

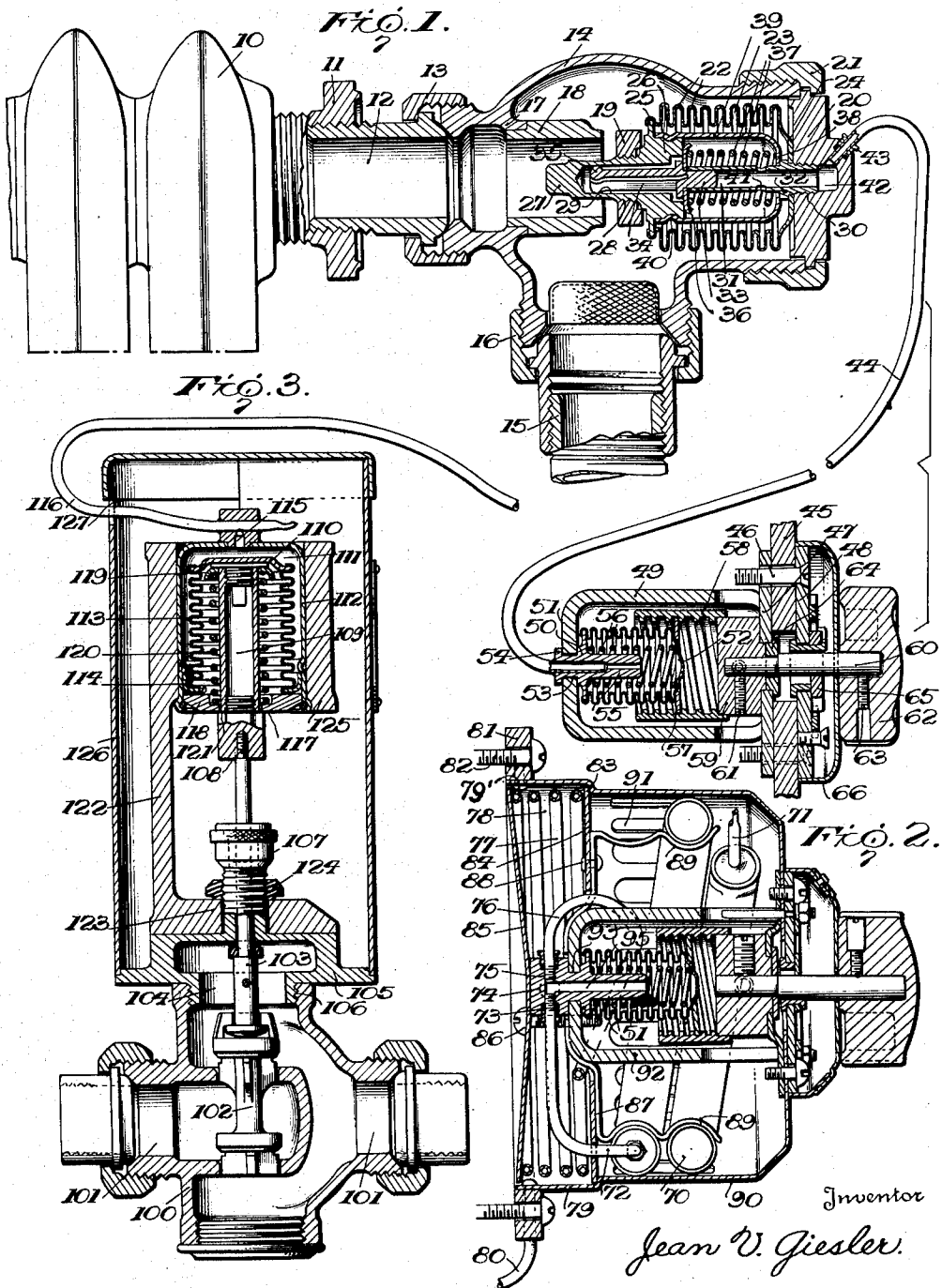
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THERMOSTATIC RADIATOR VALVE

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THERMOSTATIC RADIATOR VALVE

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This invention relates to temperature regulators, and particularly regulators of the character which employs a motor vessel subjected to a source of heat and constituting a vaporizing chamber for a liquid supplied thereto from a container for said liquid subjected to the controlling temperature.

