No. 705,907. Patented July 29, 1902.

W. B. CHAPMAN.

FURNACE FOR RETORTS.

(Application filed Mar. 17, 1902.)

(No Model.) 3 Sheets—Sheet 1.

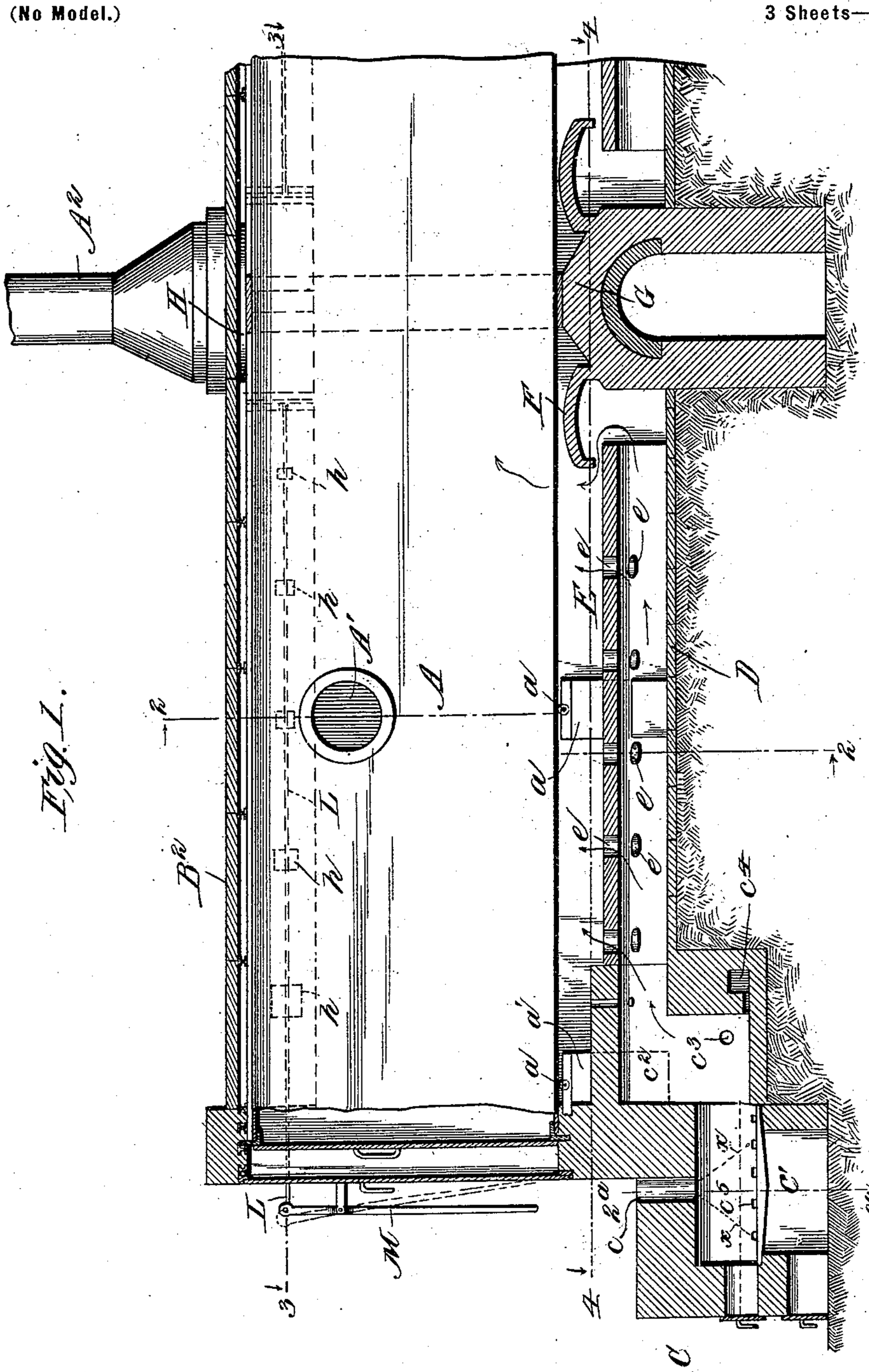


Fig. 1.

WITNESSES:
Fred D. Bradford
Edw. W. Byrn

INVENTOR
William B. Chapman.
BY Munn & Co.
ATTORNEYS

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

No. 705,907. Patented July 29, 1902.

W. B. CHAPMAN.

FURNACE FOR RETORTS.

