

R. O. BENTON.

FURNACE.

No. 370,597.

Patented Sept. 27, 1887.

Fig. 1.

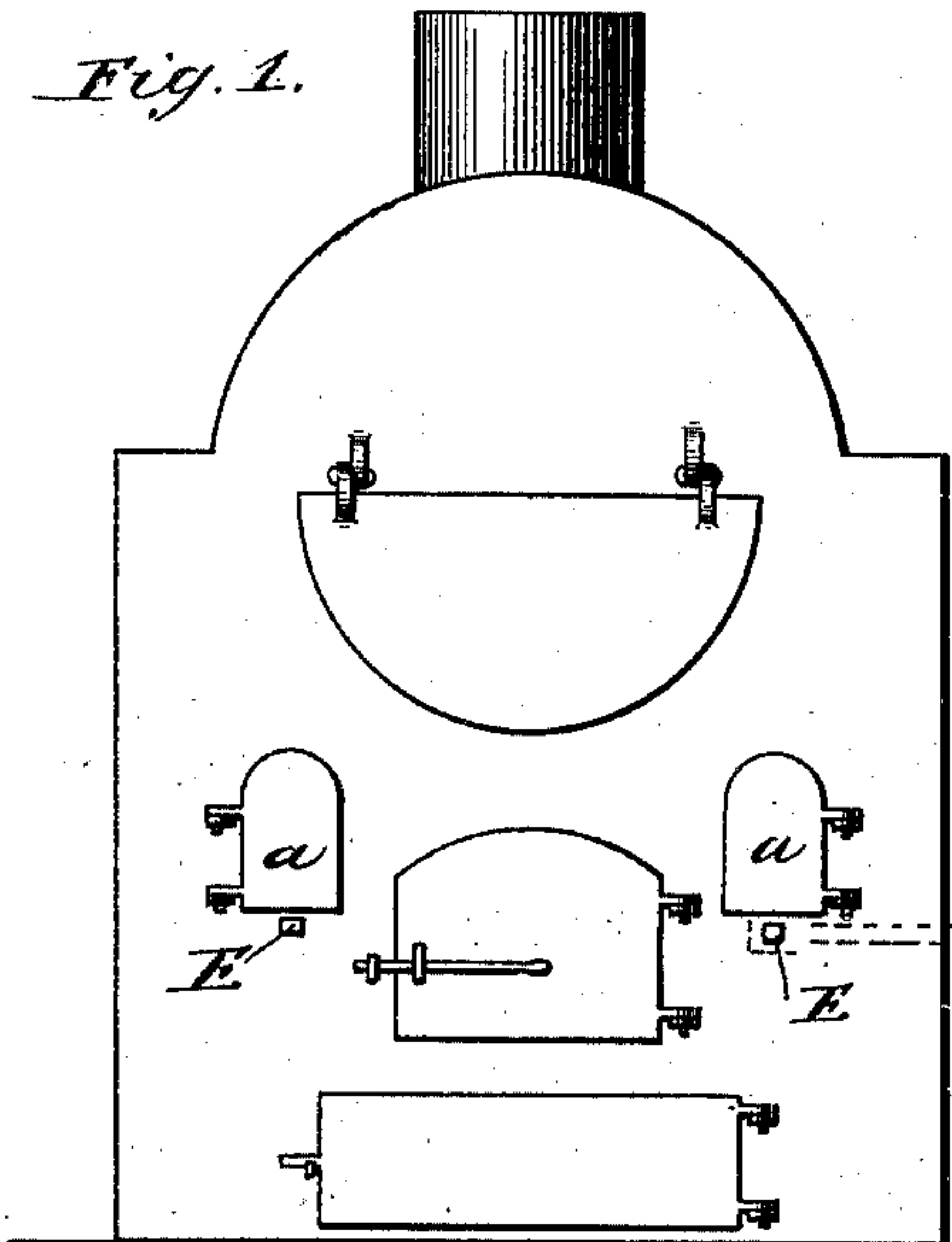


Fig. 2.

