July 31, 1934. C. R. PIEPER 1,968,351

HEATING APPARATUS

Filed March 30, 1933 2 Sheets-Sheet 1

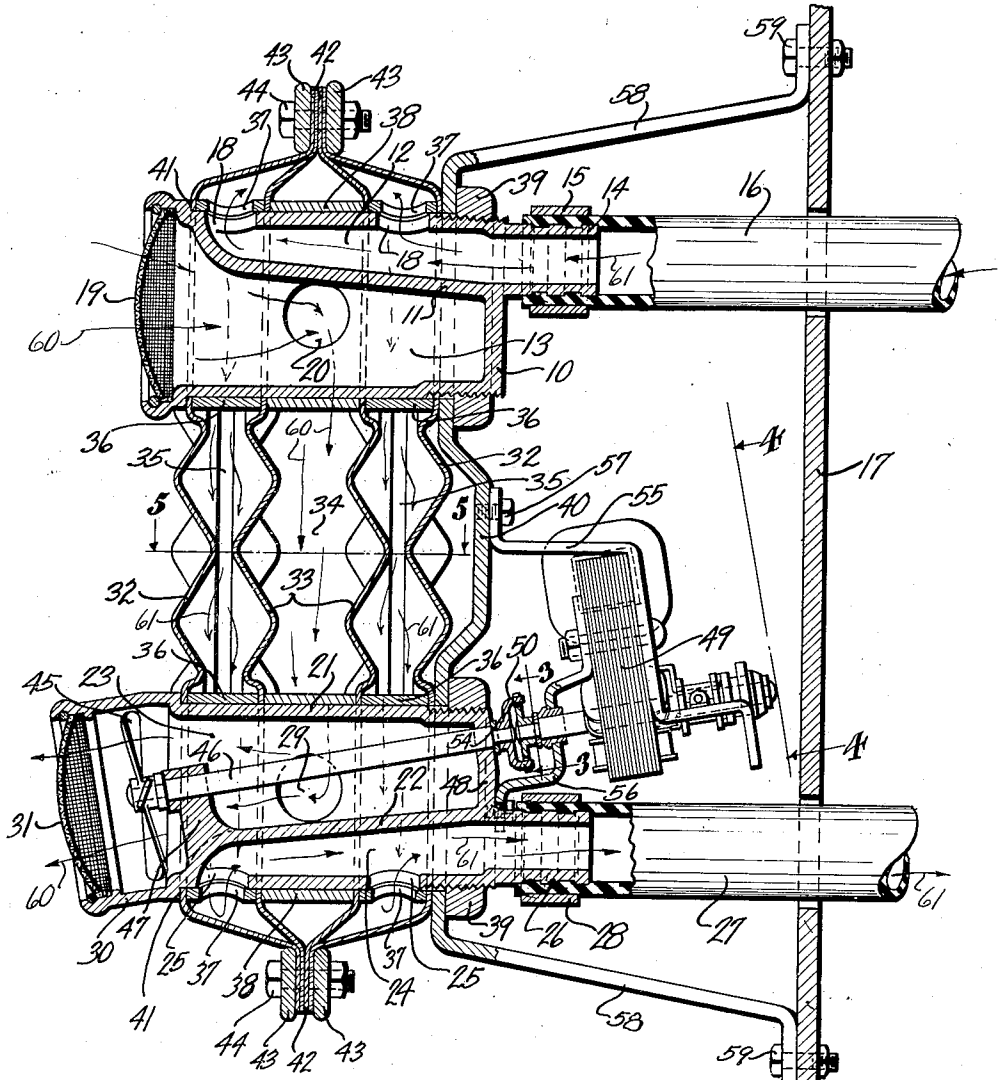


Fig. 1.

INVENTOR.
CHESTER R. PIEPER
BY
ATTORNEY.

