Aug. 21, 1928. 1,681,256

J. F. RALEIGH

AUTOMOBILE HEATER

Filed Nov. 30, 1925 3 Sheets-Sheet 1

Fig. 1.

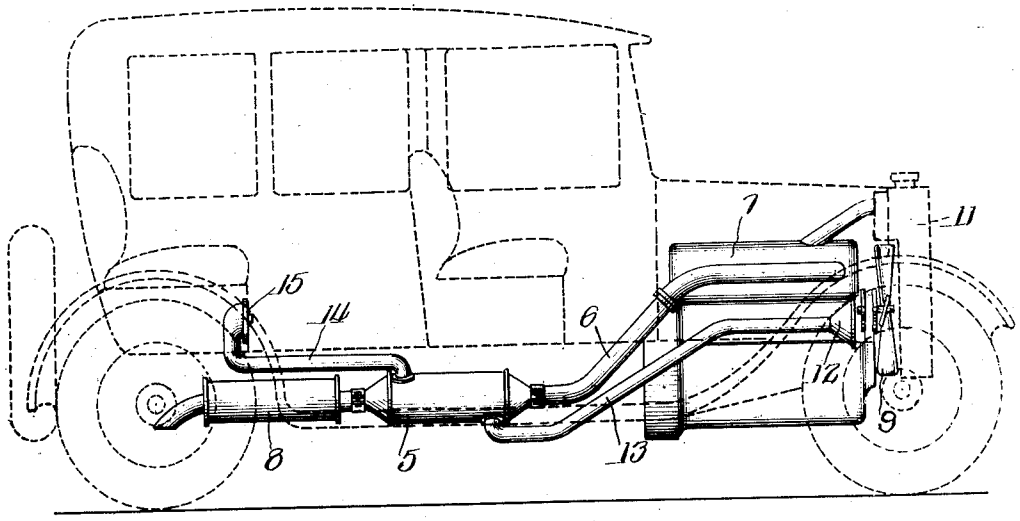
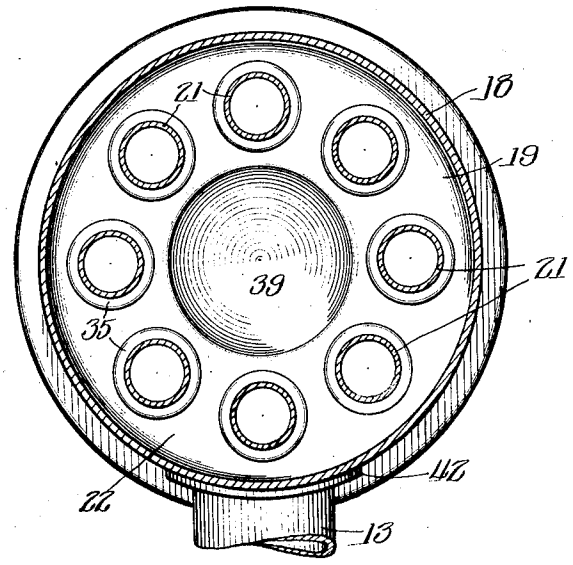


Fig. 2.



