

3 Sheets--Sheet 1.

No. 241,257.

Patented May 10, 1881.



Inventor:

James E. Weaver.

(No Model.)

3 Sheets—Sheet 2.

J. E. WEAVER.
Process of and Apparatus for Evaporating Saline and
Other Liquids.

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Fig. 3

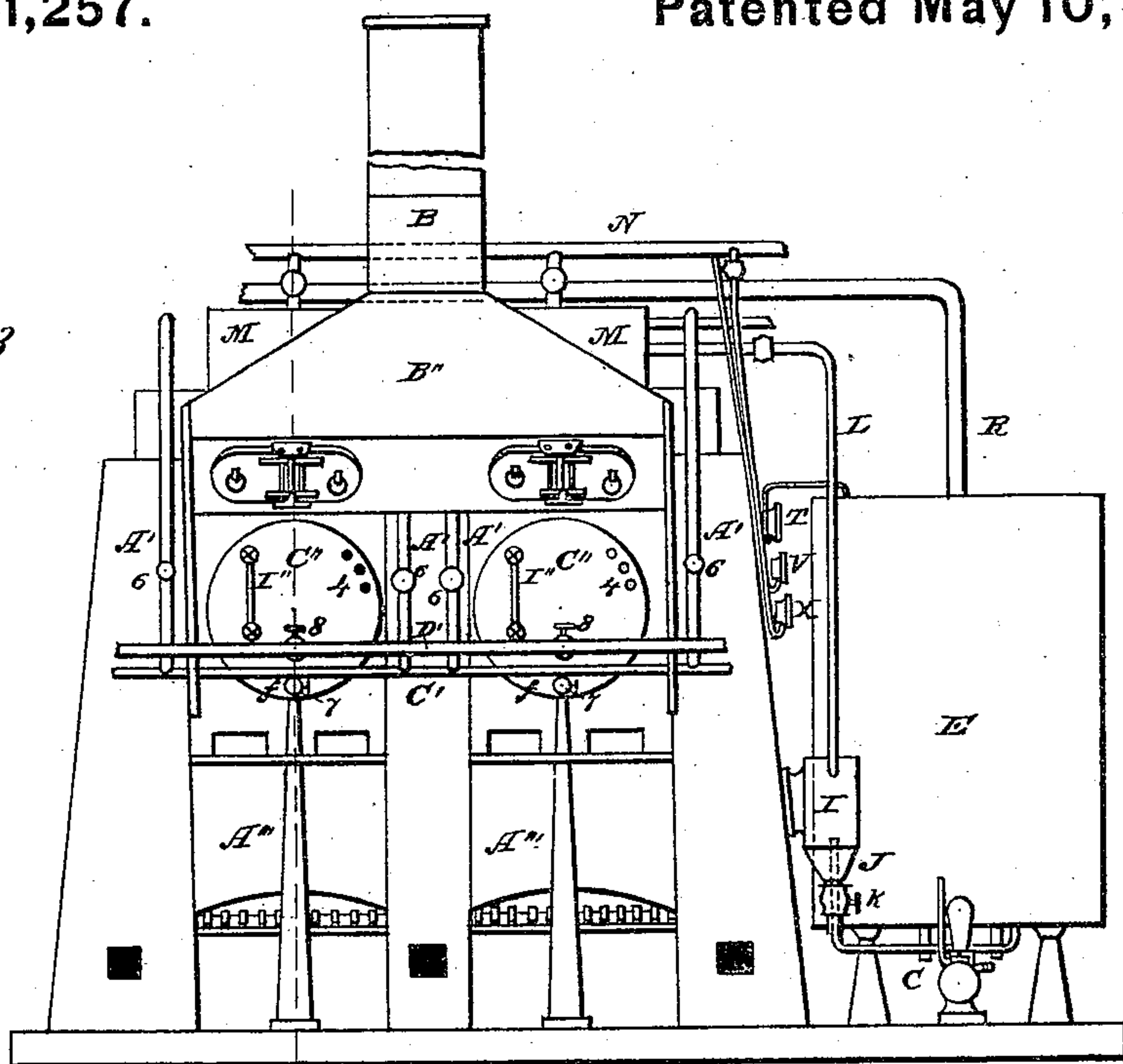
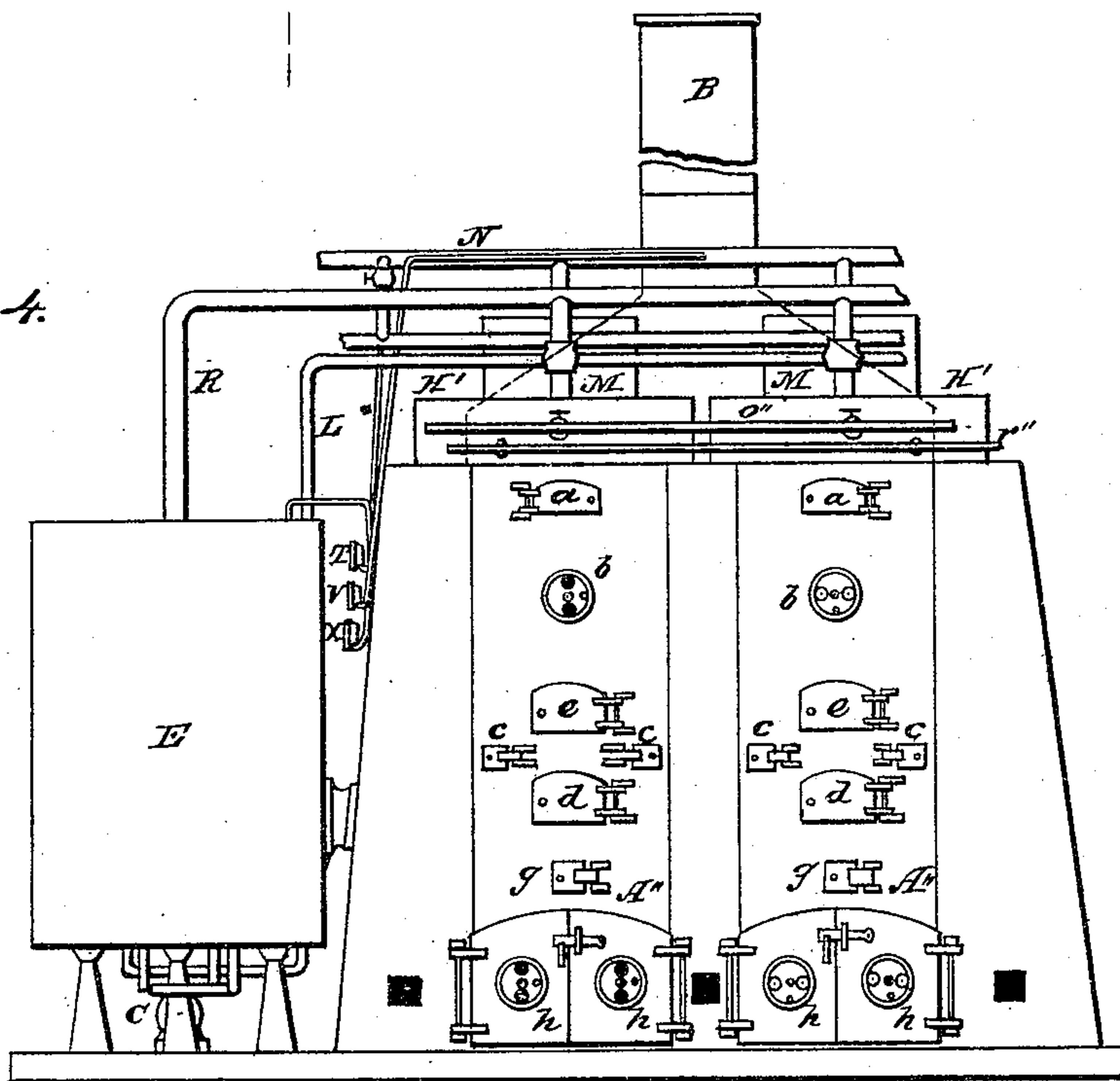