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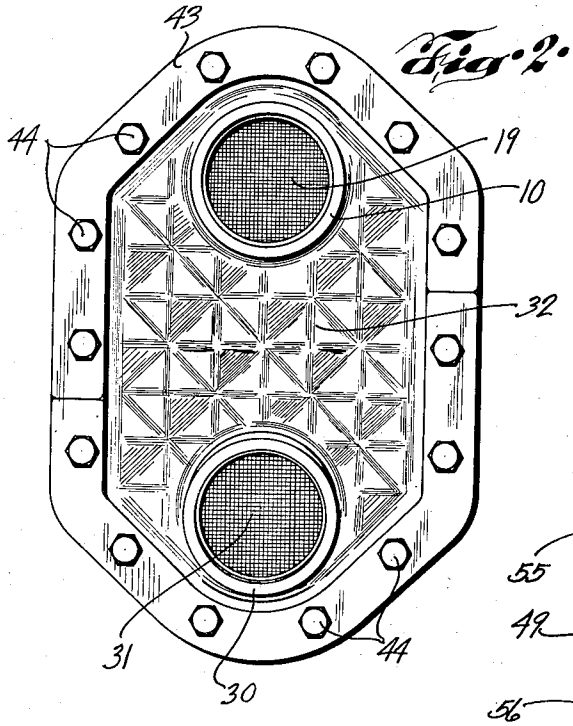



Fig. 2.

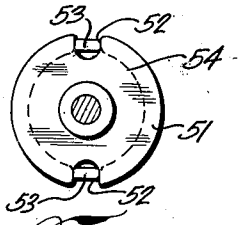



Fig. 3.

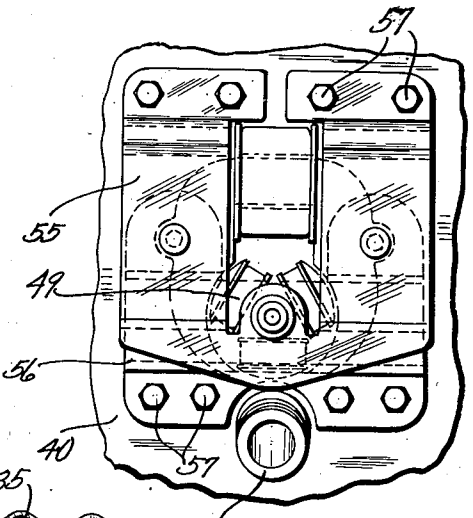



Fig. 4.

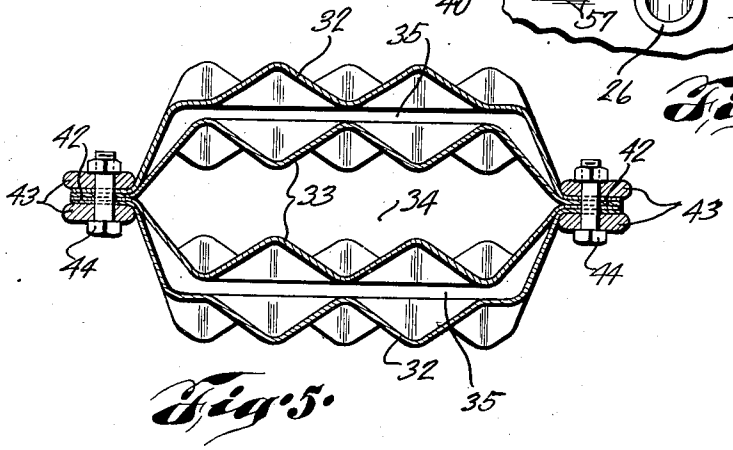



Fig. 5.

INVENTOR.
CHESTER R. PIEPER
BY
ATTORNEY.

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# UNITED STATES PATENT OFFICE

1,968,351

## HEATING APPARATUS

Chester R. Pieper, La Crosse, Wis.

Application March 30, 1933, Serial No. 663,492

16 Claims. (Cl. 257—137)

This invention relates to improvements in heating apparatus, and more particularly to an improved heater of so called hot water type, for automotive vehicles and the like.

An object of this invention is to provide an improved air heater for motor vehicles and the like, wherein the fluid utilized for cooling the engine is employed in the device as the air heating agent, such use of the engine cooling fluid being made without materially affecting the engine cooling system.

A further object of the invention is to provide an improved heating device which is neat and compact in construction, which may be readily and easily installed, and which requires only a small mounting space.

A still further object is attained in the provision of a heating device which is rugged in construction, and which is readily applicable wherever a heating fluid is available to serve as a heating agent, such a heating fluid for example, as hot water from the cooling system of an internal combustion engine, or the like.

