

(No Model.)

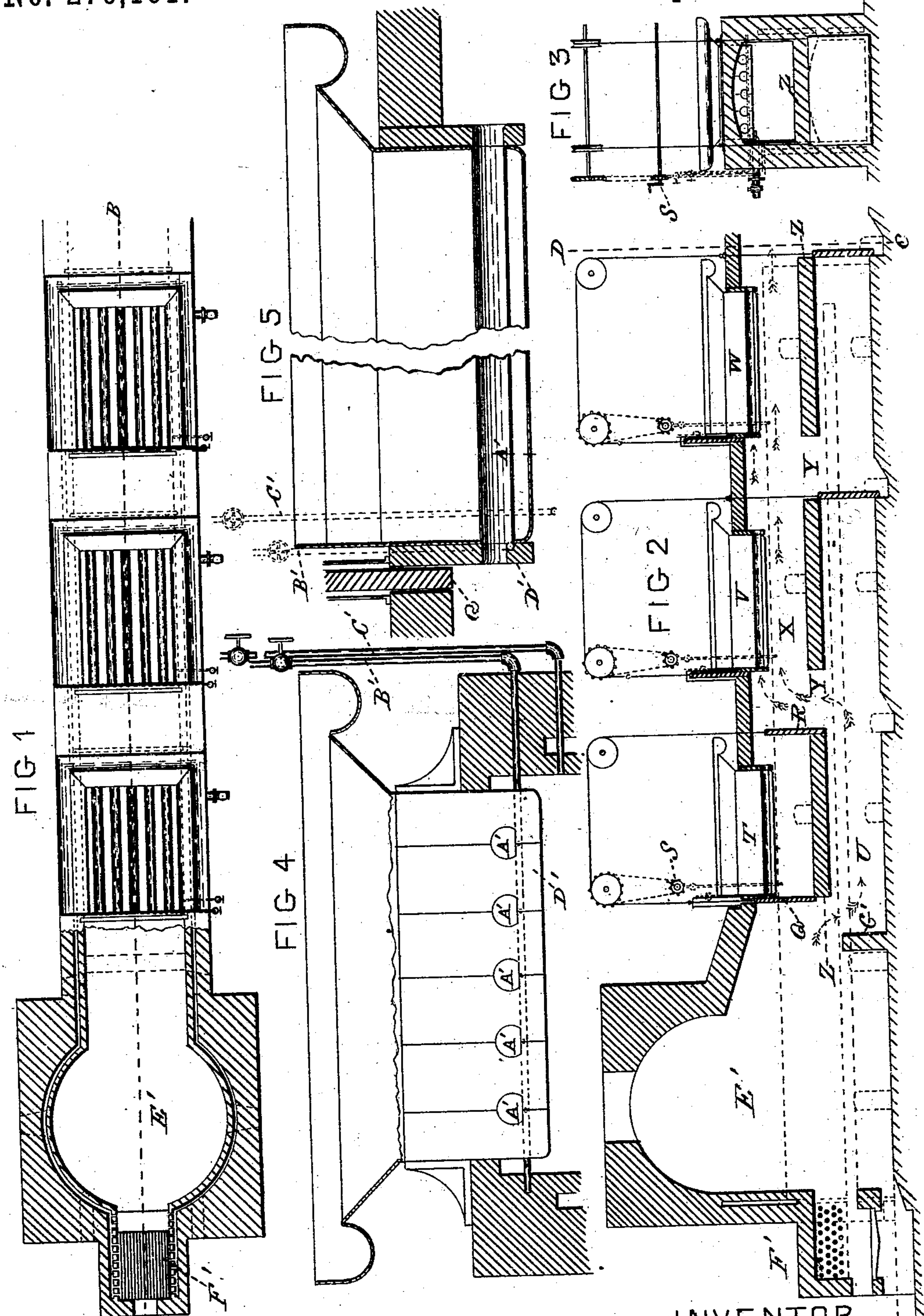
4 Sheets—Sheet 1.

F. COOK.

OPEN EVAPORATOR AND FURNACE FOR CANE JUICE.

No. 276,161.

Patented Apr. 24, 1883.



WITNESSES  
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(No Model.)

