G. G. BELL & J. ST. V. PLETTS.

METHOD AND APPARATUS FOR HEATING.

APPLICATION FILED SEPT. 25, 1909.

1,069,371.

Patented Aug. 5, 1913.

3 SHEETS—SHEET 1.

FIG. 1.

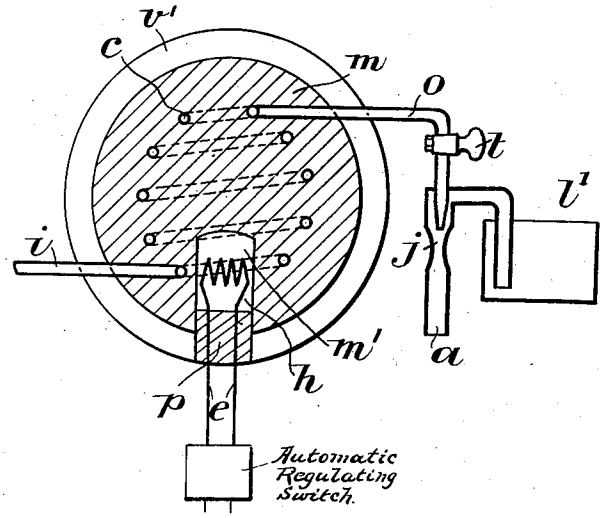
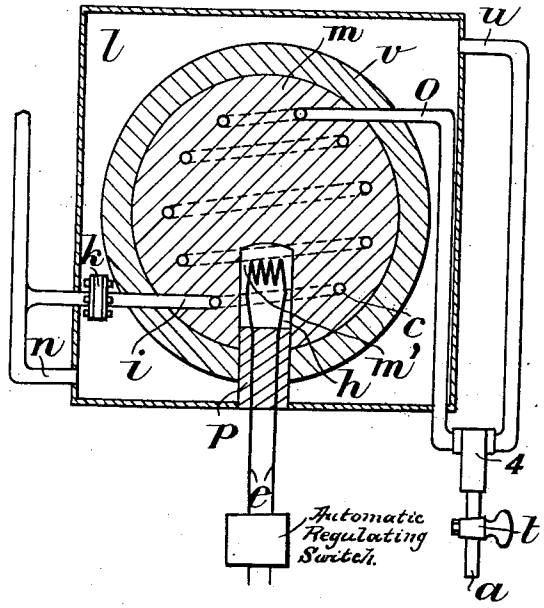


FIG. 2.



Witnesses.

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3 SHEETS—SHEET 2.

FIG. 3.

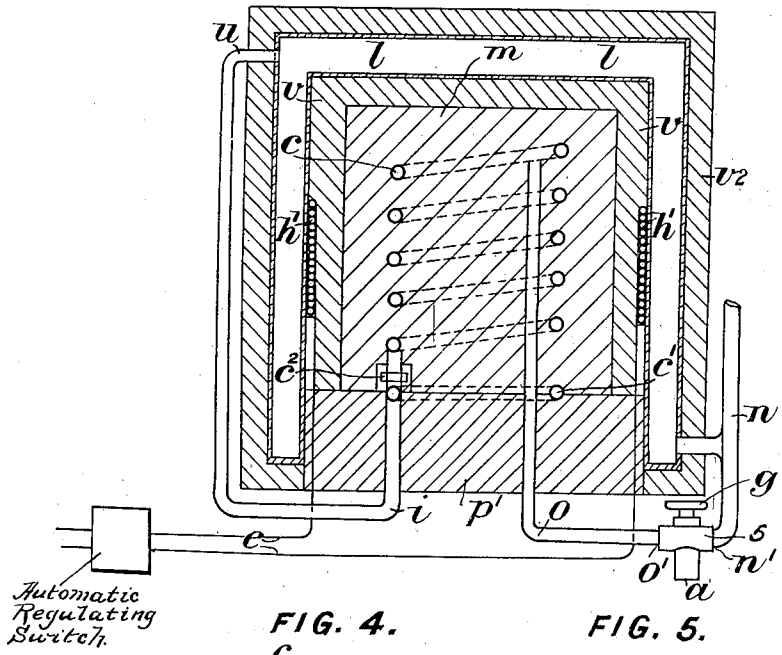


FIG. 4.

