Jan. 29, 1935. L. C. HYATT 1,989,519

BUS HEATER

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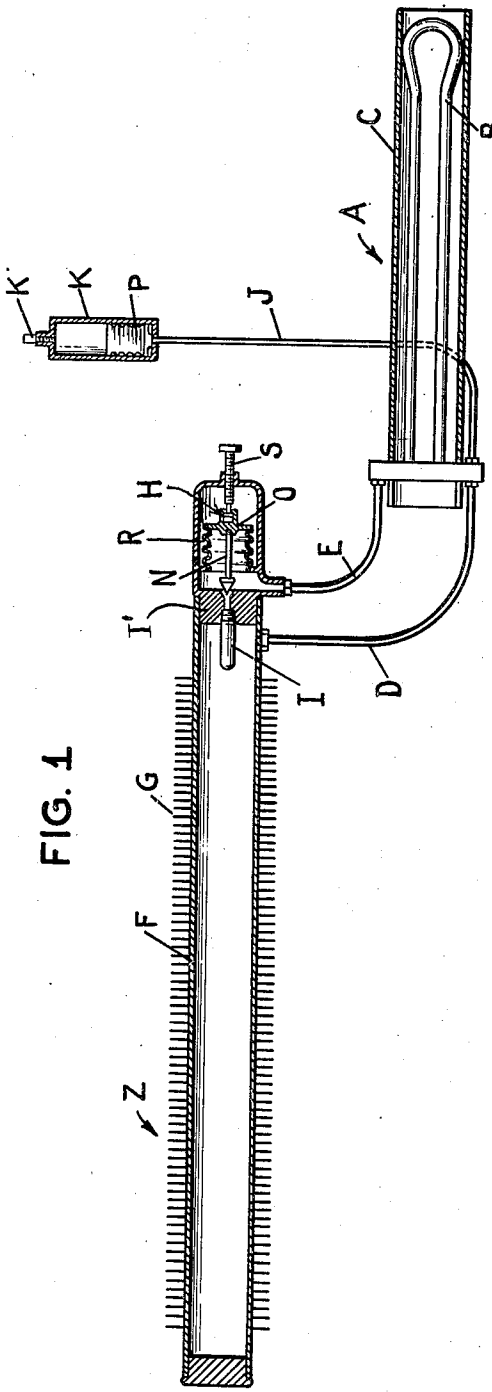