4 Sheets—Sheet 2

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FIG 6

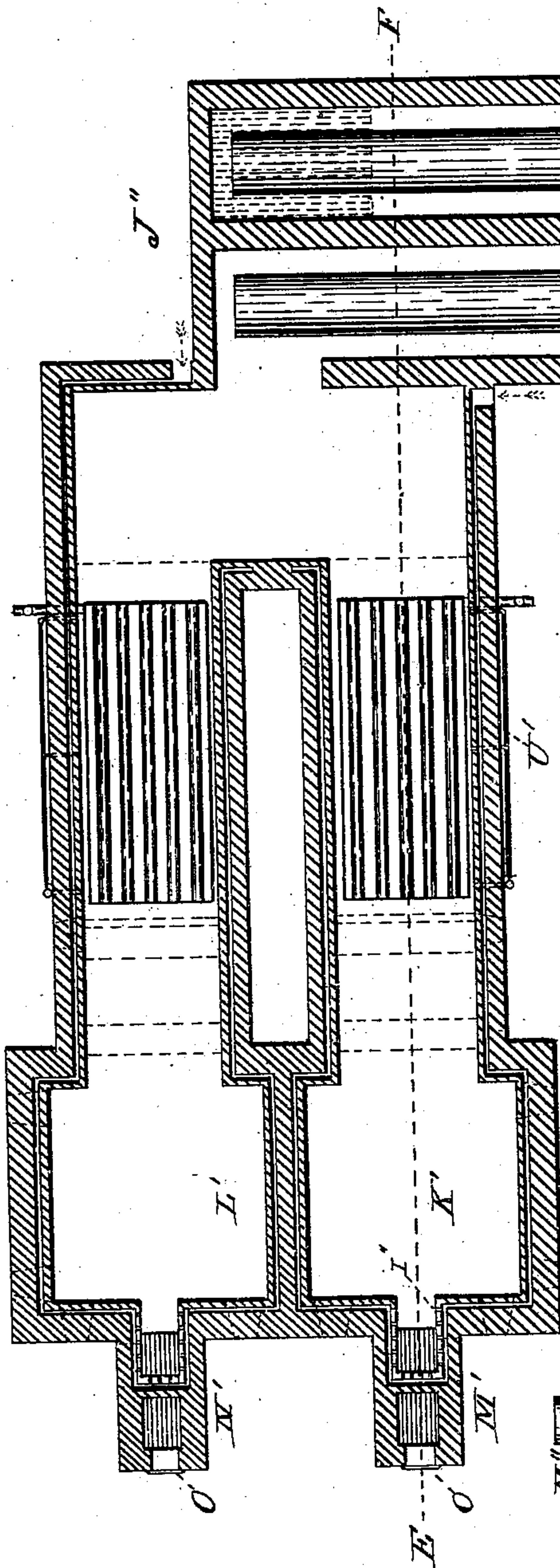


FIG 7

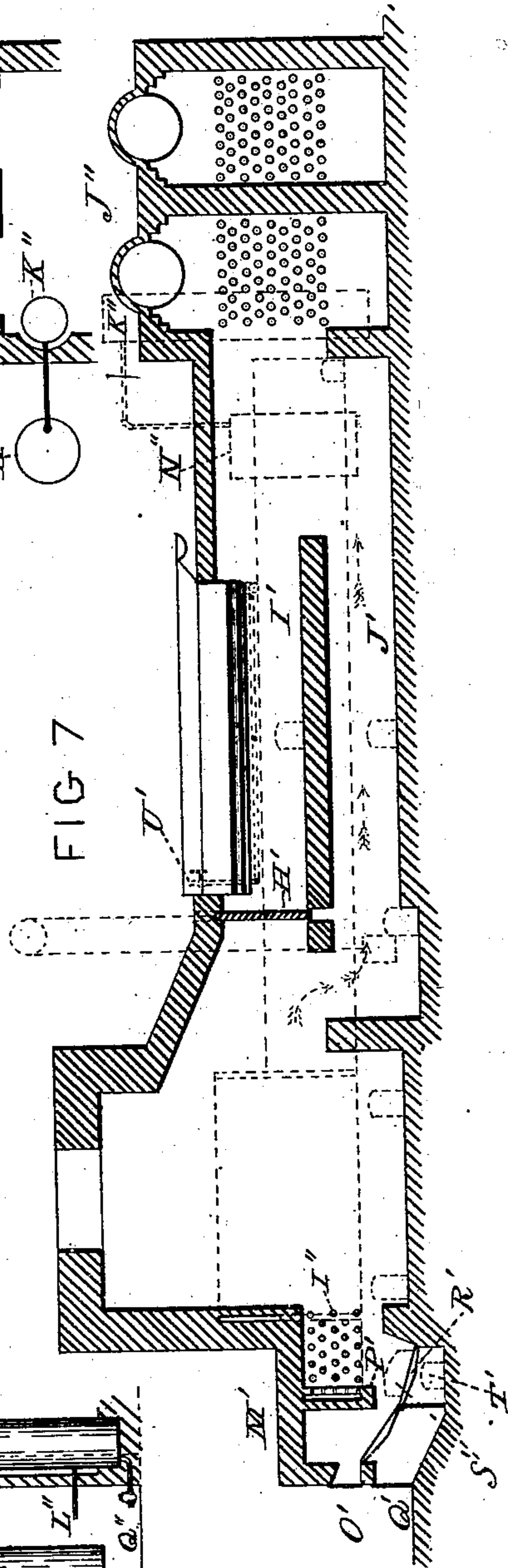
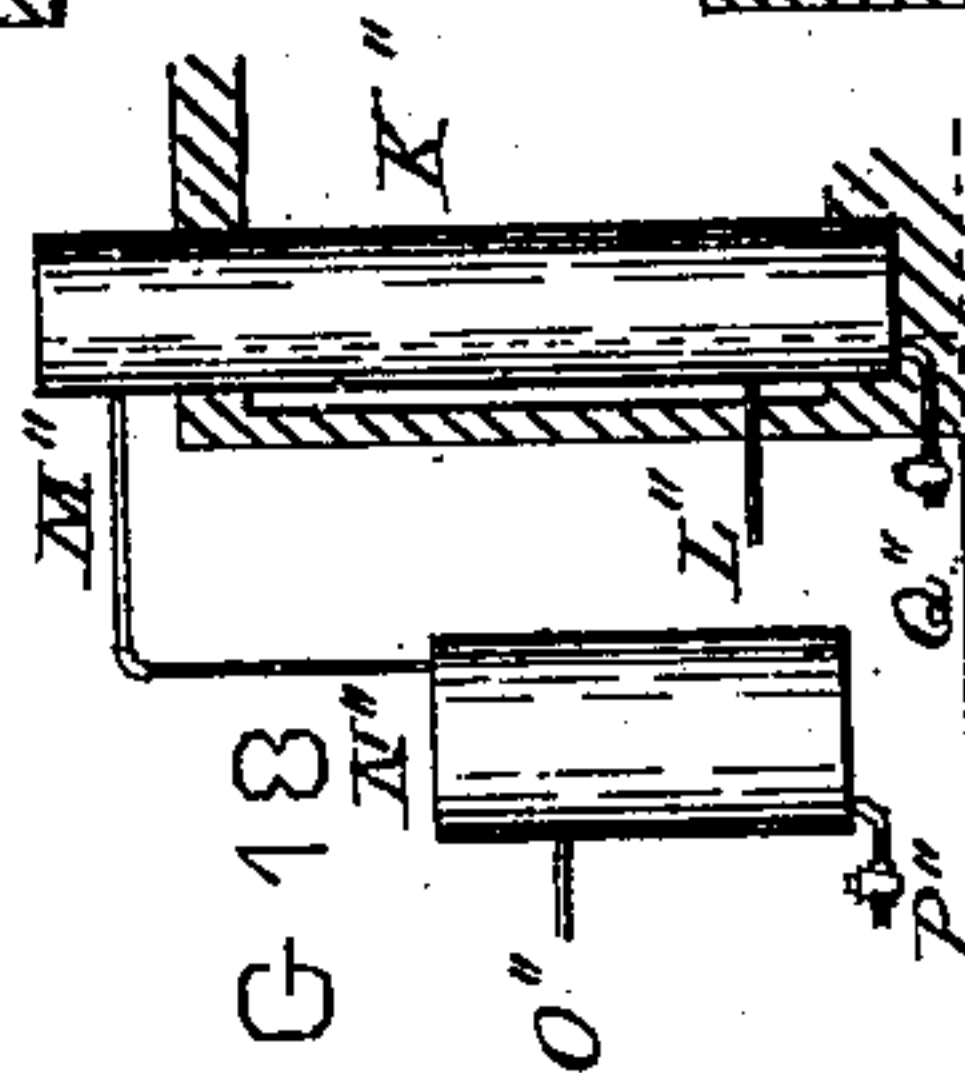


