No. 672,139. Patented Apr. 16, 1901.

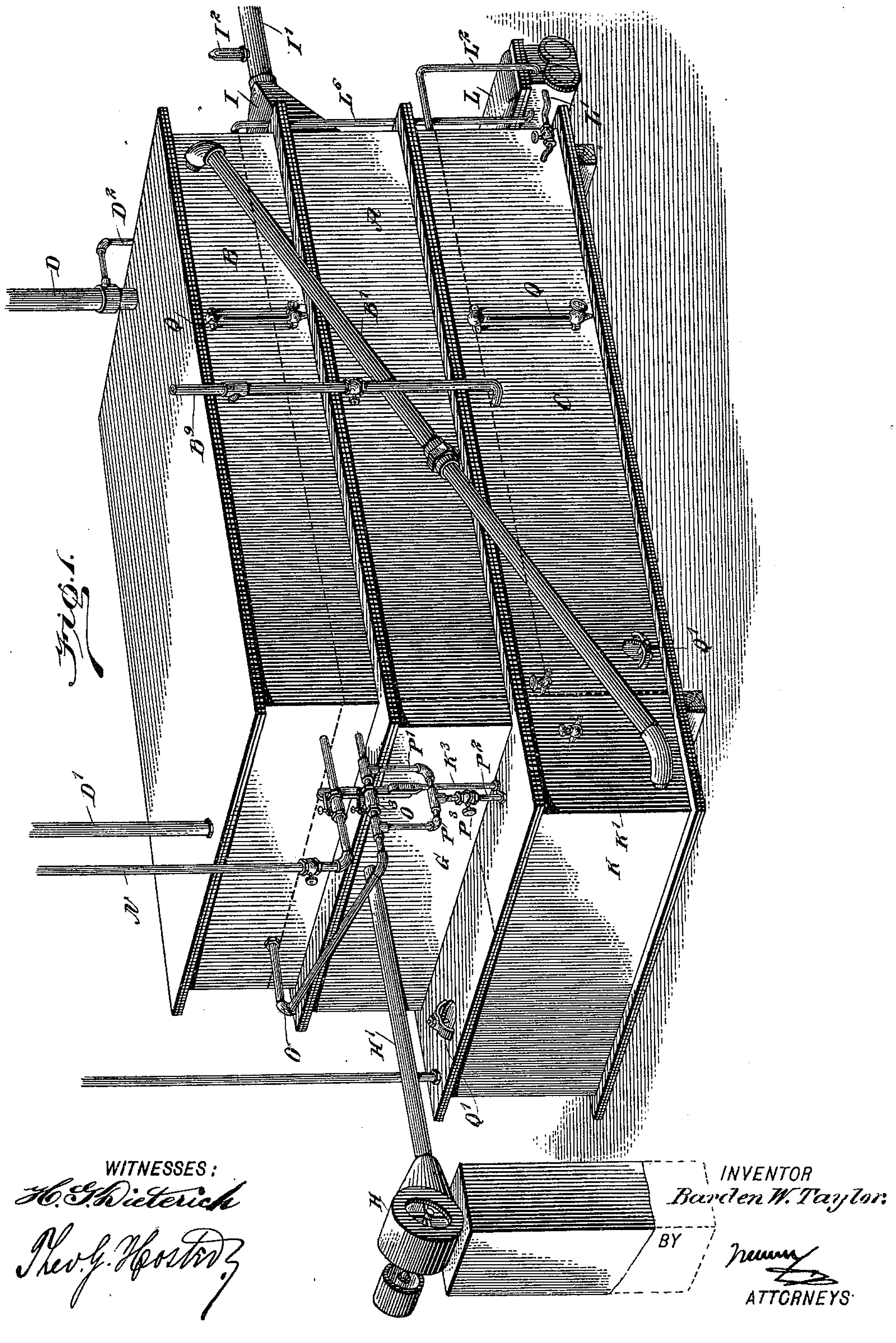
B. W. TAYLOR.

STEAM AND HEAT CONSERVATOR.

(Application filed May 23, 1900.)

(No Model.) 4 Sheets—Sheet 1.

Fig. 1.



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(No Model.) 4 Sheets—Sheet 2.