FIG. 1

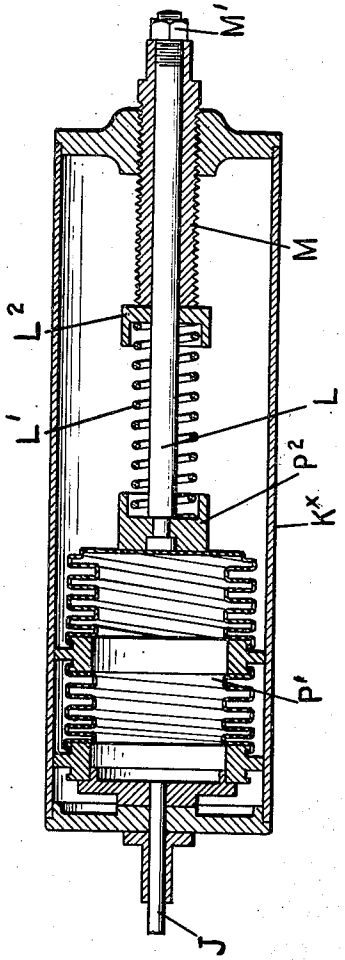


FIG. 2

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FIG. 3

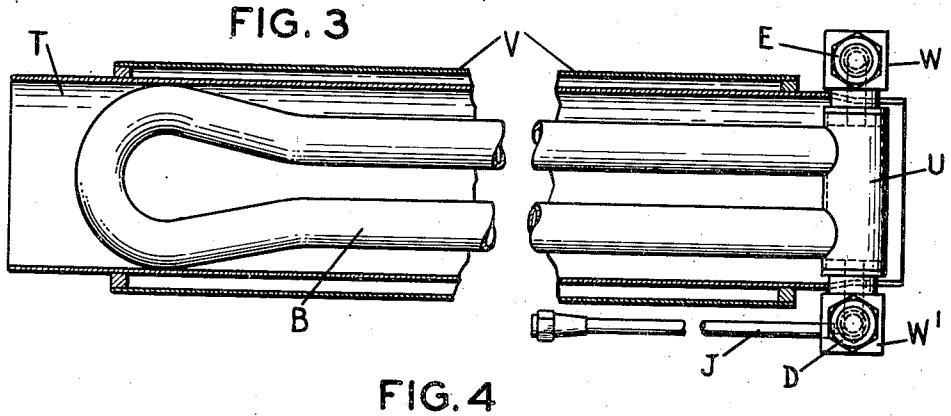


FIG. 4

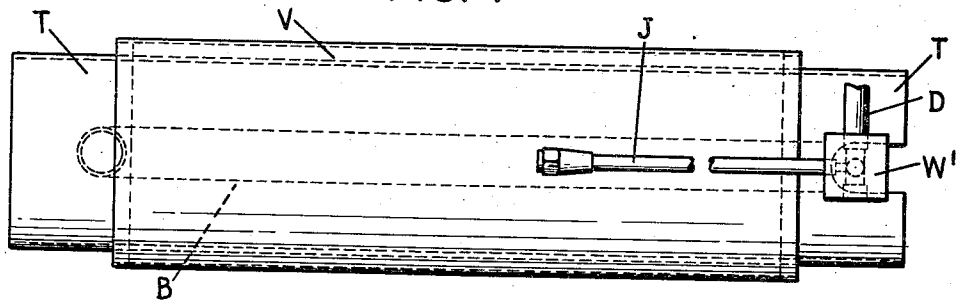


FIG. 5

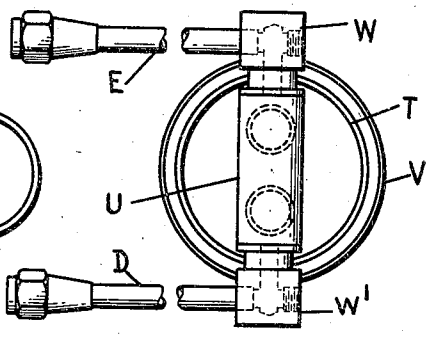


FIG. 6

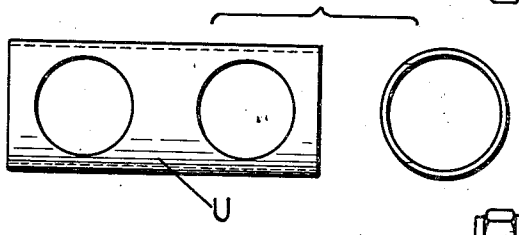
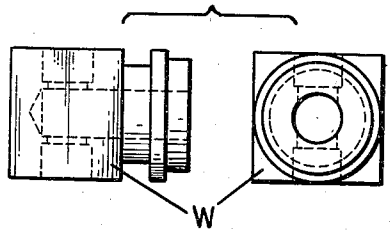