FIG 13



WITNESSES

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(No Model.)

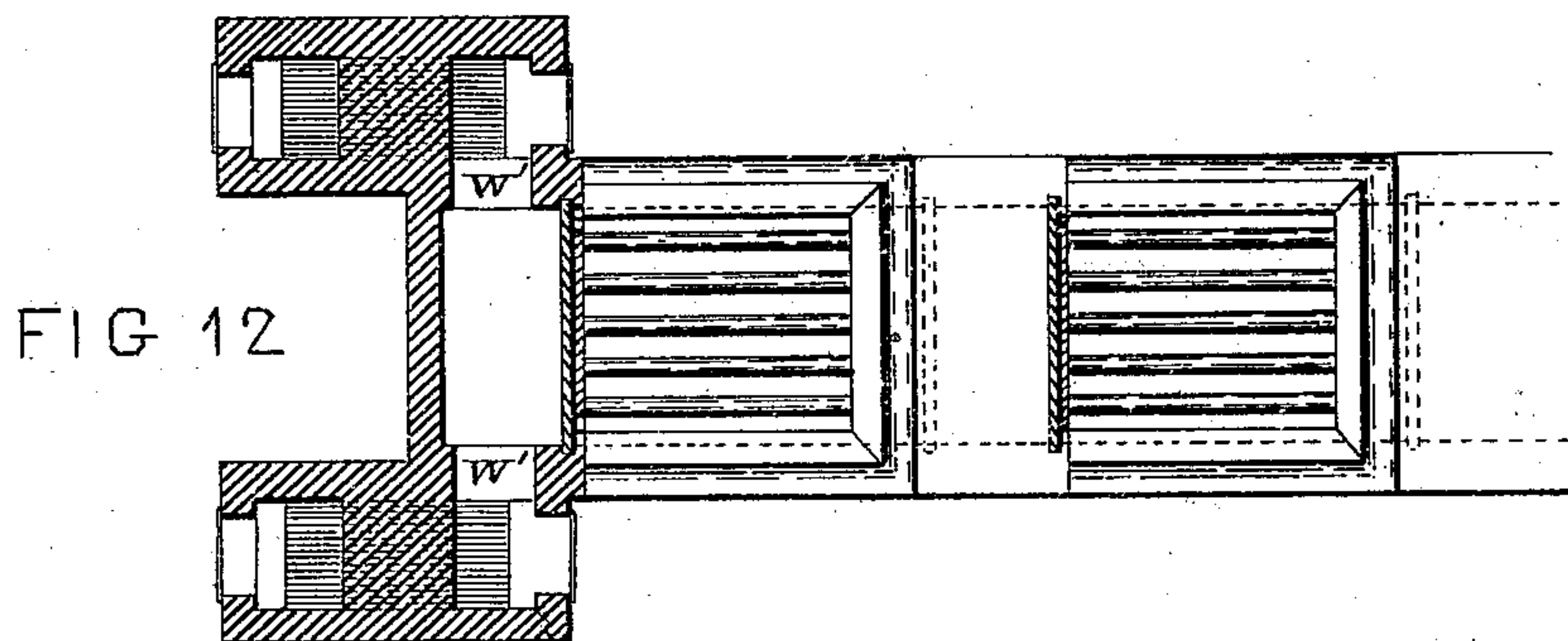