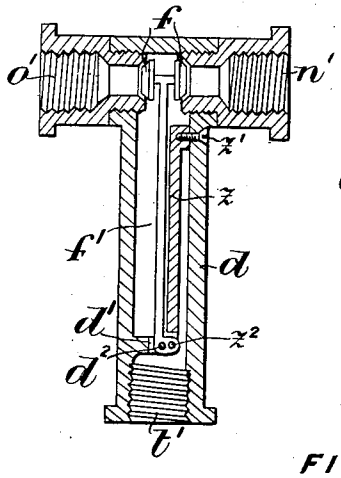


FIG. 5.

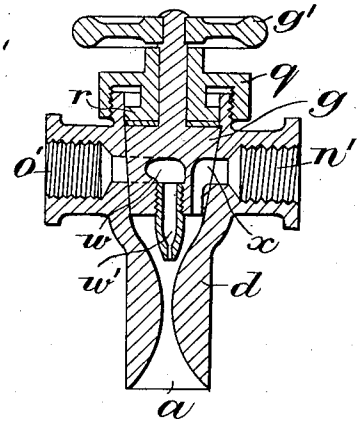
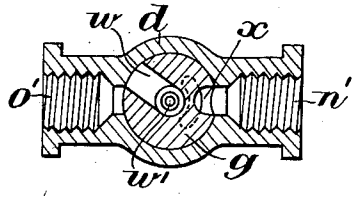


FIG. 6.



Witnesses.

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3 SHEETS—SHEET 3.

FIG. 7.

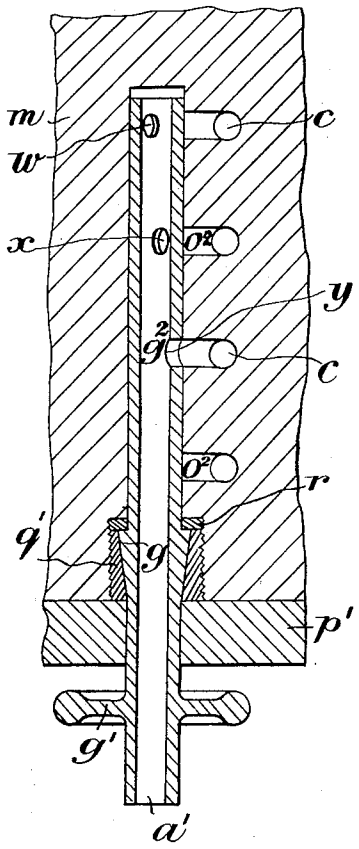


FIG. 9.

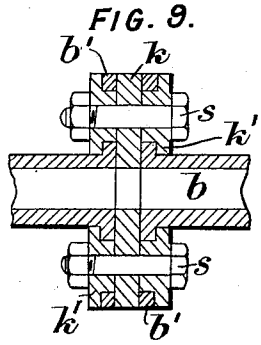
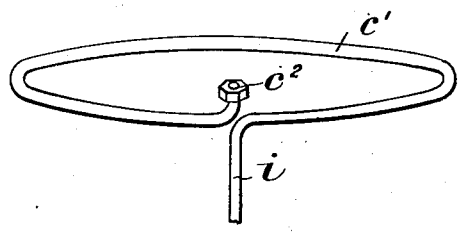


FIG. 8.



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UNITED STATES PATENT OFFICE.

GEORGE GILBERT BELL, OF LONDON, AND JOHN ST. VINCENT PLETTS, OF TEDDINGTON, ENGLAND, ASSIGNORS, BY MESNE ASSIGNMENTS, TO ELECTRIC HEAT STORAGE COMPANY, A CORPORATION OF NEW YORK.

METHOD AND APPARATUS FOR HEATING.

1,069,371. Specification of Letters Patent. Patented Aug. 5, 1913.

Application filed September 25, 1909. Serial No. 519,558.

To all whom it may concern:

Be it known that we, GEORGE GILBERT BELL and JOHN ST. VINCENT PLETTS, subjects of the King of Great Britain, residing, respectively, at 14 Addison Court Gardens, London, England, and 43 Clarence road, Teddington, in the county of Middlesex, England, have invented a Method and Apparatus for Heating, of which the following is a specification.