It is an object of this invention to provide an improved container for the vaporizable liquid to be subjected to the temperature of the ambient.

Another object of this invention is to provide a device of the type characterized with improved means for adjusting the response at the container for the vaporizable liquid subjected to the temperature of the ambient.

Another object of this invention is to provide a device of the type characterized with improved means for subjecting the vaporizable liquid to the temperature of the ambient and including readily adjustable means for predetermining the temperature to be maintained.

Another object of this invention is to provide an improved device of the type characterized which includes a container for the volatile liquid that is so constructed, arranged and mounted that the desired sensitivity of response can be obtained by use of a relatively compact unit that can be readily installed at any suitable location and which will accurately vary the amount of vaporizable liquid supplied for vaporization in the motor vessel in conformity with the fluctuations of temperature at said location.

Another object of this invention is to provide a device of the type last characterized with improved means for predetermining the temperature to be maintained thereby.

Another object of this invention is to provide a device of the type characterized with a relatively long communicating tube between the motor vessel and the container for the vaporizable liquid, so that the device may be standardized and include sufficient tubing to permit the container for the vaporizable liquid to be positioned as remote from the motor vessel as is likely to be desirable in practice, and which at the same time has provision for compactly storing any excess length of tubing when the container is to be located at a point less remote from the motor vessel than the maximum provided for.

Another object of this invention is to provide a device of the type characterized which is particularly designed for use with high pressure steam as the heating medium, and wherein the motor vessel is so disposed with respect to the passages containing high pressure steam that the

proper temperature is maintained at said vessel.

Another object of this invention is to provide an improved device of the type characterized which can be readily standardized for use under a wide variety of conditions and which is composed of relatively simple parts, which is easily manufactured, assembled and installed, and which is highly efficient in service.

Other objects will appear as the description of the invention proceeds.

This application is a continuation in part of my earlier application for Thermostatic radiator valves, Serial No. 583,559, filed December 28, 1931.

The invention is capable of receiving a variety of mechanical expressions, some of which are illustrated on the accompanying drawing, but it is to be expressly understood that the drawing is for purposes of illustration only and is not to be construed as a definition of the limits of the invention, reference being had to the appended claims for that purpose.

Referring in detail to the accompanying drawing, wherein the same reference characters indicate corresponding parts in the several figures,

Fig. 1 is an axial section, somewhat schematic in character, illustrating an embodiment of the present invention;

Fig. 2 is an axial section of the unit of improved construction which it is preferred to use for subjecting the vaporizable liquid to the temperature of the ambient; and

Fig. 3 is an axial section on a smaller scale of a construction of valve mechanism with its motor vessel and associated parts suitable for use with high pressure steam.

In the form shown in Fig. 1, 10 designates a radiator or other heat exchanger of any suitable character and supplied with a heating medium through inlet 11, tail piece 12, tail nut 13, valve housing 14, and inlet conduit 15 connected to the inlet of the housing 14 by a coupling 16 of any suitable construction. Formed in or mounted on a partition 17 within the valve housing 14 is a valve seat 18 of any suitable size, construction and material for cooperation with a valve member 19 mounted as hereinafter explained. Said valve casing 14 is closed by a cover member 20 of special construction as hereinafter described, said cover member being suitably retained on said casing 14 as by a ring nut 21 of known construction.

Supported from said member 20 in any suitable way and operatively connected to the valve member 19 is an expansible and collapsible motor vessel generally designated 22 which is subjected to the temperature of the heating medium flowing

through the valve casing 14 and which constitutes a hot vaporizing chamber for a vaporizable liquid when injected therinto as hereinafter described. As shown, motor vessel 22 is formed by an ex-
 5 pansible and collapsible bellows-like tubular wall 23 having a stationary end wall 24 suitably attached thereto or formed integrally therewith. The opposite end of said flexible wall 23 is suitably attached, as by brazing or soldering, to a
 10 flange 25 formed on or attached to an end member 26 which has an elongated boss 27 projecting axially therefrom. Boss 27 is threaded at 28 to receive the valve member 19, and interiorly said boss is provided with an elongated cylindrical
 15 recess 29 for a purpose hereinafter explained.

