(No Model.)

H. A. THOMAS.

HOT WATER STORAGE MOTIVE POWER SYSTEM AND APPARATUS.

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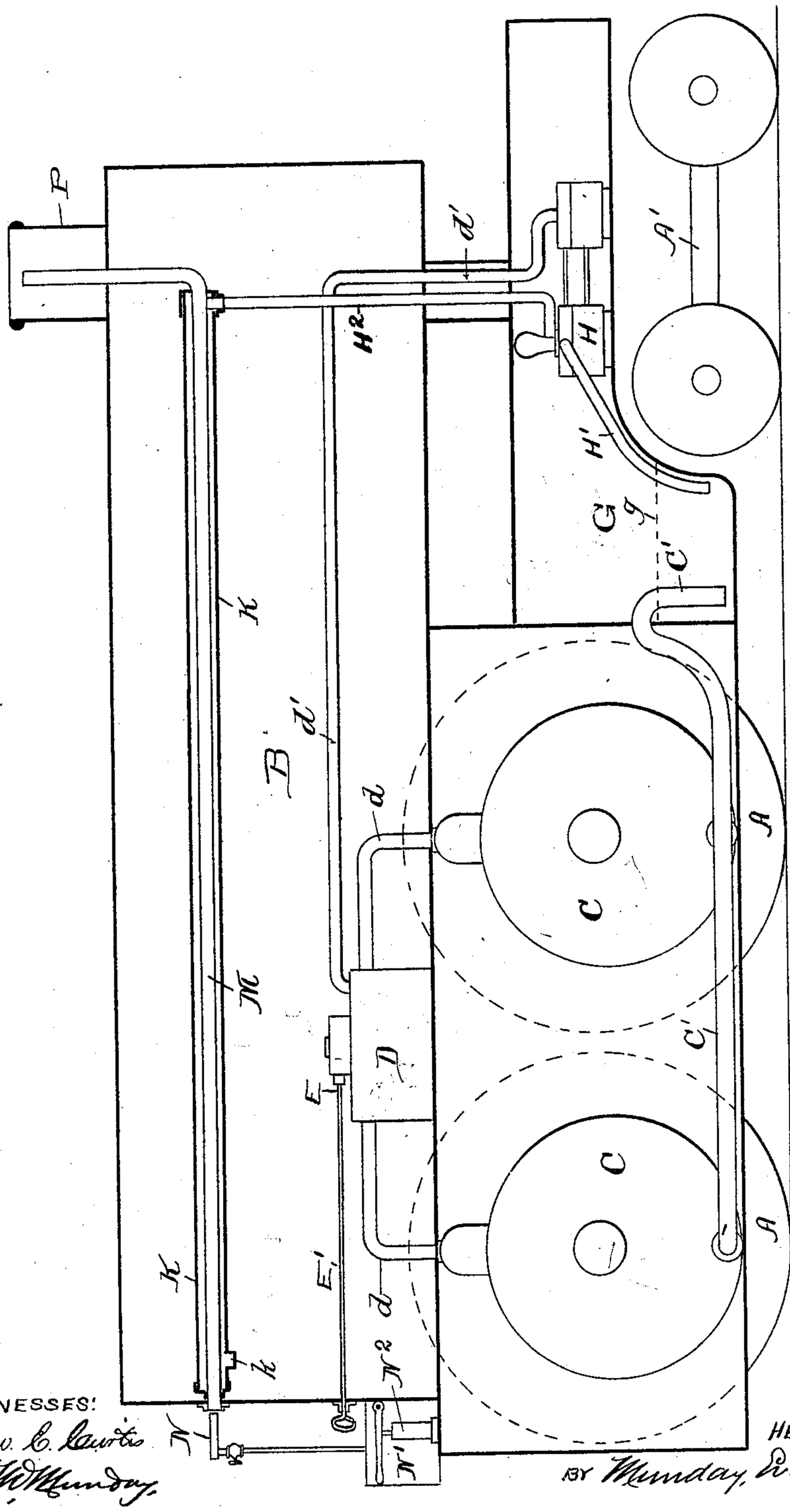

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HOT-WATER-STORAGE MOTIVE-POWER SYSTEM AND APPARATUS.

SPECIFICATION forming part of Letters Patent No. 594,185, dated November 23, 1897.

Application filed March 29, 1897. Serial No. 629,744. (No model.)

To all whom it may concern:

Be it known that I, HERBERT A. THOMAS, a citizen of the United States, residing in Chicago, in the county of Cook and State of Illinois, have invented a new and useful Improvement in Hot-Water-Storage Motive-Power Systems and Apparatus, of which the following is a specification.

My invention relates to improvements in hot-water-storage motive-power systems and apparatus.

In attempts heretofore made for deriving motive power by storage of hot water under pressure in tanks for propelling street or other cars difficulty has been experienced in practical operation owing to the fact that as the hot water is withdrawn from the storage-tank for use pressure in the storage-tank has gradually diminished and the power generated by the expansion of the hot water into steam has consequently grown continually less and less until finally the engine so operated becomes inefficient and unreliable; and this difficulty is further aggravated by the circumstance that as the hot water is withdrawn from the storage-tank for use the steam is of course thus permitted to generate or expand in the storage-tank itself and thus cause a more rapid reduction of temperature and pressure in the storage-tank and loss of power.