This invention relates to a new or improved method of heating by electricity and apparatus therefor.

The usual method of heating water electrically consists in placing the quantity of water required to be heated in an electrically heated vessel, which may or may not be provided with a heat insulating coating. Such a method however is only capable of heating a predetermined quantity of water and requires a certain time to produce the temperature required while it makes a large and brief demand upon the electric supply but this invention is characterized by electrically heating a heat accumulator or mass of a substance capable of storing heat and in imparting that stored heat to water or any other suitable substance as and when required. Moreover according to this invention it is possible to consume the electrical energy either continuously or during those hours of the day when it may be purchased most cheaply for the purpose of storing up a considerable amount of heat ("considerable amount of heat" representing the accumulation produced by the application of a smaller amount of electric energy for a period of time) and to deliver the hot water whenever required in any quantities up to a maximum depending on the size of the apparatus. The latter consists in its simplest form of a heat accumulator or mass of a substance capable of withstanding a high temperature having a high specific or latent heat value and it should be a good conductor of heat so as to impart its heat quickly to the water. Iron, for example, is a suitable material to employ and a mass of iron is provided with a coil of pipe embedded therein or passing through same for the passage of the water, and an electric heating device, both the coil and the heater being surrounded by a heat insulating coating or jacket. The mass being heated, transmits heat to the pipe coil and thus heats the water in or passing through same and means may be provided for mixing the steam or hot water with cold water to give the temperature required. The mass of iron may have any shape, but it is desirable that it should have the least possible surface for its volume in order that the escape of heat may be a minimum and it is therefore preferable to cast a sphere of iron about a coil of pipe, through which passes the water to be heated. The coil of pipe may be of any length and may be arranged so that there is an equal volume of iron within and without the convolutions and the piping may be of any section or may be corrugated in order to give a large surface so that the heat may be imparted sufficiently quickly to the water passing through it.

The heat may be produced by passing the electric current through a resistance of any kind or in the case of an alternating current by the hysteresis of a core around which the current passes or by the passage of a secondary induced current through a circuit of any form or by any combination of these methods and the heating device of the apparatus may be within or without the mass of iron or the mass of iron may itself form part of the heating device. In the case of an alternating current with a secondary heat producing circuit the primary circuit may be separated from the mass of iron by a layer of heat insulating material or may be entirely outside the insulating coating so that it conducts away as little heat as possible from the mass of iron.

The insulating coating surrounding the mass of iron and the heating device may be made of any substance which is a good heat insulator, and of any thickness, and it may if desirable, for strength or otherwise have an external or internal metal sheathing or it may consist of a double sheathing with a vacuum between the walls and the external and internal surfaces of the sheathing may be polished or silvered to minimize radiation.

The steam or hot water produced by the passage of the water through the hot mass of iron may be mixed with cold water either by employing a thermostatic valve or cock

which causes the water to issue at a practically constant temperature or by employing an injector or mixing nozzle which picks up sufficient water to condense the steam or by employing a hand regulated valve or cock by means of which the temperature of the water can be varied as desired and in the latter case means may be provided for preventing the escape of uncondensed steam and the consequent loss of latent heat by employing for example an automatic float valve which prevents the passage of steam. The temperature of the steam or hot water issuing from the hot mass of iron may also be regulated by providing a valve or cock connected to the coil of pipe at several points in such a manner that the water may be drawn from any of such points thus regulating the temperature to which the water is raised by varying the length of the pipe through which it passes.

It is evident, since there is no material which is a perfect heat insulator, that a certain amount of heat must escape from the hot mass of iron and the latter is therefore preferably placed together with its insulating coating within a tank from which the cold water to be converted into steam or hot water or to be mixed with the steam or hot water is drawn so that the heat escaping is not lost. This tank may also be provided with a heat insulating coating. Further the electrical and water connections may be constructed to have a considerable length within the tank so that what heat they conduct away from the mass of iron is given up to the water and is not lost and the water pipes may be made of a material which is not a good conductor of heat or may have insulating washers inserted at one or more places in them to break the metallic connection.

The current used in this apparatus for heating may be obtained from a source on which the demand is variable, and when the demand is at its maximum and can take all the supply, the current to the heating apparatus of this invention is adapted to be cut off by any known form of automatic switch.