Suitably mounted in member 20, as by a thread 30, is a tubular member 31 provided with a flange 32 by which the end wall 24 may be clamped fixedly to the member 20. At its opposite end
 20 said tubular member 31 carries a flanged plug 33, said plug being extended to form an elongated guide member 34 preferably provided with a spherical extremity 35 of such an exterior diam-
 25 eter that it may slide freely with respect to the cylindrical recess 29 and thereby the rectilinear movements of the end member 26 with its supported valve member 19 are guided by said extension 34 during opening and closing of the valve,
 30 while binding is prevented, owing to the spherical extremity 35, in the event that through warpage, distortion, or otherwise, member 26 tends to move at a small angle with respect to the axis of the
 35 guide member 34, said guide member throughout the major portion of its length preferably being of a somewhat smaller diameter than the diameter of the recess 29.

Mounted on the member 31 and plug 33, and shown as clamped between the end of the former and the flange on the latter, is a spring seat 36 for
 40 a coil spring 37 that surrounds the member 31 and, at its opposite extremity, engages the inwardly directed flange 38 of a tubular member 39 attached to the end member 26 in any suitable
 45 way, as by the bead 40. Spring 37 normally urges the member 39 toward the right, as viewed in Fig. 1, until the flange 38 engages the flange 32, and as the member 39 is attached to the end member 26, the motor vessel 22 is thereby normally main-
 50 tained in its contracted relation, and the valve disk 19 is held away from its seat 18. When said motor vessel is expanded by the development of an internal pressure therein, as hereinafter explained, end member 26 may move to the left,
 55 as viewed in Fig. 1, member 29 moving therewith to compress the spring 37 and flange 38 sliding on the tubular member 31. Thereby valve member 19 is caused to approach its seat 18 to the extent determined by the expansion of said vessel 22, up to the position where the disk 19 is seated
 60 to close the port in the valve seat 18.

To produce the aforesaid expansion of the motor vessel 22 means are provided for predeterminedly injecting small quantities of a vaporizable liquid into said vessel where said liquid is
 65 vaporized by heat derived from the heating medium. To this end the tubular member 31, which communicates with the interior of the vessel 22 as by one or more apertures 41, leads to a chamber 42 in the member 20, and communicat-
 70 ing with said chamber 42, and attached thereto in any suitable way as by a threaded thimble 43, is a tube 44, preferably flexible, leading to a container for the vaporizable liquid and which is subjected to the medium to be controlled so that
 75 predetermined quantities of liquid are injected

into said motor vessel upon predetermined increases of temperature.

In the form shown in Fig. 1 the container for volatile liquid is mounted on any suitable support 45 and retained thereon in any suitable way as by screws 46 which are shown as passing through supporting plates 47 and 48 on the opposite side of the member 45. Suitably secured to the plate 47 is a bracket or housing member 49 to which is
 10 suitably attached a stationary end member 50 of an expansible and collapsible vessel 51, here shown as composed of a tubular, deeply corrugated bellows-like exterior wall suitably attached,
 15 as by brazing or soldering, to a flange on the member 50 and having an opposite movable end wall 52 integral therewith or suitably attached thereto. End member 50 is secured within an aperture 53 in the bracket or housing member 49 in any suitable way, as by a coupling 54 and
 20 as shown, said end member carries a post 55 extended to a position whereby it will act as a stop to predetermine the maximum compression of the vessel 51. End member 50 and post 55 are provided with a passage extending therethrough
 25 in which is secured the end of the tube 44. Therefore, the interior of the vessel 51 is in communication through tube 44 with the motor vessel heretofore described. Mounted within said vessel 51 and cooperating with the opposed end walls
 30 thereof is a coil spring 56 which tends to hold said vessel in its most expanded position.