Fig. 4



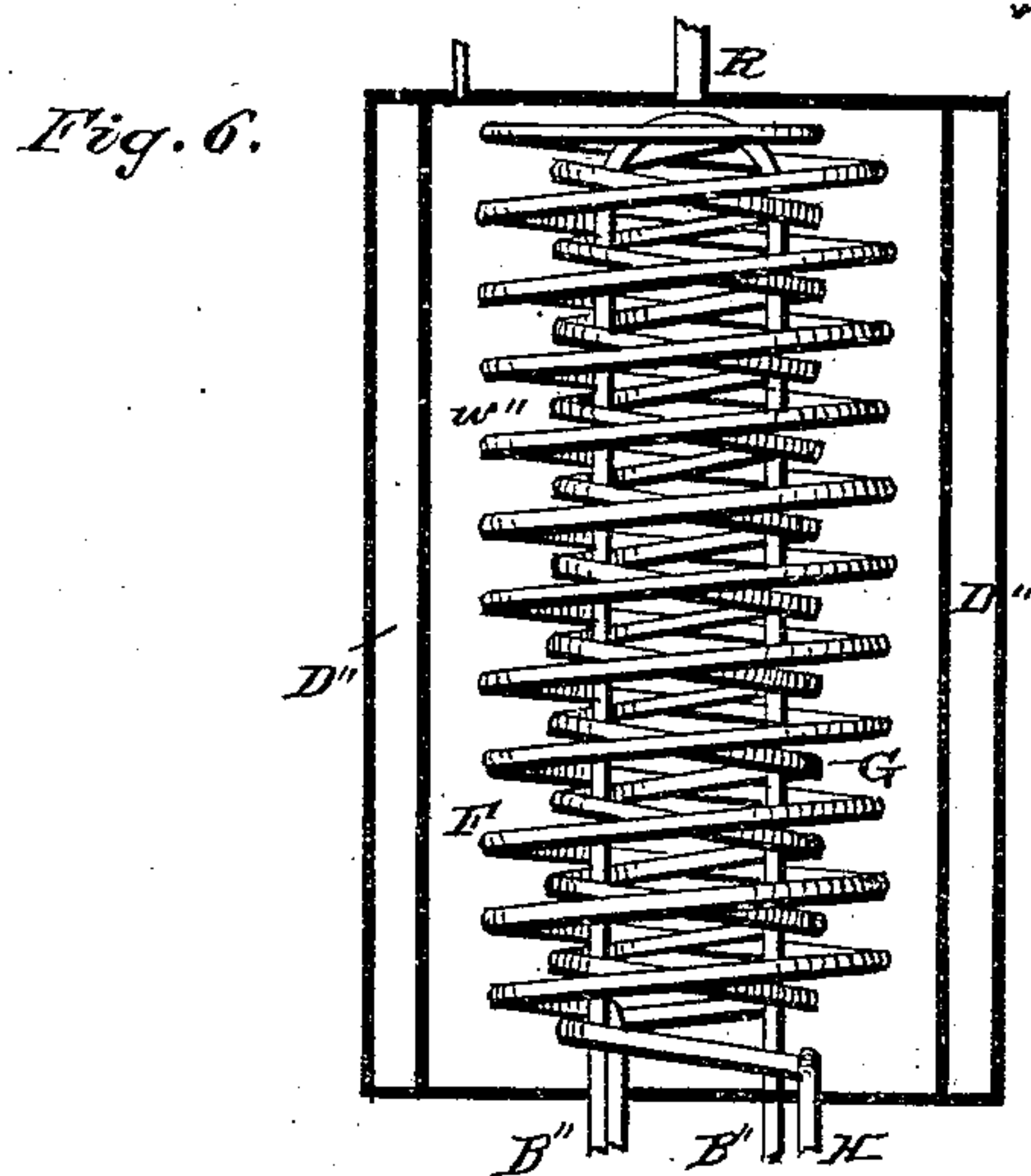
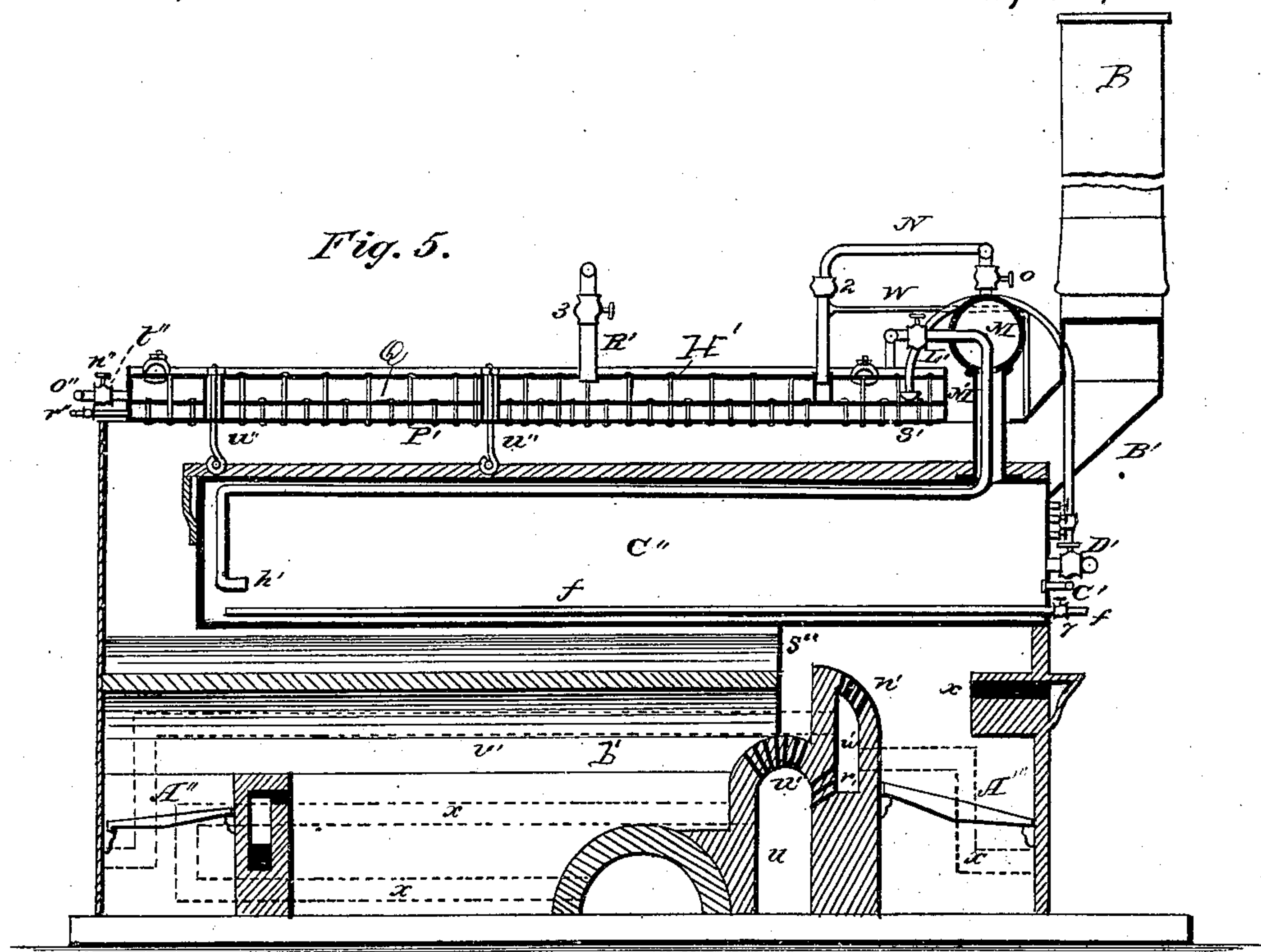
Witnesses:
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UNITED STATES PATENT OFFICE.