(Application filed Mar. 17, 1902.)

(No Model.) 3 Sheets—Sheet 2.

Fig. 5.

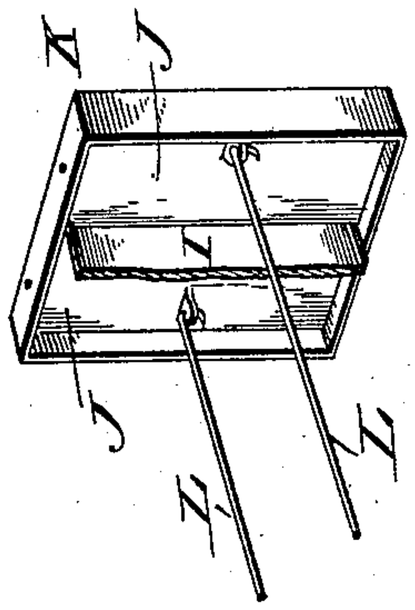


Fig. 6.

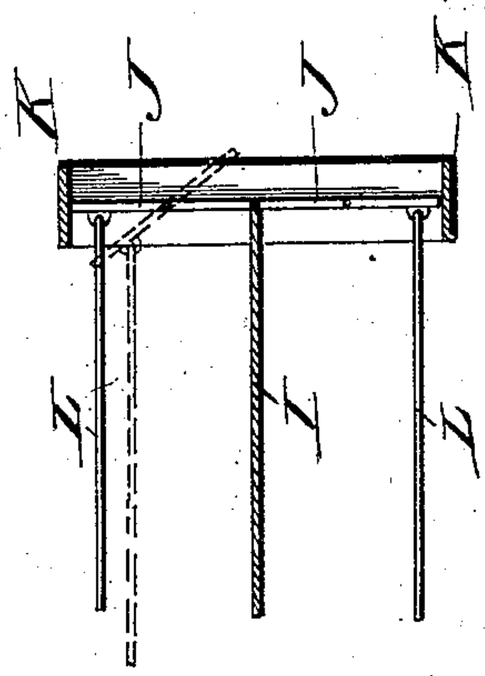
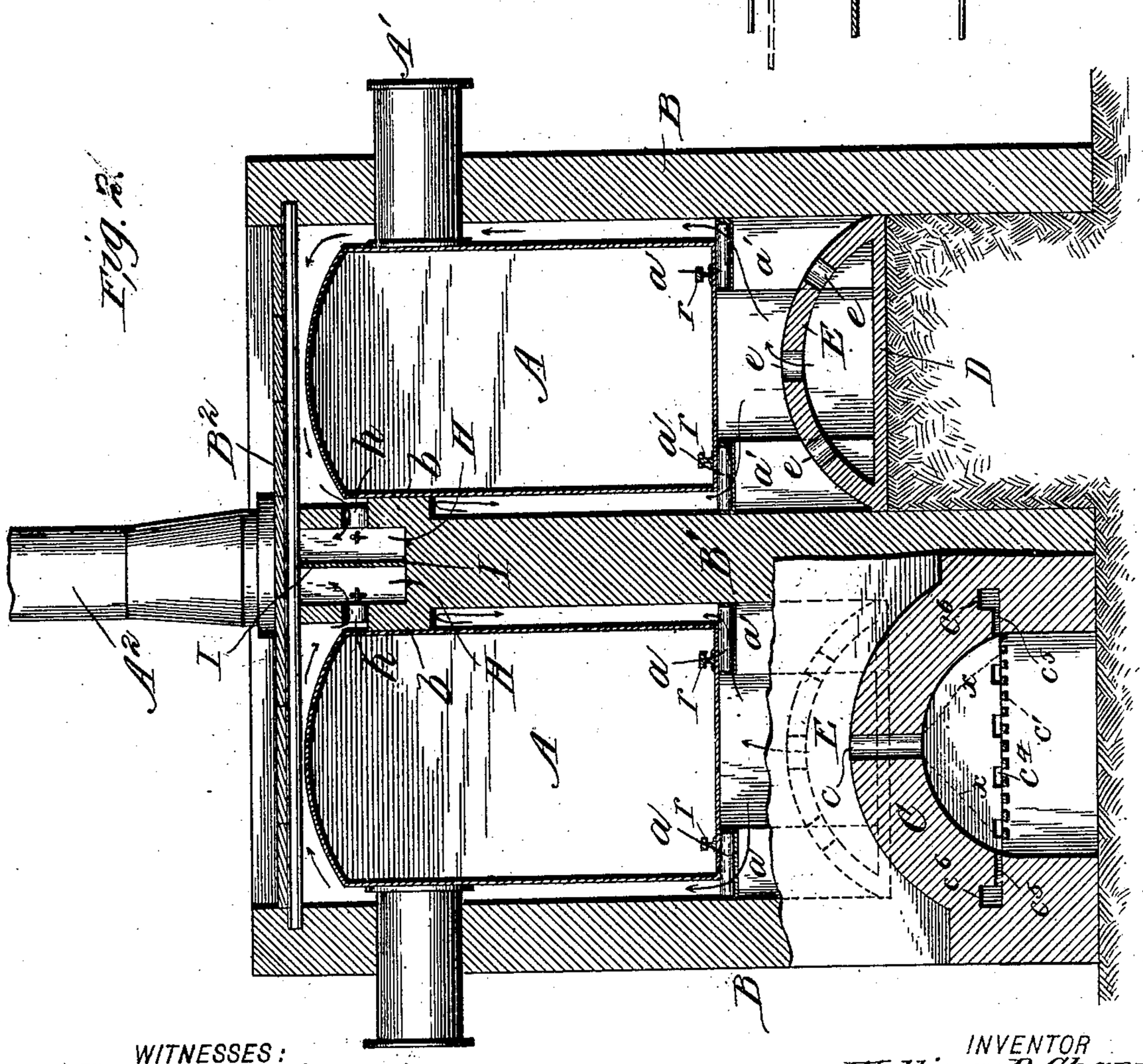


