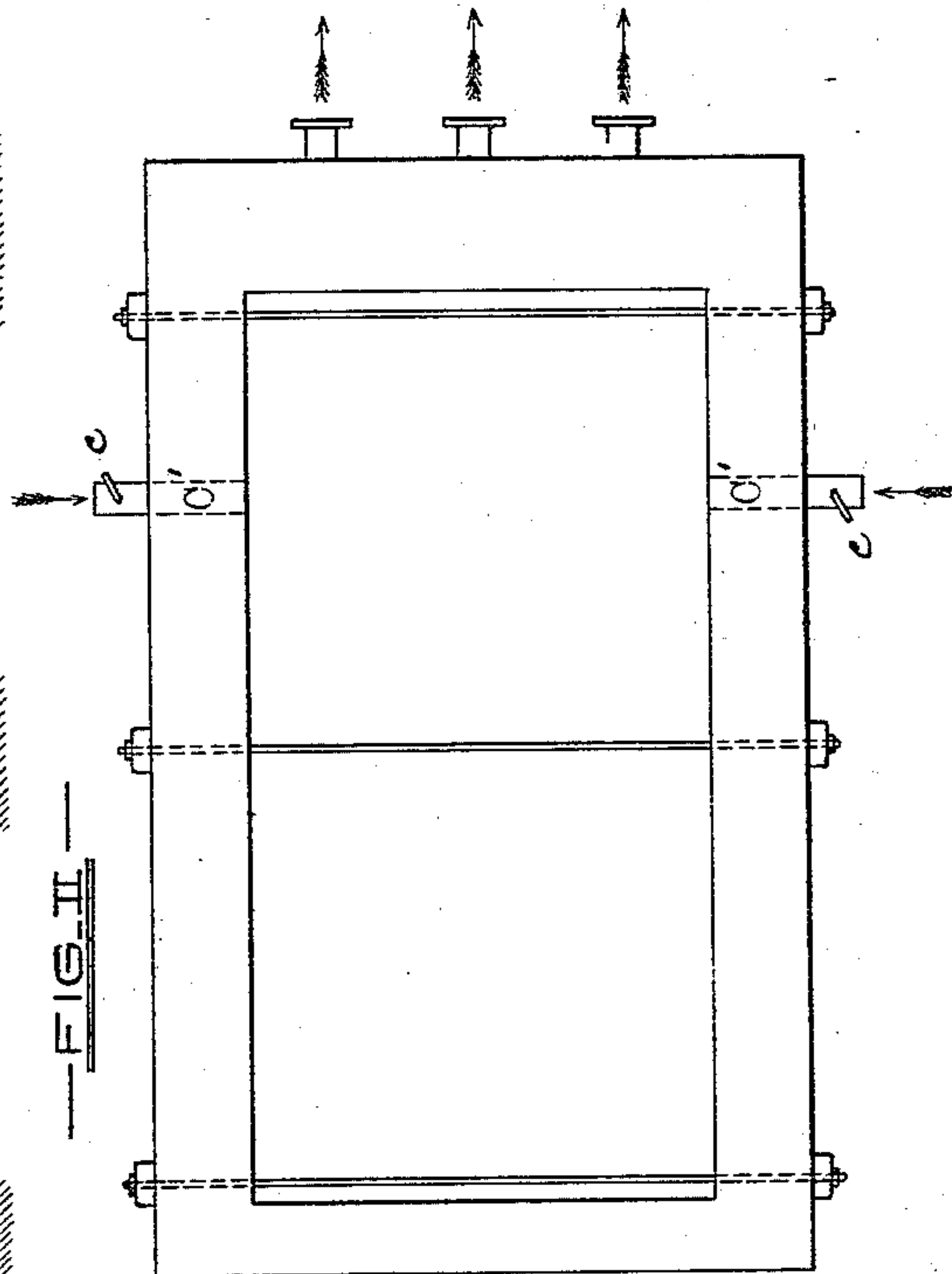