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3 Sheets-Sheet 2

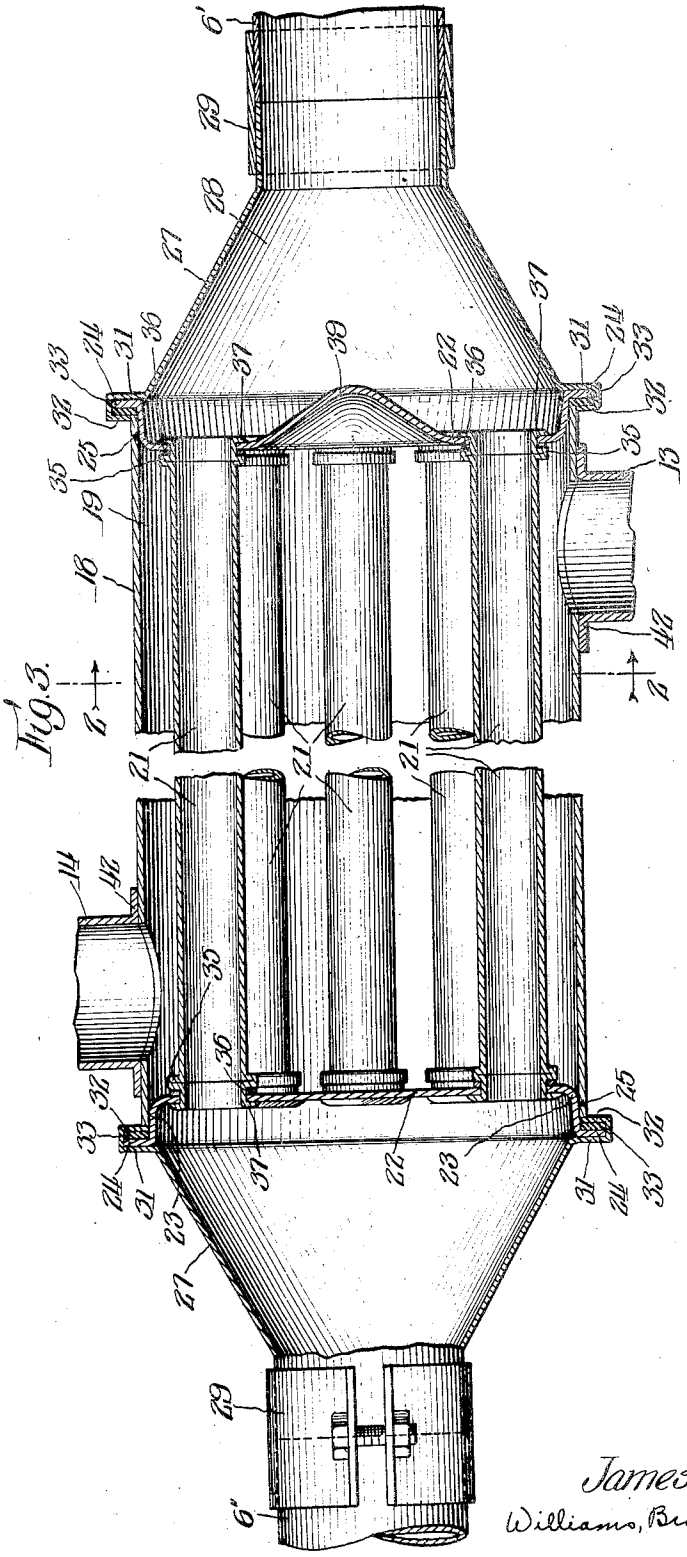

Fig. 3.

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3 Sheets-Sheet 3

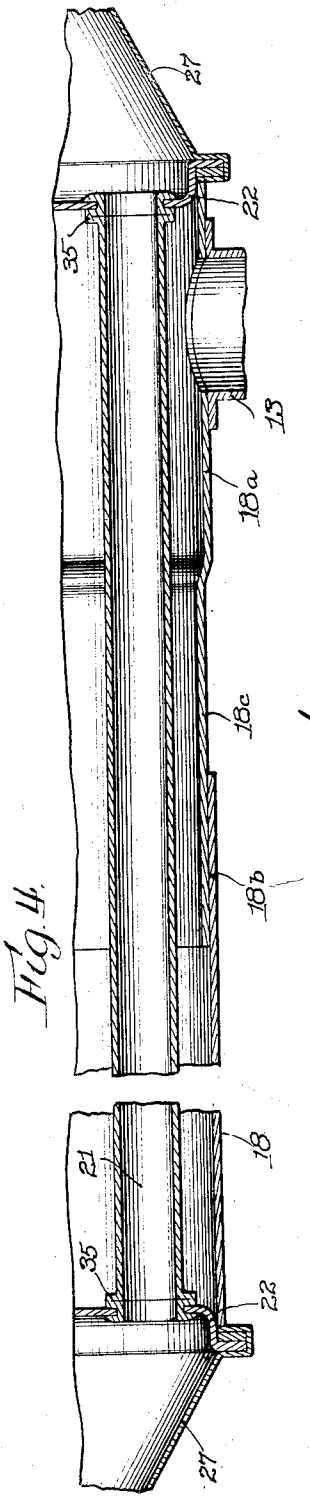

Fig. 4.