Suitably attached to the end wall 52, as by soldering or brazing, is a disk 57 provided with a helical periphery which is engaged with the interior screw threads provided on a sleeve 58 suitably
 35 attached to a rotatable plug 59. Projecting into an aperture in said plug 59 is an operating spindle 60, shown as attached to said plug by a set screw 61, and mounted on the outer end of said stem 60 is a knob or handle 62, also shown
 40 as attached to said stem by a set screw 63. Plug 59 is rotatably mounted in an aperture in plate 47 but held against axial displacement as shown at 64. Therefore upon rotating knob 62 and stem 60, the plug 59 and interior sleeve 58 are rotated,
 45 and thereby the plate 56 is caused to advance along the screw thread of the member 58 to expand or contract the vessel 51 depending upon the direction of rotation of the knob 62. Stem 60 is also rotatably mounted in an aperture in the plate 48 and is shown as provided with means
 50 65 for alternatively limiting the degree of rotation of said stem, or locking said stem against rotation, of the character disclosed and claimed in the application of William B. Mackintosh, Serial No. 583,531, filed December 28, 1931. A housing 66 through which the stem 60 projects encloses said means 65.

In order that a small range of temperature variation shall produce a predetermined volumetric change of the vaporizable liquid due to cubical expansion thereof and thereby effect the desired injection of vaporizable liquid into the vessel 22, it is desirable that a larger volume of said liquid be subjected to the temperature of the ambient than is conveniently supplied by a construction of the type illustrated in Fig. 1. At the same time, said larger volume of vaporizable liquid should be subjected to the ambient under such conditions that there is little lag
 70 in the time required to cause the entire volume of said liquid to respond to the change in temperature and thereby effect the desired volumetric change due to cubical expansion. Furthermore, the distance from the motor vessel at
 75

which said container is mounted, either for reasons of convenience of installation or because of the limits imposed by such location of said container as will cause it to respond properly to the temperature variations of the controlling ambient, is likely to vary within relatively wide limits, and at the same time it is highly desirable that a device of this character be standardized and that nothing be done to the instrument after it has left the factory, where it is properly charged and tested, that will be likely to cause modification of or interference with the proper operation thereof. A preferred construction of container with mounting and adjusting means to meet these respective needs is illustrated in Fig. 2.

As here shown, the container for the vaporizable liquid takes the form of a coiled tube-like bulb 70 which is preferably made of a diameter such that there is little lag in the response of the contained liquid to changes of temperature in the air. Said tubular bulb 70 may be made of any suitable length so that the volume thereof will be sufficiently great to submit to the temperature of the ambient such a volume of the vaporizable liquid that the percentage of change in volume, per degree change in temperature, is adequate to effect the desired injection of said liquid into the motor vessel. Thus in Fig. 2 said tubular bulb 70 is shown of such length that it is coiled through approximately 540°, but this obviously may be considerably varied, depending upon the volume of liquid desired, the diameter of the tubular bulb, the desirable compactness of unit, etc. Tubular bulb 70 is shown as provided with a filling tube 71 projecting from one end thereof, which tube may be pinched and sealed in any suitable way after the filling operation has been effected. Projecting from the opposite end of the bulb is a tube 72 leading to and suitably sealed into an opening 73 in T-shaped coupling 74. Sealed into the onposite opening 75 of said coupling is a flexible tube 76, corresponding to the tube 44 of Fig. 1 but here shown as having a substantial length coiled at 77 within a chamber 78 provided at the rear of a housing 79 and having its end 80 leading to a motor vessel of any suitable construction.