FIG 7



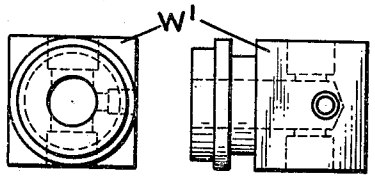


FIG.8 FIG. 9

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BUS HEATER

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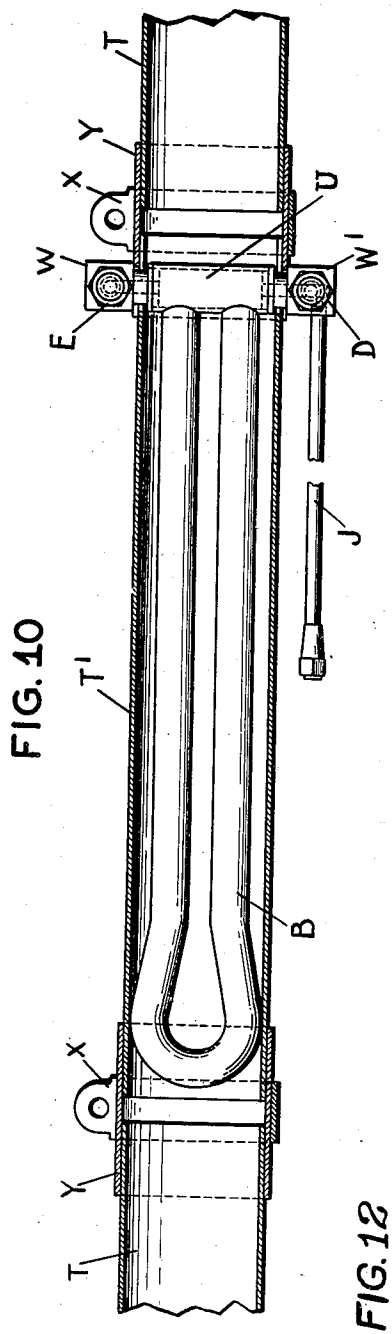


FIG. 10

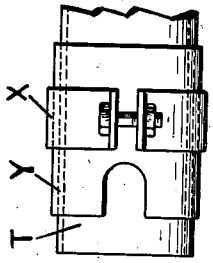


FIG. 13

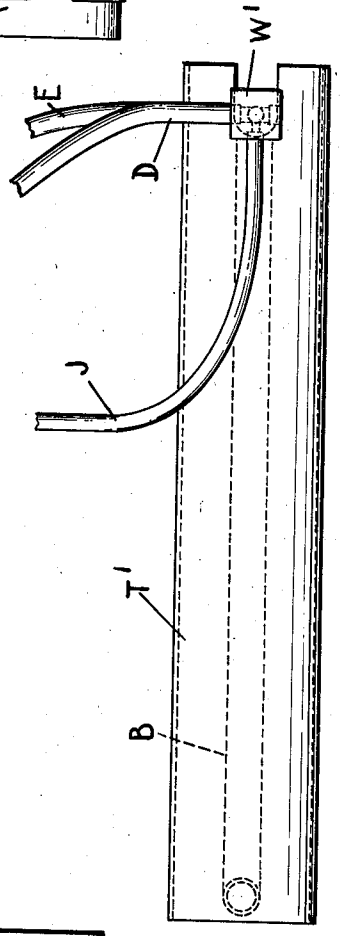


FIG. 11

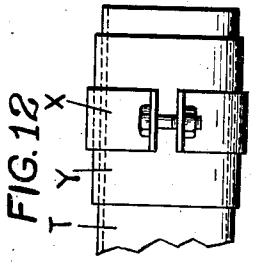


FIG. 12

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Patented Jan. 29, 1935 1,989,519

UNITED STATES PATENT OFFICE

1,989,519

BUS HEATER

Louis C. Hyatt, Albany, N. Y., assignor to Consolidated Car-Heating Company, Inc., Albany, N. Y., a corporation of New York

Application February 7, 1931, Serial No. 514,237

7 Claims. (Cl. 257—241)

For a detailed description of the present form of my invention, reference may be had to the following specification and to the accompanying drawings, forming a part thereof, wherein

Fig. 1 is a longitudinal sectional view diagrammatically illustrating a heating system embodying the novel features of the invention. Fig. 2 is an enlarged longitudinal sectional view slightly modified, of the expansion relief means. Fig. 3 is an enlarged view partly in longitudinal section and partly in side elevation illustrating the boiler. Fig. 4 is a top plan view of the boiler illustrated in Fig. 3. Fig. 5 is an end view of the boiler. Fig. 6 illustrates detail views of the end block of the boiler. Fig. 7 illustrates detail views of one of the end block plugs. Figs. 8 and 9 illustrate enlarged end and side views of the other end block plug. Fig. 10 is a view similar to Fig. 3 illustrating a slight modification. Fig. 11 is a bottom plan view of Fig. 10. Figs. 12 and 13 are detail side views illustrating the connecting sleeves of Fig. 10.