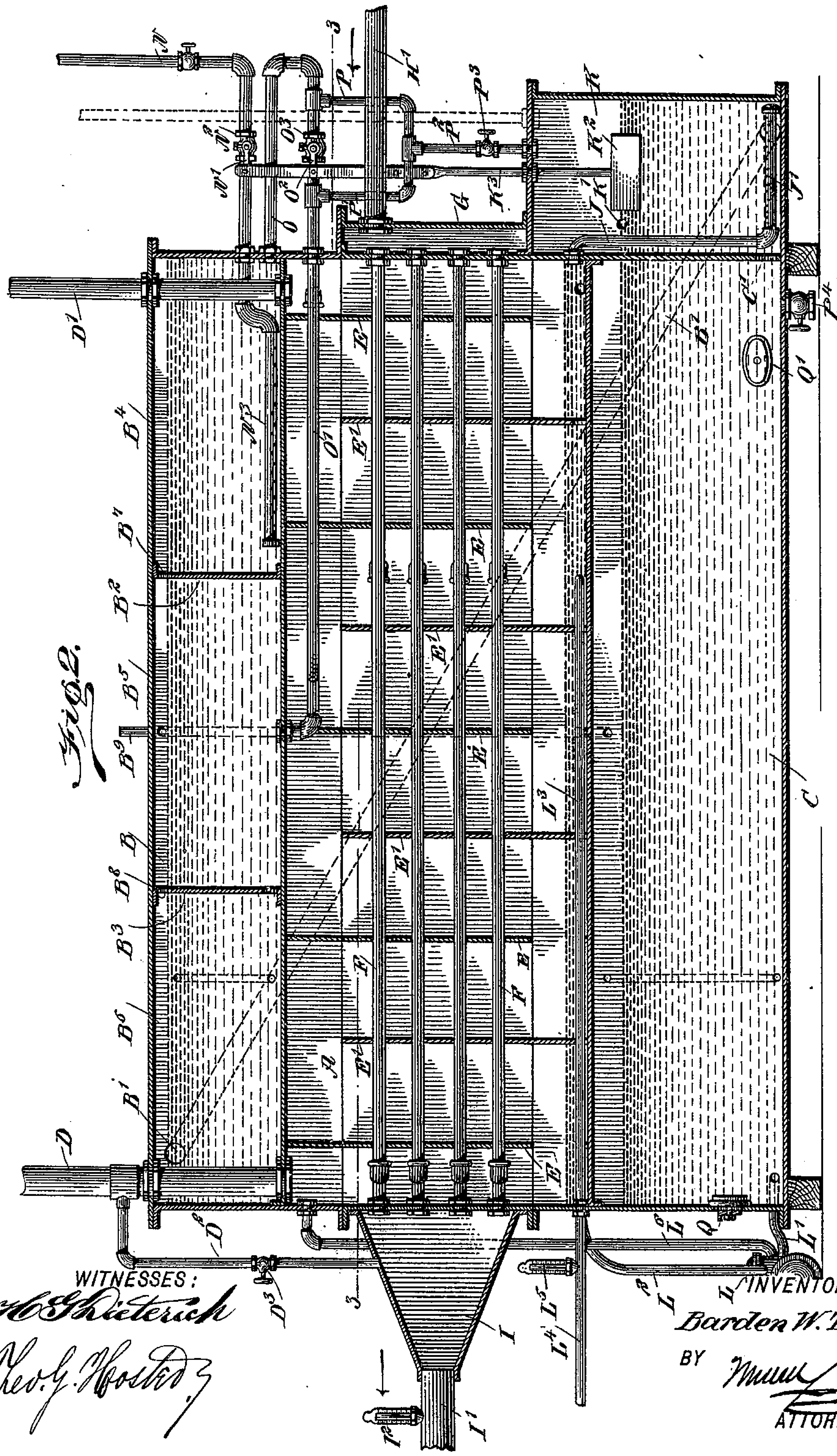

Fig. 2.

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(No Model.) 4 Sheets—Sheet 3.