We now proceed to describe in greater detail apparatus for carrying out our invention with particular reference to the figures.

Figures 1, 2 and 3 are sections of different forms of the apparatus. Fig. 4 is a section of a thermostatic valve, Fig. 5 is a section of a hand regulated cock, Fig. 6 is another section of the cock shown in Fig. 5, Fig. 7 is a section of another form of hand regulated cock, Fig. 8 is a perspective view of the removable section of the coil shown in Fig. 3, Fig. 9 is a section of the insulating washer shown in Fig. 2.

In Figs. 1, 2 and 3, m is the mass of iron cast about the coil of pipe c, which is provided with the inlet i and outlet o.

In Figs. 1 and 2 the heat accumulator or mass of iron m is provided with a recess m^1 containing the heater h connected to the electric mains e which pass out through the plug of insulating material p which can be removed so that the heater h may be removed and replaced.

In Fig. 1 the heat accumulator or mass of iron m is placed within a vessel v^1 from which the air is exhausted and the outlet pipe o of the coil c is provided with a cock t and injector j which if steam is issuing from the pipe o picks up sufficient water from the tank l^1 to condense the steam and deliver hot water at the orifice a.

In Fig. 2 the heat accumulator or mass of iron m together with its coating of insulating material v and heater h is placed within a tank l through which pass the inlet pipe i and the outlet pipe o and in which is an aperture for the insertion of the plug p with the electric mains e. The tank l is also provided with an inlet pipe n and an outlet pipe u which latter connects with the outlet pipe o of the coil c at the thermostatic valve 4 and has a common outlet through the cock t and orifice a so that when the cock t is turned on, water will flow both through the mass of iron m and tank l and be mixed at the valve 4 in such proportions that it will issue from the orifice a at a substantially constant temperature.

In Fig. 3 the heat accumulator or mass of iron m for simplicity of construction is made cylindrical instead of spherical and in place of the heater h of the former figures a coil of wire h^1 is wound around outside of the insulating coating v thus forming a primary circuit which with an alternating current will induce secondary currents and produce heat in the mass of iron m. The pre-heating tank l which is provided with an insulating coating v^2 is made with a large cylindrical recess into which fits the mass of iron m together with its insulating coating v and primary coil h^1, the recess being closed by a plug of insulating material p^1 through which pass the inlet pipe i, the outlet pipe o and the electric mains e, but the inlet pipe i, after it has passed through the plug of insulating material p^1 and before it enters the mass of iron m, makes one turn c^1 in contact with the mass of iron m so that this external turn c^1 in which the fur will be formed if the water is hard can be easily replaced. The outlet pipe u of the tank l is joined to the inlet pipe i of the coil c forming a duct or heat delivering chamber and the inlet pipe n of the tank l connects with the outlet pipe o of the coil c at the hand regulated cock 5 and has a common outlet through the orifice a so that the temperature of the water issuing from the orifice a can be regulated by turning the cock 5 which varies the proportion of water coming di-

rectly from the inlet pipe n and indirectly through the tank l, pipes u and i, coil c and outlet pipe o. Thus the water in the coil c is taken from the tank l wherein it has been pre-heated. The tank l therefore acts as a pre-heating tank or pre-heater.

In Fig. 4 which is a section on a larger scale of the thermostatic valve shown in Fig. 3, o^1 is the inlet for the steam or hot water issuing from the coil of pipe, n^1 is the inlet for the colder water and both inlets are partially closed by the valves which are carried on the rod f^1. The inlets o^1 and n^1 screw into the barrel d which is provided with a projection d^1 and is threaded at t^1 for attachment to a cock. A rod of metal z, having a smaller coefficient of expansion under the action of heat than the metal of the barrel d, is fixed to the latter as by the screw z^1 and the valve rod f^1 is pivoted to the barrel projection d^1 at d^2 and pivotally connected to the metal rod z at z^2 so that if the water passing through the barrel d increases in temperature it will cause the barrel d to expand more than the rod z thus moving the valve rod f^1 and valves f about the pivot d^2 in the direction which closes the inlet o^1 and opens the inlet n^1. If the temperature of the water decreases, the action is the reverse with the result that the water issuing at t^1 will be maintained at a practically constant temperature.