My invention relates to a system particularly adapted for heating buses, railway cars, private vehicles and for use in other appropriate situations. It consists in certain improvements on a heating device disclosed in the patent application of Lee P. Hynes, filed November 19, 1926, Serial No. 149,510, of a type characterized by a sealed pipe system, having a vapor generator at one part and a heat delivering radiator at a distant part of the system. The system contains a certain small amount of liquid—say one pint—which becomes heated and evaporated by the generator and delivers its heat at the radiator. It is regulated by diverting more or less of the liquid into a side chamber or compensator located outside of the heating influence of the generator and therefore having its own independent and lower temperature. The side chamber or compensator is so positioned with respect to the rest of the system that it is normally empty of the contents of the system while said system is operating under normal pressure and so constructed as to expel any contents of the system from the chamber back into the system as the internal pressure declines.

The above-mentioned regulation becomes automatic by making the removal and restitution of the liquid from or into the boiler dependent on the internal pressure, and my present invention consists in a device for that purpose wherein the side chamber that temporarily receives the boiler liquid is made expansible and contractible in response to said pressure. Thereby the liquid in the system, as the pressure thereon increases, finds a larger and larger capacity of the side chamber into which it may retreat from the heating influence. Such retreat tends to reduce the pressure which causes the retreat, and a balance between the two influences may be fixed at any desired point. In one form of my invention I secure such regulation, by a chamber of variable capacity, by enclosing the chamber in an external air-tight vessel and also interposing a spring behind it that is adjustable from the outside of the vessel. By this means I insure the sealing of the system while providing access to change the adjustment. Since the pipe system is sealed, it becomes important to provide a means for ejecting the water from the side chamber and restoring it to the pipe system, which means will act regardless of the temperature conditions occurring in the sealed system. A spring is one means suitable for this purpose, since it will continue to act even if the temperature conditions should be such as to produce a vacuum in said sealed chamber by condensing the vapor therein.

Referring to the drawings, A is the boiler and Z th radiator. The boiler consists of a bent tube B of hair-pin contour in a casing C, which casing contains, as the preferable form of heating agency, the exhaust gases from an internal combustion engine. Preferably the casing C is connected with the exhaust manifold of an engine of the type which is normally employed to propel the vehicle in which the heater is installed. The radiator Z comprises a sealed tube F, surrounded by vanes G. The two members A and Z may be connected by a single tube, or by two separate tubes, as shown herein, the two tubes being marked respectively D and E. The latter, E, is the feed tube leading from the steam space of boiler B, past a sealed control valve H, into one end of an open-ended central tube I having one end supported in a block I' in communication with a port through said block, the other open end projecting longitudinally into the radiator at a central position so that vapor is discharged into the radiator in a manner which will permit its expansion as discharged. The former, D, is the return tube, leading from outer tube F of the radiator back to the boiler. The said valve H forms the subject of a separate application for patent filed February 6, 1930, Serial No. 426,305 and is not here claimed, but is described hereinafter.

To this apparatus, as thus far described, I add a side chamber which may be in the form of a closed cylinder P having a corrugated side wall and therefore expansible and contractible axially. Its lower end is connected by a tube J to the

system, the point of connection being, for example, the bottom of boiler B below the water level and near the entrance point of return tube D. Pipe J may, however, be connected at any suitable point of the system. This corrugated chamber P is enclosed in a larger closed vessel K provided on top with a screw-closed air valve K^1. It will be obvious that an increase of steam pressure in the boiler will force more or less water from the boiler up tube J into chamber P and cause that chamber to expand. The elevated water is also removed thereby from the boiler and its heating influence. As a result the steam pressure in the boiler will decrease and the removed water will then return because of the natural resiliency of chamber P and also because of the resiliency of the air in vessel K which has been compressed in that vessel, as the volume of the vessel has been reduced by the expansion of chamber P. In any event the positive removal of liquid from the side chamber P, is important. In other words, if unremoved liquid can accumulate in the side chamber P the system will ultimately become dead by lack of liquid to be evaporated. The amount of air in vessel K may be adjusted by valve K^1.