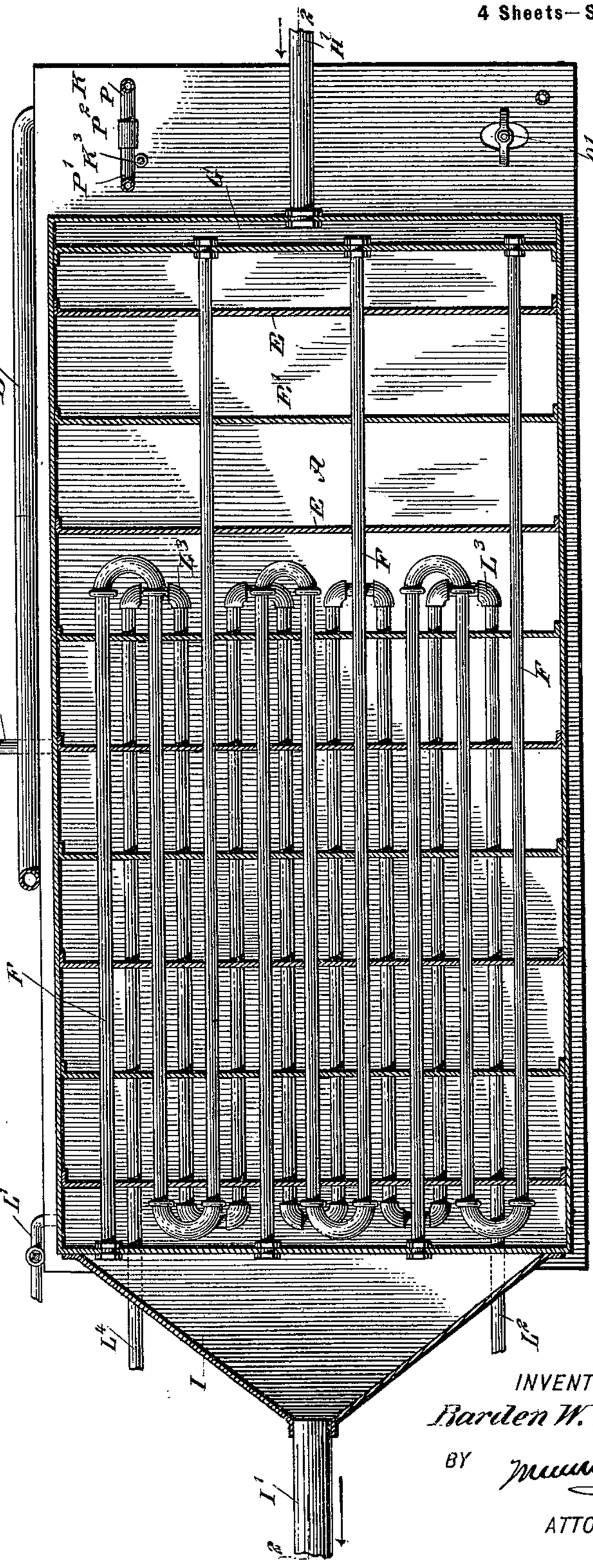

Fig. 3.

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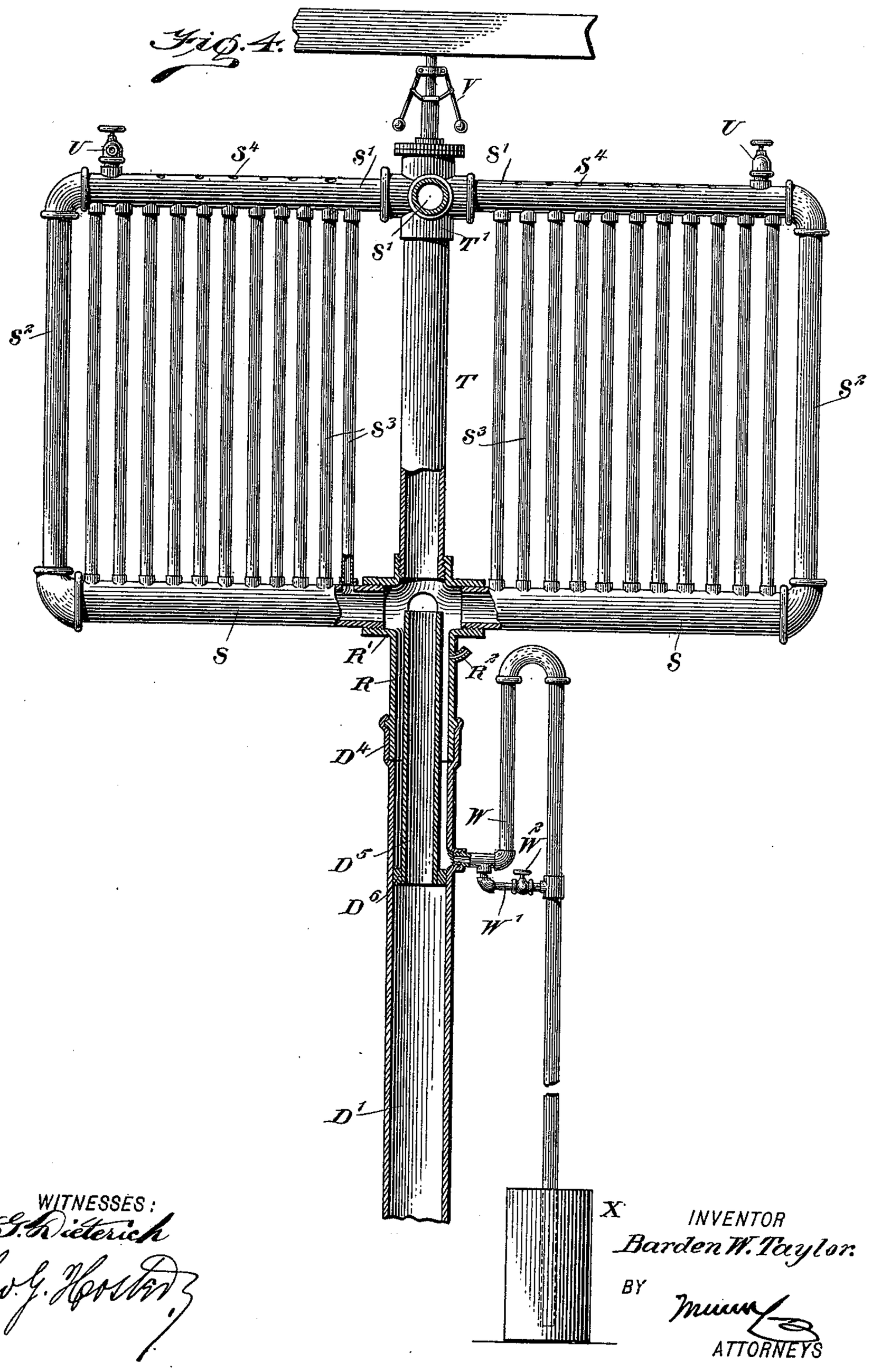
(Application filed May 23, 1900.)

