

C. N. TYLER.

Steam-Condensing and Water-Heating Tanks.

No. 139,634.

Patented June 3, 1873.

Fig 1

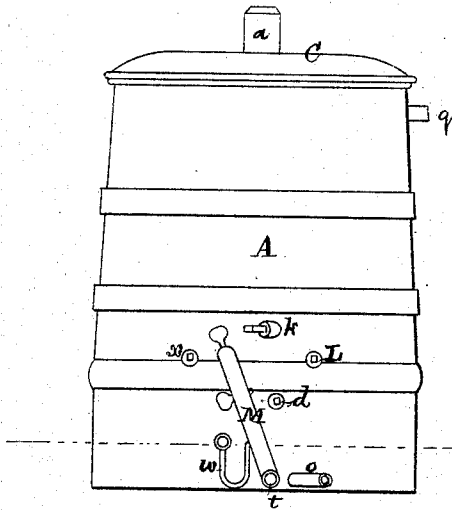


Fig 2

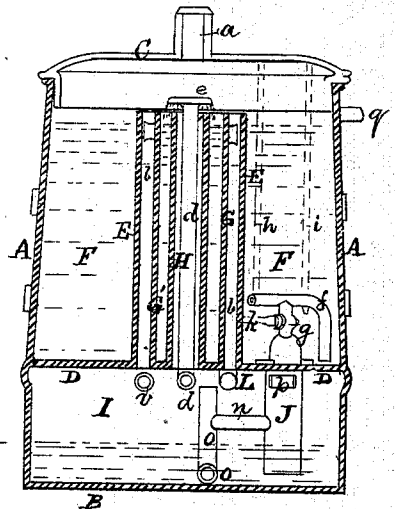


Fig 3

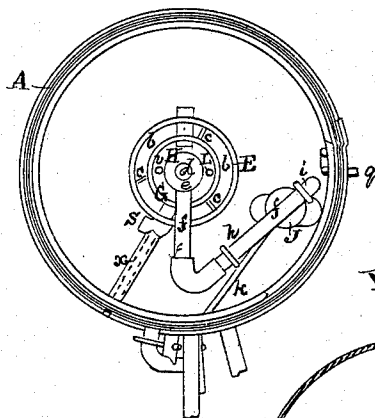


Fig 3

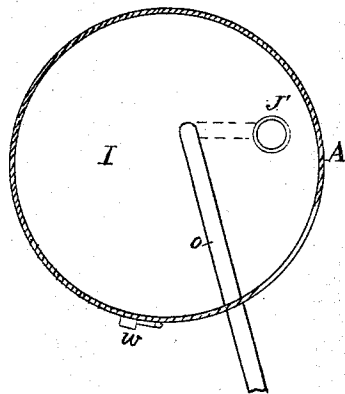
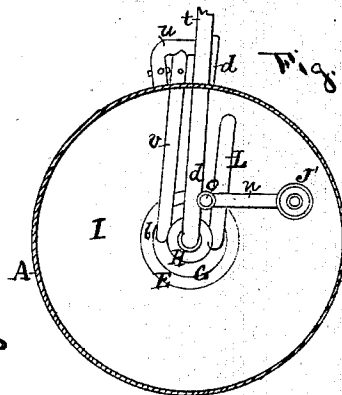


Fig 4



Witnesses  
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Donald Stuart,

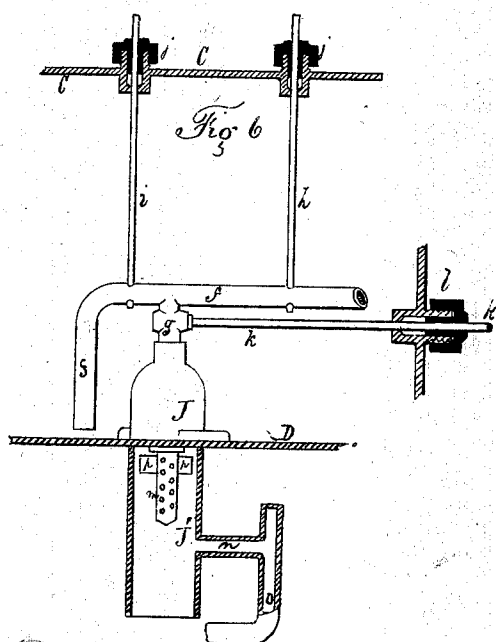
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Witnesses.  
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# UNITED STATES PATENT OFFICE.