Housing 79 is attached in any suitable way, as by rivets 79', to a flange 81 which may be secured to any suitable support as by screws 82. Housing 79 has supported therein in any suitable way, as by a shoulder 83, a partition or bracket 84 which constitutes the bottom of the chamber 78. Chamber 78 is made of such size that when the unit being described is mounted as near to the motor vessel as it is likely to be desired in practice all of the excess tubing, whose length is such as to provide for the most remote location of said unit likely to be found in practice, can be coiled in said chamber 78. Any suitable means may be provided for retaining the tube in its coiled relationship in the chamber 78. As shown, a readily removable and preferably flexible cover plate 85 is suitably attached to a stationary part of the structure, as the housing for the adjusting mechanism hereinafter described, by a screw 86. Bracket or partition 84 may also carry suitable means for supporting the tubular bulb in position. As shown, strips 87 are suitably attached to said bracket or partition 84, as by rivets 88, and have their ends 89 bent substantially at right angles to the body thereof, said ends 89 being shaped to provide curved seats

adapted to engage the periphery of the tubular bulb at each of the respective coils thereof.

Housing 79 has its forwardly projecting portion 90 of sufficient size so as to house the tubular bulb 70 and the adjusting mechanism to be described, and the periphery of said housing is provided with apertures 91 so as to provide for the free ingress and egress of air to and from said bulb.

Supported within the housing in any suitable way is a tubular bracket or casing element 92 which is apertured or slotted at 93 to receive the stem of the T-shaped coupling 74. Extending through the stem of said T-shaped coupling is a passage 95 which communicates with the passage connecting the pipe section 72 and 76, said passage 95 also communicating at its inner end with an expansible and collapsible vessel 51 which, as here shown, is of the same construction and provided with adjusting means of the same character as heretofore described in detail in conjunction with the embodiment of Fig. 1, the same reference characters being applied thereto to designate the corresponding parts.

Fig. 3 illustrates a valve and motor vessel operatively connected thereto and suitably associated therewith for use where high pressure steam is the heating medium. The valve casing 100 has suitable inlet and outlet passages 101 for the heating medium, and disposed within said casing is a balanced valve 102 of any suitable construction. Operatively connected to said valve 102 is a valve stem 103 which projects through the aperture 104 provided in a bonnet member 105 suitably attached to the valve casing as by the threaded connection 106. Said valve stem 103 extends through a suitable packing device 107 and has its outer end suitably connected, as by a threaded connection 108, to a post 109 operatively associated with the movable end wall 110 of an expansible and collapsible motor vessel 111, here formed by a relatively rigid cup-shaped exterior wall 112 and an expansible and collapsible corrugated tubular wall 113 suitably attached to said movable end wall at one end, as by brazing or soldering, and suitably attached at its opposite end, as by brazing or soldering, to a flange member 114 which in turn is secured to said cup-shaped wall 112, as by brazing or soldering. The chamber 111 is in communication through passage 115 with a tube 116 which, for example, may be an extension of the tube 44 in Fig. 1 or of the tube 80 in Fig. 2. Mounted between a flange 117 on a collar 118 suitably secured in the relatively open end of the cup-shaped wall 112, and a spring seat 119 associated with movable end wall 110, is a coil spring 120 which normally tends to expand the wall 113 and reduce the volumetric content of the chamber 111 to the extent permitted by the engagement of a shoulder 121 on the post 109 with the stop provided by the flange 117. The development of pressure in the chamber 111, when the vaporizable liquid is injected therein, causes the movable end wall 110 to move downwardly as viewed in Fig. 3, compressing the spring 120 and moving the post 109 and the valve stem 103 connected thereto to close the valve 102.

In this embodiment, owing to the high temperature existing where high pressure steam is used the motor vessel 113 is not subjected directly to the temperature of the steam but is mounted in heat conducting relation with parts subjected to the temperature of the steam, said vessel being disposed at such a position with respect to the high temperature parts with intermediate heat