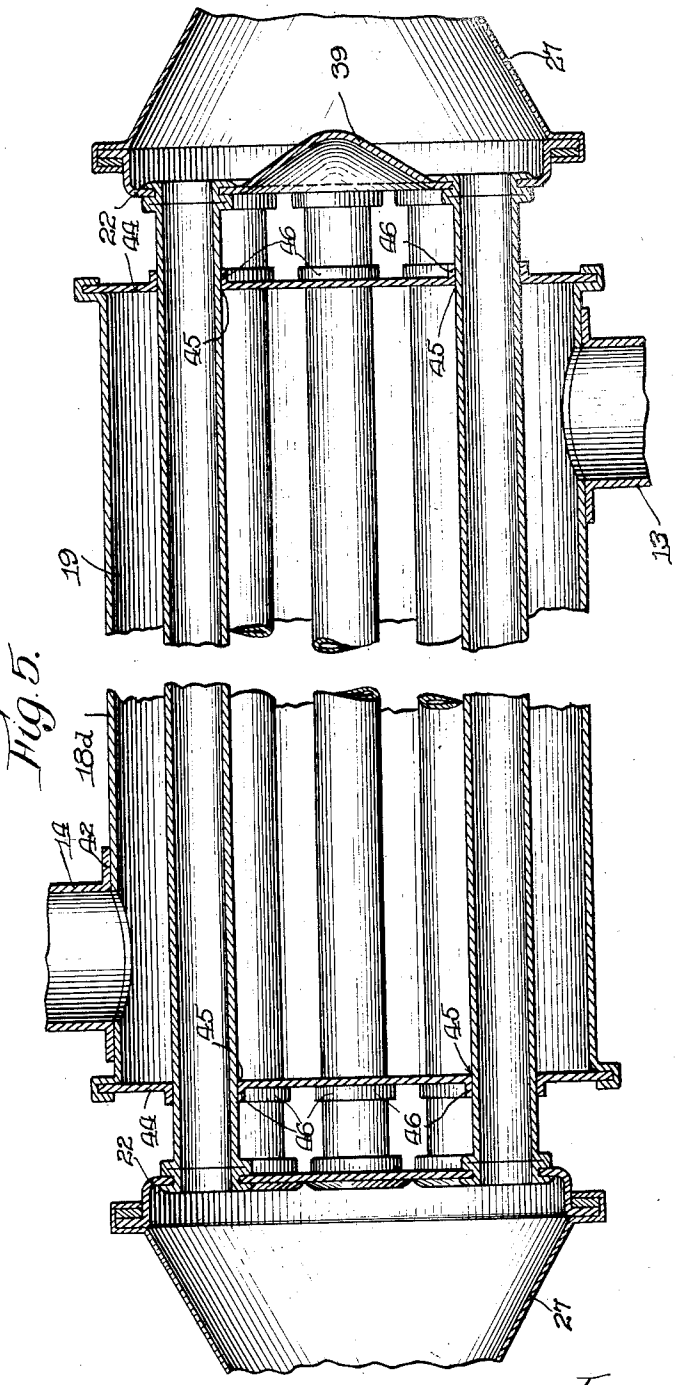

Fig. 5.

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UNITED STATES PATENT OFFICE.

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AUTOMOBILE HEATER.

Application filed November 30, 1925. Serial No. 72,074.

The present invention relates to automobile heaters, and particularly to that type of heater which utilizes the exhaust gases of the internal combustion engine for heating air which is conveyed to the interior of the automobile.

In the present type of heater the exhaust gases are conducted through a plurality of parallel tubes or passageways, and the air is circulated around and between these tubes or passageways. In the operation of such a heater these tubes or passageways which conduct the exhaust gases are expanded and contracted through a wide range, while the parts which are only in contact with the considerably cooler air stream do not tend to expand in proportion to the exhaust heated tubes. In such devices, as heretofore constructed, these differential expansions have wrought havoc with the heating tubes, joints, and other parts of the device. The seriousness of this is evidenced by the fact that in certain instances the failure of the tubes and joints has allowed the exhaust gases to intermingle with the flow of heated air into the car, with the result that the occupants of the car have been almost asphyxiated.

It is one of the principal objects of the present invention to provide a heater of this general type in which these objectionable possibilities have been completely eliminated through an improved construction which permits the necessary differential expansions but without allowing the latter to set up any stresses which might rupture any of the parts.

It is a further object of the invention to provide a heater in which a hermetic seal is maintained at all times between the passageways or chamber through which the exhaust gases are conducted and the chamber through which the air is conducted.

It is a further object of the invention to provide in a heater of this type an improved form of joint between the end of each heating tube and the heads in which these tubes are mounted.

It is a further object of the invention to provide a construction of heater in which the exhaust gases will be uniformly distributed to the several heating tubes.

It is another object of the invention to provide a heater which will oppose no additional back pressure whatever to the flow of the exhaust gases.

Referring to the accompanying drawings wherein I have illustrated a preferred embodiment of my invention:

Fig. 1 is a view illustrating a typical installation of my improved heater in an automobile, the automobile being illustrated in dotted lines.

Fig. 2 is a transverse sectional view through the heater, being taken approximately on the plane of the line 2—2 of Fig. 3.

Fig. 3 is a longitudinal sectional view through the heater, a portion of the same being broken away to foreshorten the longitudinal dimension.

Fig. 4 is a view partially cut away showing a modification of my invention, and

Fig. 5 is a full view in cross section of another modification.