In Fig. 5 which is a section on a larger scale of the hand regulated valve shown in Fig. 3, o^1 is the inlet for the steam or hot water issuing from the coil of pipe, n^1 is the inlet for the colder water and a is the common outlet. A tapered plug g having passages w and x fits into the top part of the barrel d and is held in place by the screwed cover q and made water tight by the washer r. The plug g is also fitted with a handle g^1 and nipple w^1 which, projecting into the constricted portion of the barrel d, insures the proper mixing of the steam or hot water coming through the inlet o^1 and passage w, with the colder water coming through the inlet n^1 and passage x. The use of the hand valve Fig. 5, or the thermostatic valve, Fig. 4, involves the periodic or intermittent withdrawal of hot water from c, either as such or in the form of steam and the correspondent periodic or intermittent withdrawal of heat from the accumulator m, it being the elementary idea of an accumulator that it affords a store or stock to be drawn upon from time to time as desired. This feature is referred to in the claims by the term "periodically." The same is true of the application of heat to the accumulator, it being also an elementary idea that the accumulator stores up small or irregular amounts of heat, such heat being produced by the conversion into heat of electric energy applied at such irregular times as may be permitted by the other demands for current, such as for lighting and power. The accumulator thus performs its function as a storage medium.

In Fig. 6 it is seen that the passages w and x in the plug g are so arranged that as the plug g is turned the passage x first opens to the inlet n^1 and then as this closes, the passage w opens to the inlet o^1 until when the latter is wide open the former is just closed thus enabling the steam or hot water to be mixed with the colder water in any proportion required.

In Fig. 7 m is the mass of iron and c the coil of pipe each convolution of which is connected by a short passage o^2 to a hole drilled in the mass of iron m and fitted with a hollow or tubular plug g^2. The gland q^1 screwing into the mass of iron m holds the hollow plug g^2 in position by means of its tapered surface g and makes a watertight joint by means of the washer r. The hollow plug g^2 which projects through the insulating coating p^1 and has a handle g^1 is also provided with holes w, x and y so arranged that any of the convolutions c can be connected by its passage o^2 with the hollow plug g^2 thus enabling the temperature of the water issuing at a^1 to be varied by varying the length of the path through the mass of iron m.

In Fig. 8 which is a perspective view on a larger scale of the removable section of the coil shown in Fig. 3, c^1 is the detachable turn of the coil c and c^2 is a union or coupling for connecting it to the coil.

In Fig. 9 which is a section on a larger scale of the insulating washer shown at k in Fig. 2, b is the pipe provided with flanges b^1 which are separated by the insulating washer k. The joints between the flanges b^1 and the insulating washer k are made watertight by means of the bolts s which are fitted at each end with insulating collets k^1 so that there is no metallic connection between the bolts s and flanges b^1 and the conduction of heat along the pipe b is therefore greatly retarded.

It must be distinctly understood that though only certain combinations of heating devices, pipes and valves are illustrated, any combination of these devices may be employed and further that any such apparatus may be used in combination with any known form of automatic electric switch for the purpose for instance of cutting off the current when the maximum demand is being made on the electric supply; for instance an electro-magnetic switch, which automatically opens upon a predetermined voltage drop in the main circuit, may be employed.

What we claim and desire to secure by Letters Patent of the United States is:—

1. The method of heating, which consists in

applying to a heat accumulator mass of high specific heat anl large heat storage capacity and good heat conductivity a small quantity of electric energy for a long period, periodically withdrawing heat from said accumulator and discontinuing the electric heating at periods determined by current demand.

2. The method of heating, which consists in accumulating heat by continued application of a small quantity of electric energy to a solid mass of high specific heat and good heat conductivity capable of storing a large amount of heat and retaining it after the discontinuance of the heating, and withdrawing heat from said mass internally.

3. The method of heating, which consists in accumulating heat by the application of electric energy to a mass having both large heat storing and good heat conducting capacity, and periodically withdrawing the heat from the mass internally.

4. The method of heating a substance, which consists in accumulating heat by the application of electric energy to a solid metallic mass of high specific heat and good heat conductivity and capable of storing a large amount of heat and rapidly delivering the same, and passing the substance to be heated through the interior of the mass and drawing off the heat by means of the substance heated, periodically.