The object of my invention is to provide a system and apparatus of a simple nature for deriving motive power from hot water stored in tanks by means of which a more economical use of the stored power can be secured and by which the power generated by expansion of the hot water into steam may be maintained substantially uniform during any reasonable interval or period of time that the storage-tank is required to be drawn upon for generation of motive power for propelling street or other cars or railway-trains.

In my system or apparatus, and herein my invention consists, the hot-water-storage tank is maintained constantly filled with hot water under pressure and the steam is not allowed to expand in the storage-tank itself, this important result being secured by continually pumping the water condensed from the exhaust back into the storage-tank as fast as any water is drawn from the tank for use in driving the engine by expansion into steam, and the temperature of the water in the storage-tank is also maintained by reheating the water of condensation as it is forced back into the storage-tank. The provision for maintaining the storage-tank filled with hot water under pressure is obtained by having, in addition to the usual storage-tank and expansion-tank for the proper expansion of the hot water into steam preparatory to entering the engine, an air-tight steam-condensing tank, which is partially filled with water at a temperature lower than 212° Fahrenheit, and into which the exhaust-steam is conducted directly from the engine by the exhaust-pipes and which operates to condense the exhaust-steam into water as fast as it escapes from the engine, the water of condensation being forced from this condensing-tank back into the storage-tank by a suitable pump provided for this purpose. The storage-tank is thus kept constantly filled with hot water under pressure, and no vacant space is permitted therein for expansion of the hot water into steam, which is thus entirely prevented. The provision for reheating the water that is pumped back into the storage-tank from the condensing-tank is attained, preferably, by forcing it through one or more double tubes located within the storage-tank and through which heat is passed, preferably, by a forced blast. By this means a sufficiently high heat may be applied to the water of condensation as it is forced back to raise its temperature, say, about 40°, or from a temperature of about 200° in the condensing-tank to a temperature of about 240°, which should preferably be maintained in the hot-water-storage tank. To give time and opportunity for thus reheating the water of condensation, the water-conducting tube and flue for heating the same should extend, preferably, the full length of the storage-tank.

By my system and apparatus it will thus be seen that the exhaust-steam escaping from the engine is condensed into water in the condensing-tank and is immediately pumped back into the storage-tank and only requires the addition of 30° or 40° of heat to bring it approximately or substantially up to its original temperature.

In practicing my invention the hot water is preferably introduced at the water-heating station or plant into the storage-tank at a

temperature of about 235° or 240° Fahrenheit and under a pressure of about three hundred and fifty pounds to the square inch, and as the storage-tank is kept constantly filled with water by returning the water of condensation from the engine back into the tank, thus preventing any expansion of steam in the storage-tank itself, and as the water of condensation is or may be reheated, it will be seen that the pressure in the storage-tank may be maintained substantially uniform, and that the apparatus thus becomes a practical one for supplying motive power to street-car motors, locomotives, or other machines requiring to be operated continuously for a number of hours, and this, too, without any unnecessary waste or loss of power.

In the accompanying drawing, which forms a part of this specification, I have illustrated in a diagrammatic view an apparatus or system embodying my invention.

In the drawing the invention is represented as being applied to a railway-locomotive. It will of course be understood, however, that it is applicable to other motors or machines.

In the drawing, A A represent the wheels, and A′ the framework, of a locomotive or other vehicle.

B is the storage-tank, the same being preferably about six feet in diameter and twenty-five feet in length and adapted to be filled completely full of hot water under pressure, the water being preferably heated to a temperature of about 240° Fahrenheit and the pressure being about three hundred and fifty pounds to the square inch.

C C represent steam-engines. As indicated in the drawing, the engines are of the rotary type and applied directly to the driving-wheels of the locomotive, but any other form of engine is equally well adapted for use in the system or apparatus embodying my invention.

D represents a steam-expansion chamber or tank into which the hot water from the storage-tank B is admitted and permitted to expand into steam preparatory to entering the engine or engines through the steam-pipes *d d*.

E is a throttle-valve for controlling the admission of hot water into the expansion-tank D through the supply-pipe or connection *d′*, and E′ is a rod or connection for operating the throttle-valve. The expansion-tank D may preferably be located inside the storage-tank B, although it may be otherwise located, if preferred.

G is the closed or air-tight condensing-tank, into which the exhaust-steam from the engine C is directly delivered through the exhaust-pipe C′. The closed condensing-tank G is partially filled with water, as indicated by the dotted line *g*, so that the exhaust-steam will be readily condensed as fast as it escapes from the engine.