In Fig. 2 the expansible chamber P' is shown as formed in two sections, the non-corrugated part between the two corrugated sections also serving as a guide, bearing on the inside wall of vessel Kx. Secured to chamber P' is a bearing block P^2 in which is swiveled the lower end of rod L. A coiled spring L^1 is seated between block P^2 and a similar top block L^2 and surrounds rod L. Engaging block L^2 is one end of a hollow screw M which passes through the top of the vessel and is squared at one end thereof. The aforesaid rod L passes through screw M and at its outer end carries a nut M^1. By means of screw M the spring L^1 may be adjusted and by means of nut M^1 and rod L the chamber P' may be adjusted or compressed without twisting it. To the abutment seat of chamber P' the pipe J is secured and through an opening in the seat communicates with the interior of said chamber. The form shown in Fig. 2 adds the spring L^1 as a means additional to the compressed air in vessel Kx for collapsing the chamber P' and returning the liquid to the boiler and provides for the external adjustment of spring L^1 by screw M. It also provides for changing the axial length of the chamber P' by raising or lowering movement in either direction imparted to its end plate without twisting and with or without changing the tension of spring L^1.

The valve H mentioned above has its closing plug mounted on the end of a rod N carried by the end plate O of a corrugated cylinder R. An adjusting screw S is seated in the casing and is swiveled at its end to the outer side of said end plate O. By this device the position of the plug may be changed by screw S without affecting the seal between the two ends of the cylinder R and the casing at one side and plate O at the other side and also without twisting the corrugated cylinder.

In the boiler drawings (Figs. 3–9) T represents the exhaust pipe of a car-engine or other container of a heating medium. Surrounding exhaust-pipe T, but spaced therefrom by end rings, is a cover V. Inside of T is the boiler B, consisting, preferably, of a single loop of bent tubing enlarged at its curved end to give it a side bearing on the inside surface of T. The two ends of the loop are sealed to the tubular end-block U which, at one end, is closed by a plug W and, at its other end, by a similar plug W^1. Each plug has a contracted neck outside the end-block, as appears in Figs. 7 and 9, whereby the boiler tube B and its end-block U are provided with the plugs W, W^1 in place thereon, and such an assembly may be thrust into the open end of exhaust pipe T till the aforesaid necks come into notches formed to receive them in the end edge of said pipe T. In the sides of the respective plugs W, W^1, are holes into which are sealed the ends of the above-mentioned pipes D and E from the radiator which thus communicates with boiler B. In plug W^1 there is also on its rear side a hole into which is sealed one end of the aforesaid pipe J leading to chamber P.

A modified arrangement, shown in Figs. 10 and 11 is employed when the boiler is to be at an intermediate point in the exhaust pipe, instead of the end thereof. In this case, a section T^1 of the exhaust pipe is cut from the exhaust pipe T, T, but is normally held in line with the remainder of the pipe by means of short sleeves Y, Y, overlapping the joints at each end of T^1 and secured by split-ring clamps X, X. When it is desired to introduce the boiler, the clamps X, X are loosened and the sleeves Y, Y are slipped back from section T^1 at each end thereof. Thereby the section T^1 can be displaced from its position in line with the rest of the exhaust pipe, being, for instance, dropped below it, as shown in Fig. 11. Then the boiler, while still connected to pipes E and D, and while the outer ends of those pipes are connected to the radiator, can be brought down to the same level as section T^1, the pipes E and D being sufficiently flexible for the purpose. Then the section T^1 can be slipped over the boiler, having end slots to receive the projections W, W^1. When the boiler is in position in section T^1, the said section, together with the boiler therein, can be lifted back into line with the exhaust pipe and the sleeves Y, Y replaced over the joints at each end of the section and secured by the clamps X, X.

By my invention the entire heating apparatus of a car is contained in one practically unitary sealed, solid frame or block. It needs no replenishment of the heating liquid because that liquid is not dissipated by evaporation; it is merely transferred back and forth between boiler B and chamber P to remove it from and restore it to the heating influence without going through valves and without exposure to the atmosphere, and without manipulation. If the engine exhaust is made the heating agency, the system only utilizes heat that would be otherwise lost. The apparatus is cheap, not subject to wear and requires no attention except to close valve H in the spring and open it in the autumn.