(No Model.) 4 Sheets—Sheet 4.

Fig. 4.



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UNITED STATES PATENT OFFICE.

BARDEN WALTON TAYLOR, OF NEW YORK, N. Y., ASSIGNOR TO ROSS TAYLOR, OF SAME PLACE.

STEAM AND HEAT CONSERVATOR.

SPECIFICATION forming part of Letters Patent No. 672,139, dated April 16, 1901.

Application filed May 23, 1900. Serial No. 17,684. (No model.)

To all whom it may concern:

Be it known that I, BARDEN WALTON TAYLOR, a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented a new and Improved Steam and Heat Conservator, of which the following is a full, clear, and exact description.

The invention relates to steam apparatus; and one object is to condense the exhaust or waste steam and utilize the heat of such steam for reheating and superheating the water of condensation and for heating air to be used in the fire-box to insure a complete combustion of the fuel in the furnace.

A further object of the invention is to purify the water of condensation and form feed-water free from all foreign matter liable to produce scale in the boiler or incrustation therein or foam from oil.

In addition to the advantages enumerated others are contemplated and will appear to those skilled in the art as the invention is comprehended.

The invention consists of novel features and parts and combinations of the same, as will be fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a perspective view of the improvement. Fig. 2 is a longitudinal sectional rear elevation of the same on the line 2 2 in Fig. 3. Fig. 3 is a sectional plan view of the same on the line 3 3 in Fig. 2, and Fig. 4 is an enlarged elevation with parts in section of a modified form of the condenser for the exhaust-steam.

The improved apparatus shown in the drawings appears in the shape of an oblong box made in sections fastened together by suitable means, and the box is divided, essentially, into a central steam-condensing and air-heating compartment A, over which is located a settling-chamber B and below which is arranged a feed-water tank C. The exhaust-steam from the engine, motor, or other steam apparatus passes into one end of the condensing and heating chamber through an inlet-pipe D, and this steam is wholly or partly condensed in the said compartment, and any steam not condensed in the compartment is carried off therefrom by an outlet-pipe D′, rising from the other end of said compartment.

In the compartment A are arranged baffle-plates E E′, of which the baffle-plates E′ rise from the bottom of the compartment A to within a distance of the top of said compartment, while the other baffle-plates E depend from the top of the compartment A to within a distance of the bottom thereof, so that the steam entering the compartment A at one end travels in a tortuous route through the compartment before reaching the outlet-pipe D′.

As shown in Fig. 2, the top of the compartment A forms the bottom of the settling-chamber B, and the bottom of said compartment A forms the top of the feed-water tank C, so that the steam in its passage through the compartment A gives off units of heat to the said chamber B and the tank C.

In the compartment A are arranged banks of coils F, each opening at one end into an air-distributing chamber G, connected with the discharge-pipe H′ of a fan H, of any approved construction, used for forcing air into said distributing-chamber G, from which the air can pass through the several banks of coils F and finally pass through the other ends of said banks of coils into a receiver I, connected by a pipe I′ with the furnace used for generating steam to assist in the complete combustion of the fuel employed in said furnace. Now it is evident that air traveling through the coils F takes up heat from the exhaust-steam traveling in a circuitous route through the compartment A and around said coils, the travel of the air being in an opposite direction to that of the steam, so that air passing through the coils F is gradually heated, as it is first subjected to steam of a low temperature and gradually subjected to steam of a higher temperature until it leaves the coils and passes into the receiver I, at which point the coils are subjected to the higher heat of the entering waste or exhaust steam, as will be readily understood by reference to

Fig. 2. As the exhaust or waste steam passes from the comparatively small pipe D into the large compartment A, open to the atmosphere at the pipe D′, it is evident that the said steam is free to expand in the compartment, thus relieving the engine of back pressure.