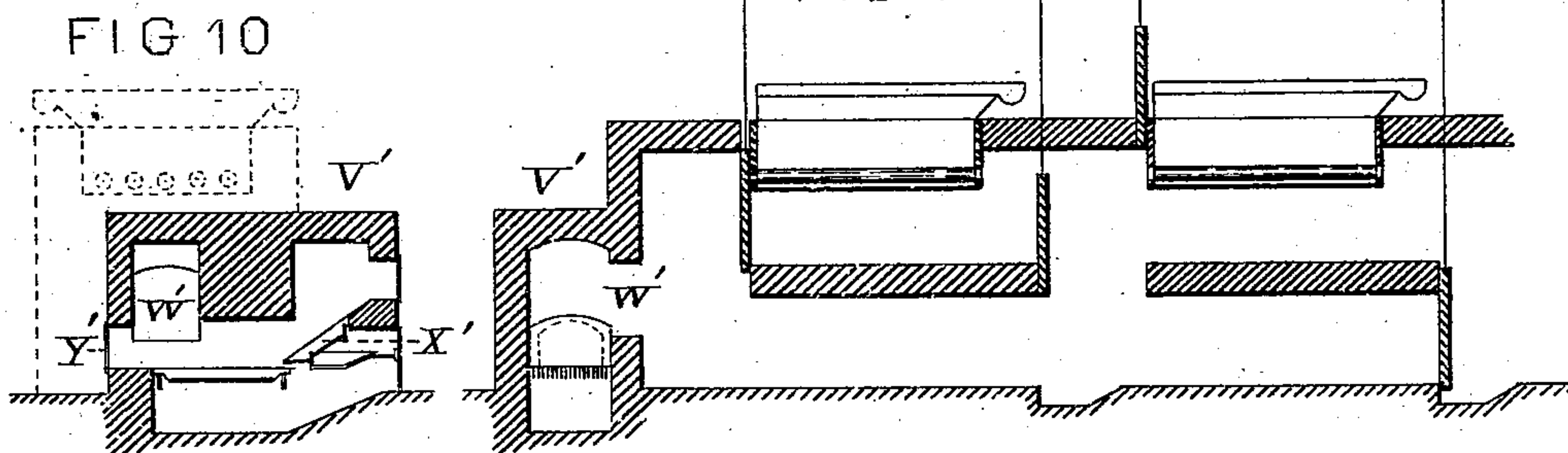
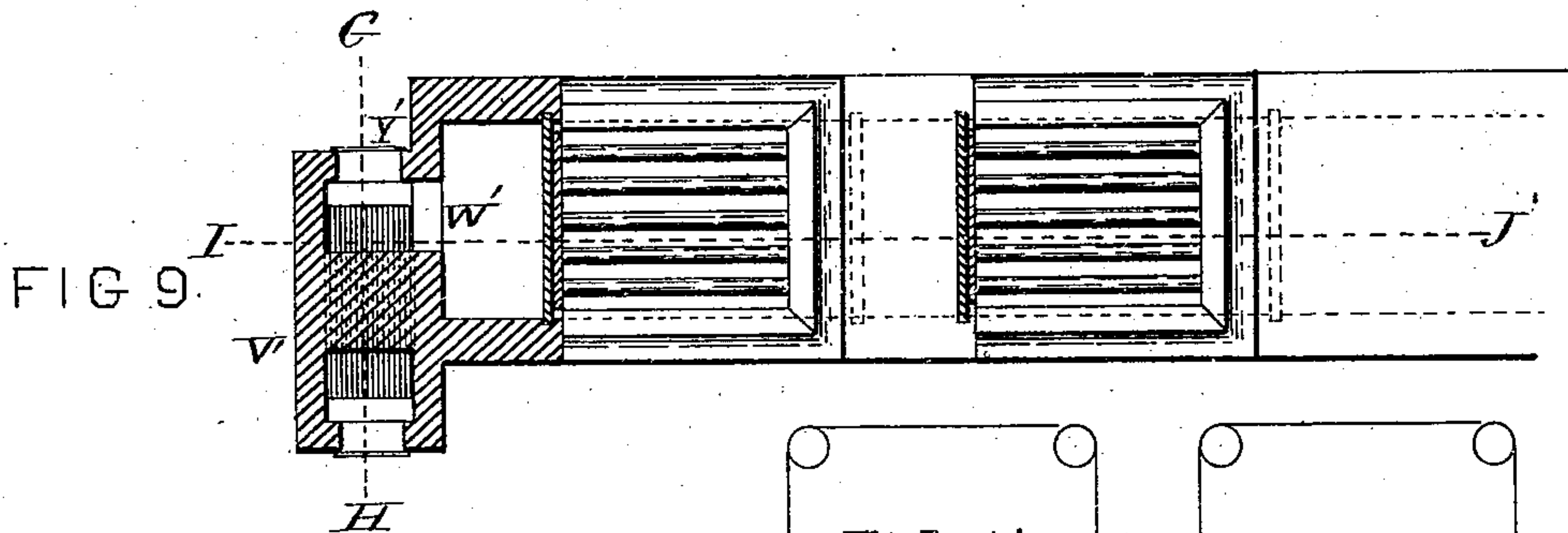
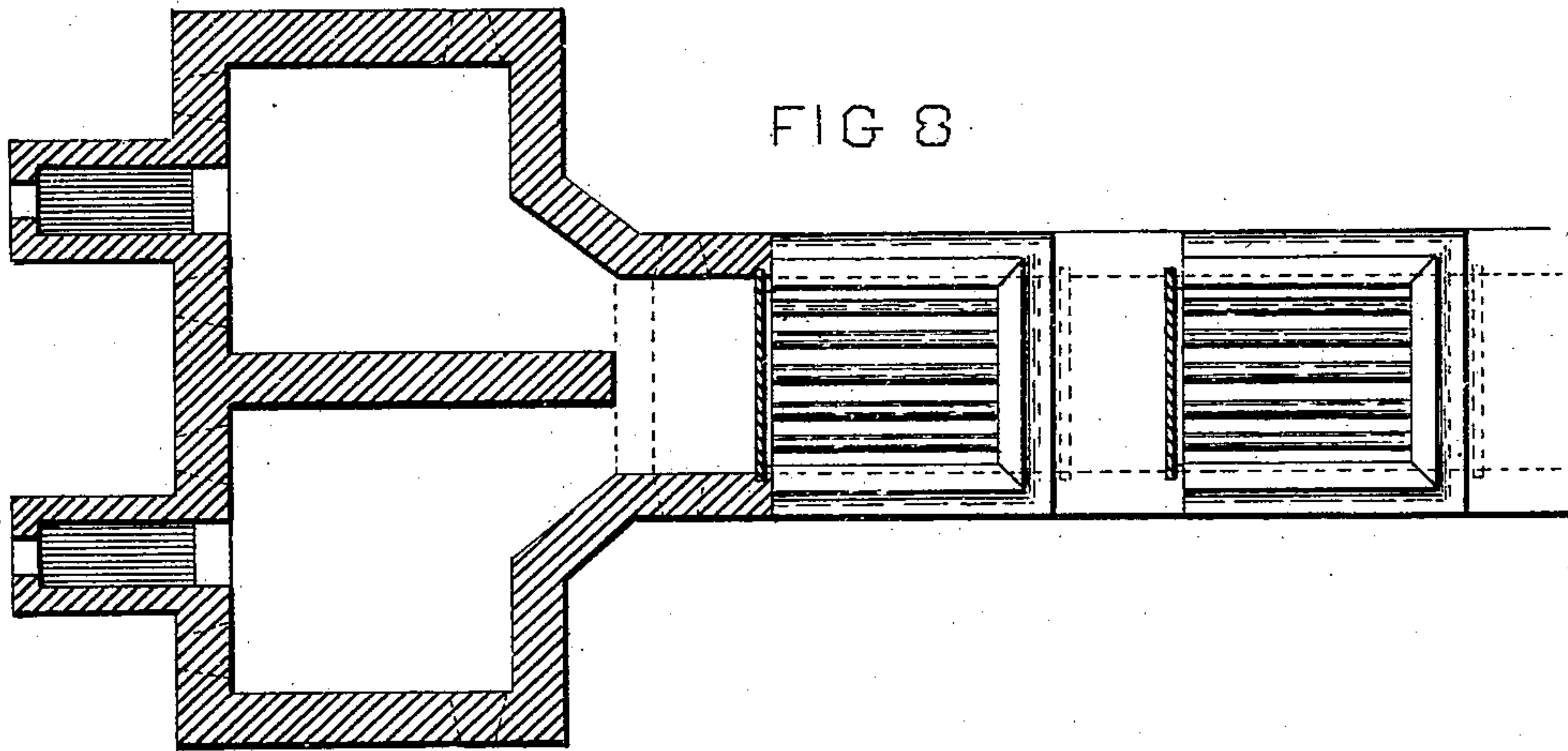
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