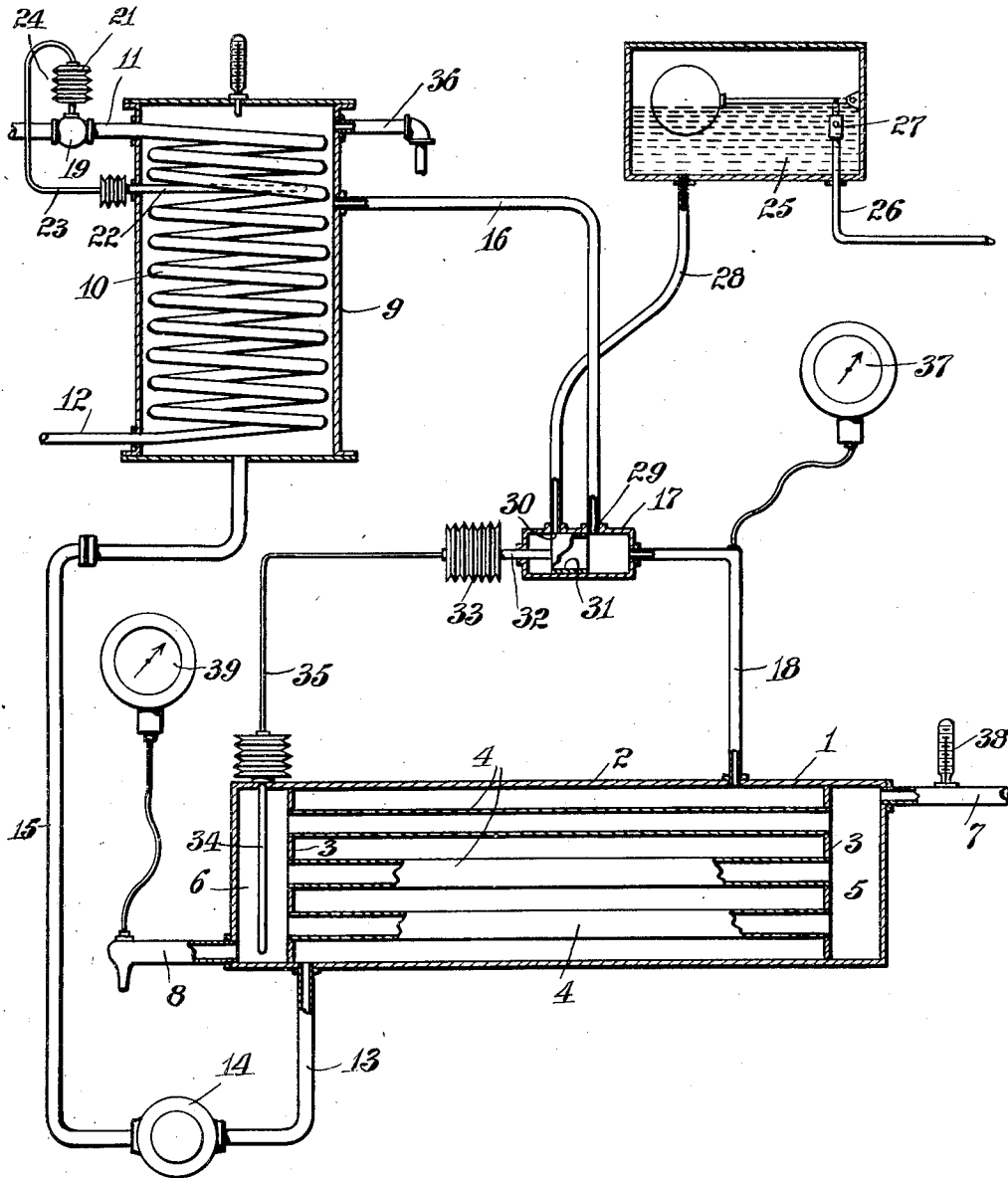


G. M. S. TAIT.
TEMPERATURE CONTROLLER.
APPLICATION FILED NOV. 20, 1920.

1,382,569.

Patented June 21, 1921.



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TEMPERATURE-CONTROLLER.

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To all whom it may concern:

Be it known that I, GODFREY M. S. TAIT, a citizen of the United States, residing at 1820 K street N. W., in the city of Washington and District of Columbia, have invented certain new and useful Improvements in Temperature-Controllers, of which the following is a specification.