From the foregoing it is evident that the temperature of the exhaust-steam in the compartment A is lowered by the transfer of heat units to the air, and this lowering of temperature insures condensation of the steam and the formation of water of condensation accumulating in the bottom of the compartment A. The heated air transfers the heat units to the furnace for reuse in the generation of steam, the degree of heat being indicated by a thermometer I^2, arranged on the pipe I′, as indicated in Figs. 1 and 2. The heated air, besides serving as a medium to transfer the heat of the steam back to the furnace, has the additional function of supplying highly-heated oxygen to the furnace to insure a complete combustion of the fuel and to avoid the formation of smoke and the escape of unconsumed gases. In order to increase the efficiency of this air as an aid for complete combustion, it may be charged with exhaust-steam, and for this purpose the inlet-pipe D is connected by a pipe D^2 with the receiver I to conduct steam from said pipe D to the receiver for the steam to mix with the highly-heated air, the mixture passing into the fire-box of the furnace for the purpose mentioned. The amount of steam admitted to the receiver is regulated by a valve D^3 in the pipe D^2.

The baffle-plates E′ in the compartment A are either perforated at the lower ends or set slightly above the bottom of the compartment to permit the water of condensation to readily flow at one end to a pipe J, which delivers the water of condensation into a separator K, used for freeing the water from oil, scum, and other floating matter previous to passing the water to the tank C by way of an opening C′, arranged in the separating-plate between the separator K and the tank C. (See Fig. 2.) Into the separator K is also passed heated and purified water necessary to make up the deficiency of water in filling the boiler, and this water is passed into the separator K by a pipe B′ from the settling-chamber B, hereinafter more fully described in its detail construction. Thus the water of condensation and the fresh water are mixed in the separator and pass from the latter into the tank C, which in turn is connected by a pipe L′ with a feed-water pump L, having its discharge-pipe L^2 terminating in a coil L^3, located in the bottom of the central compartment A, the end of the coil being connected by a feed-water-delivery pipe L^4 with the boiler. A thermometer L^5 on the said pipe L^4 indicates the temperature of the feed-water as it leaves the apparatus and passes into the boiler. The waste or exhaust steam from the pump L passes by a pipe L^6 into the compartment A, adjacent to the entrance of the exhaust-steam from the pipe D to be treated in the compartment A, as above described.

The pipe J, previously mentioned and used for conducting the water of condensation into the separator K, is formed at its lower end with a perforated discharge-pipe J′, extending over the bottom of the separator K, so that the water of condensation is uniformly distributed in the separator. From the latter leads a blow-off valve K′ for removing the oil, scum, or other foreign matter floating on the top of the water in the separator K. A float K^2 rises and falls with the water in the separator, and this float is provided with a stem K^3, extending through the top of the separator K to connect at its upper end with an arm N′ on a valve N^2, arranged in a feed-water-supply pipe N, discharging by a perforated pipe N^3 into the bottom of the settling-chamber B, near one end thereof, as is plainly indicated in Fig. 2. Now by the use of the float K^2 the amount of feed-water admitted to the settling-chamber B is regulated according to the amount of feed-water forced by the pump L back into the boiler, the level of the water in the tank C being at a uniform height at all times, as will be readily understood by reference to Fig. 2.

The perforations in the pipe N^3 are in the lower portion thereof to direct the feed-water against the highly-heated top of the compartment C. The settling-chamber B is provided with a number of transverse partitions B^2 B^3 for forming settling-basins B^4 B^5 B^6, located one alongside the other and in communication with each other through apertures B^7 B^8 in the upper parts of the partitions B^2 B^3. The feed-water from the pipe N passes into the basin B^4 and is then by its own gravity transferred to the basin B^5 by a pipe O, extending from one end of the said basin B^4 outside of the box and terminating in a coil O′, arranged in the upper portion of the compartment A, the end of the coil opening into the bottom of the basin B^5. The water accumulating in the basin B^5 overflows through the aperture B^8 into the basin B^6, from which the water finally passes by the pipe B′ into the separator K. The apertures B^7 B^8 permit any steam that may arise in the settling-chamber B to pass to the basin B^5, from which the steam may escape into a discharge-pipe B^9, which also connects with the upper portion of the feed-water tank C to carry off any steam that may rise therein. The stem K^3 of the float K^2 is also connected with an arm O^2 on the stem of the valve O^3 in the pipe O. The pipe O is also connected on opposite sides of the valve O^3 by drain-pipes P P′ with a pipe P^2, opening into the top of the separator K, and in said pipe P^2 is a valve P^3 for controlling the amount of water passing to the separator K by way of the pipes P P′ P^2. The valve P^3 is normally closed, and when it is de-