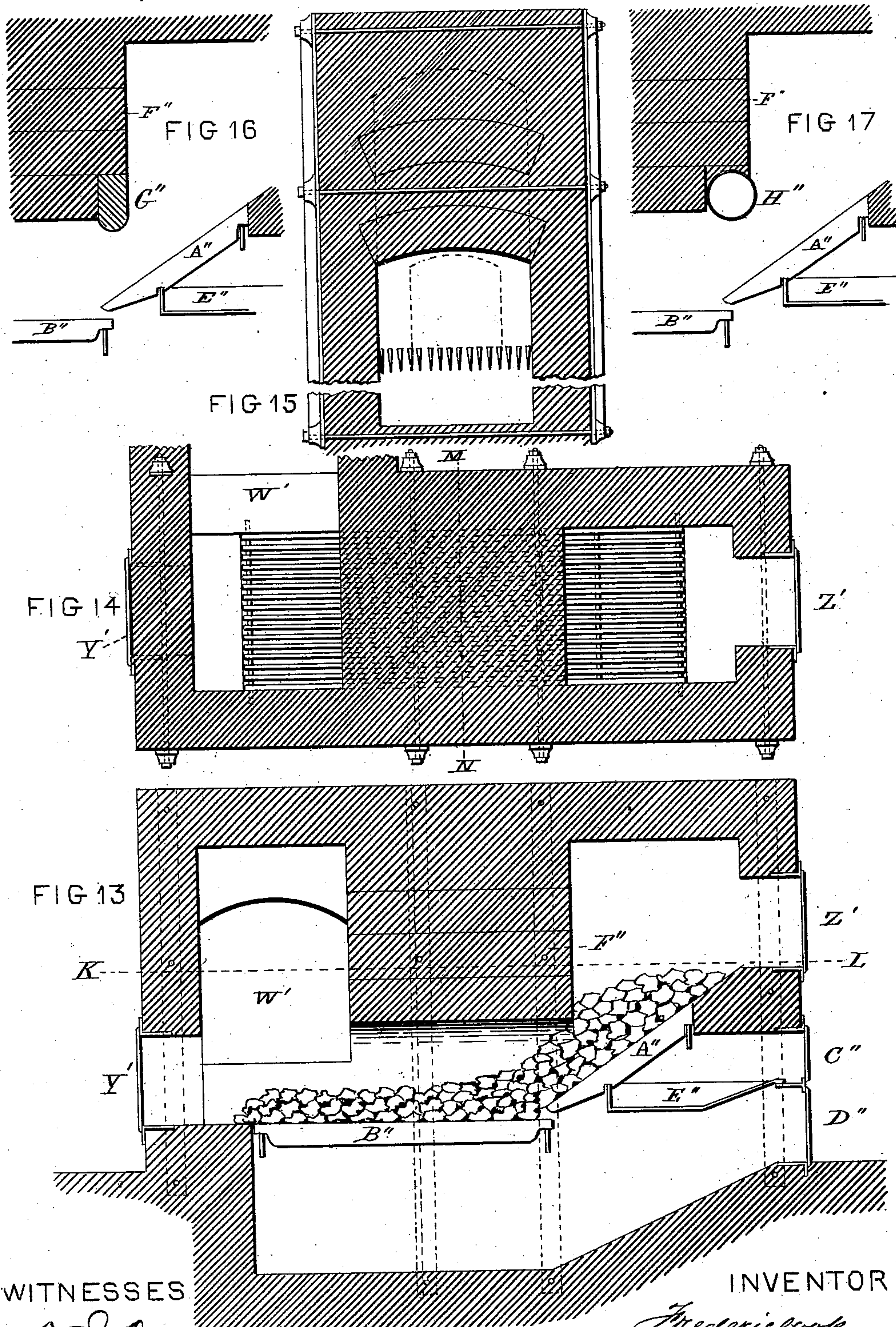
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# UNITED STATES PATENT OFFICE.