My invention relates to apparatus for raising to a fixed temperature liquid and other fluids supplied at variable rates, and is particularly intended for the preheating of milk and other liquids which are to be subjected to a pasteurizing or sterilizing treatment, though applicable to other purposes. My invention comprises means for automatically regulating the temperature of a heating fluid, in accordance with minute variations of temperature of a liquid or other fluid to be heated. Other features of my invention will be pointed out hereinafter.

The object of my invention is to provide a simple and effective apparatus for maintaining a practically fixed temperature of delivery of a liquid or other fluid which is supplied at a variable rate.

I will now proceed to describe my invention with reference to the accompanying drawing, illustrating more or less diagrammatically, one embodiment of my apparatus.

In the drawing, 1 designates what is known technically as a preheater, consisting essentially of a shell 2 having within it tube sheets 3 connected by tubes 4; the tube sheets forming, with the heads of the shell 2, an intake chamber 5 and an outflow chamber 6. 7 designates the pipe through which the fluid to be heated is supplied and 8 designates the pipe through which the fluid discharged from the preheater is carried off. The space between the tube sheets and surrounding the tubes 4 can be understood to be filled with a heating fluid, usually hot water.

Pasteurization and like processes require very accurate maintenance of temperature; if the temperature be not as high as intended, the treatment may be, in part at least, ineffective; if the temperature be too high, the material treated may be spoiled. If the material to be treated were supplied at a uniform rate, it would be a relatively

simple matter to maintain a temperature of heating fluid required to bring the fluid to be heated to just the right temperature; but in practice, the fluid to be heated is usually supplied at a very irregular rate; therefore, a heating fluid of uniform temperature will not bring the fluid to be heated to just the right temperature at exit, under all conditions, hand regulation has proved ineffective, in large measure, and means heretofore employed for automatic regulation of temperature have not proved effective, according to my information.

9 designates a heater, which may be termed the primary heater, for the heating fluid; the particular heater shown being of the general nature of a "feed water heater," and comprising a suitable chamber within which is a pipe coil 10 supplied with steam or other suitable heating fluid through a pipe 11; 12 is the discharge pipe for this coil 10.

Water to be heated in this heater 9 is drawn from the preheater 1 by a pipe 13 and is forced, preferably by a pump at 14, through a pipe 15 into the heater 9; and the heated water is discharged from the heater 9 through a pipe 16 into a mixing valve 17 and thence through a pipe 18 into the preheater 1. The arrangement is such that mere "thermo-siphon" flow would take place through the conduit 13-15-16-18, without any action of pump 14. But the use of a circulating pump is preferable in most cases.

The supply of heating fluid (such as steam) through pipe 11, is regulated automatically by a valve 19 controlled by an automatic regulator 21. One suitable type of regulator for the valve 19 is a so-called "siphon" regulator, which is indicated diagrammatically in the drawing; such regulator comprising a capsule 23 immersed in the fluid contained within the vessel 9, and containing a fluid which will volatilize at some desired predetermined temperature, the vapor of this fluid being communicated by a pipe 23 to a bellows chamber 24 which will actuate the valve 19. However, I do not limit myself to any particular means for actuating the valve 19.

As above stated, it is to be understood that the fluid to be heated in the preheater

1 is, or may be, supplied to that preheater at a variable rate and at a variable temperature. The capacity of the heater 9 must be sufficient to enable it to supply hot water to the preheater 1 at a rate, and at a temperature, such as will suffice to raise to the desired temperature, the fluid to be heated in that heater 1, when such fluid to be heated in the heater 1 is supplied at the maximum rate, and at the minimum temperature, of supply. Naturally, therefore, the temperature to which the water will be raised in the heater 9 will be considerably above the temperature to which the milk or other fluid is to be raised in the preheater 1; for it is only by maintaining a considerable difference of temperature planes that efficient transfer of heat from the one fluid to the other can be obtained in apparatus of moderate size in proportion to its flow capacity. It is evident that, with the heating water supplied to the preheater 1 at a temperature considerably above the temperature to which the milk or other fluid to be treated is to be raised, if the rate of supply of this milk or other fluid to be treated decrease suddenly, and considerably, there is danger that such milk or other fluid to be treated will be heated to above the desired temperature. Mere restriction by some means or other, of the supply of hot water from heater 9 to the preheater 1, will not suffice to prevent this over-heating of the liquid treated in the preheater 1, because the capacity for heating liquid of that preheater is considerable, and what is required is a rapid reduction in the temperature of the heating water of that preheater, to correspond with the reduced rate of supply of the liquid to be heated.