sired to drain the basins B^4 and B^5 the said valve is opened to allow the water to flow from the basins to the separator. A drain-cock P^4 leads from the bottom of the tank C to drain the latter whenever it is desired to empty the apparatus.

The settling-chamber B and the feed-water tank C are provided with suitable water-gages Q, as shown in Fig. 1, to indicate the level of the water in said chambers. Suitable manholes Q′ are provided for the water-tank C and for the separator K. (See Figs. 1 and 3.)

As previously mentioned, the steam finally leaving the compartment A by way of the pipe D′ may be exhausted into the outer air or it may be condensed in a supplementary or auxiliary condenser. (Shown in detail in Fig. 4.) For this purpose the upper end of the pipe D′ is provided with a socket D^4, in which is mounted to turn a tube R, carrying a head R′, from which extend radially a plurality of tubes S and also a vertically-disposed pipe T, formed at its upper end with a head T′, from which radiate a number of tubes S′, connected at their outer ends with the tubes S by pipes S^2, the said tubes S and S′ being also connected with each other throughout their length by branch pipes S^3, as is plainly indicated in said Fig. 4. On the top of the tubes S′ and near the ends thereof are arranged steam-discharge pipes or valved nozzles U, standing at an angle to the tubes S′, so that reaction of the escape of the steam from the nozzles U causes a turning of the several parts enumerated in the socket D^4, whereby the several pipes S^2 S^3, together with the tubes S S′, are rapidly carried through the air to insure a rapid condensation of the steam passing through the same. The tubes S′ are also provided with outlet-openings S^4 for the free escape of the steam. The water of condensation flows down the several pipes into the tubes S and to the head R′ and tube R around a pipe D^5, forming an extension of the pipe D′ within the latter, the upper end of said pipe D^5 reaching a distance up into the head R′, as is plainly indicated in Fig. 4. A collar D^6 supports the extension-pipe D^5 within the pipe D′, and from the latter leads a siphon-pipe W directly above the said collar to discharge into a water-receptacle X. A branch pipe W′ connects the short and long leg of the siphon-pipe W, and in this branch pipe is arranged a valve W^2, which when closed causes the water to be siphoned through the pipe W and when open, which is necessary in cold weather, causes a direct flow of water without the siphoning action. A suitable governor V is employed for the rotating part of the auxiliary condenser to insure uniformity in the speed of said condenser. An air-vent R^2 is arranged in the tube R.

When the apparatus is in use, the exhaust-steam entering the central compartment A and traveling through the tortuous passage formed by the baffle-plates E E′ readily gives off its heat to the air passing through the banks of coils F, also to the water passing through the coils O′ and L^3, as well as to the water in the settling-chamber B and that in the tank C, so that the said steam readily condenses. As the heat given off by the exhaust-steam is all utilized, or, in fact, returned to the boiler, partly by the heated feed-water and partly by the air used for insuring a complete combustion of the fuel in the boiler-furnace, it is evident that with my improved apparatus a great saving in the expense of generating and utilizing steam is obtained.

It is further evident that by the preliminary heating of the feed-water in the settling-chamber B by the heat of the exhaust-steam in the compartment A, located below the chamber, and by the heating of the water in the coil O′ a quick precipitation of foreign undesirable matter contained in the feed-water is obtained, and the feed-water is thus purified to prevent the formation of scale in the boiler without the use of chemicals. As the oil, scum, and other matter contained in the exhaust or waste steam is removed from the feed-water in the separator K, there is no danger of the formation of foam.

Having thus fully described my invention, I claim as new and desire to secure by Letters Patent—

1. A steam and heat conservator, comprising a steam-condensing compartment arranged for receiving the exhaust or waste steam, a closed settling-chamber superimposed on said compartment and connected with a feed-water supply, a feed-water tank below the said compartment, a separator adjacent to the said tank and connected therewith and with the said settling-chamber, so that the water of condensation from the said compartment and the water from the settling-chamber pass into and mix in the said separator and then flow into the said tank and a steam-actuated feed-water pump for drawing the water from the said tank, the steam-exhaust pipe from the pump being connected with the said steam-condensing compartment, substantially as shown and described.