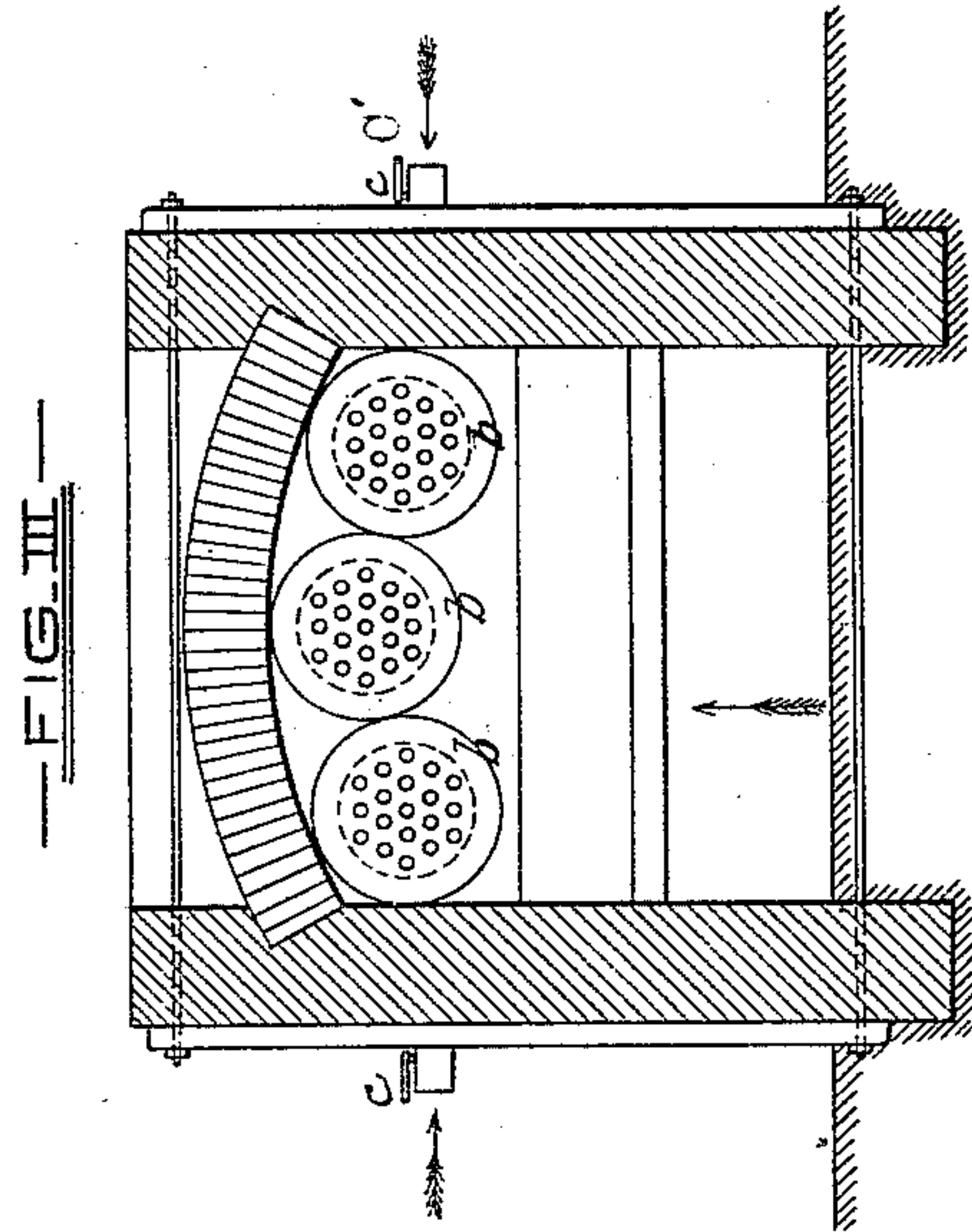