Fig. 4.



WITNESSES:

Fred D. Bradford

Edw. W. Byrn.

INVENTOR

William B. Chapman

BY Munn & Co.

ATTORNEYS

THE NORRIS PETERS CO. PHOTO-LITHO., WASHINGTON, D. C.

No. 705,907. Patented July 29, 1902.

W. B. CHAPMAN.

FURNACE FOR RETORTS.

(Application filed Mar. 17, 1902.)

(No Model.) 3 Sheets—Sheet 3.

Fig. 3.

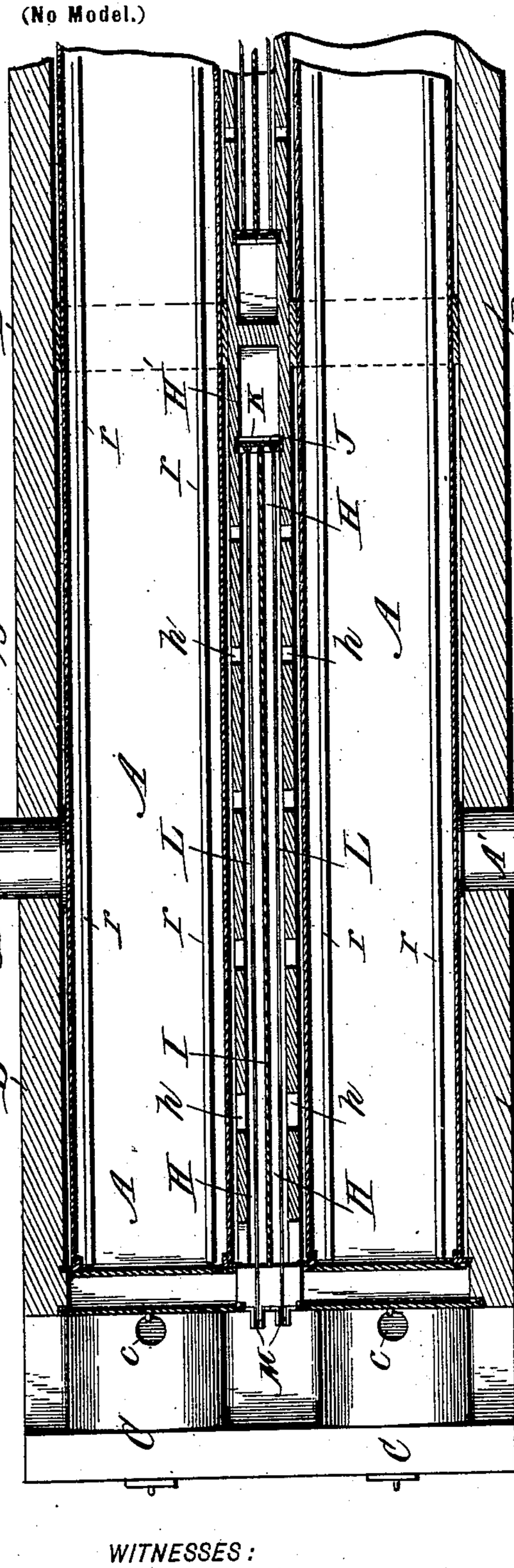
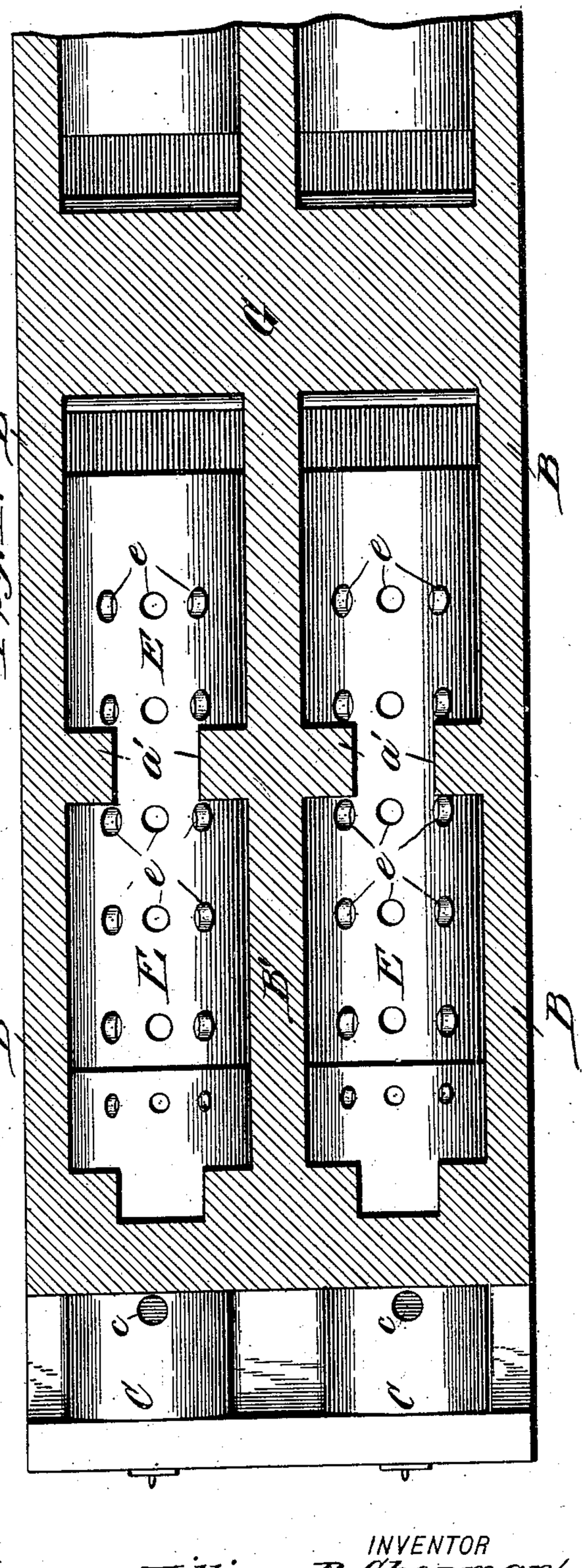


Fig. 4.



WITNESSES:

Fred. P. Bradford

Edw. W. Byrn.

INVENTOR

William B. Chapman.

BY Munn & Co.

ATTORNEYS.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

WILLIAM BREWSTER CHAPMAN, OF BOYNE CITY, MICHIGAN.

FURNACE FOR RETORTS.

SPECIFICATION forming part of Letters Patent No. 705,907, dated July 29, 1902.

Application filed March 17, 1902. Serial No. 98,570. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM BREWSTER CHAPMAN, of Boyne City, in the county of Charlevoix and State of Michigan, have invented a new and useful Improvement in Furnaces for Retorts, of which the following is a specification.

My invention is in the nature of a novel form of furnace and furnace-setting for retorts, and especially such retorts as are used in the distillation of wood to produce wood-alcohol. In this art the retorts employed are very long, and for heating them uniformly throughout their length the only practical results attained have been with natural gas.

My invention provides a construction of furnace that enables me to use solid fuel—such as wood, sawdust, shavings, and the like—whereby I am enabled to get the same results of uniform heating at much less cost and to carry out the process of distillation at any point where wood fuel is available and natural gas is not to be obtained.