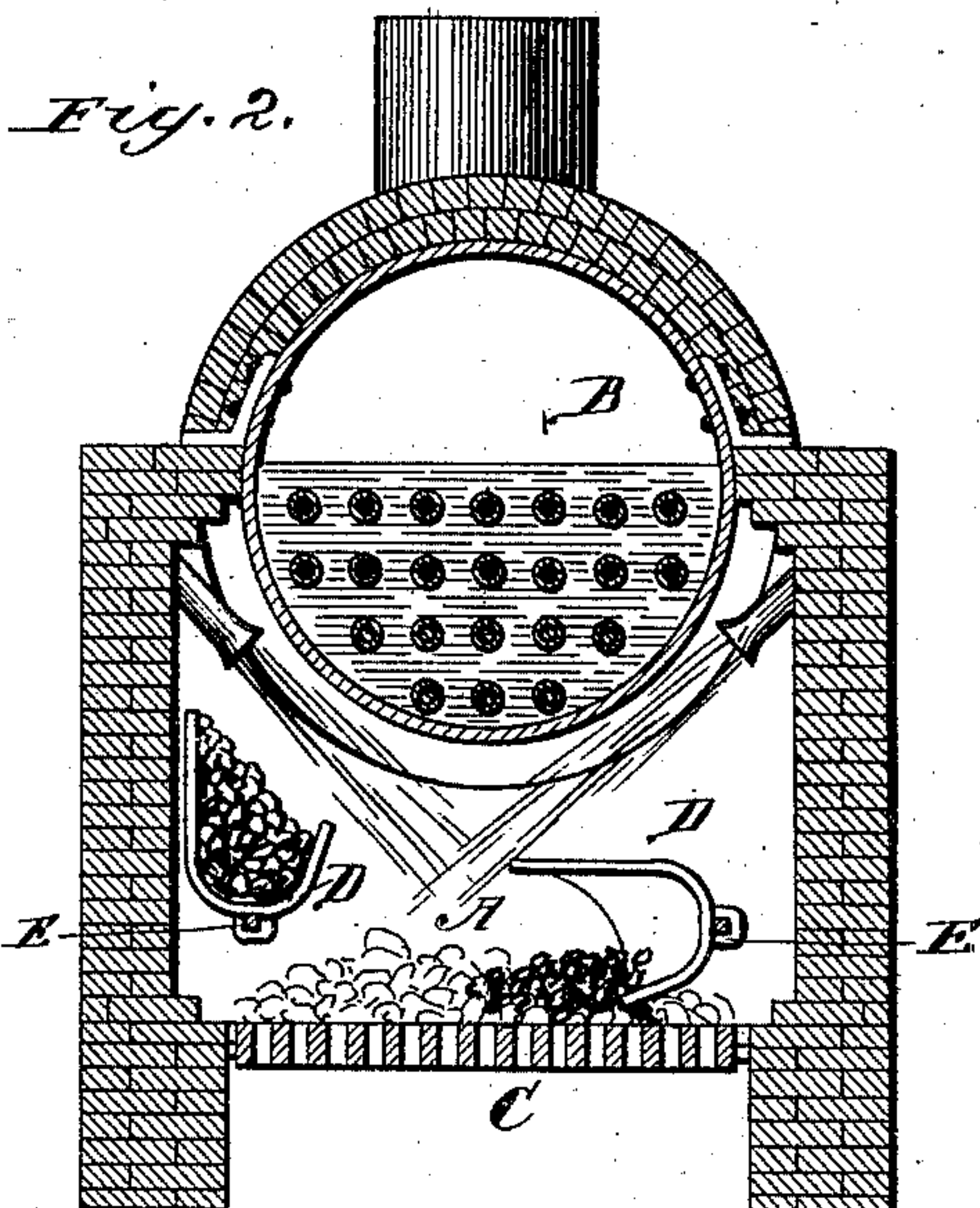


Fig. 3.

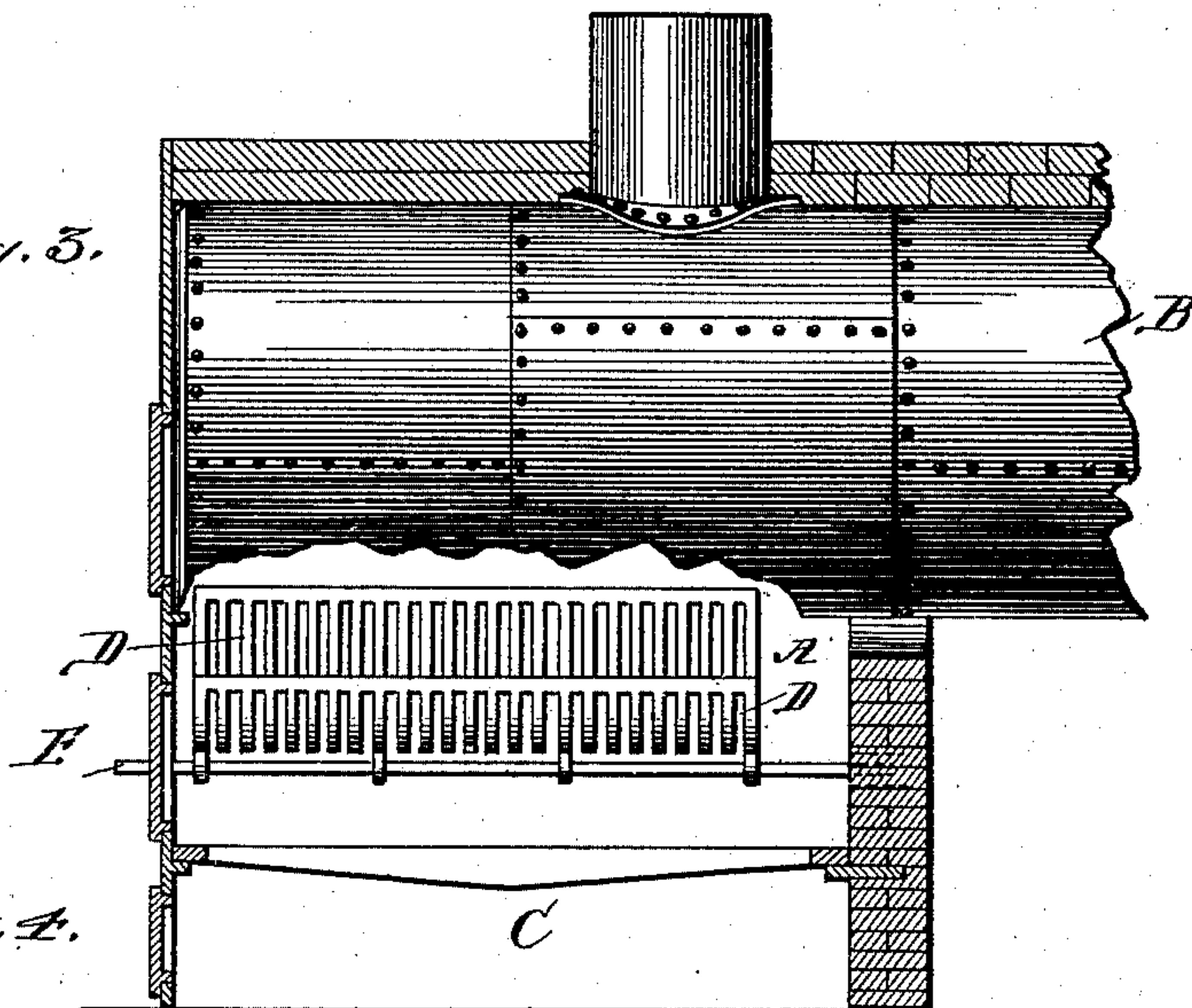


Fig. 4.