conducting members of such construction and material that the motor vessel is maintained at the desired temperature when the high pressure steam is flowing through the valve casing 100. As shown, a generally L-shaped bracket 122, which may be formed of a brass casting, has an annular base portion 123 which may be clamped to the bonnet member 105 by the nut 124, and a tubular portion 125 within which the outer wall 112 of the expansible and collapsible chamber 111 is secured in any suitable way. Heat is therefore transferred to the motor vessel 111 by conduction from the bonnet member 105 through the bracket 122 to the wall of said motor vessel. Said vessel and its bracket are preferably provided with an enclosing casing 126 which may be supported on the bonnet member 105 in any suitable way as by a flange thereon, and said housing has a suitable aperture 127 through which the tube 116 extends. In operation the container for vaporizable liquid is subjected to the temperature of the ambient and the liquid therein varies in volume by cubical expansion in conformity with the changes in the temperature of the ambient. If the temperature of the ambient rises the expansion of said liquid causes the injection of predetermined quantities of said liquid into the hot vessel, where it is vaporized and produces an expansion of said vessel by reason of the increase in pressure therein, moving the valve member toward closed position. If the temperature of the ambient decreases, the liquid in the container exposed to the ambient contracts, thereby decreasing the pressure in the motor vessel and withdrawing some of the vapor therefrom into the communicating tubing where it is condensed, this operation continuing until the readjustment of pressure in the motor vessel corresponds with the contraction of the liquid in the container. Thereby the position of the valve member is adjusted with respect to the temperature existing at the container for vaporizable liquid and an accurate regulation of temperature is effected. The temperature to be maintained can be predetermined by adjusting the container itself, in the embodiment of Fig. 1, or the reservoir for the liquid in communication with the tubing, in the embodiment of Fig. 2, so that a greater or less expansion of the liquid is required before the predetermined injection of liquid into the motor vessel takes place.

It will therefore be perceived that the present invention provides means whereby a container for vaporizable liquid in communication with a relatively hot motor vessel which constitutes a vaporizing chamber for said liquid may be subjected to the temperature of the ambient under conditions wherein the amount of vaporizable liquid injected into said hot motor vessel is nicely controlled by the temperature of the ambient. Moreover, means have been provided whereby the volume of liquid so subjected to the temperature of the ambient may be made relatively large and yet the container therefor is of such character that the entire volume of said liquid may respond promptly to changes in the temperature of the air while, at the same time, the container is of compact construction. The present invention also enables the apparatus to be standardized with such a length of communicating tubing as is likely to be necessary for the most remote location of the container from the motor vessel while at the same time said container may be positioned relatively close to the motor vessel without modifying the structure or interfering with the condition of adjustment of the apparatus as

it leaves the factory. Means have also been provided whereby a hot motor vessel can be employed with high pressure steam. Provision has also been made for the ready and accurate adjustment of the temperature by varying the extent to which said vaporizable liquid must be expanded to effect the desired injection into the hot motor vessel. The structure illustrated and described is composed of relatively simple parts which can be manufactured and assembled in quantities without the use of highly skilled labor and therefore the device is economical to manufacture. Moreover, the unit designed to be mounted on an exposed surface within the room or other compartment whose temperature is to be controlled is simple and compact in construction and of a character not to be objectionable either because of its appearance or because of danger of injury thereto because of projections, delicate parts, etc.

While the embodiments illustrated on the drawing have been described with considerable particularity, it is to be expressly understood that the invention is not restricted thereto. Various other embodiments thereof will now readily suggest themselves to those skilled in the art, while changes may be made in the details of construction, arrangement, proportion and material of the parts, and certain features used without other features, without departing from the spirit of the invention. Reference is therefore to be had to the appended claims for a definition of the limits of the invention.

What is claimed is:—

1. In a temperature regulator for heat exchangers, in combination with valve mechanism for controlling the flow of a heating medium, an expansible and collapsible motor vessel subjected to the temperature of said heating medium and operatively connected to said valve mechanism, means containing a vaporizable liquid responsive to changes in temperature of the medium to be controlled for injecting predetermined quantities of said vaporizable liquid into said hot motor vessel, said means including a coiled elongated tube constituting a container for said volatile liquid, a housing for said container, a partition in said housing providing a storage compartment separated from the compartment in which said container is subjected to the medium to be controlled, and a long flexible conduit connecting said container and vessel and adapted to permit said container to be positioned relatively remote from said vessel, said conduit adapted to be coiled in said compartment when said container is to be positioned at a distance from said vessel which is less than the length of said conduit.