It consists in the peculiar construction and arrangement of the furnace and setting, which I will now proceed to describe, reference being had to the accompanying drawings, in which—

Figure 1 is a vertical longitudinal section of one half of one of my furnaces. Fig. 2 is a vertical transverse section through the line 2 2 of Fig. 1, the lower part of the left-hand furnace being in section on line 2^a 2^a. Fig. 3 is a horizontal section on line 3 3 of Fig. 1. Fig. 4 is a horizontal section on line 4 4 of Fig. 1, and Figs. 5 and 6 are details of the draft-dampers.

My invention is designed to be applied to both long iron retorts of fifty feet or more in length and to shorter ones. The long ones have a furnace at each end and the short ones a single furnace at one end.

In the drawings, A represents the long iron retort, one half of one of which is shown in Fig. 1 and the other half of which is exactly like the left-hand end shown in Fig. 1. These retorts are arranged in pairs, in parallel position side by side, as seen in Fig. 2. Each retort is supported upon piers a', being mounted upon steel rollers a a, so as to be free to have some endwise movement from expansion and contraction. These retorts are inclosed between outside masonry walls B B and a middle partition-wall B′ and a tile roofing B^2 and have below them at each end and running along one-half their length the peculiar form of furnace and setting which constitutes the leading feature of my invention. Each retort has on its bottom a pair of rails r r, on which are run through doors in the end of the retort and casing trucks or buggies provided with wood-racks, upon which are piled sticks of cord-wood. This wood when subjected to the high heat of the subjacent furnace is distilled to produce wood-alcohol, charcoal, and other by-products, the distilled vapors passing off through pipe connections A′ in the side of the retort to suitable condensers.

In my furnace I employ two main elements. One is a fire-box C, which has a top feed-hole c, which fire-box is built out beyond the end of the retort, and the other feature is a construction of fire-flues which are brought up close to the bottom of the retort, but separated therefrom by a partition having distributing-openings to effect an even distribution of the hot currents of combustion and prevent the concentration of heat at any one spot under the retort. Both of these constructions are especially related to the use of solid but disintegrated fuel, such as sawdust, shavings, &c. These materials are fed in through the top opening c of the fire-box C and burn on the grate c'. The fire-chamber opens at its back end into a more lofty combustion-chamber c^2, and from this point the flames and gases are carried up close to the bottom of the retort by an elevated floor D, whose level is considerably above that of the furnace proper. Above this floor D there is built of tile an arched partition E, running about half the length of the retort to a position near the middle transverse wall G. The flue formed below this arched partition E opens through various holes e in the tile partition up to the space immediately below the retort and also opens at the back end into the same space beneath an overhanging tile deflector F. The products of combustion are thus brought up close to the bottom of the retort, where the best effect of heat may be

utilized, and yet the concentration and undue localizing of excessive heat at one point of the retort is avoided by the separation and distribution of the hot currents through the separated holes *e* and the overhanging deflector F, so that all parts of the bottom of the retort are subjected to a practically uniform heat.

An important feature of my invention is that the heat-flues from the furnace are parallel with the longitudinal axis of the retort and immediately under the retorts, and the hot currents from the furnace C go out through the bottom part of the longitudinal flue under the retort to return again over the top of the same to the front end of the retort. By so doing the return-currents, which are colder than the currents just starting out, are immediately above the greatest heat below, while the heat of average temperature is at the point where the currents double back upon themselves. It will thus be seen that although the return-currents get cooler toward the front the outgoing subjacent currents are hottest at the front, and the decreased heat of the upper flue is therefore compensated for by the greater heat of the subjacent flue, so that at any point along the length of the retort the total average of the combined heat-units in the upper and lower flues will be the same as that of every other point. If the flues were not longitudinal and the hot currents did not double back upon themselves, and thus make a uniform average at every cross-section, it would be almost impossible to heat the retort as evenly at all points as it is necessary to do in order to obtain good results.

When the hot gases pass to contact with the retort, they are distributed around the side walls of the same, as seen in Fig. 2. Between the inner side wall of the retort and the middle partition-wall B′ the upward passage of the hot currents is blocked or closed at *b*, so that the currents have to traverse the bottoms, outer sides, and tops of the retort in gaining access to the horizontal exit-flues H H, thus heating all sides of the retort. These exit-flues H H are built horizontally on the top of the partition-wall B′, and the flue H for one retort is separated from the flue for the other retort by a long horizontally-extended partition-plate I, standing vertically between the flues H and H. These flues at their inner ends communicate with a space H′ immediately below the smoke-stack A^2, and the said flues open along their sides through a series of holes *h* into the space around the retort, which holes increase in size at points more remote from the smoke-stack, so as to equalize the passage of hot currents into the flues throughout the length of the retort.