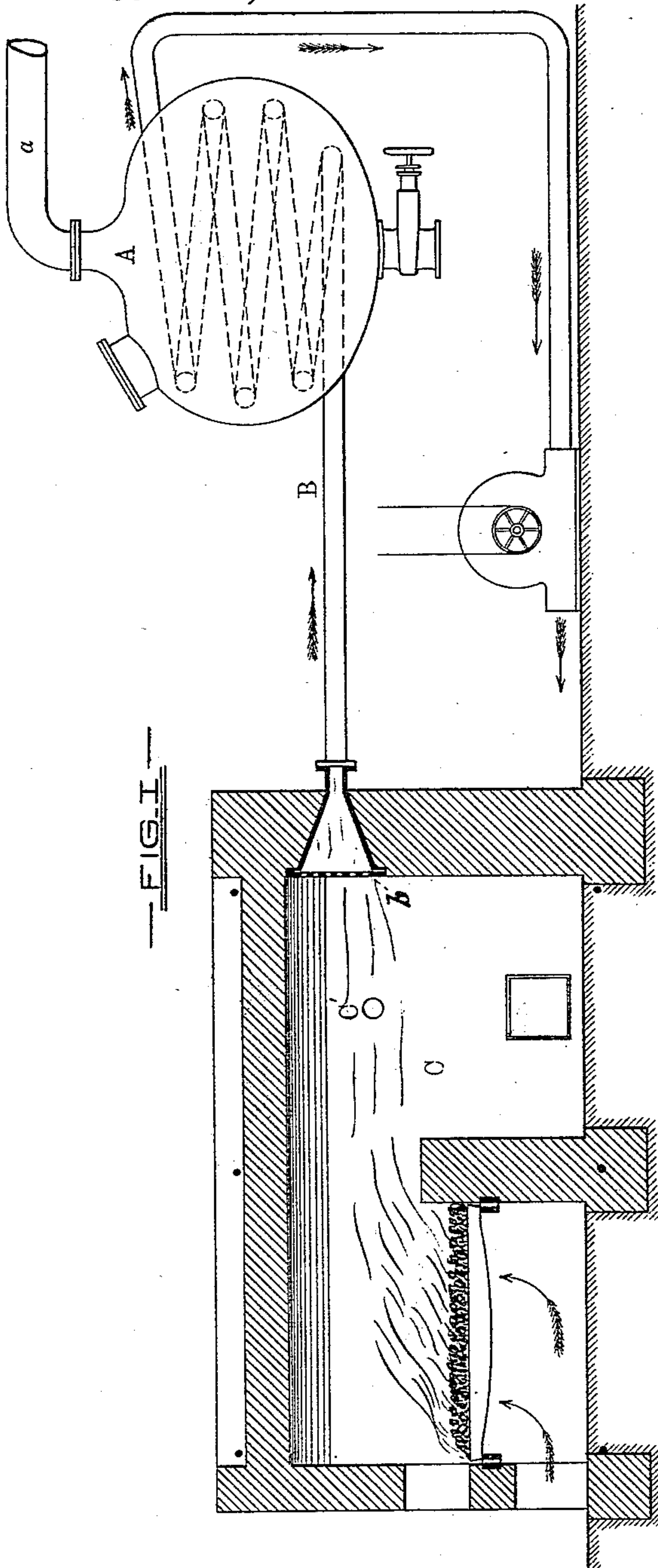