Still another object of this invention is attained in the provision of a heating device which, by reason of its improved construction and assembly, may be readily and easily dismantled for purposes of repairing and cleaning the parts thereof.

Yet a further object of this invention is to provide an improved air heating device, in which the air to be heated is given a positive motion over a large heating surface which is confined in a small space, the heating surface being obtained by substantially dish shaped baffle plates presenting a series of staggered pyramidal projections.

Further objects and advantages will appear from the following description, and from the appended drawings.

For convenience in description, the heater device will be described as mounted on the cowl or panelboard of a closed motor vehicle, since the device is intended, primarily, for use in automobiles and the like.

In the drawings, Fig. 1 is a sectional side elevation of an improved heater; Fig. 2 is a front end elevation of the heater assembly; Fig. 3 is an enlarged end elevation of a preferred form of motor-blower coupling, as viewed from the line 3—3 in Fig. 1; Fig. 4 is an enlarged, fractional rear end elevation of the heater device, as viewed from line 4—4 in Fig. 1, and Fig. 5 is a transverse sectional elevation of the baffle plate assembly, as taken along line 5—5 in Fig. 1.

Referring now by characters of reference to the drawings, 10 indicates, generally, a tubular or header member, hereinafter termed the upper head casting. The head casting 10 is provided with an internal partition wall 11 which divides the space within the casting into relatively smaller and larger chambers or passages 12 and 13, respectively. Projecting rearwardly of the member 10 and opening into the chamber 12, is a tubular extension piece, or nipple 14. Connected to the nipple 14, by means of a clamping strap or collar 15, is a pipe 16, which, in the present example, forms a part of the cooling system for the engine of an automobile. The pipe 16 which may consist of a rubber hose, extends through an opening in the cowl, or forward panelboard 17, of the automobile. Water, heated by the engine, is conveyed to the chamber 12 through the pipe 16, and flows out of the passage 12 through a pair of spaced openings or ports 18 formed in the upper wall portion of the head casting 10. Air to be heated is drawn into the open forward end of the head member 10, which end, by preference, is provided with a screen 19 which serves to exclude dirt and foreign matter from the heater. A pair of air exit openings are disposed in opposite side wall portions of the casting 10, these openings or ports, one of which is indicated at 20, being located centrally of the casting 10, between the water discharge ports 18.

Located at a distance below the intake end casting 10 is a collector or discharge head casting 21. The casting 21 is tubular in form and may be substantially similar to the upper casting 10. A longitudinal partition wall 22, corresponding to the wall portion 11 of the upper casting 10, divides the lower casting into two internal chambers 23 and 24. Disposed in the lower side wall of the head member 21 and opening into the water passage 24 of that member, is a pair of spaced inlet ports 25, each of which is arranged in vertical alignment with one of the discharge ports 18 of the water passage 12 in the upper head casting 10. Water is discharged from the chamber 24 through a tubular extension piece, or nipple 26, formed on the rear end wall of the casting 21. A discharge pipe or hose 27 is connected to the nipple 26 as by means of a clamping collar 28. A pair of lateral openings, one of which is indicated at 29, are formed in the side wall portions of the casting 21, the openings 29 forming air inlet ports for the chamber 23. The casting 21 terminates forwardly in a tubular extension 30, which, by preference, is adapted to discharge the heated air from the casting 21 at a slight downward angle to the horizontal longitudinal

axis of the casting. Like the air inlet opening of the upper casting 10, the air discharge opening of the casting 21 is preferably provided with a screen 31.