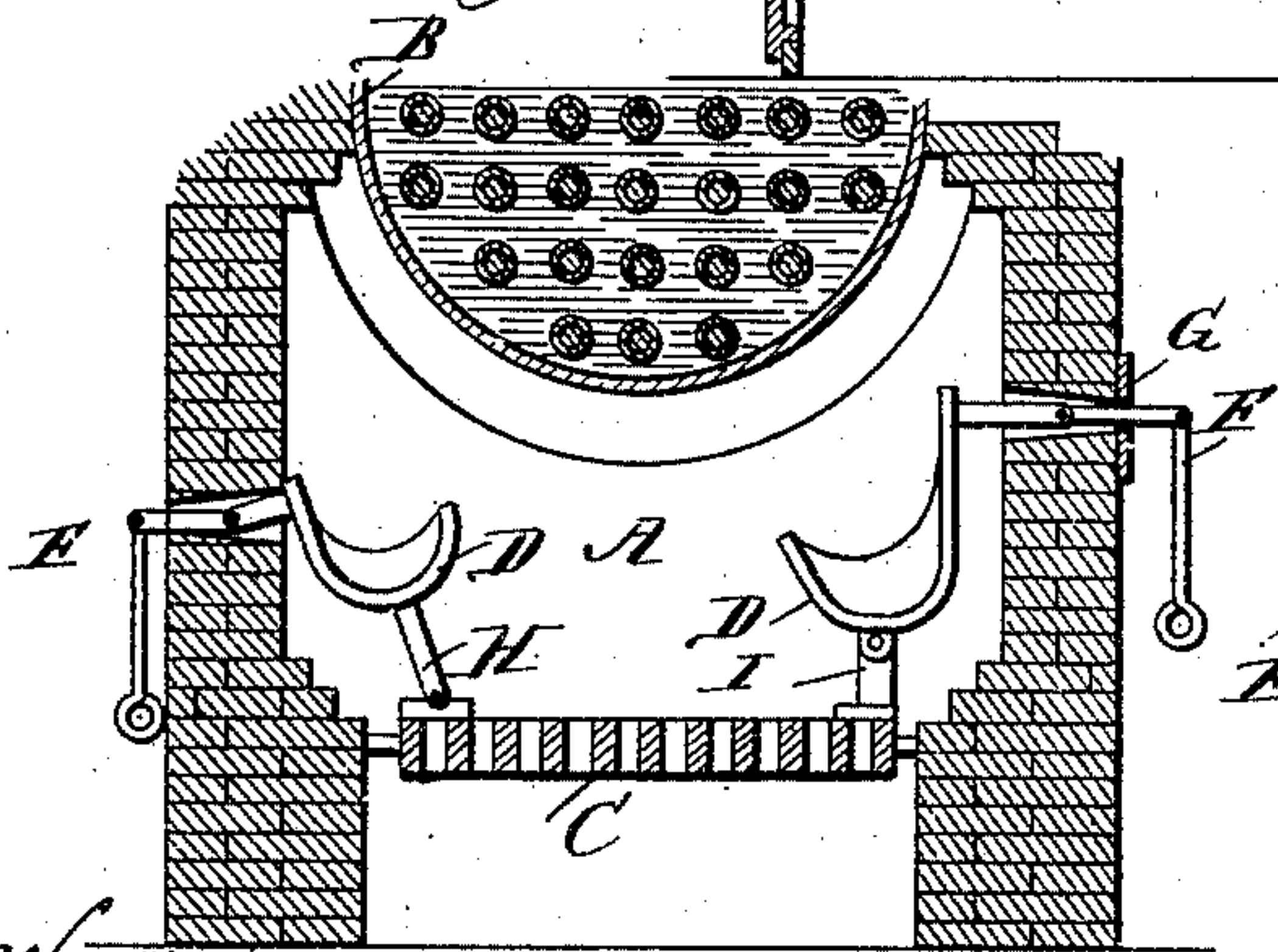
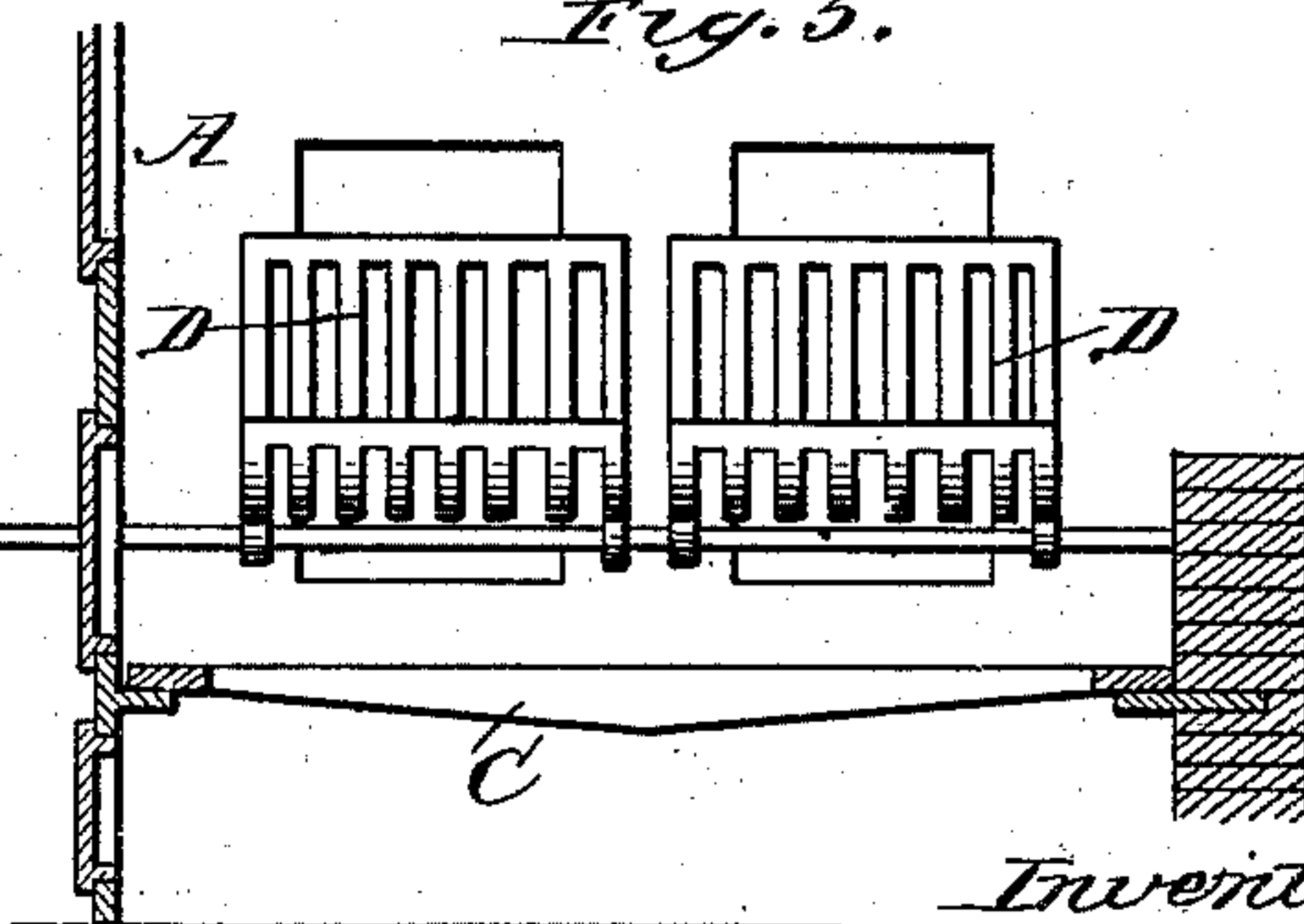


Fig. 5.