5. The method of heating, which consists in accumulating heat by the continued application for long periods of time of a small quantity of electric energy to a mass of high specific heat and good heat conductivity capable of storing a large amount of heat and delivering it rapidly, and withdrawing heat from said mass at periods independent of the heating periods.

6. The method of heating, which comprises electrically supplying heat to a heat accumulator during normal load conditions on the electrical circuit, and automatically discontinuing the heating when the peak load is on the electrical circuit, and utilizing the stored heat in the accumulator independently of the load conditions in the electrical circuit.

7. In combination, a heat accumulator for storing heat, comprising a large solid body of metal of high specific heat and good heat conductivity, an electrical heating element for the accumulator capable of delivering heat to the accumulator, and a heat delivering chamber for containing a body to receive heat from the accumulator, and means for supplying and removing the body to receive heat.

8. In combination, an electric line, a heat accumulator of large capacity for storing heat and having a heat delivering chamber, an electrical heating element connected to the line to heat the accumulator, the rate at which the heat is supplied to the accumulator being generally less than the rate at which the heat is delivered by said chamber, and means to automatically cut out the heating element during the peak load on the line.

9. The method of heating, which consists in accumulating heat by a low rate of application of electric energy to a mass of high specific heat and good heat conductivity capable of storing a large amount of heat and parting with it rapidly and delivering the heat from said mass to the object to be heated at a faster rate than the rate at which the heat was accumulated.

10. The method of heating which comprises electrically supplying heat to a heat accumulator during normal load conditions on the electric circuit, and discontinuing the heating when the peak load is on the electric circuit, and utilizing the stored heat in the accumulator independently of the load conditions in the electric circuit.

11. The method of electrically heating water, which comprises electrically heating, during service conditions below the peak of the load, a substance adapted to store a large quantity of heat, passing water through said substance whereby the heat stored is transferred to the water when required and independently of the electrical service conditions.

12. The method of heating, which consists in accumulating heat by the continued application of a small quantity of electric energy to a metallic mass of high specific heat and good heat conductivity capable of storing a large amount of heat, maintaining a heat-receiving fluid in close association with said mass and withdrawing heat at intervals by drafts upon said fluid.

13. The method of heating water, which comprises supplying to a solid heat accumulator of high specific heat and good heat conductivity capable of storing a large amount of heat and of rapidly delivering the same a small quantity of heat for a long period, periodically passing supplies of water into the accumulator, and discontinuing the heating of the accumulator periodically.

14. The method of heating water, which comprises supplying to an insulated solid heat accumulator of high specific heat and good heat conductivity and capable of storing a large amount of heat and rapidly delivering the same, a small quantity of electrically generated heat for intermittent periods of time, and periodically passing fresh supplies of water into and through the accumulator, independent of the heating periods.

15. The method of heating water, which comprises supplying to an insulated solid heat accumulator of high specific heat and good heat conductivity and capable of stor-

ing a large amount of heat and rapidly delivering the same, a small quantity of electrically generated heat for intermittent periods of time, maintaining a body of water around the insulated accumulator to collect the heat radiated therefrom and periodically passing water from said body through the accumulator independently of the periods of heating of the accumulator whereby heat will be transferred to the water at all times.

16. The method of heating water, which comprises supplying to an insulated heat accumulator having a high latent heat value a small quantity of electrically generated heat for intermittent periods of time, maintaining a body of water around the insulated accumulator to collect the heat passing through the accumulator, periodically passing water from said body through the accumulator independently of the periods of heating, and mixing separate quantities of water from said body with the water that has passed through the accumulator.

17. In an apparatus for heating water, a solid heat accumulator of high specific heat and good heat conductivity, electrical means to supply a small quantity of heat thereto for long periods of time, and means to supply water therethrough for relatively short periods of time, the rate of heat supply being generally less than that absorbed by the water during its passage through the accumulator.

18. In an apparatus for heating water, a solid heat accumulator that is a good heat conductor and has a high heat storing capacity, electrical means to supply a small quantity of heat thereto and means to supply water therethrough, the rate of heat supply being generally less than the rate of absorption by the water.

19. In a heat storing apparatus, the combination with a heat accumulator provided with a fluid coil; of an electric heating device therefor, and a pre-heater receiving its heat from said device and communicating with the inlet end of said coil.