Air to be heated, and the heating fluid are conducted from the upper casting 10 to the lower collector casting 21 through a plurality of individual passages formed by a series of sheet metal plates. Each of the plates, by preference, is indented or depressed to provide a plurality of staggered, pyramidal raised portions, which serve to increase the fluid contact surfaces, and thereby augment the interconduction of heat from the fluid heating agent to the air to be heated passing through the heater unit. In the present example, four such heat transfer or radiator plates are employed, two outer plates 32 and two intermediate plates 33, which provide an inner passage 34 and two outer passages 35 arranged on opposite sides of the inner passage. The outer passages 35 are in fluid conducting communication with the openings 18 and 25 in the upper and lower body castings 10 and 21, respectively, and the inner or intermediate passage 34 communicates with the lateral openings 20 and 29 forming ports in the upper and lower body chambers 13 and 23, respectively. Each of the plates 32 and 33 resembles a shallow pan of substantially hexagonal contour as best appears in Figs. 2 and 5. Each plate is provided with an opening at one end, of a size and shape adapted closely to fit and receive the body casting 10, and a similar opening at its opposite end to receive the casting 21. In the plate assembly, as a radiator body, Figs. 1 and 5, each of the body castings extends transversely through a registering series of the plate openings. Disposed between adjacent pairs of plates 32 and 33, and fitting closely about the periphery of the body members 10 and 21, are spacer sleeves 36. Each of the sleeves or collars 36 is provided with an opening 37 which is adapted to register with one of the openings 18 or 25 formed in the walls of the upper and lower body members 10 and 21, respectively. Similarly, spacer collars 38 extend about the body members between the intermediate plates 33. Like the collars 36, suitable apertures are provided in the collars 38, the apertures being in register with the openings 20 or 29 in the side wall portions of the upper and lower body castings.

The rearward end of each of the headers 10 and 21 is provided with external pipe threads which are adapted to be engaged by the threads of a nut 39. The nut 39 serves to secure the heater assembly to a mounting bracket 40, to be hereinafter described, and also to clamp the plates 32 and 33 in stacked relation over the headers, and in fluid-tight connection with the collar members 36 and 38, the forward plate 32 having a portion thereof, about the apertures through which the head members extend, seated against shoulders 41 adjacent the forward ends of the head members 10 and 21. If desired, washers or gaskets (not shown) may be disposed between the ends of each collar member and the marginal portions of the plate openings, this expedient further assuring a fluid-tight joint between the recited members.

As has been previously mentioned, each of the plates 32 is dished outwardly so that, when properly assembled, they may form the passages 34 and 35 therebetween. Likewise, the inner plates 33 are dished, but to a lesser extent than the outermost plates 32. In assembly the marginal portions of the plates 32 and 33 converge for mutual, fluid-tight securement. Each plate is laterally flanged as indicated at 42. The flanges 42 are adapted to be clamped between a pair of apertured clamping members 43, a series of bolts 44 extending through the clamping or frame members 43 and the flanged portions 42 of the plates serving to clamp the members and plate flanges together. Obviously, suitable gaskets may be interposed between the flanges 42, and between the flanges and clamping plates 43, for the purpose of creating a more fluid-tight junction.

As a means for inducing circulation of the air through the heater, I provide a fan member 45 preferably disposed within the lower head casting, immediately rearwardly of the air exit screen 31. The fan member is fixed for rotation on the forward end of a drive shaft 46 which extends longitudinally through the passage 23 in the lower body casting. The drive shaft is journalled at its forward end in a bearing arm 47, consisting of an integrally projecting portion of the partition wall 22. The rearward end of the drive shaft is journalled in the rear wall 48 of the lower head casting. An electric motor indicated generally at 49, is connected in driving relation with the shaft 46 by means of a flexible coupling 50, the coupling consisting of a disc 51 having peripheral slots 52 for receiving lug portions 53 of a coupling member 54. The motor 49 is preferably supported by means of a pair of brackets 55 and 56, the brackets being secured, respectively, to the heater support 40 and wall portion 48 of the header 21 by any suitable means, such as bolts 57.

The principal mounting bracket 40, previously mentioned, has leg portions 58 which are secured to the cowl or panelboard 17 as by means of bolts 59. The central portion of the bracket 40 is provided with spaced openings for receiving the externally threaded ends of the head members 10 and 21. The nuts 39 serve to fasten the head members, and hence the heater unit, to the bracket.