CHARLES N. TYLER, OF BUFFALO, NEW YORK.

## IMPROVEMENT IN STEAM-CONDENSING AND WATER-HEATING TANKS.

Specification forming part of Letters Patent No. **139,634**, dated June 3, 1873; application filed February 25, 1873.

*To all whom it may concern:*

Be it known that I, CHAS. N. TYLER, of the city of Buffalo, in the county of Erie and State of New York, have invented certain Improvements in Steam-Condensing and Water-Heating Tank, of which the following is a specification, reference being had to the accompanying drawings, in which—

Figure 1 represents an elevation of a condenser and water-heater having my improvements applied thereto, and Fig. 2 a vertical section of the same. Fig. 3 represents a plan with the top or cover removed, and Fig. 4 a horizontal section through the line *xx* of Fig. 1, looking upward; and Fig. 5, the same sectional view looking downward. Fig. 6 represents a view partially in section and partly in elevation of the spray device and its connections detached from the condenser.

It has long been an object to reclaim and utilize the waste heat from the exhaust of an engine, and to this end many plans have been devised, but hitherto without meeting that general approval which would enable them to come into general use. The principal objection urged against the adoption of the system lies in the slow and imperfect manner with which the condensation of the steam is effected, as such retards the exhausting process, and by that means materially impairs the available working capacity of the engine.

My invention consists in a new and improved mode of constructing and arranging the condensing apparatus, by means of which I am not only enabled to effect a most rapid condensation of the exhaust steam, so as to relieve the engine from back pressure, but a more perfect condensation, whereby the heat is more perfectly reclaimed and accumulated for useful and economic purposes; as, for instance, it may be applied to the supply of the boiler with hot instead of cold water, thereby saving fuel, and to the warming of the engine-house, and for heating and manufacturing purposes generally, where such is capable of being effected through the instrumentality of hot water, either in a stationary or circulating condition.

To enable others skilled in the art to make, construct, and use my invention, I will now proceed to describe its parts, and the mode of putting them together, in detail.

The outer wall or side A of the apparatus is intended to be made of wooden staves securely bound together with hoops in the manner of a barrel, or it may be made of other water-tight material having a low capacity for conducting heat; or it may be made of metal coated on the outside with any suitable and known non-conducting material.

This vessel may be made of any suitable shape and of any required capacity, so as to adapt it to the amount of work to be performed by it; but as a rule it will be made of circular or cylindrical form, provided with a permanent or removable water-tight bottom, B. The top is open, but provided with a removable cover, C, in the center of which is arranged an opening, into which is screwed the end of a small pipe, *a*, for the purpose of allowing the uncondensed steam to escape into the open air under certain circumstances; as, for instance, such escape might be necessary in heating a small quantity of water for rapidly supplying the boiler with hot water on first starting the fire, but as a rule not otherwise. This pipe may be provided with a stop-cock to open or close it, as desired.

The tank A is further provided with an annular plate or false bottom, D, which is firmly secured to it in any suitable and well-known manner, and is made of iron or other strong and good heat-conducting material. To the upper edge of the opening *b* in the plate D is firmly secured a metallic cylinder, E, which extends up to within a short distance of the top of the main tank A. This cylinder, with the wall and bottom D of the main tank A, forms an annular water-chamber, F. Within and to the cylinder E is firmly secured, by means of arms *c* or other suitable devices, an inner cylinder, G, flush at both ends with the former, but, unlike it, closed at the bottom, so as to form an independent water-chamber, G'. The diameter of cylinder G is less than that of cylinder E by from one to two inches, so as to leave a clear space between them for the passage of the exhaust steam. Within chamber G' is arranged another metallic cylinder, H, the lower end of which passes through and is securely attached to the bottom of cylinder G, in such manner that while rendering chamber G' water-tight it itself is left open at both ends for the passage of the cold-water-

supply pipe *d*, which, however, is made of smaller diameter in order to leave a free passage for steam around the latter between it and cylinder H.

By reference to Figs. 2, 3, and 4, it will be observed that the cold-water-supply pipe *d*, in order to be connected with the supply tank or pump, extends through the wall of the tank A from below the false bottom D, and above the water-line of the lower water-heating compartment I, and hence in the space into which the exhaust steam is first discharged into the condenser, and from thence is prolonged upward, as before mentioned, through the inner cylinder H, until it terminates, at its upper extremity, in a cup-shaped opening, *e*, having an enlarged and downwardly-flaring rim or edge, shown in Fig. 2, over which the water slowly flows and falls into annular chamber G', forming a spray-condenser for the steam as it passes up through the interior cylinder H from chamber I.