2. In a temperature regulator for heat exchangers, in combination with valve mechanism for controlling the flow of a heating medium, an expansible and collapsible motor vessel subjected to the temperature of said heating medium and operatively connected to said valve mechanism, a container for a vaporizable liquid responsive to changes in temperature of the medium to be controlled and adapted to inject predetermined quantities of said vaporizable liquid into said hot motor vessel, a relatively long flexible conduit communicating with said vessel and said container, and a housing for said container providing a chamber in which said conduit may be coiled when said container is positioned at a distance from said vessel which is less than the length of said conduit, said chamber being separated from the chamber

in which said container is subjected to the medium to be controlled.

3. In a temperature regulator for heat exchangers, in combination with valve mechanism for controlling the flow of a heating medium, an expansible and collapsible motor vessel subjected to the temperature of said heating medium and operatively connected to said valve mechanism, a container for a vaporizable liquid responsive to changes in temperature of the ambient and subjecting a substantially constant volume of said liquid to said ambient temperature, said container adapted to inject predetermined quantities of said vaporizable liquid into said hot motor vessel, a support for said container, a conduit in communication with said container and vessel, an expansible and collapsible reservoir for said liquid mounted on said support and in communication with said conduit, and means for expanding and contracting said reservoir to vary the volume of said liquid in said conduit and thereby the amount of expansion of liquid in said container required to effect injection into said motor vessel.

4. In a temperature regulator for heat exchangers, in combination with valve mechanism for controlling the flow of a heating medium, an expansible and collapsible motor vessel subjected to the temperature of said heating medium and operatively connected to said valve mechanism, means containing a vaporizable liquid responsive to changes in temperature of the ambient for injecting predetermined quantities of said vaporizable liquid into said hot motor vessel, a support for said container, said means including a relatively rigid coiled elongated tube for subjecting a substantially constant volume of said liquid to the ambient, a conduit communicating with said container and said vessel, an expansible and collapsible reservoir for said liquid mounted on said support concentrically with the coil of said container, said reservoir being in communication with said conduit, and means for expanding and collapsing said reservoir to vary the amount of liquid in said conduit and thereby the expansion of said liquid required to effect injection of said liquid into said vessel.

5. In a temperature regulator for heat exchangers, in combination with valve mechanism for controlling the flow of a heating medium, an expansible and collapsible motor vessel subjected to the temperature of said heating medium and operatively connected to said valve mechanism, means for subjecting a substantially constant volume of vaporizable liquid responsive to changes in temperature of the ambient and thereby injecting predetermined quantities of said vaporizable liquid into said hot motor vessel, said means including a coiled tubular bulb filled with said liquid, an expansible and collapsible container for said liquid around which said bulb is coiled, a conduit in communication with said bulb, said container and said vessel, said container adapted to vary the volume of said liquid in said conduit, and means for expanding and contracting said container.

6. In a temperature regulator for heat exchangers, in combination with valve mechanism for controlling the flow of a heating medium, an expansible and collapsible motor vessel subjected to the temperature of said heating medium and operatively connected to said valve mechanism, means containing a vaporizable liquid responsive to changes in temperature of the medium to be controlled for injecting predetermined quantities of said vaporizable liquid into said

hot motor vessel, said means including a casing adapted to be positioned relatively remote from said vessel, a tube coiled within said casing and constituting a container for said liquid, and a flexible conduit of standardized length communicating with said container and said vessel, said casing providing a chamber in which the excess length of said conduit may be coiled when said conduit is longer than the distance between said casing and said vessel.