JAMES E. WEAVER, OF ALLEGHENY, PENNSYLVANIA.

PROCESS OF AND APPARATUS FOR EVAPORATING SALINE AND OTHER LIQUIDS.

SPECIFICATION forming part of Letters Patent No. 241,257, dated May 10, 1881.

Application filed April 26, 1880. (No model.)

To all whom it may concern:

Be it known that I, JAMES E. WEAVER, of Allegheny, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Process of and Apparatus for Evaporating Saline and other Liquids; and I do hereby declare that the following is a full and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon.

My invention relates to an improvement in process and apparatus for evaporating saline and saccharine liquids in the manufacture of salt and sugar; and it consists in gradually heating said liquids in a coil or coils of pipe or pipes by the vapors evolved from the liquid in the evaporating-pans, said heated liquid continuously passing from said coil or coils of pipe or pipes into a boiler or boilers by means of a pipe or pipes passing through the steam drum or drums and steam space or spaces of said boiler or boilers, in which the said liquid is highly heated and its specific gravity increased, from which boiler or boilers the liquid passes into an evaporating pan or pans, where its specific gravity is further increased by the vapor or steam evolved in said boiler or boilers, the said liquid flowing continuously from said evaporating pan or pans into a vat or vats for its further treatment and manipulation by the ordinary process in making salt or sugar, the improvement in evaporating said liquids being an automatic and continuous process from the time the liquid enters the heating coil or coils until it is discharged into the vats, the whole being accomplished through the medium of the apparatus hereinafter described.