FREDERIC COOK, OF NEW ORLEANS, LOUISIANA.

## OPEN EVAPORATOR AND FURNACE FOR CANE-JUICE.

SPECIFICATION forming part of Letters Patent No. 276,161, dated April 24, 1883.

Application filed June 27, 1882. (No model.)

*To all whom it may concern:*

Be it known that I, FREDERIC COOK, a citizen of the United States, residing at New Orleans, in the parish of Orleans and State of Louisiana, have invented certain new and useful Improvements in Open Evaporators and Furnaces for Cane-Juice, &c., of which the following is a specification.

My invention relates to further improvements in open evaporators for working with direct fire-heat, to furnaces for supplying the heat, and to utilization of the waste heat, being additional improvements on my application for a patent filed January 25, 1882. These improvements are illustrated in the accompanying drawings in four sheets by eighteen figures, in which—

Figure 1 is a ground plan, partly in section, of three separate evaporators and combined furnace for bagasse and coal or wood. Fig. 2 is a vertical longitudinal section of Fig. 1 through line A B. Fig. 3 is a vertical cross-section through line C D of Fig. 2. Fig. 4 is an enlarged end view, partly in section, of an evaporator and its supporting-walls (partly) and steam-jet pipes. Fig. 5 is an enlarged side view, in section, of an evaporator and part of the masonry setting. Fig. 6 is a horizontal section of a pair of evaporators set side by side, with a pair of bagasse and coal furnaces, with the Babcock & Wilcox Company's patent water-tube steam-boilers—one of them set to receive the waste heat from the evaporators, the other to work with an independent furnace. Fig. 7 is a vertical longitudinal section through line E F of Fig. 6. Fig. 8 shows a horizontal section of evaporators set in line with a double bagasse-burner and auxiliary coal or wood furnaces. Fig. 9 shows a plan, partly in section, of evaporators set in line with a new arrangement of coal-furnace to supply the direct heat. Fig. 10 is a vertical longitudinal section of furnace through line G H of Fig. 9. Fig. 11 is a vertical longitudinal section of evaporators and furnaces through line I J of Fig. 9. Fig. 12 is a ground plan, partly in section, of evaporators and double coal-furnaces. Fig. 13 is a vertical longitudinal section of coal-furnace on an enlarged scale. Fig. 14 is a horizontal section through line K L of Fig. 13. Fig. 15 is a cross-section through line

M N of Fig. 14. Fig. 16 is part of a vertical longitudinal section through part of furnace, showing a fire-tile, G'', set in front of arch. Fig. 17 is part of a vertical longitudinal section through part of furnace, showing a pipe, H'', set across furnace, containing flowing water. Fig. 18 is an elevation of heater K'' and settling-tank N'' shown on Fig. 6.