J. B. THOMAS.

Apparatus for Concentrating Sugar-Cane Juice.

No. 226,255.

Patented April 6, 1880.



—WITNESSES—

Wm. H. Towner
W. W. Wharton

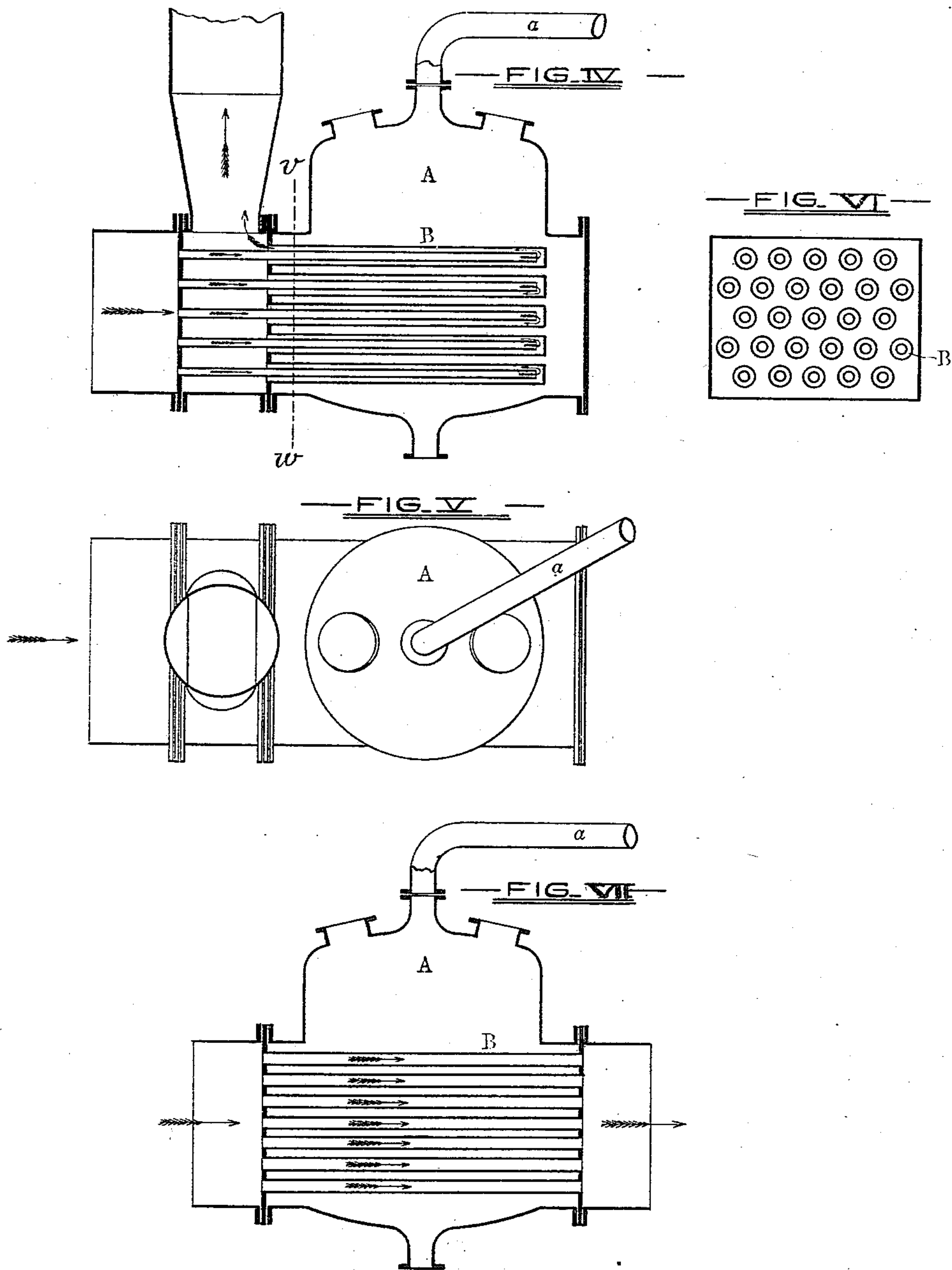
—INVENTOR—

John B. Thomas.
by G. H. M. J. Howard
Atty.