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(No Model.)

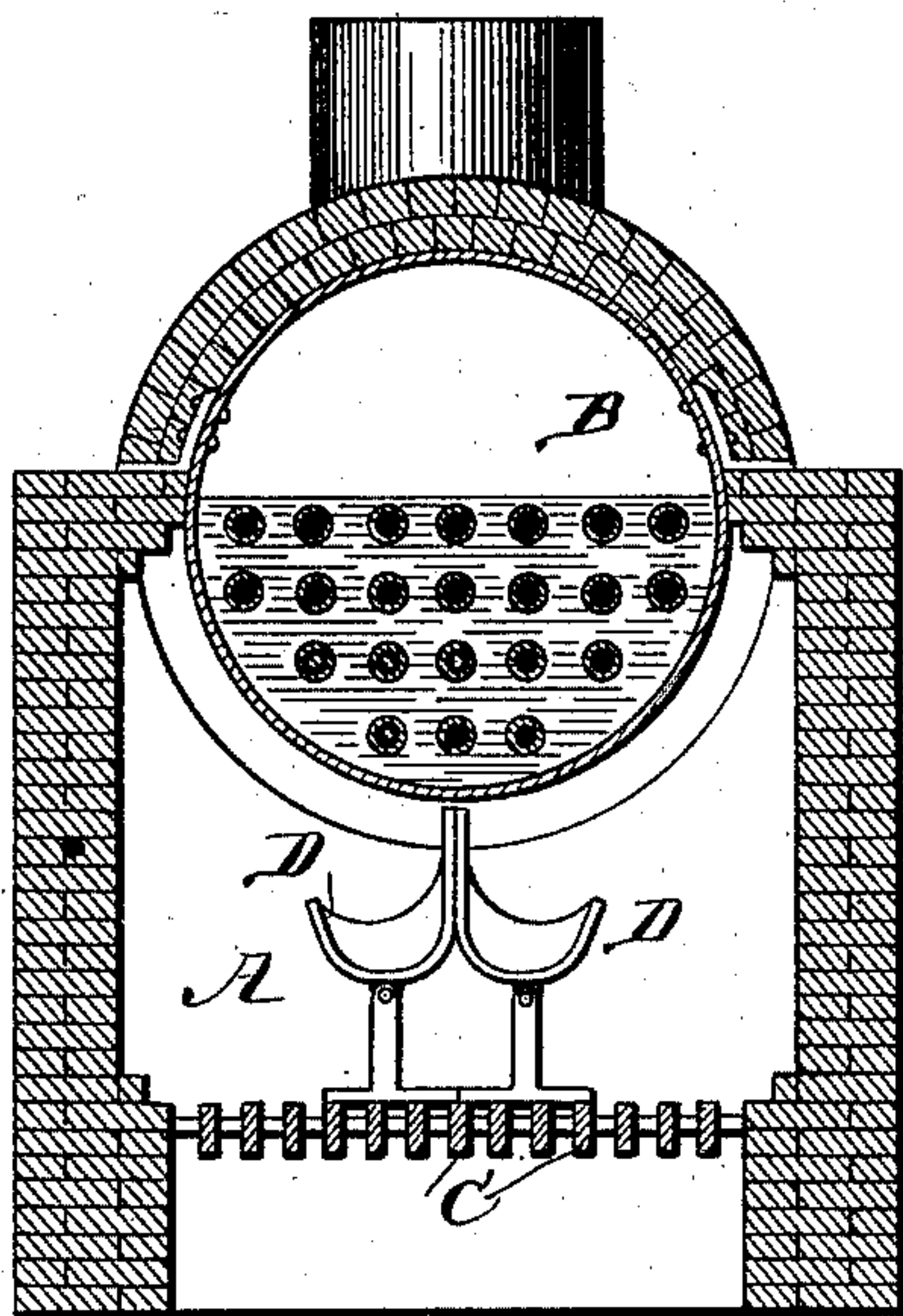
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