7. In a temperature regulator for heat exchangers, in combination with valve mechanism for controlling the flow of a heating medium, an expansible and collapsible motor vessel subjected to the temperature of said heating medium and operatively connected to said valve mechanism, means containing a vaporizable liquid responsive to changes in temperature of the medium to be controlled for injecting predetermined quantities of said vaporizable liquid into said hot motor vessel, said means including a casing adapted to be positioned relatively remote from said vessel, an elongated tubular container for said liquid coiled within said casing, a flexible conduit of standardized length connecting said container and said vessel and adapted to have the excess length thereof coiled within said casing when said conduit is longer than the distance between said vessel and said casing, and means for holding said coiled conduit in said chamber.

8. In a temperature regulator for heat exchangers, in combination with valve mechanism for controlling the flow of a heating medium, an expansible and collapsible motor vessel subjected to the temperature of said heating medium and operatively connected to said valve mechanism, a container for subjecting a substantially constant volume of a vaporizable liquid to changes in temperature of the ambient, said container adapted to inject predetermined quantities of said vaporizable liquid into said hot motor vessel, a support for said container, a conduit connecting said container and said vessel, and means mounted on said support and associated with but separated from said container casing for varying the amount of liquid in said conduit without varying the size of said container and thereby varying the amount of expansion of said liquid required to effect an injection into said vessel.

9. In a temperature regulator for heat exchangers, in combination with valve mechanism for controlling the flow of a heating medium, an expansible and collapsible motor vessel subjected to the temperature of said heating medium and operatively connected to said valve mechanism, a coiled tubular container for subjecting a substantially constant volume of a vaporizable liquid to changes in temperature of the ambient and adapted to inject predetermined quantities of said vaporizable liquid into said hot motor vessel, a casing for said container, a flexible conduit connecting said container and said vessel, and means within said casing for varying the amount of liquid in said conduit without varying the amount of liquid in said container, and thereby varying the amount of expansion of said liquid required to effect an injection into said vessel, said last named means including an expansible and collapsible vessel concentrically arranged with respect to said container and in communication with said conduit and means cooperating with said vessel for expanding and contracting the same.

10. In a temperature regulator for heat ex-

changers, in combination with valve mechanism for varying the flow of heating medium, an expansible and collapsible motor vessel operatively connected to said valve mechanism and subjected to the temperature of said heating medium, whereby said vessel constitutes a vaporizing chamber for a vaporizable liquid, liquid-containing means for subjecting a substantially constant volume of said vaporizable liquid to the temperature of the ambient and including means for varying the degree of cubical expansion of said liquid required to effect an injection of liquid into said motor vessel without varying the volume of said liquid subjected to said temperature by said liquid-containing means, said last-named means being associated with but separated from said liquid-containing means and including an expansible and collapsible container for said liquid, and means for expanding and contracting said container.

11. In a temperature regulator for heat exchangers, in combination with a valve casing and valve mechanism therein for controlling the flow of a heating medium through said exchanger, an expansible and collapsible motor vessel operatively connected to said valve mechanism, means for mounting said vessel outside of said valve casing, said mounting means constituting a conductor of heat from said valve casing to said vessel whereby said vessel is maintained at a predetermined temperature below that of said heating medium by heat conducted thereto from

said heating medium and constitutes a vaporizing chamber for a vaporizable liquid, a container for said vaporizable liquid adapted to be mounted in a position relatively remote from said vessel and to inject predetermined quantities of said liquid thereinto, and a conduit connecting said container and vessel.

12. In a temperature regulator for heat exchangers, in combination with a valve casing and valve mechanism therein for controlling the flow of a heating medium through said exchanger, an expansible and collapsible motor vessel having an inflexible tubular exterior wall and operatively connected to said valve mechanism, a metallic bracket in heat conducting relationship with said exterior wall of said motor vessel and mounted exteriorly of said valve casing in heat conducting relationship therewith whereby said vessel is maintained at a predetermined temperature below that of said heating medium by heat metallically conducted to said vessel through said bracket and said vessel constitutes a vaporizing chamber for a vaporizable liquid, a container for said vaporizable liquid adapted to be positioned relatively remote from said vessel and to inject predetermined quantities of said vaporizable liquid into said vessel upon predetermined increases of temperature in the medium to which said container is subjected, and a conduit connecting said vessel and said container.

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