J. B. THOMS

2 Sheets—Sheet 2.

Apparatus for Concentrating Sugar-Cane Juice.
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—WITNESSES—

Wm. W. Johnson

W. W. Wharton

—INVENTOR—

John B. Thoms

by G. H. M. Howard
Atty.-

UNITED STATES PATENT OFFICE.

JOHN B. THOMS, OF BALTIMORE, MARYLAND.

APPARATUS FOR CONCENTRATING SUGAR-CANE JUICE.

SPECIFICATION forming part of Letters Patent No. 226,255, dated April 6, 1880.

Application filed April 27, 1877.

To all whom it may concern:

Be it known that I, JOHN B. THOMS, of the city of Baltimore and State of Maryland, have invented an Improved Apparatus for Boiling
5 or Concentrating Sugar-Cane Juice, of which the following is a specification; and I do hereby declare that in the same is contained a full, clear, and exact description of my said invention, reference being had to the accompanying
10 drawings and to the letters of reference marked thereon.

In the manufacture of sugar, a use to which my invention is specially applicable, the primary and subsequent boilings to which the sugar-liquor is subjected are effected at a reduced
15 boiling-temperature, which is obtained by condensing the vapors arising from the liquor. This condensation of vapors is usually obtained through the medium of suitable exhausting apparatus and a condenser into which the said vapors are introduced.

The ordinary method of heating the sugar-liquor to the boiling-temperature in the vacuum-pans is by means of steam-pipes arranged
25 in various ways within the said vacuum-pans, but generally in the form of a gang or coil connected to a steam generator or boiler. Among the objections to this method of heating the sugar-liquor is the extravagant expenditure of fuel, as is indicated by the great
30 disparity between the water evaporated in the boiler and that distilled from the sugar-liquor and carried off in the form of vapor. It is admitted that a certain amount of heat is necessarily expended in heating the solid particles of sugar held in mechanical suspension
35 in the sugar-liquor; but this, in itself, is not sufficient to account for the comparatively heavy consumption of fuel. One of the principal causes of the loss of heat alluded to
40 arises from the extensive heat-radiating surface of boilers and from the deposit of scale, mud, and other non-conducting accumulations on the heating-surfaces of the same. Another
45 cause of loss of heat is found in the discharge of the heating medium (steam) as water at about 212° Fahrenheit, this discharge being necessary to give the required current or circulation in the coils.

50 Steam-boilers, in addition to their first heavy

cost, are a source of continual expense for repairs, and with the most careful treatment will only last a few years before requiring to be replaced by new ones.

The loss of heat from the above-described
55 causes is obviated in my invention by the substitution for steam in the pipes in the vacuum-pans of heated atmospheric air, or air, gases, and the products of combustion of fuel.

My invention consists in combining a furnace having heated-air pipes and valved air-passages for promoting combustion in said furnace with a vacuum-pan and an air-inducing device, the said heated-air pipes passing through
60 the vacuum-pan and being furnished with net-work at the ends uniting with the furnace, to prevent the entrance to the pipes and vacuum-pan of ashes, soot, and the like, all as hereinafter set forth.

By boiling *in vacuo* and at a low temperature the sugar is produced in larger quantities and discoloration is greatly reduced. By boiling in an open vessel the temperature attained is between 240° and 250° Fahrenheit, and this high temperature causes the formation of a large amount of caramel, which not
75 only destroys a considerable percentage of sugar, but also discolors the boiling mass in proportion as the caramel is formed.

By boiling *in vacuo* the temperature, under
80 favorable conditions, need not exceed 150° Fahrenheit; and although a slight discoloration will occur, by reason of the trifling formation of caramel necessarily effected in the process of concentration, the discoloration is
85 reduced to such an extent as to exert an important advantage in the manufacture.

My invention aims, by taking advantage of this fact, to economize in fuel, effect a greater yield of sugar, and to produce this article with as little discoloration as possible
90 without the use of steam as an agent in the conducting of the process. The planter, in carrying on the said process, is by my invention relieved from the expense and care of
95 steam-boilers—a consideration to him of the highest importance.