What I claim as new and desire to secure by Letters Patent is:

1. In a heating system of the character described, a boiler comprising a tubular casing constructed and arranged to be connected with the exhaust manifold of an internal combustion engine, a removable end block diametrically disposed within said tubular casing near an end thereof, hollow plugs connected with the end portions of said end block and projected outwardly from the tubular casing, said plugs being constructed and arranged to anchor said end block in position, and to close the ends thereof, a tubular vaporizing member of loop-like form disposed longitudinally within said tubular casing and having its ends connected to and com-

municating with said end block, a supply pipe connected with one end block plug, and a return pipe connected with the other end block plug.

2. In a heating system of the character described, a boiler comprising a tubular casing constructed and arranged to be connected with the exhaust manifold of an internal combustion engine, a tubular end block removably located within said tubular casing at one end thereof, hollow plugs removably connected with the ends of said end block and also extended through said tubular casing, said hollow plugs closing the ends of said end block, a tubular vaporizing member of loop-like form disposed longitudinally within the tubular casing and having its ends connected to and communicating with said end block, a supply pipe connected with one of said plugs, and a return pipe connected with the other plug.

3. In a heating system of the character described, a boiler comprising a tubular casing constructed and arranged to be connected with the exhaust manifold of an internal combustion engine, a tubular end block diametrically disposed across one end of said casing, hollow plugs extended through the wall of said casing and engaging the ends of said tubular end block in a manner to anchor the end block to the casing, a tubular vaporizing member of loop-like form disposed longitudinally within the tubular casing and having its ends connected to and communicating with said end block, a supply pipe connected with one of said plugs, and a return pipe connected with the other plug.

4. In a heating system of the character described, a boiler comprising a tubular casing constructed and arranged to be connected with the exhaust manifold of an internal combustion engine, a tubular end block having its ends engaged with one end of said tubular casing, hollow plugs removably connected with the ends of said end block and also connected with said tubular casing, a tubular vaporizing member of loop-like form disposed longitudinally within the tubular casing and having its ends connected to and communicating with said end block, a supply pipe connected with one of said plugs, a return pipe connected with the other plug, and expansion relief means also connected to one of said plugs.

5. In a heating system of the character described, a boiler comprising a tubular casing having oppositely disposed slots in one end thereof, said casing being constructed and arranged to be connected with the exhaust manifold of an internal combustion engine, a tubular end block diametrically disposed across said casing with its ends in register with said slots, hollow plugs engaging the ends of said tubular end block, said plugs having reduced necks fitting in said slots, a tubular vaporizing member of loop-like form disposed longitudinally within the tubular casing and having its ends connected to and communicating with said end block, a supply pipe connected with one of said plugs, and a return pipe connected with the other plug.

6. In a heating system of the character described, a boiler comprising a tubular casing having oppositely disposed slots in one end thereof, said casing being constructed and arranged to be connected with the exhaust manifold of an internal combustion engine, a tubular end block diametrically disposed across said casing with its ends in register with said slots, hollow plugs engaging the end of said tubular end block, said plugs having reduced necks fitting in said slots, a tubular vaporizing member of loop-like form disposed longitudinally within the tubular casing and having its ends connected to and communicating with said end block, a supply pipe connected with one of said plugs, a return pipe connected with the other plug, and a tubular jacket surrounding said casing and of a length approximately coextensive with the length of said vaporizing member.

7. In a heating system of the character described, a boiler having a tubular casing, an end block arranged across one end of said casing, hollow plugs engaging said casing and connected with the ends of said end block, a tubular vaporizing member of loop-like form extended longitudinally within said casing and having its ends connected to and in communication with the end block, short sleeves engaging the ends of said tubular casing and so constructed and arranged as to engage complemental end portions of the exhaust pipe of an internal combustion engine, and means for clamping said sleeves to adjacent ends of said casing and said pipe.

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