To the upper end of supply-pipe *d*, immediately below cup *e*, is secured one end of a cold-water-supply pipe, *f*, for chamber F, the other or lower end of which is connected with a short supply-pipe, *g*, of another spray-condenser J, an enlarged view of which and its connections is shown in Fig. 6. Pipe *f* is prolonged beyond connection *g* in a downward direction to within a short distance of false bottom D, to form a siphon, for a purpose to be hereafter referred to. In the horizontal part of pipe *f* are inserted two stop-cocks, *h* and *i*, with connecting-pipe *g* arranged between them, as shown in Figs. 3 and 4, for reasons to be hereafter explained. The handles of these stop-cocks are prolonged upward, and project through the cover C, in their course passing through stuffing-boxes similar to those shown at *j*, Fig. 6. In the same way connection *g* of spray-condenser J is provided with a stop-cock, K, the handle of which is made, for convenience of handling, to protrude through a stuffing-box, *l*, provided for the purpose in the side of tank A, a short distance above false bottom D. (See Fig. 6.)

By this arrangement the operation of spray-condenser J can be started or stopped at any moment.

With regard to the construction of the spray-condenser itself, it may be made and secured to bottom D in any well-known or suitable manner; as, for instance, it may consist of a short pipe, *m*, closed at its unattached end and perforated with a number of fine holes, and inclosed within an open cylinder, J', to which the steam, by a suitable connection, *n*, with the exhaust-pipe *o* from the engine, has free access, and from which that which remains uncondensed may escape by means of openings *p* into chamber I, there to be afterward condensed, in the manner hereafter to be described. The pipe *o*, which conducts the exhaust steam into the condenser, is made to pass through stuffing-boxes in the

wall of tank A, near its bottom, as shown in Fig. 2, a clear space, however, being left between it and the bottom, so that it shall be perfectly surrounded with water. For this purpose the lower compartment I is partially filled with water, the height of which is limited by a goose-neck connection, *q*, which communicates with the interior of compartment I, and allows the escape of all water above that depth, the object of which is to leave a large steam-space between the bottom D and the top of the water for the free admission of the exhaust steam of the engine for condensation, only a few inches of water being allowed to remain in that chamber over and above what is necessary to cover the exhaust-pipe *o* as it enters, and that simply to facilitate condensation. L represents a pipe, which forms a communication between water-chambers F and G, through their respective bottoms, a stop-cock being inserted at that end which projects through the bottom of chamber F, by means of which to open up or shut off the communication whenever desired, the end of the handle *r*, like handle *k*, being made to pass through a stuffing-box in the side of tank A. A similar communication, but at a point above, between the same chambers F and G, is made by means of a short pipe, *s*, which is made to pass directly through cylinders H and G, and to which it is firmly secured; it being also provided with a stop-cock, *x*, for stopping the communication between them, the handle of which projects, like the others, through a stuffing-box in the side of tank A.

The object of having two, the one arranged above, the other below, is to establish a circulation between them whenever desired.

M represents a pipe for conducting the heated water off to whatever point it may be desired to do so, and is intended, where the water is to be used for supplying feed-water to the boiler, to be connected to the force-pump for that purpose. It is connected by three branch pipes with the different water-compartments, the lower one, *t*, with compartment I, the one *v* with the central chamber G', and the other, *u*, with the large outer chamber F. Each of these branch pipes is provided with a stop-cock by means of which to open or close their communication with the main pipe M, so that the water may be drawn from any chamber separately, or from any two or all three at a time, as may be desired. Thus constructed, the operation is as follows: First, let us suppose that hot water is desired to be got quickly for the supply of the boiler when first started, and let us suppose that both chambers F and G' are empty. This being understood, the cock of the cold-water pipe *d* is then turned to admit the water into chamber G', and the handles *h* and *i* both turned on if chamber F is desired to be filled, also; the cock *k* of connection-pipe *g* is then turned off to prevent the escape of the water through spray-condenser J, and so with the cocks of