In the accompanying drawings, forming a part of this specification, are shown the devices preferably used to heat air and conduct
100

it, either separately or in combination with the gases and products of combustion of the fuel, to the pipes or coils in the vacuum-pans.

In the said drawings, Figure 1 is a partial-ly-sectional view of a furnace, vacuum-pan, and connections designed to utilize the gases and products of combustion by combining them with the air. Figs. 2 and 3 are, respectively, a plan and a transverse section of the furnace. Fig. 4 is a sectional view of a vacuum-pan, showing a certain arrangement of the heating-pipes. Fig. 5 is a plan of the said vacuum-pan, and Fig. 6 a transverse section of the same on the line *vw*. Fig. 7 illustrates another method of applying the heating-pipes to a vacuum-pan.

Similar letters of reference indicate similar parts in all the figures.

A is a vacuum-pan, containing the sugar-liquor to be concentrated by evaporation, provided with a pipe, *a*, leading to a condenser.

B B are pipes to convey hot air or air, gases, and the products of combustion from the furnace C to the vacuum-pan and through the sugar-liquor contained therein.

The furnace illustrated in Figs. 1, 2, and 3 is of a very simple construction and arranged with the pipes B, each one of which leads to a vacuum-pan, constituting the only means of exit for the gases and products of combustion.

The pipes B are protected against the entrance thereto of ashes, soot, and the like by means of net-work *b*, secured to their inner ends.

C' C' are apertures to admit air to the combustion-chamber of the furnace, to be heated before entering the pipes B, and to combine with the gases eliminated by the heat from the fuel and render their combustion as nearly perfect as practicable.

Valves *c* are provided, by means of which the admission of air is regulated.

The outer ends of the pipes B connect with a chimney or stack, or, if a stack is not used, with a fan or a series of fans or other exhausting devices, to produce the currents in the pipes necessary to maintain them at a proper temperature.

The rapidity of the currents in the pipes B is regulated by the speed of the exhausting devices, or, when a stack is used, by means of

dampers, and is such as will prevent the air leaving the vacuum-pan at a temperature much higher than that of the boiling mass, so as not to cause any unnecessary waste of heat.

By means of this description of furnace and air-pipes the usual loss of heat by the passage of the heated products of combustion to the chimney, as in the ordinary boiler, is greatly reduced.

In Figs. 4, 5, 6, and 7 modifications in the manner of applying the pipes B are shown. Arrows indicate the direction of air and other currents in all the figures except Fig. 7.

I am aware that in apparatus for rendering fats and deodorizing gases a steam rendering-tank has been employed in connection with an internal hot-air drum or chamber, and the independent means of heating the air supplied to it and regulating its temperature, and that also with such apparatus a condenser with coil has been used, and also an exhaust apparatus for drawing off the gases and inducing a flow of hot air through the drum of the tank.

I am also aware that air has heretofore been heated for various uses in the arts, and also that it is not new to promote combustion by admitting fresh air to a furnace beyond the point of primary combustion, and also that smoke and other pipes have heretofore, in other connections, been provided with network or gratings; and such appliances I do not claim, broadly; but,

Having thus described my invention, what I claim as new, and wish to secure by Letters Patent of the United States, is—

A furnace having heated-air pipes and valved air-passages for promoting combustion in said furnace, combined with a vacuum-pan and an air-inducing device, the said heated-air pipes passing through the vacuum-pan and being furnished with net-work at the ends uniting with the furnace, to prevent the entrance to the pipes and vacuum-pan of ashes, soot, and the like, substantially as set forth.

In testimony whereof I have hereunto subscribed my name this 31st day of January, A. D. 1877.

JOHN B. THOMS.

Witnesses:

WM. T. HOWARD,
THOMAS MURDOCH.