2. A steam and heat conservator, comprising a steam-condensing compartment arranged for receiving the exhaust or waste steam, a closed settling-chamber superimposed on said compartment and connected with a feed-water supply, a feed-water tank below the said compartment, a separator adjacent to the said tank, a pipe leading from the settling-chamber to the separator, a pipe leading from one end of the steam-condensing compartment at the bottom thereof and extending to the bottom of the separator the said pipe being formed at its lower end with a perforated discharge-pipe extending over the bottom of the separator, so that the water of condensation from the said compartment and the water from the settling-chamber pass into and mix in the said separator and then flow into the said tank, and a blow-off valve leading from the separator for removing the

oil, scum and like floating matter from the level of the water in the said separator, as set forth.

3. A steam and heat conservator, comprising a steam-condensing and air-heating compartment, an inlet-pipe for conveying the exhaust or waste steam to said compartment, a distributing-chamber at one end of said compartment and connected with an air-supply, a receiver at the other end of said compartment, banks of coils extending in the said compartment and connected with the receiver a pipe connecting the said inlet-pipe with the receiver, a feed-water tank, and a steam-actuated pump for drawing the water from the feed-water tank, the steam-exhaust pipe for the pump being connected with the said steam-condensing compartment, substantially as shown and described.

4. A steam and heat conservator, comprising a steam-condensing and air-heating compartment arranged for receiving the exhaust or waste steam, and having a tortuous passage for the steam from one end of the compartment to the other, an air-distributing chamber at one end of the said compartment and connected with an air-supply, a receiver at the other end of said compartment, coils extending in the said compartment and connecting the air-distributing chamber with the said receiver, a feed-water tank, a separator connected with the said steam-condensing compartment and with the said tank, and a steam-actuated feed-water pump for drawing the water from the said tank, the steam-exhaust pipe for the pump being connected with the said steam-condensing compartment for directing the exhaust-steam of the pump into the said compartment, substantially as shown and described.

5. A steam and heat conservator, comprising a steam-condensing and air-heating compartment arranged for the exhaust or waste steam, and provided with baffle-plates forming a tortuous passage for the steam from one end of the compartment to the other, a distributing-chamber at one end of the said compartment and connected with an air-supply, a receiver at the other end of the said compartment, banks of coils extending in the said compartment and connected with the said receiver, a feed-water tank, a steam-actuated feed-water pump for drawing the water from the said tank, the steam-exhaust pipe for the pump being connected with the said compartment, for discharging the exhaust-steam of the pump into the said compartment, and a feed-water coil extending in the said compartment and connected at one end with the water-discharge pipe of the pump and at the other end with the feed-water-delivery pipe for the boiler, substantially as shown and described.

6. A steam and heat conservator, comprising a steam-condensing and air-heating compartment provided with baffle-plates forming a tortuous passage for the steam from one end of the compartment to the other, a distributing-chamber at one end of the said compartment and connected with an air-supply, a receiver at the other end of the said compartment, coils extending in the said compartment and connecting the air-distributing chamber with the receiver, a settling-chamber connected with a feed-water supply, a feed-water tank, a separator adjacent to the said tank and connected therewith and also connected with the settling-chamber and the steam-condensing compartment, and a steam-actuated feed-water pump for drawing the water from the said tank, the steam-exhaust pipe from the pump being connected with the said steam-condensing compartment, substantially as set forth.

7. A steam and heat conservator, provided with a settling-chamber for supplying any deficiency in the pure-feed-water supply, and having a plurality of settling-basins, a heating-compartment below said chamber, a pipe leading from the outer end of one end basin and terminating in a coil extending into the heating-compartment, the other end of said pipe opening into the bottom of an adjacent or middle basin, and an overflow connection for connecting the middle basin with the other end basin, substantially as shown and described.

8. A steam and heat conservator, comprising a steam-condensing and air-heating compartment arranged for receiving the exhaust or waste steam, a settling-chamber superimposed on said compartment and having a series of settling-basins, a feed-water-supply pipe discharging into one of the end basins, a pipe leading from said end basin and terminating in a coil extending into the heating-compartment, the other end of said pipe opening into the bottom of the adjacent settling-basin, the latter basin being connected by an overflow with the other end basin of the series, a feed-water tank below the said heating-compartment, a separator adjacent to the said tank and connected therewith, and also connected with the heating-compartment and with the last settling-basin of the series, a feed-water pump for drawing the water from the feed-water tank, and means for automatically controlling a valve in the feed-water-supply pipe leading to the settling-chamber, substantially as set forth.