the circulating-pipes L and S. In this condition the cocks are allowed to remain until both chambers are filled, which will be discovered by the overflow of water at the mouth of the goose-neck *w* on the outside of the main tank A, near the top O. As soon as this takes place, and the water also wastes at goose-neck *g*, near the bottom of compartment I, the stop-cock of cold-water pipe *d* is turned off to stop the supply, and the steam-exhaust meanwhile having been turned on through pipe *o*, the water in tank G' will be speedily heated to the requisite degree, on which the stop-cock of pipe *v* is turned to supply pipe M with hot water for the pump to force into the boiler. The chamber G' will provide sufficient hot water for the supply of the boiler until the main tank F is heated to the requisite temperature, when the cock *u* may be turned on to admit the water from chamber F into supply-pipe M, and so with pipe *t* from chamber I, on which the cock of the cold-water pipe *d* may be turned on to refill chamber G', after which the cocks of circulating-pipes L and S may also be turned to establish a communication and circulation between the waters of the two chambers F and G to equalize the temperature of the water contained in each. This done, cock *i*' of the siphon end of pipe *f* may be turned off and cock *k* of pipe *g* turned on, so as to allow the passage of cold water through spray-condenser J in order to establish a speedy condensation of the steam. When the condenser J is connected in this way to pipe *f*, chamber F receives its supply from chamber G' through pipes L and S. Spray-condenser J is also capable of being supplied from chamber F through the lower or siphon end of pipe *f* by cutting off the cold-water-supply cock *h* and turning on the stop-cock *i*. When the condenser is run in this way, if it is desired to supply chamber F directly from cold-water pipe *f*, a branch pipe with accompanying stop-cock may be connected to pipe *f* at any suitable point between stop-cock *h* and its connection with the main cold-water-supply pipe *d*. From what has been said it will be seen that the apparatus can be so worked as to supply water either of a different or of a common temperature by withdrawing it from any particular chamber or from any two or all three simultaneously, and now it only remains to show the sufficiency of the means for procuring a rapid and perfect condensation. To this end the exhaust steam is made to enter at the bottom of compartment I through a pipe, O, immersed in water at its lower end, and thence upward into an open cylinder, J', by means of pipe *n*, where it is subjected to the action of a cold-water spray ejected from a spray-condenser, J; from here such as remains uncondensed passes out through openings *p* into the empty

space formed between the false bottom D and the upper water-line of chamber I. Here expanding, it is brought in contact with the bottom of chambers F and G', and thence upward between the cold surfaces of cylinders E and G and G and H, and in the latter case up through the spray formed by the overflow of cold water from the flared rim of cup *e* on the top of cold-water pipe *d*, by which time but little is left uncondensed, the cold inner surface of the cover C finishing the condensation of that which had escaped. It is here to be observed that the action of the large steam-receiving chamber I, coupled with the great extent of condensing-surface exposed to the waste steam, effect so rapid a condensation as to create a partial vacuum, which, so far from causing a back pressure on the engine, tends rather to facilitate the exhausting process by its demand upon the steam to fill the vacuum as fast as formed.

If desired, the cylinders E, G, and H may be corrugated so as to increase the condensing-surface and compel a more perfect contact between their surface and the steam.

Beside supplying the boiler with hot water the water thus heated may be used for a variety of useful and industrial purposes here unnecessary to be described, as such will readily suggest themselves to those requiring the assistance of such an agent.

Having described my invention, I claim—

1. The combination of the water-chambers F, G', and I, as arranged and constructed for operation in the manner set forth.
2. The combination of the condensing-surfaces E, G, and H, as arranged for the purpose set forth.
3. The combination of the pipes L and S, and their respective stop-cocks, with the chambers F and G, for the purpose set forth.
4. The combination of pipe *d* for the supply of cold water and its overflow *e* with chamber G' and steam-chamber H, the whole being arranged in the manner and for the purposes set forth.
5. The combination of cold-water pipes *d*, *f*, and *g*, and stop-cocks *h*, *i*, and *k*, with chamber F, for the purpose set forth.
6. The spray-condenser J and steam-pipe *o*, in combination with the subject-matter of the fifth claim, for the purpose set forth.
7. The combination of hot-water pipe M and its branches *t*, *u*, and *v*, and their respective stop-cocks, with chambers F, G', and I, for the purposes set forth.
8. The combination of the goose-necks *q* and *w* with the chambers F and I and cold-water-supply pipe *d*, for the purpose set forth.

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Witnesses:

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