20. In a heat storage apparatus, the combination with a heat accumulator having a fluid coil therein and a surrounding preheating tank connecting with the inlet end of the coil.

21. The method of heating which consists in accumulating heat by the long-continued application of a small quantity of electric energy to a solid mass of high specific heat and good heat conductivity and capable of storing a large amount of heat and of delivering it rapidly, and withdrawing heat from said mass, at intervals as desired, more rapidly than the rate at which it is accumulated.

22. In combination, a heat accumulator for storing and delivering heat comprising a large solid body of metal of high specific heat and good heat conductivity capable of storing a large amount of heat and delivering it rapidly, an electrical heating element capable of delivering heat to the heat accumulator at a low rate, and a heat delivering chamber connected with the accumulator for containing a body to receive heat from the accumulator.

23. In an apparatus for producing hot water, a heat accumulator which is a good conductor of heat and has a high heat storing capacity, a coating of heat insulating material surrounding said accumulator and means for electrically heating the accumulator, a water supply, a coil in said accumulator for the passage of the water, said coil being in connection with the water supply and passing through the accumulator, means for varying the effective length of said coil and an outlet from said coil, substantially as set forth.

24. In an apparatus for producing hot water, a heat accumulator of iron, a coil therein, means to electrically heat the accumulator and a tubular draw-off valve in the accumulator having connections adapted to tap said coil at various points in the length thereof.

25. In apparatus for producing hot water by means of electricity, the combination with a mass of a substance which is a good conductor of heat and has a high heat storing capacity, a coating of heat insulating material surrounding said mass, means for electrically heating the mass, a water supply and a coil in said mass for the passage of the water in connection with the water supply and passing through the mass; of a tank within which the heat producing and storing apparatus and water are contained and means for drawing off the heated water, substantially as set forth.

26. In apparatus for producing hot water by means of electricity, the combination with a mass of a substance which is a good conductor of heat and has a high heat storing capacity, a coating of heat insulating material surrounding said mass, means for electrically heating the mass, a water supply, a coil in said mass for the passage of the water in connection with the water supply and passing through the mass, and a removable section connected to said coil outside of the mass; of an inclosed and insulated tank within which the heat producing and storing apparatus and water are contained and means for drawing off the heated water, substantially as set forth.

27. In apparatus for producing hot water by means of electricity, the combination with a mass of a substance which is a good conductor of heat and has a high heat storing capacity, a coating of heat-insulating material surrounding said mass, means for electrically heating the mass, an inclosed in-

sulated tank containing said mass, and a coil in said mass for the passage of the water connected at one end to said tank; of a water supply connected to said tank and to the outlet end of said coil by a three-way valve, the said valve, and a discharge pipe in connection with said valve, substantially as set forth.

28. In apparatus for producing hot water by means of electricity, the combination with a mass of a substance which is a good conductor of heat and has a high heat storing capacity, a coating of heat insulating material surrounding said mass, means for electrically heating said mass, an inclosed insulated tank containing said mass, a coil in said mass for the passage of the water connected to a removable coil outside of said mass and the said removable coil connected at one end to said tank; of a water supply connected to said tank and to the outlet end of said coil by a three-way valve, the said valve and a discharge pipe in connection with said valve, substantially as set forth.

29. In a heat storage apparatus, the combination with a heat accumulator; of an electric heating device therefor, a heating coil contained within the accumulator and having a removable section in contact with the accumulator.

30. The method of heating water and of supplying the water at any desired temperature, which consists in electrically heating a relatively small amount of water to a high temperature, conserving the heat in excess of that required to heat said small amount of water and employing it to heat a large amount of water to a lower temperature, and drawing off and discharging the heated water.

31. The method of heating water and of supplying the water at any desired temperature, which consists in electrically heating a relatively small amount of water to a high temperature, conserving the heat in excess of that required to heat said small amount of water and employing it to heat a large amount of water to a lower temperature, supplying the small amount of water to be heated to a high temperature from the larger amount of water of lower temperature, and drawing off and discharging the heated water.

32. A system for electrically heating water and supplying it at any desired temperature, comprising a central source of electricity, an electric heater supplied with electricity from said source, to heat a relatively small amount of water to a high temperature, conserving the heat in excess of that required to heat said small amount of water in a heat accumulator, means to contain a large amount of water heated by said accumulator to a lower temperature, and means for drawing off and discharging the heated water.