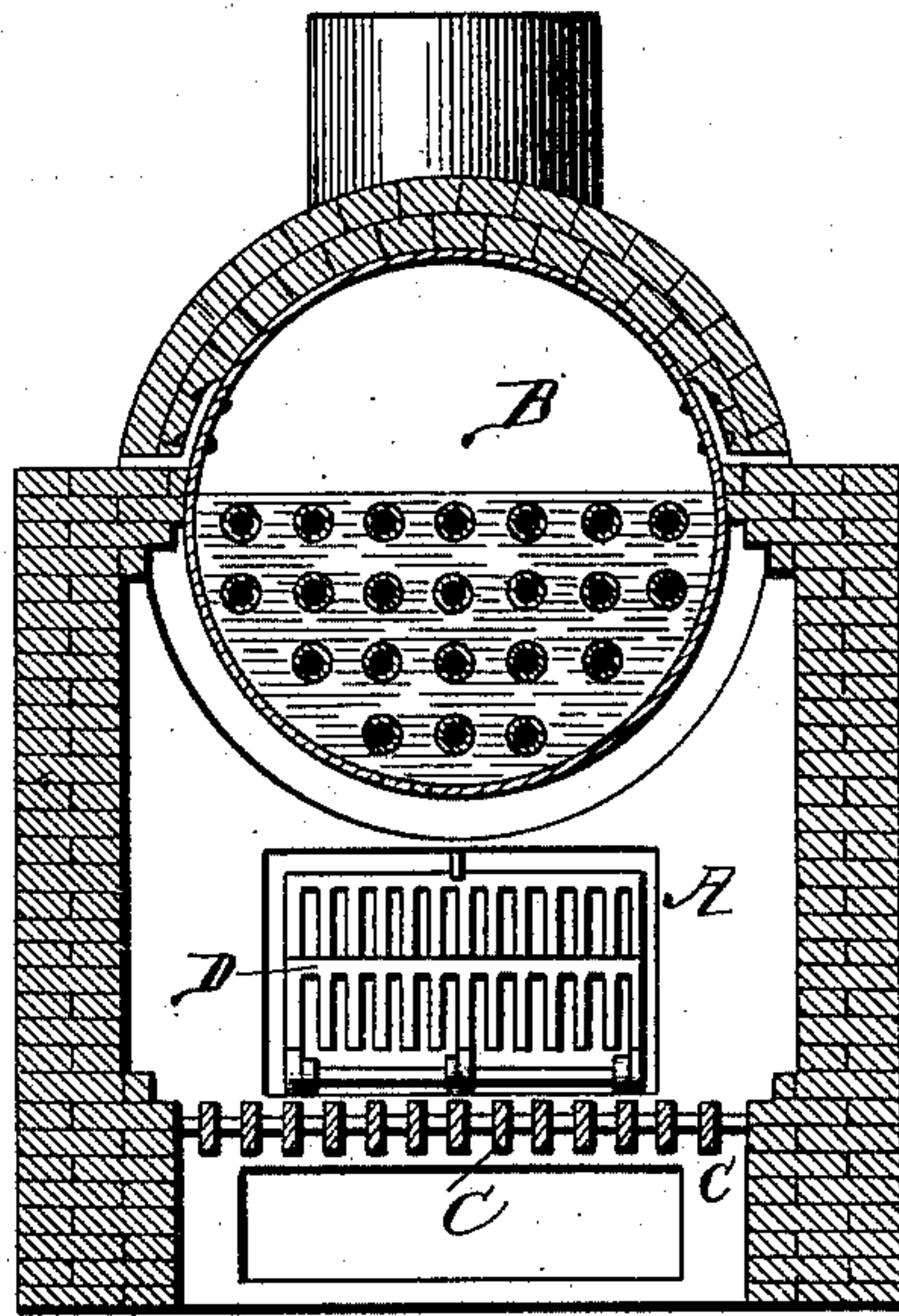
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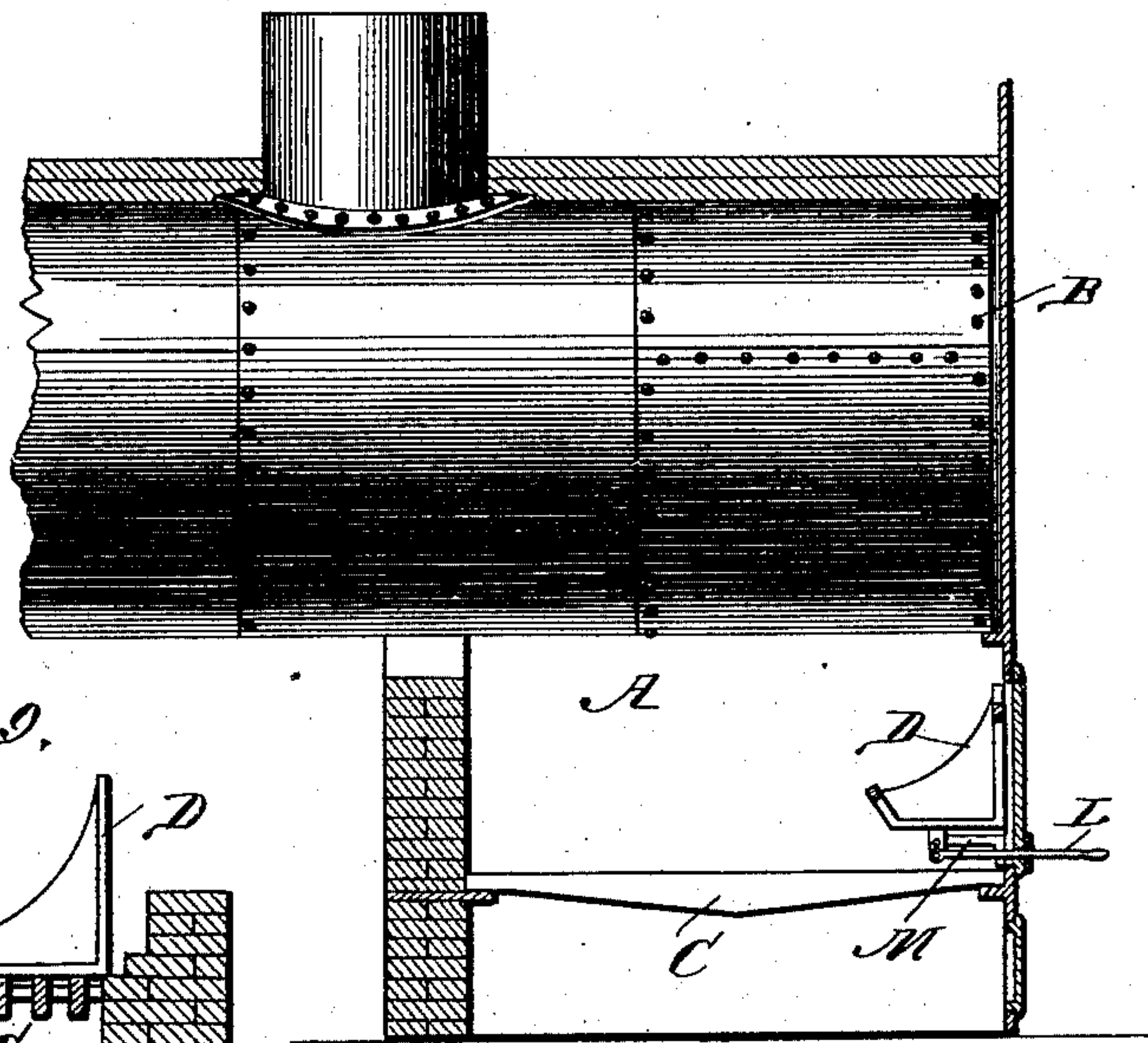
*Fig. 6.*