As illustrated in Fig. 1, the heater of my invention, indicated in its entirety at 5, is located at any preferred point in the exhaust pipe 6 between the engine 7 and the muffler 8. Preferably the heater is located under the floor of the car and just forward of the muffler 8 as shown. The air which is conducted through the heater is preferably drawn from a point adjacent the fan 9 and radiator 11, whereby the velocity of the air stream, effective at this point, can be utilized to maintain a forced circulation of the air through the heater and into the car. A conical air inlet 12, located directly behind the fan 9, discharges into air intake pipe 13 which leads back to the heater 5. After circulating around and between the heating tubes in the heater 5, the air is discharged up into a discharge pipe 14 communicating with the interior of the car.

A preferred point of admission of the heated air into the car body is through the panel extending downwardly from the rear seat. In the case of a one seated car this air conduit 14 could discharge under the single seat or at any other preferred point. Any suitable damper 15 may be provided in the register through which the hot air is admitted, or, if desired, this damper may be located at a lower point in the air conduit 14.

Referring to Figs. 2 and 3, the heater 5 comprises an outer cylindrical shell 18 which defines a primary chamber 19 through which the air to be heated is circulated. Extending through this primary chamber are a plurality of substantially parallel heating tubes 21, the several passageways of which define a

secondary chamber for the heating medium. These tubes are supported at their ends in circular heads 22, the tubes extending through apertures in these heads and having hermetic joints in these apertures as I shall presently describe.

Each head is formed with a horizontally turned annular flange 23 and an outwardly turned peripheral flange 24. The outer sides of the flange 23 form annular seating surfaces 25 for the ends of the shell 18, as I shall presently describe.

The exhaust gases are conducted from the forward section 6′ of the exhaust manifold to the front ends of the tubes 21 through a conical manifold 27 which defines a front manifold chamber 28. The gases discharging from the rear ends of the tubes 21 are conducted to the rear section 6″ of the exhaust pipe (or directly to the muffler 8) through a similar manifold connection 27. The cylindrical ends of these manifold connections may be coupled to the ends of the exhaust conduit in any suitable manner, preferably by split clamps 29.

For joining these manifold connections to the end heads 22, they are provided with outwardly extending flanges 31 which abut the outer sides of the peripheral flanges 24 on the heads 22. These manifold flanges are then turned over the inner sides of the flanges 24, as indicated at 32. A sealing gasket 33 is preferably interposed between each head flange 24 and the inwardly turned locking flange 32. The joint formed by these flanges and gaskets effectually prevents any of the exhaust gases from entering the air chamber 19.

In joining the ends of the tubes 21 in their respective holes in the end heads 22, each tube is first formed at both ends with an outwardly extending bead or flange 35, preferably formed by shortening and expanding the cylindrical wall of the tube. A gasket 36, of heat refractory material similar to a spark plug gasket, is then interposed between this bead or flange 35 and the inner side of the head 22. After the cylindrical end of the tube has been forced through its aperture in the head, the end of the tube is spun down over the outer side of the head, as indicated at 37. The operation of spinning the end of the tube over the outer side of the head draws the flange 35 and gasket 36 into a tight sealing engagement with the inner side of the head. The spun outer end of the tube also forms a sealed joint with the outer side of the head 22, so that a hermetically sealed joint is thereby perfected between the end of each tube and the end head. This manner of joining the ends of the tubes to the end heads avoids the difficulty and expense of welding or brazing and provides a joint which is equally effective from the standpoint of strength and tightness of seal. The necessity of hermetically sealed joints between the tubes and end heads is obvious from the fact that no exhaust gases should leak into the air chamber 19 under any circumstances. The tubes 21 and the end heads 22 are constructed of the same kind of material, preferably copper, so that they will both have the same co-efficient of expansion.

The tubes are proportioned in size and in number so that their combined areas will equal or exceed the area of the exhaust pipe 6′. This completely avoids the creation of any additional back pressure, which is a very objectionable characteristic in prior automobile heaters.

It will be noted from Fig. 2 that all of the tubes 21 are disposed in circular arrangement, spaced outwardly from the centers of the end heads 22. Attention is directed to the fact that no central tube is employed which would receive more than its share of the exhaust gases and thereby become more highly heated than the other tubes. All of the tubes being located equidistantly from the centers of the heads, they will receive uniform volumes of exhaust gases. To avoid turbulence in the front manifold chamber 28 and to assist in this equality of distribution of the gases, I provide a deflecting or distributing surface 39 in the center of the front head 22, directly in the path of impingement of the entering gases. This deflecting surface 39 may be of conical or spherical form, and is preferably produced by punching a correspondingly shaped depression in the center of the front head 22. The gases striking the sloping surfaces of this distributing projection 39 will be deflected uniformly into the open mouths of the several tubes 21.