33. A system for electrically heating water and supplying it at any desired temperature, comprising a central source of electricity, an electric heater supplied with electricity from said source to heat a relatively small amount of water to a high temperature, a heat accumulator conserving the heat in excess of that required to heat said small amount of water, means to contain a large amount of water heated by the excess of heat in the accumulator to a lower temperature, means to connect the large and small amounts of water, and means for drawing off and discharging the heated water.

34. A system for electrically heating water and supplying it at any desired temperature, comprising a central source of electricity upon which there is a variable demand, an electric heater supplied with electricity from said source, means to cut off the electric supply to the heater when demand on the source is at its maximum, a heat accumulator heated by said heater and containing a small amount of water heated to a high temperature, means to contain a large amount of water heated to a lower temperature by the accumulator, and means for drawing off and discharging the heated water.

35. A system for electrically heating water and supplying it at any desired temperature, comprising a central source of electricity upon which there is a variable demand, an electric heater supplied with electricity from said source, means to cut off the electric supply to the heater when the demand on the source is at a maximum, a heat accumulator heated by said heater and containing a small amount of water heated thereby to a high temperature, means to contain a large amount of water heated to a lower temperature by the accumulator, means to supply the smaller amount of water from the larger amount, and means for drawing off and discharging the heated water.

36. In combination, an electric heater, a heat storage mass, heated thereby, a small water heating coil in the storage mass near the electric heater adapted to be highly heated, a water tank surrounding the mass, means for supplying water from the tank to the coil and means for discharging heated water from the coil.

37. The method of electrically heating water, which consists in electrically heating a large mass of material having high specific heat and good heat conductivity and capable of storing a large amount of heat and delivering the same rapidly by the application of a small amount of energy for a long period and passing water at periods

independent of the heating periods over a small portion of the surface of said mass whereby a fraction of the heat absorbed by the water is withdrawn from the mass by surface contact and the remainder by conduction through the mass to the contact surface.

38. In an electric heater for liquids the combination with a tank or receiver for the liquid to be heated, an insulating jacket therefor, a second receiver of lesser capacity, an electric heating device arranged to heat the second receiver to a higher degree than the first and means for withdrawing the heated liquid.

39. In an electric heater for liquids, the combination with two receivers one of larger and the other of smaller capacity, the larger of the receivers being permanently connected with a source of supply, of an electric heating device arranged to heat both receivers but the receiver of lesser capacity to a higher degree than the other and means for withdrawing the heated liquid.

40. In an electric heater for liquids, the combination of two receivers of differing capacity, both receivers being permanently connected to a source of supply and communicating with each other in series, means for heating the two receivers unequally and means for withdrawing the heated liquid.

41. In an electric heater for liquids, the combination with two receivers for the liquid to be heated both permanently connected in series to a source of supply, a heat accumulator for one receiver, an electric heater for said accumulator and means for discharging the heated liquid.

42. In an electric heater for liquids, the combination with two receivers permanently connected in series to a source of supply, a heat accumulator acting directly on one receiver and indirectly on the other, an electric heater for said accumulator and means for withdrawing the heated liquid.

43. In an electric heater for liquids, a receiver for the liquid to be heated, an insulating jacket for said receiver, a second insulated receiver of smaller capacity, means for electrically heating the two receivers to differing degrees of temperature and a mixing cock communicating with the receiver of smaller capacity for discharging the heated liquid.

44. In an electric heater for liquids, the combination of an external heat-insulated receiver, a second receiver contained in the external one with intervening insulation and composed of a mass of heat storing material forming the wall of the receiving chamber, an electric heater applied to said heat-storing mass and a mixing cock communicating with the second receiver for discharging the heated liquid.

45. In an electric heater for liquids, the combination of an external heat-insulated receiver permanently connected to a source of supply, a second receiver contained by and in communication with said external receiver and composed of a mass of heat-storing material with a receiving chamber, an electric heater applied to said mass and a mixing cock communicating with the second receiver and also with the source of supply for discharging water from either one or both in varying amounts as desired.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

GEORGE GILBERT BELL.
JOHN ST. VINCENT PLETTS.

Witnesses:
H. W. JAMESON,
C. P. LIDDON.