To control the passage of the hot currents to the stack, dampers J J, Figs. 5 and 6, are arranged to turn on vertical axes within a frame K, which is set at the back end of the flues H H within the space H′, (see Fig. 3,) and these dampers have pull-rods L, extending to the front of the furnace and connected to levers M, fulcrumed to the end of the furnace and depending to range of convenient operation, as seen in Fig. 1.

In the side wall of the combustion-chamber c^2 of my furnace I form an inlet passage-way c^3, into which are discharged the waste gases which do not condense and which are conveniently and economically utilized as fuel, and an air-passage c^4 is formed in the bridge-wall to supply air to complete combustion. The air to support combustion of the sawdust is not taken from below the grate, but comes in above the grate through a series of side holes c^5, which communicate with the outer air through side chambers c^6, Fig. 2, opening through dampers at the front of the furnace.

The roof of the fire-box is a low arch, as seen on the left of Fig. 2, and the pile of sawdust fed in through hole *c* in the roof conforms to the chamber, as shown by the dotted lines *x x*, so that in assuming the angle of repose on the grate-bars it does not obstruct and choke the side drafts c^5 above the grate-bars. This enables me to perfectly burn the cone of sawdust from its surface rather than from its center and avoids all sparks and unconsumed smoke and takes much less draft for the furnace.

With a furnace of this construction I am enabled to economically effect the distillation of wood-alcohol away from sources of supply of natural gas and to utilize a practically waste material for fuel wherever sawmills or woodworking machinery are located. I would state, however, that my furnace is in addition to the top feed provided with a side door, as seen in Fig. 1, through which cord-wood or other fuel may be charged when desired.

Instead of arranging my furnaces in separated pairs the pairs may be located side by side in one continuous bank of furnaces and retorts.

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

1. A furnace for a retort comprising a fire-box extending beyond the end of the retort and having a feed-hole for fuel in the top of the same and a fire-flue communicating with the said fire-box extending longitudinally beneath the retort on a higher level than the fire-box and having interposed between the retort and said flue a perforated distributing-partition substantially as shown and described.

2. A furnace for a retort comprising a fire-box extending beyond the end of the retort and having a feed-hole for fuel in the top of the same, and a fire-flue communicating with the said fire-box and extending longitudinally beneath the retort on a higher level than the fire-box, a perforated arch covering said flue and extending to a point near the middle of

the retort, and an overhanging deflector-plate at the inner end of said arch substantially as described.

3. The combination with two retorts; of the two outside walls and the middle partition-wall between the retorts, the partition-wall having exit-flues built in its top, and independent furnaces and hot-air flues located beneath each retort substantially as described.

4. The combination with the two retorts and their outer inclosing walls and furnaces; of a middle partition-wall having two horizontal flues built in the top of the same and opening into the space about the retorts, dampers controlling said flues, pull-rods attached to the dampers and extending to the ends of the retorts, and levers connected to said pull-rods substantially as and for the purpose described.

5. The combination with the two retorts, and their outer inclosing walls, and furnaces; of a middle partition-wall having two horizontal flues built in the top of the same and opening at their ends into the smoke-stack and along their sides into the space about the retorts through holes increasing in size away from the smoke-stack substantially as and for the purpose described.

6. The combination with two retorts, and their outer inclosing walls and furnaces; of a middle partition-wall having two horizontal flues built in the top of the same with a common chamber H′ at the end opening into the smoke-stack and a series of holes in the sides opening into the spaces about the retorts, a damper-frame with hinged dampers set in the chamber H′ at the ends of the flues, and pull-rods extending through said flues to the front of the furnace and provided with means for working the same substantially as described.

7. A furnace for burning pulverulent or comminuted material, comprising a fire-box having its air-inlets above the grate-bars, said fire-box having a feed-hole for the comminuted fuel in the roof, and said roof being made as a low arch arranged in relation to the grate as described whereby the angle of repose of the pile of comminuted fuel fed through the roof onto the grate shall not cover up and obstruct the air-inlets above the grate-bars combined with a retort and its setting, said setting having a return longitudinal flue built below the retort with one end of the lower portion of said flue in communication with the furnace-chamber, and the other portion of the flue opening into the space about the retort substantially as and for the purpose described.

WILLIAM BREWSTER CHAPMAN.

Witnesses:
R. M. CHAPMAN,
R. W. CHAPMAN.