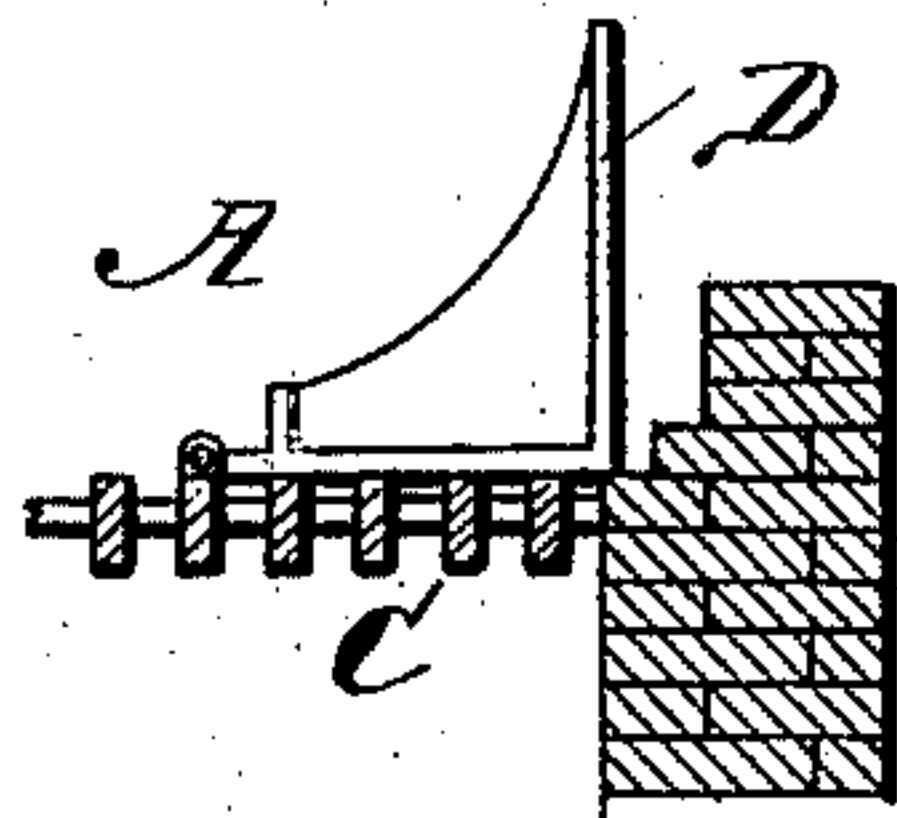
*Fig. 7.*



*Fig. 8.*



*Fig. 9.*



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# UNITED STATES PATENT OFFICE.

RUSSELL O. BENTON, OF CHICAGO, ILLINOIS.

## FURNACE.

SPECIFICATION forming part of Letters Patent No. 370,597, dated September 27, 1887.

Application filed June 14, 1887. Serial No. 241,306. (No model.)

*To all whom it may concern:*

Be it known that I, RUSSELL O. BENTON, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Furnaces, of which the following is a specification.

When a fresh charge of coal is thrown in a furnace in an active state, the heat by which the distillatory or gas-generating process is effected is derived from the remaining portion of the previous charge then in an incandescent state on the bars. When the charge is thus thrown directly upon the fire, in place of augmenting the general temperature, it becomes at once an absorbent of it and the source of the volatilization of the bituminous portion of the coal. In an ordinary furnace a large quantity of gaseous and inflammable material is given out and partly lost, there being no interval from the beginning to the end of a charge, when there is not a large body of combustible gas generated in the furnace. The first result of the application of heat to the coal is assumed to be the absorption of the heat by the coal and the disengagement of gas from which flame is derivable, while so long as any of the bituminous constituents remain to be evolved from any portion of the coal its solid or carbonaceous part remains black at a comparatively low temperature and inefficient as a heating-body, the carbonaceous part having to wait its turn for that heat which is essential to its own combustion. When a fresh charge is thus thrown directly upon the fire, the passage of air through the charge is necessarily restricted at a time when it is most needed. Since, in such case, as the fire is under the charge, the latter may be said to commence to burn from below, the temperature in the gas-burning space above the charge being lessened and the facilities for consuming the volatile products at such point being decreased proportionally to the depth of the fresh charge. Various constructions of fuel-saving and so-called "smoke-consuming" furnaces, based upon various and varied theories and involving more or less complexity of structure, have been devised with a view of effecting more perfect combustion, prominent among other features in such furnaces being the use of jets of superheated steam or air, or both, separate coking-cham-

bers with auxiliary fires, or separate magazines with automatic devices for effecting a gradual feed to the main fire or combustion chamber. It is a common fact, however, that at the present time the old method of feeding by shoveling the fresh charge directly upon the fire more generally prevails.

The object of my invention is to provide simple, economical, convenient, and efficient means for receiving and containing in the first instance within the main fire-chamber the fresh charge of coal without placing such charge upon the fire, but in a way to expose to the direct action of the fire for a desired period the surface, or a large portion of the surface, of the entire charge, so as to burn from the surface and at a point where the gases evolved may, with the aid of properly-directed jets of superheated steam or air, or both, be consumed, and for then dumping such charge onto the bed of incandescent fuel on the grate. A further and important object is to adapt said means for application to any ordinary furnace already constructed with comparatively small cost and labor and without necessitating a reconstruction of the furnace.

To the attainment of the foregoing and other useful ends my invention consists in matters hereinafter described, and particularly pointed out in the claim.

In carrying out my invention I provide directly within the main fire-chamber, and substantially on a level with or not far above the level of an ordinary depth of such bed of incandescent coal as will be left upon the grate at the end of a charge, one or more dumping charge-burning receptacles adapted for receiving and containing the fresh charge and for exposing the same at the surface to the direct action of the fire within the fire-chamber, and in conjunction with such open charge-burning receptacles provide any suitable means for tilting the same, so as to dump the charge at a proper stage over upon the bed of incandescent fuel on the grate. In such connection I propose employing any desired arrangement of means for directing jets of superheated steam or air, or both, into the furnace, thereby facilitating the combustion of the volatile matters evolved from the charge, which being thus exposed within the main fire-chamber will necessarily burn from the surface. Various



dispositions of such open dumping charge-burning receptacles may be made within the main fire-place or main combustion-chamber of the furnace, and various dumping devices for tilting such receptacles can be employed without departing from the spirit of my invention, as will hereinafter appear.