To enable those skilled in the art with which my invention is most nearly connected to make and use it, I will proceed to describe its construction and operation.

In the accompanying drawings, which form part of my specification, Figure 1 is a top view or plan of the apparatus which I employ for carrying out my improvement in process for evaporating saline or saccharine liquids for the manufacture of salt or sugar. Fig. 2 is a side elevation of the same. Fig. 3 is a front-end elevation of the same. Fig. 4 is a rear-end elevation of the same. Fig. 5 is a vertical and

longitudinal section of the same. Fig. 6 is a vertical section of the condenser, representing the arrangement of the coils for heating the saline or saccharine liquid in its passage to the boilers.

In the accompanying drawings, A'' and A''' represent furnaces for heating the liquid in the boilers C''. These furnaces are provided with breeching B' and stack B, and are operated in the same manner as the ordinary furnaces for steam-boilers. A fire of coke is started on the grate of the furnace A'', and when the coke is thoroughly burning the furnace is charged with "slack" of bituminous coal. The doors a b c d e g and registers h are then closed, shutting off the ingress of air. The slack in a short time commences throwing off a heated smoke or gas, which, traveling toward the fire of the furnace A''', unites with heated currents of air, (heated through the medium of flues indicated by the dotted lines b' and x, communicating with the chamber u and with the chamber w' through openings r',) which heated air passes through the openings n' and w' and commingles with the smoke and gas from the furnace A'', which uniting at S'', the flame and heat of the furnace A''' ignites the gaseous mixture, resulting in complete combustion of the smoke and gases of both furnaces. This furnace being the subject of another application, marked "Division B," of even date with this application, I will therefore not further describe it in this specification.

C represents an ordinary steam-pump, which is connected with the supply of saline or saccharine liquid, and is attached by means of a pipe, D, with coils of pipe F G in the case of the condenser E, said coils being connected by means of a pipe, H, with a trap, I, the lower end, J, of which is conformed, and is provided with a valve, K.

To the upper end of the trap I is connected a pipe, L, having branches L', which passes into the drum M, and, passing down the leg M' of said drum, enters the boilers C'', and passing along in the upper part of said boilers to their rear end, where it turns down and has its discharge end h' near the bottom of the boilers, as shown in Fig. 5.

To the front end of the boilers C'', a little above the bottom, is attached a pipe, C', hav-

ing branches A', provided with valves 6, the upper end of said branches entering a trough, S', arranged transversely in the chambers Q of the evaporating-pans H'.

5 To the front end of the boilers C'', a little above the pipe C', is a pipe, D', furnished with valves 8, which pipe and valves are used for the purpose of keeping the same quantity of liquid in each of the boilers, which will be
10 shown by the glass indicator I''.

The boilers C'' are each furnished with a blow-off pipe, f, furnished with a large number of perforations on its under side, and furnished with a valve, 7, at the front end of said boilers.
15 This pipe is used for the purpose of preventing the bottom of the boiler from being coated with a crust of salt or other matter, which may settle down in the process of boiling. By opening the valve 7 an agitation of
20 the liquid at the bottom of the boiler will follow, and the precipitated matter will be drawn into the perforated pipe and carried off by the outgoing current caused by the opening of said valves and by the pressure on the surface of
25 the liquid in the boiler.

To the steam-drum M of the boilers C'' is connected pipe N, which passes down through the chamber Q of the evaporating-pans H' and communicates with the chamber P'. This pipe
30 N is furnished with valves O and 2, and is used for conveying steam into the chamber P' for a heating medium.

To the top of the evaporating-pans H' are attached pipes R', which communicate with the
35 case of the condenser E, said pipes being provided with valves 3, for regulating the flow of vapor into the condenser and for cutting off communication between the evaporating-pans when it is desirable to do so, as in case of ac-
40 cident or some parts of the pans or their connections needing repairs.