In the old manner of evaporating cane-juice by direct heat in ordinary open kettles the juice or sirup, as it becomes ready, is passed out by means of a bucket at the end of a long pole, and as the quantity becomes diminished in the kettle the sirup runs down the interior fire-exposed surfaces while discharging, the full fire-heat at same time being on the exterior surface of kettle. A portion of the sirup has to remain in the kettle, which darkens and is mixed up with the fresh charge of juice. In consequence of this a discoloration takes place of the juice by burning or browning of the sirup and films of sirup on the interior of the exposed fire-surfaces of the kettle; also, when a kettle is discharged as above, the exposed fire-surfaces become very hot, and there is great liability to crack the metal when a fresh charge of juice is put in by sudden contraction.

The above discoloration of the sirup I avoid in my improved evaporators, and I do so by shutting off the heat or fire from them before discharging sirup and by subjecting their exterior fire-surfaces and interior fire-tubes to a steam-bath while discharging and until refilled, when steam is shut off from exterior and fire-tubes and the fire-heat again turned on. I arrange the evaporators so that each can in its turn be boiled or shut off and discharged.

Figs. 1, 2, and 3 show three evaporators set on same fire-flue, but independent of each other, and arranged so that each can be worked or shut off at pleasure, the heat being turned away into a separate flue when any evaporator is discharged.

Q and R are fire-tile dampers, suspended from overhead and balanced by means of a wire rope or chain passing over pulleys, as shown on drawings, and provided with suitable means of winding them up or down, as shown at S.

The first evaporator, T, is shown with the dampers in position to shut off the heat from



evaporator, the heat then passing down into the lower flue, U, and up again to boil the evaporators V and W, as is indicated by the course of the arrows on the drawings, Fig. 2.

5 The dampers for the evaporators V and W are shown in position to shut up lower flue, U, and open upper flue, X, to the heat.

Between each evaporator there are holes Y in the arch Z, through which holes the heat  
10 can rise from lower to upper flue, or the reverse. Immediately after shutting off heat from a full evaporator, as described, steam is blown through the fire-tubes A', and also under the evaporator by means of jet-pipes B' and C'. The pipe B' has small holes in it opposite each fire-tube, and it is protected from fire by the fire-tiles D', which are in front of evaporators. This steam-jet I also use to blow out ashes from tubes, and, if necessary, to increase draft through them. Thus I blow out the fire-heat from fire-tubes and underneath evaporators by steam, which escapes over top of back damper, R, and, as the evaporator is shut off from the fire and its heating or fire surface  
20 is subjected to a steam-bath, instead of fire-heat, I can draw off the sirup or fluid contained in it entirely, as no burning or charring of the films of sirup remaining on heating-surfaces will take place, which in the old  
25 manner of evaporating cane-juice by fire-heat causes a discoloration of the sirup.

I also include as my invention the admission of cold air through an opening in walls, (regulated by a damper or valve,) or a mixture of  
35 steam and air, in which case the steam may be injected in center of an air-opening to force in the air, forming an air-siphon for the same purpose of cooling off exterior fire-surfaces of evaporators before and during their  
40 discharge.

The bagasse is burned green from the mill in furnace E', which acts in combination with a small furnace, F', for solid fuel, and provided with hot-air jets obtained from the heat of the  
45 walls acting on a current of cold air traveling through air-flues in walls, or other known means of heating the air. The bridge-wall G' prevents the lower flue, U, becoming choked with ashes, and throws the flames upward toward the evaporating-flue X.

The double evaporators and double bagasse-furnaces shown at Figs. 6 and 7 are arranged so that the evaporators can work alternately and with one damper, H', in front to shut off  
55 either upper evaporating-flue, I', or lower flue, J'. When steam is blown under the bottom and through tubes of either evaporator when discharging, it passes off to the chimney without going under the evaporator that is boiling.  
60 The waste heat passes from evaporators to boilers J'', which in this case, as shown at Figs. 6 and 7, are the Babcock & Wilcox Company's patent water-tube boilers, which, having very large fire-surface in proportion to  
65 water, are the best adapted for absorbing waste heat.

One boiler receives the waste heat from the

evaporators. The other is fired independently. In the flue between end of boilers and chimney I place a heater, K'', Figs. 6, 7, and 18. The  
70 waste heat surrounds it. Water is fed in near bottom at L''. The heat causes precipitation of impurities. The purified water overflows at M'' to settling-tank N'', from which pipe O'' supplies a feed-pump to boilers. P'' and Q''  
75 are cocks to discharge settlings. Pipe M'' descends to near bottom of tank N''.

The bagasse-furnaces K' and L' have a reversible chute to discharge the bagasse direct from the mill alternately into the furnaces.  
80

Each bagasse-furnace has a small coal-furnace attached, M' and N', arranged with a double set of inclined bars, each set having a separate draft-door. The coal is thrown into door O'. At P' is a hanging bridge-wall. The  
85 coal on first set of bars burns from the base, and but little air being admitted at door Q', cokes, and is pushed down on bars R', where the final combustion is effected. The smoke and gases from the raw coal pass through its  
90 base downward and over the fire from bars R', and then encounters hot-air jets, as shown at I'', which, entering at the temperature of ignition, assist in making a more perfect combustion. The ignited gases pass into the  
95 bagasse-furnace and mix with the products of combustion of the green bagasse direct from the mill. The result is, I believe, a more perfect and economical result than has heretofore been obtained in utilizing green bagasse as  
100 fuel for evaporation. Both grates of furnace M' are stationary, and grates R' are cleaned by means of a side door, S', as shown.