In the drawings, Figure 1 represents in front elevation a boiler-furnace provided with doors suitable for feeding in the charge at the front. Fig. 2 represents a transverse section of the furnace, taken on a vertical plane, the open dumping charge-burning receptacles arranged within the main fire or combustion chamber being at opposite sides of its middle. Fig. 3 represents a central longitudinal section taken on a vertical plane through the preceding figure, but with the boiler mainly in elevation, a portion of the boiler being, for convenience of illustration, broken away. Fig. 4 is a section similar to Fig. 2, but showing different ways of mounting and tilting the open dumping charge-burning receptacles and omitting the upper portion of the boiler and furnace. Fig. 5 is a detail representing in vertical longitudinal section a portion of the furnace, and showing an open dumping charge-burning receptacle made in separate sections with doors at the side of the furnace. Fig. 6 is a vertical section taken transversely through the furnace, and represents the open dumping charge-burning receptacles located at the middle of the main fire-chamber. Fig. 7 is a vertical section taken transversely through the furnace, looking toward the front thereof, and represents one of the open dumping charge-burning receptacles hung upon the main front door of the furnace. Fig. 8 represents a portion of the furnace in vertical longitudinal section, with a portion of the boiler in elevation, and represents one of the open dumping charge-burning receptacles located within the main fire-chamber at a point adjacent to the front thereof, means being shown for raising and lowering such charge-burning receptacle at will. Fig. 9 is a detail section taken transversely through one of the lower side corners of the furnace, and shows the open dumping charge-burning receptacle set down nearly on a level with the grate-bars.

In said drawings I have selected an ordinary construction of boiler-furnace and represented my improvement applied thereto, it being understood, however, that I do not confine myself to any particular type or construction of furnace.

In the present illustration, A indicates the main fire or combustion chamber, B the boiler, set, as usual, at the upper part of the furnace, and C the grate-bars, arranged, as usual, at the bottom of the main fire-chamber and over the ash-pit.

D refers to the open dumping charge-burning receptacle, one or more of which is or are hung or mounted directly within the fire-chamber A. The open dumping charge-burning receptacle D may be made of any material

best adapted to withstand the action of the fire, and may be reticulated or formed with interstices in any suitable way. Thus it can be made of cast metal and formed like a grate, being shaped, however, to form an appropriate open charge-receiving receptacle, which can receive and hold the charge as long as required, and then part with the same when it becomes desirable to tilt the receptacle to an extent to dump the fuel therefrom onto the fire upon the grate-bars C. The form of receptacles herein shown proximates to a trough, whereof the back may be higher than the front, although of course both sides can be of equal height, the high form of back being convenient when the dumping-power is applied at the side of the furnace, as in Fig. 4.

In Fig. 2 the two charge-burning receptacles D are mounted on rock-shafts E, which may be journaled at the ends of the furnace, as in Fig. 3, and at other proper points, should the weight demand additional supports. In such case the ends of the rock-shafts can project out from the front of the furnace, in order that a dumping-lever can be applied to the projecting end of either shaft, as in Fig. 1, wherein a crank or lever thus applied to one of the rock-shafts is shown. In said Fig. 2 one of the receptacles D is shown upright and back against or near to one of the side walls of the main fire-chamber A, while the remaining receptacle is shown in a tilted condition, so as to empty its load directly onto the fire upon the grate. Where the receptacles are thus arranged, the doors for permitting a fresh charge to be thrown in the receptacles can be at the front of the furnace, as at a; or the doors can be arranged at the side when found convenient.

In Fig. 4 the two receptacles D are shown arranged, respectively, at opposite sides of the middle of the main fire-chamber A, with means for dumping them from the side. While a variety of dumping devices could obviously be employed upon such occasion, I have shown, as an illustration of one of a variety of mechanical devices for such purpose, a jointed rod, F, for each dumping-receptacle D, the rods in such case being extended through openings in the side walls of the furnace. Should it be desired to close any air-passage which might occur around the point where the rod enters the furnace, a slide-plate, G, could be arranged upon the rod, although a small inlet for the admission of air at such point, in place of being objectionable, may in some cases be found of use. One of the receptacles D in said figure is provided with legs H, (whereof but one is shown,) the legs in such case being hinged or pivoted at their lower ends in order to give to the dumping-receptacle a more extended throw, it being observed that the extent of throw may of course be varied according to the width of the main fire-chamber. The other one of the two receptacles D (shown in Fig. 4) is pivoted upon stands I, one of which is shown. The



height of stands I and the length of legs H will be proportional to the extent to which it is desired to elevate the receptacles D within the fire-chamber, it being seen that the lower  
5 the position of the receptacle D within the fire-chamber the more slowly the gases will be driven off from the charge, and hence that, where desired, the dumping-receptacle can be set down upon the grate, as in Fig. 9.

10 In Fig. 5 the dumping-receptacle along one of the side walls of the main fire-place is made in sections, thereby practically forming two or more separate dumping-receptacles D, as may be desired. In such figure I have also  
15 shown doors K, arranged at the side of the furnace, whereby the charge may be fed into the receptacles from the side. This arrangement, when permitted by the location of the furnace, will be found convenient, and by mak-  
20 ing the receptacle in separate tilting sections the dumping can be easily effected.

In Fig. 6 I have shown a couple of the open dumping charge-burning receptacles D arranged back to back and at or about the mid-  
25 dle of the main fire-place A. This disposition can be used upon some occasions, but is not so desirable as other arrangements herein shown.

In Fig. 7 I have shown one of the open  
30 dumping charge-burning receptacles D hung upon the door, whereby the door can be swung open, so as to throw a fresh charge into such receptacle when necessary.

In Fig. 8 I have shown a lever, L, for rais-  
35 ing and lowering one of said open dumping charge-burning receptacles, it being understood that in such case the dumping-receptacle will be pivoted upon any suitably-arranged slide or slides, as at M, for which said  
40 slides the wall of the main fire-chamber can be provided with appropriate guides. It will also be obvious that any latching device can, if desired, be employed for temporarily main-  
45 taining the dumping-receptacle in an upright condition, although where the pivot is somewhat to the front of the receptacle such will not be required. The dumping-receptacle shown in said Fig. 8 is alongside the front wall of the furnace, whereby it could cross the door-  
50 way and yet be lifted sufficiently to permit access to the bed of coal on the grate when necessary. Means for raising and lowering the open dumping charge-burning receptacles can, however, be employed where the latter are lo-  
55 cated near the side walls of the main fire-chamber, whereby the said receptacles can be raised or lowered according to the requirements of the furnace and the character of fire desired. In most instances, however, I prefer setting  
60 the dumping-receptacles low down at one or both sides of the main fire-place.