While the operation, and the courses which the air and heating fluid pursue through the various chambers and passages of the heater, as shown by suitable indicia, such as the arrows 60 indicating the direction of air flow, and the arrows 61 showing the direction of fluid flow, is thought to be clear from the foregoing description, for purposes of completeness these points will be reviewed as follows: Water or other equivalent cooling agent which has been heated by reason of its passage through the automobile engine, enters the chamber or passage 12 in the upper head casting 10 through the rubber hose 16 and nipple 14. The fluid flows from the chamber 12 through the ports 18 and 37 in the head casting 10 and spacer collars 36, respectively, and flows downwardly through the vertical passages 35 formed between adjacent plates 32 and 33. From the vertical passages 35 the water enters the chamber 24 in the lower head casting 21 through the ports 37 and 25. From the chamber 24 the fluid is returned to the cooling system of the engine through the hose 27. It will appear that the course of the fluid through the heater is in accord with the normal path of the convection current set up in the cooling system, the path of flow being indicated by the arrows 61. A positive flow of the fluid through the heater is assured by the usual pump or impeller which forms a part of all modern automotive engine fluid cooling systems.

Air is drawn into the chamber 13 in the upper

head casting through the screen 19. From the chamber 13 the air passes through the lateral ports 20 into the vertical passageway 34, formed between the plates 33. Due to the irregular surface of the plates 33, the air stream is rendered turbulent, hence the time in which the air is in contact with the heated plates 33, is increased. Induced by the action of the fan member 42, the air is drawn through the ports 29 in the chamber 23 of the lower head casting 21, and is expelled from the header 21 through the screen 31.

From the foregoing description it will appear that, in accordance with the objects hereinabove set forth, I have provided an economical heater of extremely simple construction, which is adapted for easy cleaning and repairing.

While the invention has been shown and described with reference to a single particularly preferred embodiment, it is to be understood that various changes may be made in the device herein shown and described without departing from the spirit and full intended scope of the invention as defined by the appended claims.

I claim as my invention:

1. A heater including a radiator body, and headers constituting means for circulating distinct heating and heated fluids through the body, the body including sheet metal radiating elements, apertured to receive, and stacked over the headers, and means for keeping the elements in spaced relation adjacent and between the headers, the radiating elements being marginally secured together beyond the headers.

2. A heater unit including a plurality of indented plate members, spaced to form an inner passage and outer passages therebetween, a plurality of tubular members extending transversely through said plate members, each tubular member having wall apertures opening respectively into said inner passage and communicating with one of said outer passages, and means dividing the interior of each tubular member into a plurality of separate chambers.

3. In an air heater, a pair of tubular header elements in spaced relation, a plurality of sheet metal plates mounted in spaced relation over said header elements, spacers for the plates, carried by the header elements, means for clamping the plates and spacers into assembled relation to the header elements, means for circulating air into one of said header elements, between certain of the plates and through the other header element, and means for circulating a heating fluid into and between the header elements and between other of the plates.

4. A heater including a plurality of plate-like elements disposed in spaced relation so as to provide passages therebetween, each of the plates being provided with endwise spaced apertures, detachable clamping means securing the plates together in fluid tight relation, near opposite margins, the plates being mounted with corresponding apertures in registering relation, header elements near the opposite ends of the plate assembly, each of the headers extending through a registering series of the plate apertures, spacers carried by the headers, and means coacting with the headers for clamping the plates and spacers in assembled relation to the headers, each of the headers being provided with inlet and outlet ports for air or other fluid to be heated, and provided with inlet and outlet ports for a heating fluid.

5. In a heater of unit type, a plurality of plates stacked in spaced relation to provide distinct passages therebetween, respectively adapted for distinct circulated fluids, means clamping the plates together near their periphery, the plates being transversely apertured, in register near each end of the assembly, tubular members extending through the registering apertures, one near each opposite end of the heater unit, means associated with the tubular members for maintaining the plates in spaced relation, and securing the plates in fluid-tight relation to the tubular members, and means for circulating distinct fluids in adjacent separate passages through the tubular members and between the plates.

6. A heater unit comprising a plurality of plate-like members, spaced to form outer passages and an inner passage therebetween, tubular members extending transversely through said plate-like members, each tubular member having a plurality of wall openings, certain of said openings communicating with said inner passage, and other of the openings communicating with said outer passages, and means dividing the interior of each tubular member into a plurality of separate receiving chambers for handling, respectively, a heated fluid and a heating fluid.

7. A heater unit comprising a plurality of corrugated plate-like members, spaced to form outer passages and an inner passage therebetween, tubular members extending transversely through said plate members, a partition in each tubular member dividing the interior of the member into separate chambers, each tubular member having at least one wall opening interconnecting one of its chambers with said inner passage, and having like openings serving to interconnect the remaining chambers and the outer passages.