To the rear end of the chambers Q of the evaporating-pans H'' are attached pipes t'', furnished with valves n'', and to said pipe is at-
45 tached a pipe, O'', which is used for conveying the liquid from the chamber Q to the settling or graining vats. The pipes t'' should be at the point of attachment with the chambers Q, about two inches above the bottom of said
50 chamber, so that it will at all times have a depth of two inches of liquid in said chamber.

To the rear end of the chamber P', at two inches above the bottom, is attached a pipe, r'', which is used for carrying off the products of
55 condensation.

The side walls of the condenser E are made double, so as to form a chamber, D'', between the two walls, as shown in Fig. 6, which chamber is supplied with cold water, which should
60 enter the bottom of said chamber, with a waste-water conductor connected with the top of said chamber. The inner chamber, w'', of the condenser is connected with a pressure gage or indicator, T, by means of a pipe, s, for the pur-
65 pose of indicating the amount of pressure of steam or vapor in said chamber.

To the pipes N is attached a pipe, U, which communicates with a pressure gage or indicator, X.

To the pipe P is attached a pipe, W, which
70 communicates with a pressure gage or indicator, V. These pipes U W and pressure gages or indicators V X are for the purpose of showing the pressure in the pipes N U and boilers C''. The boilers C'' are furnished with try-
75 cocks 4, and are held in position by the front of their respective furnace and suspended by means of rods u'' u'' (which pass up through the evaporating-pans H'') and a screw-nut, v'',
80 secured on their upper end.

The evaporating-pans H' are constructed of plate-iron and made in two compartments, which form the chambers Q and P, the bottom,
85 top, and partition being supported by a large number of stay-bolts, as shown in Fig. 5.

The evaporating-pans herein referred to being the subject of an application for a patent marked "Division C," and of even date with this application, I will therefore not further de-
90 scribe them in this specification.

In the chamber w'' of the condenser E is placed a double coil of pipe, F G, and within the inner coil, G, is placed a pipe, B'', bent in the form of an inverted U, one end of which is con-
95 nected with a pump of an engine, and the other end with a pipe communicating with a steam-boiler for supplying it with heated water, said pipes at the same time aiding in condensing the vapor conveyed into the chamber w'' from the evaporating-pans. The coils of pipe F G are
100 employed for heating the saline or saccharine liquid prior to its entering the boilers C'', and for condensing the vapor conveyed into the chamber w'' from the evaporating-pans. In the construction of the apparatus hereinbefore
105 described all pipes through which the saline liquid has to flow should be constructed of copper, and those through which the steam or vapor passes may be of iron.

Having all things constructed and arranged
110 with relation to each other as hereinbefore described, the boilers C'' and chambers Q of the evaporating-pans H' are charged with a quantity of saline or saccharine liquid and the cham-
115 bers P' of said pans supplied with fresh water to the depth of about two inches. The primary charging of said boilers and chambers may be done by any suitable means, but must be done prior to starting fires in the furnaces A'' and A'''. Otherwise said boilers and pans would
120 be injured by the heat of the furnaces. The boilers C'' and chambers Q and P' being charged, as stated, fires are made in the furnaces A'' and A''', which will heat the liquid in said boilers, and also heat the water in the chamber
125 P', which will heat the liquid in the chamber Q. When the steam or vapor in the boilers C'' has attained a pressure of about fifty pounds to the square inch of boiler-surface, the operator then opens the valves 1 of pipes L' and
130 starts the pump C, which will force liquid up through the coil F and down through the coil

G, and through pipe H into the trap I, from which it flows through pipe L, and from it through the branch pipes L', (which enters the steam-drums M and down through the legs M', and along in the upper part of the boilers C',) and is discharged at h' into the liquid in said boilers. The operator then opens the valves 6 of the pipes A', which will cause the liquids in the boilers C' to flow through said pipes into the chambers Q of the evaporating-pans H'. The valves O and 2 of the pipes N are then opened, which allows steam from the drums M to flow through said pipes into the chamber P' of the evaporating-pans H'. The valves 3 of the pipe R are then opened, which will allow steam from the chamber Q to flow into the chamber w''. The apparatus now may be said to be in working condition, and the method or process is as follows:

The pump U forces the liquid through the coils F G, in which it is heated by the vapor or steam from the chambers Q of the evaporating-pans, which vapor or steam, in performing its office in heating said coils and in coming in contact with the walls of the chamber w'' of the condenser E, is condensed, and the products by condensation flow off through a waste-pipe connected to the bottom of the chamber w''. The liquid flows from the coil G, through pipe H, into trap I, where the iron or other matter in the liquid precipitates, and, settling down in the coniform part J of the trap, may be drawn off at suitable intervals by opening the valve K. The liquid, heated and free from foreign matter, flows from the upper part of the trap I, through pipe L and branches L', and is discharged into the heated liquid in the boiler C', where it is highly heated and its specific gravity increased, and from the boilers flows into pipe C', and from it into pipes A', and from them into the chambers Q of the evaporating-pans, where its specific gravity is still further increased by the heat of the steam in the chambers P', which receives steam from the boilers C', the temperature of which is retained to a considerable extent by the heat of the furnaces acting upon the bottom of the chambers P'. The liquid with increased specific gravity flows from the chamber Q of the evaporating-pans H', through pipes t'', into pipe O'', and from it into the settling or graining vats, and then treated and manipulated in the usual manner.

It will be observed that from the time the liquid enters the coils of pipe in the condenser until it leaves the evaporating-pans is a continuous operation, and that the liquid is freed from foreign matter, and is being continuously increased in its specific gravity.

By the process and apparatus hereinbefore described it has been ascertained that the liquid increases about twelve degrees (by the salinometer) in specific gravity, and that salt manufactured by said process and apparatus is of a superior quality.

Having thus described the nature, construc-

tion, and operation of my improvement, what I claim as of my invention, and desire to secure by Letters Patent, is—

1. The herein-described continuous process for evaporating saline and other liquids, consisting in heating the liquid and condensing the vapor evolved from the liquid in the evaporating-pan by passing said liquid through a heated pipe or pipes inclosed in a case, subsequently removing the foreign matter from the liquid by passing it through a trap on its passage to the boiler, further heating the liquid in said boiler and forcing it through a pipe or pipes into the evaporating-pan by the pressure of the vapor or steam in said boiler, and further heating the liquid in said pan by steam and heat supplied from said boiler and the furnace, substantially as specified.

2. In an evaporating apparatus, the combination of a pipe or pipes inclosed in a case surrounded by water, and means, substantially as described, for conveying the vapor evolved from the liquid in the evaporating pan or pans into said case, whereby said vapor is condensed and the liquid in its passage through said pipe or pipes is heated prior to entering the evaporating pan or pans, substantially as herein shown and described.

3. In an evaporating apparatus, the combination of a heated pipe or pipes, through which the liquid passes, and a trap or chamber connected with said pipe or pipes, for separating foreign matter from said liquid prior to conveying it into the evaporating pan or pans, substantially as herein described.

4. In an evaporating apparatus, the combination of a boiler with an evaporating-pan communicating with each other through the medium of a pipe or pipes, whereby liquid from said boiler is forced into the evaporating-pan by the pressure of the vapor evolved in the former, substantially as herein described.

5. In an evaporating apparatus, the combination of two or more boilers, communicating with each other below their liquid-level, and two or more evaporating-pans, the latter communicating with the former, so that the pressure of the vapor evolved in said boilers will force the liquid from them into said pans, substantially as herein described, and for the purpose set forth.

6. In an apparatus for evaporating liquids, a boiler having its liquid-supply pipe arranged in the steam-space, with the discharge of said pipe below the liquid-level in said boiler, substantially as herein described, and for the purpose set forth.

7. In an apparatus for evaporating liquids, two or more boilers communicating with each other, and having their liquid-supply pipes arranged in the steam-spaces, with the discharge end of said pipes below the liquid-level in said boilers, substantially as herein described, and for the purpose set forth.

8. In an apparatus for evaporating liquids, the combination of a boiler and evaporating-

pan, the latter having a steam heating-chamber and an evaporating-chamber, the former chamber being supplied with steam and the latter with heated liquid from said boiler, substantially as herein described, and for the purpose set forth.

9. An evaporating apparatus consisting of the heating and condensing device E, trap I, boilers C'' C'', and evaporating-pans H' H', said

parts communicating with each other through the medium of pipes, all arranged and operating with relation to each other substantially as herein described, and for the purpose set forth.

JAS. E. WEAVER.

Witnesses:

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D. C. ALLEN.