The arrangement of one of the dumping charge-burning receptacles set low down is, as heretofore stated, represented in Fig. 9, where-  
65 in the hinge or pivot about which the receptacle is to swing is somewhat in front of the main body of the receptacle, which at its bot-

tom has a forward extension, to provide a bearing for the pivot or pivots employed. Such arrangement will permit the receptacle to be  
70 swung up and over, notwithstanding the depth of fuel on the grate at a point in front of the said receptacle. This arrangement illustrates, however, but one of various obvious mechanical means whereby the receptacle can be  
75 swung over to dump without being hindered by the fuel in front of it. In connection with the open dumping charge-burning receptacle shown in Fig. 9, any suitable mechanical dump-  
80 ing device or devices may be employed—such, for example, as a rock-shaft, lever, or the like—the arrangement of such dumping devices being a matter of mechanical judgment, dependent on the weight to be overcome.

By the foregoing arrangements, and par-  
85 ticularly when the receptacle is set low down, I attain the effect of banking or piling the fresh charge at the side of the middle of the main fire-place, and at the same time provide simple and convenient means for first receiving  
90 and retaining for a suitable period the fresh charge, and for then dumping the same over upon the fire without necessitating the labor and extreme inconvenience of shoveling, and, moreover, affording a device not objectionable  
95 to a fireman, who, if relied upon to dispose of fuel by shoveling fuel in a particular way in a hot furnace, would find the ease of the old way of disposing of the fuel, as a rule, too great a temptation to induce him to shovel it about  
100 in any particular and laborious manner.

While the receptacle D is open, substantially as herein shown, so as to expose the top surface of the fresh charge to the direct action  
105 of the heat within the main fire-chamber, the fineness or coarseness of the reticulations in the sides and bottom of the receptacle can be varied according to the kind of fuel used. Thus, for scraps, screenings, or refuse coal, the  
110 reticulations can be very fine, or dispensed with altogether. Furthermore, I do not limit myself to the use of reticulations in the sides or sides and bottom of the open dumping-receptacle D in employing any of the coarser  
115 grades of fuel, since the same, when present in the receptacle, will, without such reticulations, present its surface in a manner whereby the fuel may burn from the surface.

The disposition of pipes or inlets for the admission of superheated steam or air, or both,  
120 into the furnace will necessarily depend somewhat upon the construction of the furnace and the preferred location of the open dumping charge-burning receptacles. Any of the well-  
125 known systems or arrangements of pipes for the admission of superheated steam or air, or both, into a furnace may, when compatible with my arrangement of open dumping charge-burning receptacles D, be employed, it being  
130 a matter of judgment as to the exact location of such pipes or inlets, so as to cause the superheated steam or air to be directed to the points where its presence for supporting the combustion of the gases is most needed.



In Fig. 2 I have shown pipes N disposed for directing jets of superheated steam (or air and steam, where it is desired to bring in air along with the steam) diagonally across the main fire-chamber and over the receptacle D.

While regarding the use of superheated steam or air, or both, as highly essential, I do not confine myself to any particular arrangement of pipes or inlets, observing, however, that an inlet-pipe having a bell-mouth either with or without a rose will be found highly efficient in distributing the steam or air, or both, over or onto the fuel.

In feeding a furnace supplied with my improvement the door or doors, located with relation to the open dumping charge-burning receptacles, can be opened and a fresh charge thrown into one or more of said receptacles, where it can be allowed to remain until the gases have to a proper extent been evolved and burned, and it becomes necessary to dump the fuel remaining in the receptacles onto the grate. It will also be observed that the open dumping charge-burning receptacles can be supplied, respectively, at separate times, so that a charge from one receptacle can be dumped onto the fire, while in another receptacle there will be a charge, say, at a stage about midway of the length of time the charge last dumped was allowed to remain in its allotted receptacle.

The direct heat from the fire on the grate will obviously be available for heating the fresh charge at the surface of the latter, and by the aid of properly-directed jets or currents of superheated steam or air, or both, the gases and volatile products evolved from the charge can be efficiently consumed, thereby effecting a great saving in fuel, and consequently avoiding the production of smoke.

The lessening of the temperature to any undesirable extent is obviously avoided, it being evident that the introduction of the charge relatively to the condition of the fire on the grate can be so regulated as to maintain the temperature within the main fire-chamber at a practically uniform standard. The transfer of the contents of any one of the open dumping charge-burning receptacles onto the fire can be instantly effected at the proper moment in a

ready and efficient way, and since such receptacles are comparatively low down, it will be as easy to throw coal into the same as it would be to throw coal onto the fire through the main door under the old plan.

It will also be seen that the location and formation of the open dumping charge-burning receptacle, as hereinbefore described, defines the position it is desired the fresh charge should occupy relatively to the fire on the grate, and, while superficially exposing the charge directly to the heat from such fire, separates the charge therefrom and prevents the fresh charge from being thrown in the first instance onto the fire.

In conclusion, it may be stated that any of the dumping-receptacles hereinbefore described can be placed within any ordinary furnace without enlarging or reconstructing the furnace, the only material change in the furnace being to provide an opening for a door for feeding, and also that the dumping-receptacle, which is readily distinguishable from a flat tilting grate, may be set high up or low down, as desired, and so pivoted as to permit it not only to be dumped with ease, but to throw its contained charge of coked coal well over onto the fire, with a clean and unobstructed discharge, regardless of the width of the furnace and the height of burning fuel in the middle thereof.

What I claim as my invention is—

The combination, substantially as described, with the main fire-chamber in a furnace, of an open tilting charge receiving and coking receptacle, D, permanently supported within the fire-chamber in position to expose its contained charge superficially to the fire at one side of the tilting receptacle, said tilting receptacle being pivotally supported at its base over an ordinary furnace-grate floor and having an extent of swing sufficient for dumping the coked charge with a clean throw from one side of the fire-place on the fire at the middle thereof, substantially as shown and described, and for the purposes specified.

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