The tubes 21, being highly heated by the exhaust gases, will have a much greater linear expansion than the outer shell 18, which is maintained relatively cool by the flow of air there-through. For example, with tubes of a length of approximately 2 feet the overall expansion of these tubes between extreme changes of temperature will be approximately $\frac{3}{8}$ of an inch. Obviously, if the outer shell 18 offers any constraint to this expansion the tubes will bow and fracture or the joints between the tubes and the end heads will be ruptured, thereby admitting exhaust gases into the air chamber 19. I have obviated all possibility of this by providing one or more movable joints between the shell 18 and the head or heads 22. Preferably these movable joints occur between the ends of shell 18 and the annular seating surfaces 25, formed by the flanges 23 on the end heads. Each of these annular surfaces 25 is formed with a slight taper (of approximately $\frac{1}{2}°$) and the ends of the shell are of the proper size to snugly engage these tapered surfaces. The slight taper maintains a tight joint between the ends of the shell and the heads 22 during the

entire expansive movement of the heads relative to the shell. It will be understood that one end of the shell can be rigidly anchored to one of the end heads so that this relative movement will occur only at the other end of the shell. I prefer, however, to have this relative movement occur at both ends of the shell. Each tapered seating surface 25 is as long or longer than the total linear expansion of the tubes, and by providing one of these expansion joints at each end of the shell the complete expansion of the tubes is accommodated without any possibility of breaking the joint between the heads and shell.

The air tubes 13 and 14 preferably connect with the shell at opposite ends to establish a circulation of air through the entire length of the shell in intimate heat transferring relation to the tubes. These air tubes may be connected to the shell in any suitable manner, such as by the riveting or welding of the flanges 42 on these tubes to the shell. The two tubes preferably open into the shell at diametrically opposite points to secure a transverse circulation of the air between the tubes. One or both of the tubes 13 or 14 may be fixedly supported to support the shell 18 and thereby the entire heater.

In Fig. 4 I have shown the outer shell 18 as having a telescoping joint intermediate its ends. One section 18^a has a reduced portion 18^c which can move with a snug sliding fit in the other section 18^b. The outer ends of both sections can be securely fastened to their respective end heads 22, the telescoping joint referred to affording an expansion joint permitting the necessary differential expansions.

In Fig. 5 I have shown a construction in which the air heating chamber 19 has end heads separate from the end heads 22 of the exhaust chamber. The shell 18^d of this air heating chamber has its ends secured to heads 44. These heads have holes 45 punched therein for receiving the tubes 21. The metal is preferably flanged outwardly around these holes, as indicated at 46, to snugly engage over the tubes. The tubes have sliding engagement in these flanged holes at one end or at both ends of the air heating chamber. This sliding engagement will permit the differential expansions; any minute air leakage between these tubes and the flanges 46 will be inconsequential. If desired, only one end of the shell 18^d may be provided with an independent head 44, the other end of the shell being connected to the tube head 22.

Having thus described my invention, what I claim is:

1. In an automobile heater of the class described, the combination of a pair of flanged end heads having apertures therein, a plurality of heating tubes extending between said heads and secured in said apertures, each of said tubes having flanges adjacent its ends for engaging the inner sides of said end heads, the extremities of said tubes being spun over the outer sides of said end heads, an air heating chamber embracing said tubes and slidably supported about the same, means for circulating air through said chamber, and means for circulating exhaust gases through said tubes.

2. In an automobile heater of the class described, the combination of a cylindrical shell, flanged end heads for said shell having apertures therein, heating tubes extending through said shell and having their ends seating in said apertures, an outwardly expanded flange on each tube adjacent its end, a gasket interposed between said flange and the inner side of the respective head, flanges extending from the extremities of said tubes over the outer sides of said heads formed by spinning the extremities of said tubes outwardly, conduit means slidably supported about said tubes for circulating air through said shell and around said tubes, and means for circulating exhaust gases through said tubes.

3. In an automobile heater of the class described, the combination of an outer cylindrical shell, end heads for closing the ends of said shell, each of said heads comprising a laterally turned annular flange and a radially extending annular flange, the ends of said shell seating on said laterally turned annular flange, heating tubes extending between said heads and having their ends joined thereto, conduit means for circulating air through said shell and a conical manifold having a flanged end joined to the radial flange of the adjacent head, said manifold establishing communication with an exhaust conduit.

I witness whereof, I hereunto subscribe my name this 18th day of November, 1925.

JAMES F. RALEIGH.