9. A steam and heat conservator, comprising a steam-condensing compartment arranged for receiving the exhaust or waste steam, a closed settling-chamber superimposed on said compartment and connected with a feed-water supply, a feed-water tank below the said compartment, a separator adjacent to the said tank and connected therewith and with the said settling-chamber, so that the water of condensation from the said compartment and the water from the settling-chamber pass into and mix in the said separator and then flow into the said tank, a deficiency feed-water-supply pipe discharging

into the said settling-chamber, and a float in the said separator and controlling a valve in the said pipe, to regulate the supply of feed-water to the said settling-chamber, substantially as shown and described.

10. A steam and heat conservator, comprising a steam-condensing compartment, a settling-chamber, a feed-water-supply pipe discharging into the settling-chamber, a feed-water tank, a separator adjacent to the said feed-water tank and connected therewith and also connected with the said settling-chamber and the steam-condensing compartment, so that the water of condensation from the said steam-condensing compartment and the water from the settling-chamber pass into and mix in the separator and then flow into the feed-water tank, means for removing the oil, scum and like floating matter from the level of the water in the separator, and means for automatically controlling a valve in the feed-water-supply pipe leading to the settling-chamber, substantially as described.

11. A steam and heat conservator, provided with a settling-chamber for supplying any deficiency in the pure-feed-water supply, and having a plurality of settling-basins, a feed-water-supply pipe discharging into the settling-chamber, a heating-compartment below said chamber, a coil extending in the said compartment and connecting one end basin with an adjacent or middle basin, a separator into which discharge both the said settling-chamber and the said compartment, and a float in the said separator and controlling a valve for the said coil to regulate the flow of water from one basin to the other, the said float also controlling a valve in the feed-water-supply pipe, as set forth.

12. A steam and heat conservator, comprising a heating-compartment arranged for receiving the exhaust or waste steam, a settling-chamber superimposed on said compartment and having a plurality of settling-basins, a feed-water-supply pipe leading to the settling-chamber, a feed-water tank below the heating-compartment, a separator adjacent to the tank and connected therewith and with the settling-chamber, a pipe provided with a valve, and leading from one of the settling-basins, the said pipe terminating in a coil extending in the said heating-compartment and connected with one of the other settling-basins, drain-pipes leading from said pipe at opposite sides of the valve and connected with a pipe opening into the separator, and a float in said separator and controlling a valve in the feed-water-supply pipe leading to the settling-chamber, the said float also controlling the valve in the pipe connecting the said settling-basins, substantially as set forth.

13. A steam and heat conservator, comprising a steam-condensing and air-heating compartment arranged for receiving the exhaust or waste steam, an inlet-pipe for conveying the waste steam to said compartment, a distributing-chamber at one end of the said compartment and connected with an air-supply, a receiver at the other end of the said compartment, banks of coils extending in the said compartment and connected with the said receiver, and a valve-controlled pipe leading from the inlet-pipe for exhaust steam and discharging into the said receiver to charge the heated air therein with steam, substantially as shown and described.

14. A steam and heat conservator, comprising a steam-condensing and air-heating compartment having a tortuous passage for the exhaust or waste steam, a discharge-pipe leading from the said compartment, and an auxiliary condenser connected with the said discharge-pipe and mounted to rotate and driven by the reaction of the steam escaping from the auxiliary condenser, as set forth.

15. A steam and heat conservator, comprising a steam-condensing and air-heating compartment having a tortuous passage for the exhaust or waste steam, a discharge-pipe leading from the said compartment, an auxiliary condenser connected with the said discharge-pipe and mounted to rotate and driven by the reaction of the steam escaping from the auxiliary condenser, and a discharge device for the water of condensation from the said auxiliary condenser, substantially as shown and described.

16. A steam and heat conservator, comprising a steam-condensing and air-heating compartment having a tortuous passage for the exhaust or waste steam, a discharge-pipe leading from the said compartment, an auxiliary condenser connected with the said discharge-pipe and mounted to rotate and driven by the reaction of the steam escaping from the auxiliary condenser, and a discharge device for the water of condensation from the said auxiliary condenser, the said device having a siphon-pipe and a valved branch pipe between the short and long legs of the said siphon-pipe, as set forth.

17. A steam and heat conservator, comprising a steam-condensing and air-heating compartment, having a tortuous passage for the exhaust or waste steam, a discharge-pipe leading from the said compartment, an auxiliary condenser connected with the said discharge-pipe and mounted to rotate, and means for regulating the speed of said condenser, as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

BARDEN WALTON TAYLOR.

Witnesses:

THEO. G. HOSTER,

EVERARD BOLTON MARSHALL.