H is a steam-pump for forcing the water of condensation from the condensing-tank G back into the storage-reservoir B through the pipe H′, leading from the condensing-tank G to the pump, and pipe H², leading from the pump back into the storage-tank B. The pipe H² connects with the pipe K, extending, preferably, about the whole length of the storage-tank and surrounding a heating pipe or flue M, so that the water of condensation, as it is forced back into the storage-tank B, may be reheated before it is discharged into the hot water in the storage-tank through the exit-orifice *k*. The pipe or flue M may be heated by any suitable means, but preferably by a liquid-fuel burner N, by which gasolene or other hydrocarbon fuel is forcibly projected under pressure into and through the heating pipe or flue from the reservoir N′. The heating pipe or flue M should extend up through the hot-water-storage tank B, as indicated in the drawing, and may preferably be surrounded by a smoke-stack P.

The gasolene or other liquid fuel in the reservoir N′ may be maintained under suitable pressure by an air-pump N².

As my invention does not relate to any particular kind or construction of steam-engine, pump, or valve mechanism, but may be practiced equally well with any suitable kind or construction of these devices known to those skilled in the art, it is not necessary for a full description and explanation of my invention to show or describe any detail construction of these parts.

I claim—

1. The hot-water-storage motive-power system or apparatus, comprising in combination a hot-water-storage tank, filled with hot water under pressure, a steam-expansion chamber communicating therewith, a steam-engine, a condensing-tank partially filled with water, an exhaust-pipe leading from the engine to said condensing-tank, a pump for forcing the water from said condensing-tank back into the storage-tank under pressure to maintain the storage-tank constantly filled with water under pressure, and a heating pipe or flue for reheating the water returned to the storage-tank by the pump from the condensing-tank; whereby steam is prevented from expanding in the storage-tank as the hot water is withdrawn therefrom for use in the engine, and the temperature and pressure in the storage-tank maintained, substantially as specified.

2. The hot-water-storage motive-power system or apparatus, comprising in combination a hot-water-storage tank filled with hot water under pressure, a steam-expansion chamber communicating therewith, a steam-engine, a condensing-tank partially filled with water, an exhaust-pipe leading from the engine to said condensing-tank, a pump for forcing the water from said condensing-tank back into the storage-tank under pressure to maintain the storage-tank constantly filled with water under pressure, a reheating pipe or flue for reheating the water returned to the stor-

age-tank by the pump from the condensing-tank, whereby steam is prevented from expanding in the storage-tank as the hot water is withdrawn for use in the engine and the temperature and pressure in the storage-tank maintained, and a fluid-fuel reservoir and burner for supplying heat to said flue or heating-pipe, substantially as specified.

3. In a hot-water-storage motive-power system or apparatus, the combination with a hot-water-storage tank filled with hot water under pressure, of a steam-expansion tank, a steam-engine, a steam-condensing tank into which the exhaust is delivered from the engine, and a pump for forcing the water of condensation from the condensing-tank into the storage-tank and thus maintaining the same constantly filled with water under pressure, substantially as specified.

4. The combination with a wheeled car or vehicle of a motor apparatus therefor comprising a hot-water-storage tank filled with hot water under pressure, a steam-expansion tank, a steam-engine, a steam-condensing tank into which the exhaust is delivered from the engine, and a pump for forcing the water of condensation from the condensing-tank into the storage-tank and thus maintaining the same constantly filled with water under pressure, substantially as specified.

5. The combination with a wheeled car or vehicle of a motor apparatus therefor comprising a hot-water-storage tank filled with hot water under pressure, a steam-expansion tank, a steam-engine, a steam-condensing tank into which the exhaust is delivered from the engine, a pump for forcing the water of condensation from the condensing-tank into the storage-tank and thus maintaining the same constantly filled with water under pressure, and a reheating pipe or flue for reheating the water of condensation returned by the pump from the condensing-tank to the storage-tank, substantially as specified.

6. The combination with a wheeled car or vehicle of a motor apparatus therefor comprising a hot-water-storage tank filled with hot water under pressure, of a steam-expansion tank, a steam-engine, a steam-condensing tank into which the exhaust is delivered from the engine, a pump for forcing the water of condensation from the condensing-tank into the storage-tank and thus maintaining the same constantly filled with water under pressure, and a reheating pipe or flue for reheating the water of condensation returned by the pump from the condensing-tank to the storage-tank, and a water-conducting pipe contiguous to said heating pipe or flue located in the storage-tank for conducting the water from the pump and delivering it after reheating into the storage-tank, substantially as specified.

7. The combination with a wheeled car or vehicle of a motor apparatus therefor comprising a hot-water-storage tank filled with hot water under pressure, a steam-expansion tank, a steam-engine, a steam-condensing tank into which the exhaust is delivered from the engine, a pump for forcing the water of condensation from the condensing-tank into the storage-tank and thus maintaining the same constantly filled with water under pressure, and a reheating pipe or flue for reheating the water of condensation returned by the pump from the condensing-tank to the storage-tank, and a water-conducting pipe contiguous to said heating pipe or flue located in the storage-tank for conducting the water from the pump and delivering it after reheating into the storage-tank, and a fluid-fuel reservoir and burner for supplying heat to said heating pipe or flue, substantially as specified.

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