On the other hand, should the rate of supply of heating water to the preheater 1 be regulated by some means to correspond to a low moderate rate of supply of the milk or other liquid to be treated, and if this rate of supply of the milk or other liquid to be treated be raised suddenly, then obviously the milk or other liquid to be heated will not be raised to the desired temperature, for a time at least, and until the temperature and rate of flow of the heating water through the preheater can be increased greatly.

To obviate these difficult conditions of regulation, I provide, not only a source of hot water supply (the heater 9), but also a source of cold water supply, means for mixing the cold water with the hot water, and automatic means, controlled by the temperature of the outflowing liquid which has been heated in the preheater 1, for regulating the admixture of the cold water with the hot water.

The source of cold water supply consists of a cold water chamber 25, itself supplied to a pipe 26 and float valve 27, the regu-

lating valve 17 already mentioned, and a cold water pipe 28, leading from tank 25 to the mixing valve 17. Said mixing valve has two inlet ports, one, 29, for hot water pipe 16, and the other, 30, for cold water pipe 28; and within said valve chamber 17 there is a piston valve 31, adapted to move back and forth in that valve chamber, and thereby to open and close, selectively, the ports 29 and 30; said piston valve 31 being actuated by a piston rod 32 and by an automatic regulator (represented diagrammatically by the siphon regulator 33 which is of a construction similar to that of the regulator 21 for valve 19). The volatile fluid capsule 34 of this regulator 27 is within the discharge chamber 6 of the preheater 1 and is connected by pipe 35 to the bellows chamber 33 connected to piston rod 32.

The operation of the apparatus is as follows:

The heater 9 being of sufficient heating capacity to heat heating water to be supplied to preheater 1 to a predetermined temperature and at a rate sufficient to maintain the temperature in chamber 6 of the preheater, at a certain fixed temperature, at the maximum rate of supply through pipe 7, and the supply of heating steam or other heating fluid through pipe 11 being regulated automatically by the regulator 21, to maintain with approximate accuracy the temperature of the water outflowing from the heater 9, under all conditions, the automatic regulating device 33 will adjust the valve 31 to admit only hot water from the heater 9, or to admit more or less such hot water and more or less cold water from tank 25, according to the temperature and rate of supply of the liquid to be heated, supplied through pipe 7. In this way such liquid, supplied through pipe 7, will be raised in the preheater 1, to a determined temperature, which will be maintained with great exactness through the action of the automatic regulator 33 and valve 31, whereby just that proportion of cold water will be mixed with the hot water as may be required to produce and maintain the desired temperature in the discharge chamber 6.

Heretofore there have been various automatic regulating devices which would maintain with a considerable degree of accuracy the temperature of the outflow in a heater such as heater 9. But as will be apparent from what has been said above, that is not sufficient for the maintenance of the desired temperature of outflow, in a preheater such as preheater 1, supplied with heating fluid from a heater such as heater 9, when the rate of supply of fluid to be heated to the preheater 1 varies greatly, or when the temperature of the liquid to be heated in the heater 1, varies greatly. The apparatus herein described, however, meets these conditions.

36 designates an overflow for heater 9. Suitable thermometers 37, 38 and 39 are supplied at various points.

What I claim is:—

5 1. Apparatus such as described comprising a heat exchanger adapted to exchange heat between a heating fluid and a fluid to be heated, means for the supply of heating fluid to such exchanger comprising a primary heater, means for regulating the temperature of the outflow therefrom, a source of cold fluid, a mixing device adapted to mingle the warm fluid from the primary heater and the said cold fluid and arranged to discharge the mixed fluid into a heating space of said heat exchanger, said mixing device comprising also regulating valve means whereby the proportion of heated fluid to cold fluid may be varied, and automatic means, controlled by the temperature of the outflowing heated liquid of the heat exchanger, for regulating the said valve means of the mixing device.

2. Apparatus such as described, comprising a heat exchanger adapted to exchange heat between a heating fluid and a fluid to be heated, means for the supply of heating fluid to such exchanger comprising a primary heater, means for regulating the temperature of the outflow therefrom, a source of supply of cold fluid, a mixing device adapted to mingle the warm fluid from the primary heater and the said cold fluid and arranged to discharge the mixed fluid into a heating space of said heat exchanger, said mixing device comprising also regulating valve means whereby the proportion of heated fluid to cold fluid may be varied, automatic means controlled by the temperature of the outflowing heated liquid of the heat exchanger, for regulating the said valve means of the mixing device, and means for returning heating fluid from the heat exchanger to the primary heater.

In testimony whereof I affix my signature. 45
GODFREY M. S. TAIT.