8. A heater unit comprising a plurality of corrugated plate members, marginally secured together in spaced relation to form outer compartments and an inner compartment therebetween, spaced tubular members extending transversely through said plate members, a partition dividing the interior of each tubular member into separate chambers, passages interconnecting said inner compartment with one of said chambers in each tubular member, similar passages interconnecting the outer compartments with the other of said chambers in each tubular member, and an inlet and outlet fitting associated with each tubular member.

9. An air heater unit comprising a plurality of sheet metal plates, marginally bent together and secured in spaced relation to form outer compartments and an inner compartment therebetween, spaced tubular members extending transversely through said plates, a partition dividing the interior of each tubular member into separate chambers, passages interconnecting said inner compartment with one of said chambers in each tubular member, similar passages interconnecting the outer compartments with the other of said chambers, an air inlet port in one of said tubular members, an air outlet port in the other of said tubular members, and means disposed adjacent one of said ports for causing a continuous flow of air through the unit.

10. An air heater unit comprising a plurality of plate members, marginally secured together, with their intermediate areas in spaced relation to form outer compartments and an inner compartment therebetween, spaced tubular members extending transversely through said plate members, a partition dividing the interior of each tubular member into separate chambers, passages interconnecting said inner compartment with one of said chambers in each tubular member, similar

passages interconnecting the outer compartments with the other of said chambers, an air inlet in one of said tubular members, an air outlet in the other of said tubular members, and means disposed adjacent said air outlet for causing a continuous flow of air therethrough, said means including a blower member within one tubular member, and a driving motor therefor mounted externally of said tubular member.

11. In a heat-exchanging device, a body portion comprising a plurality of plates oppositely dished to provide passages between adjacent pairs thereof, means marginally securing the plates together in assembled relation, a pair of tubular members extending transversely through said plates, each of said tubular members having openings communicating with said passages, and means in each tubular member dividing the interior thereof into separate chambers.

12. In a heat-exchanging device, a body portion comprising a plurality of plates, depressed in opposite directions to provide passages between adjacent pairs thereof, means marginally securing the plates in assembly, and tubular members extending transversely through said plates and having openings therein communicating with said passages, the plates forming the walls of said passages being indented or depressed to present a staggered series of projections whereby to increase the radiating surface of said plates.

13. In a heat-exchanging device, a body portion comprising a pair of plates, having oppositely depressed areas, to provide a chamber therebetween, said plates being formed to present a series of projections whereby to increase the heat-exchanging surface of the plates, means within said chamber dividing it into a plurality of separate chambers, and a plurality of tubular members extending transversely through said plates and dividing means, said members having wall openings communicating with said chambers.

14. In a heat-exchanging device, a body portion comprising a pair of plates, oppositely dished to provide a chamber therebetween, means marginally securing said plates in assembled relation, means partitioning said chamber into a plurality of individual, laterally adjacent passages of irregular section, spaced tubular members extending through said plates and partitioning means, each of said tubular members having wall openings communicating with one of said passages.

15. In a heat-exchanging device, a body portion comprising a pair of plates oppositely dished to provide a chamber therebetween, means marginally securing said plates in assembled relation, partitions dividing said chamber into a plurality of individual, laterally adjacent passages, said partitions being indented to present a series of staggered projections, whereby to increase their heat-exchanging surface, and a plurality of tubular members extending laterally through said plates and partitions, each tubular member being provided with a wall opening communicating with one of said passages.

16. A heater including a plurality of indented plate-like elements disposed in spaced relation so as to provide passages therebetween, each of the plates being provided with endwise spaced apertures, detachable spacing and clamping members securing the plates in assembly in fluid tight relation, near opposite margins, the plates being mounted with corresponding apertures in registering relation, header elements, each extending through a registering series of the plate apertures, and each having a shouldered portion near one end adapted to engage external marginal portions of the plate assembly, each header being provided further with an externally threaded portion on its opposite end, to receive the companion threaded portion of an assembly nut for clamping the plates and spacing members in assembled relation to the header, between said header shoulder portion and said clamping nut, and each of the headers being provided with inlet and outlet ports for air or other fluid to be heated, and provided with inlet and outlet ports for a heating fluid.

CHESTER R. PIEPER.