right hand passage 56 and a left hand passage 57. To these may be coupled conduits 58 leading, for example, to left hand and right hand defroster nozzles or discharge outlets for the similar portions of a windshield. Substantially equal volumes of air will be discharged through each of the conduits 58, due to the particular construction as illustrated, especially in Fig. 3. It has already been seen that air discharged between the free and right hand edges of the body will, for example, serve to warm or cool the feet of the driver or passenger. Air flowing through collar 40 will again heat or cool (as desired) a remote portion of the enclosure as for example the rear of the tonneau, and thus it is apparent that a control is furnished which may be used in the particular association afore described in connection with Fig. 7, or which may be utilized in association with any other desired form of heat transfer unit to place within the will of the operator any desired regulation of air flow.

It is, of course, understood by those skilled in the art, that the motor 15 is controlled preferably by a variable rheostat which may also have a disconnect provision such that the operation of the motor may be interrupted. Thus again the volume of air may be regulated with nicety, this being quite aside from the control afforded by valves 22 or any other forms of regulating valves which are employed.

In conclusion, it will be understood that whenever air is being distributed through passages 56 and 57, the flow through each of these passages will be substantially equal. This is because the air column has been "split" incident to the pro-

vision of partitions 42, 43 and 44 before it has entered the Y fitting. It has been found that if an attempt were made to distribute the air by simply utilizing the fitting with or without its central partition 55, the distribution of air through passages 56—57 would be unequal and unsatisfactory. However, by the arrangement shown, or its functional equivalent, all difficulties in this connection are avoided, it being understood that while the partition 55 of the fitting extends across both outlets of the control casing, an equalized flow will nevertheless occur. This is because of the tendency of the air flowing over partition 44 and diverted by flap 49 to follow along the surface of such partition in the form of a relatively thin layer, such air naturally entering passage 56. Substantially no air deflected by partition 44 will enter passage 57, the latter receiving its air incident to the alignment of partition 43 with the central partition 55.

Obviously, numerous changes in construction and rearrangement of the parts might be resorted to without departing from the spirit of the invention as defined by the claims.

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

1. A heat exchange device including a heat transfer core, air impelling means associated therewith and to provide a column of air which has been exposed to contact with said core, a control including a body having at least three outlet openings, said body being connected to said apparatus to receive said column of air, and a valve including a shaft movably associated with said body and a pair of flaps, one fixed with respect to said shaft and the other movably disposed thereon.

2. A heat exchange device including a heat transfer core, air impelling means associated therewith and to provide a column of air which has been exposed to contact with said core, a control including a body having at least three outlet openings, said body being connected to said apparatus to receive said column of air, a valve including a shaft movably associated with said body, a pair of flaps, one fixed with respect to said shaft and the other movably disposed thereon, and a stop and spring connected to said shaft and bearing against said last named flap to control the position of the latter.

3. A heat exchange device including a heat transfer core, air impelling means associated therewith and to provide a column of air which has been exposed to contact with said core, a control, means coupled to said control and providing a plurality of passages through which air is to be distributed in substantially equal volume, and a plurality of partitions within said control, one of said partitions extending to provide a wall inclined towards one of the passage walls and another of said partitions extending to define a wall substantially segregating the intake ends of said passage.

4. In combination, an automobile-type heater including a heat-exchange core, air impelling means for drawing air through said core, a fitting to receive air from said impelling means, a housing coupled to said fitting and being formed with an opening through which air is to be discharged for windshield-defrosting purposes, and a further opening through which air may also be discharged, a single actuator extending from said housing, a valve assembly secured to said actuator and disposed within said housing, said assembly including a body portion fixed with re-

5 spect to said actuator, a body portion connected to said actuator and movable with respect to the same, and means for yieldingly coupling said latter body portion with said actuator whereby solely by manipulation of said single actuator said first-named body portion may be shifted to positions obstructing the flow through either

of said openings as well as a position whereby a flow of air may occur simultaneously through both of said openings, said second body portion automatically assuming positions complementary to said first-named body portion and assisting in directing certain of such air flow. 5

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