T' is an ash-pit door for bars R'. A steam-jet pipe is shown at U' for blowing steam under bottom of evaporators when discharging sirup.  
105

Fig. 8 is an arrangement of evaporators set in a line with a double bagasse-burner and a furnace for coal or wood outside each. The  
110 bagasse is fed in from the mill alternately to each bagasse-furnace. Each furnace discharges its fire-heat into same flue on which the evaporators are set.

Figs. 9, 10, and 11 show the application of  
115 my new furnace for coal to a train of evaporators. The furnace V' sets at right angles across the end of train, and the heat is discharged through the side of the furnace at W', which enables the furnace to be cleaned, and the fuel  
120 spread and raked down from base of angling-bars X' through the door Y'.

Fig. 12 shows a ground plan, partly in section, of double improved coal-gas furnaces to a train of evaporators. The arrangement  
125 of flues and dampers of Figs. 9, 10, 11, and 12, are the same as in Figs. 1, 2, and 3, before described.

Figs. 13, 14, and 15 show enlarged views of the furnace shown at Figs. 9, 10, 11, and 12,  
130 combined with evaporators.

The coal is thrown in at door Z' and lies on angle-bars A''. The coal is kept near a level on top, so that it burns at the base. The smoke and



gases disengaged by the heat are drawn down through the incandescent coal and over the fire on lower bars, B''. The lower portion of the coal on bars A'' slides down onto bars B'', and can be drawn over and spread on bars B'' by fire-tools inserted through door Y', through which door the clinker can be taken out and the fire stirred. Both bars A'' and bars B'' are stationary. At C'' is a draft-door for bars A'', and at D'' the ash-pit or draft-door for bars B''.

E'' forms a division and water-trough, in which I admit water which overflows into ash-pit, and the vapor keeps bars cool, which, being drawn through the fire, decomposes and assists combustion. F'' is a hanging bridge-wall, and W' is the flue opening from furnace to the evaporators.

Fig. 16 shows a portion of bars and furnace with a cross-tile bar, G'', set across furnace, which may be replaced as it burns out, or a water-tube, H'', Fig. 17, may be used at this point, through which water flows, which has been used in steam-boiler furnaces as water-legs under pressure of the boiler, and may be used for heating the feed-water; but I prefer having no pressure on it except the weight of the water entering by a pipe from an overhead tank, and any steam formed escapes back to the tank by a separate pipe, condensing back into water, as described in my application filed January 25, 1882, for water-dampers used in connection with trains of open evaporators and furnaces for cane-juice, &c. The water in the tank becomes heated by the return of the steam, precipitates impurities, and can be used to feed boilers; or, instead of a pipe shown at Fig. 17, an open top water-tank may be used, through which water flows, and set across furnace to take the place of the bridge-wall F'', and when such a tank is used the bottom of it forms the top of furnace over grates B''. The overflow from such a tank I discharge into another tank not exposed to heat; but the water coming in hot and not being in a state of ebullition in outside tank, will precipitate its foul and earthy matter, and by drawing from the top can then be used to advantage for feeding the steam-boilers, and will be in a comparatively pure condition. So by substituting a water-tank for the hanging bridge-wall F'' it forms a furnace-top that cannot burn out, and at same time a means of heating and purifying feed-water for the boilers. The water-tube H'' may also be used as a heater for feed-water, which may discharge

into a settling-tank, will precipitate in same way as described, and thence be used for the boilers.

What I claim, and desire to secure by Letters Patent, is—

1. The combination of a furnace with the two flues leading therefrom, the evaporating-pans, and the dampers hung so that they can be passed into either flue for the purpose of closing the same, substantially as described.

2. The combination of a furnace with the two flues leading therefrom, the passages Y, located at intervals through the partition between said flues, the evaporators, and the sliding dampers R, hung so as to be passed into either flue for the purpose of closing the same, substantially as described.

3. The combination, with the two furnace-flues communicating with each other through passages Y of the evaporators, and the dampers R, adapted to be passed through the passages between the flues, and to close either flue, two of said dampers being provided for each evaporating-pan, whereby the heat can be entirely shut off from any one evaporating-pan, substantially as described.

4. The combination of the evaporators located above a furnace-flue, of the fire-tubes A', the steam-pipe B' for discharging steam into the said fire-tubes, and the steam-pipe C', for discharging steam under the evaporators, substantially as described.

5. The evaporating apparatus provided with a furnace at one end, boilers J'' at its opposite end, and flues U X, one of said boilers being located in a passage leading from the two flues, whereby the waste heat is utilized, substantially as described.

6. An evaporating apparatus to work with fire-heat, composed of a separate furnace for solid fuel discharging into a separate furnace for bagasse fuel, a train of open evaporating-pans to receive the first direct heat, arranged to be worked independently or together by means of dampers, a steam-boiler to receive the waste heat from evaporators, and a water-heater and purifier set in flue to receive the waste heat from boilers, arranged thus for the purpose of utilizing the waste heat of each portion of the apparatus and economizing fuel.

FREDERIC COOK.

Witnesses:

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