

No. 765,977.

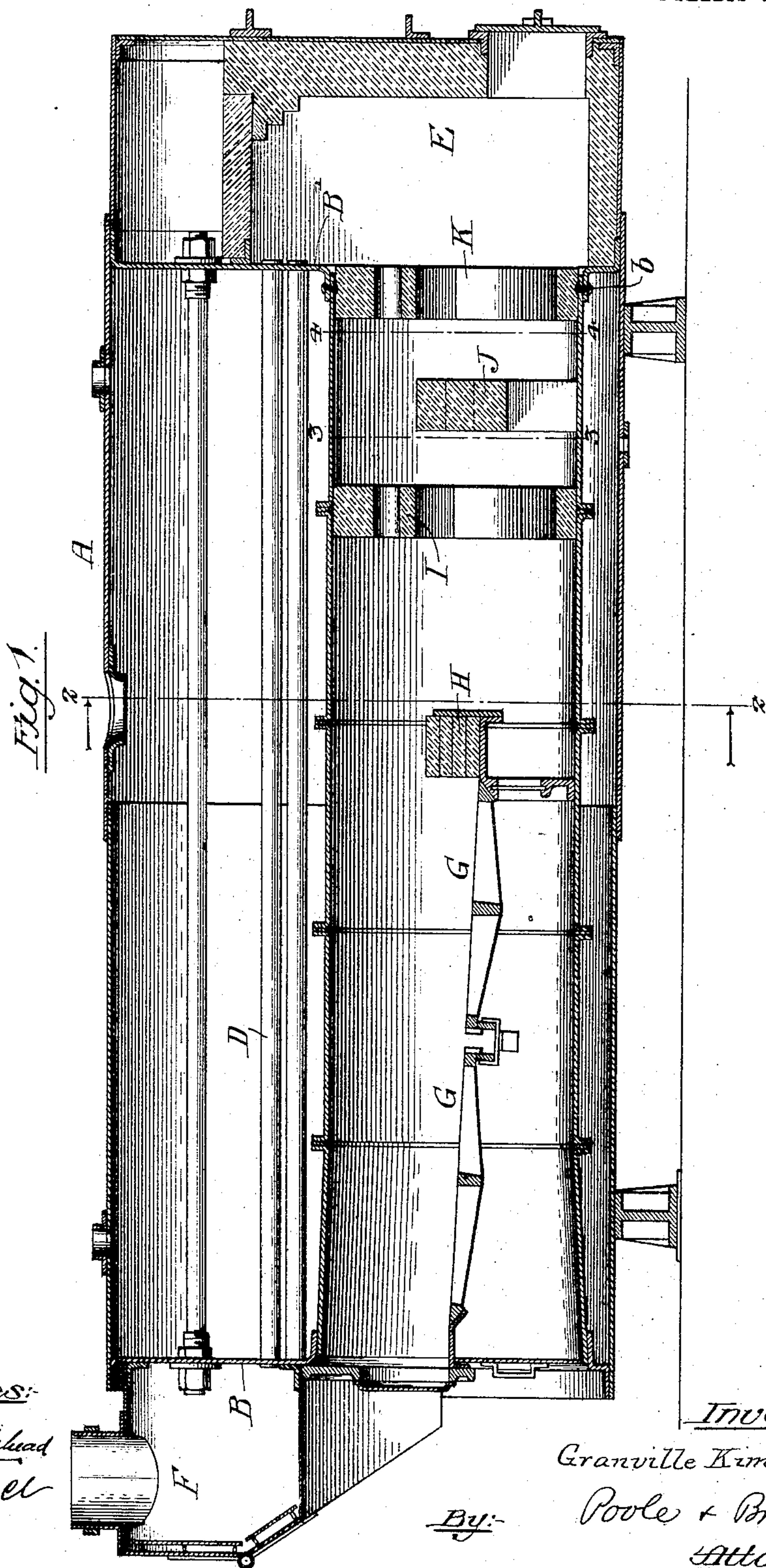
PATENTED JULY 26, 1904.

G. KIMBALL.
STEAM BOILER FURNACE.

APPLICATION FILED SEPT. 21, 1903.

NO MODEL.

2 SHEETS—SHEET 1.



Witnesses:

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2 SHEETS—SHEET 2.

Fig. 4.

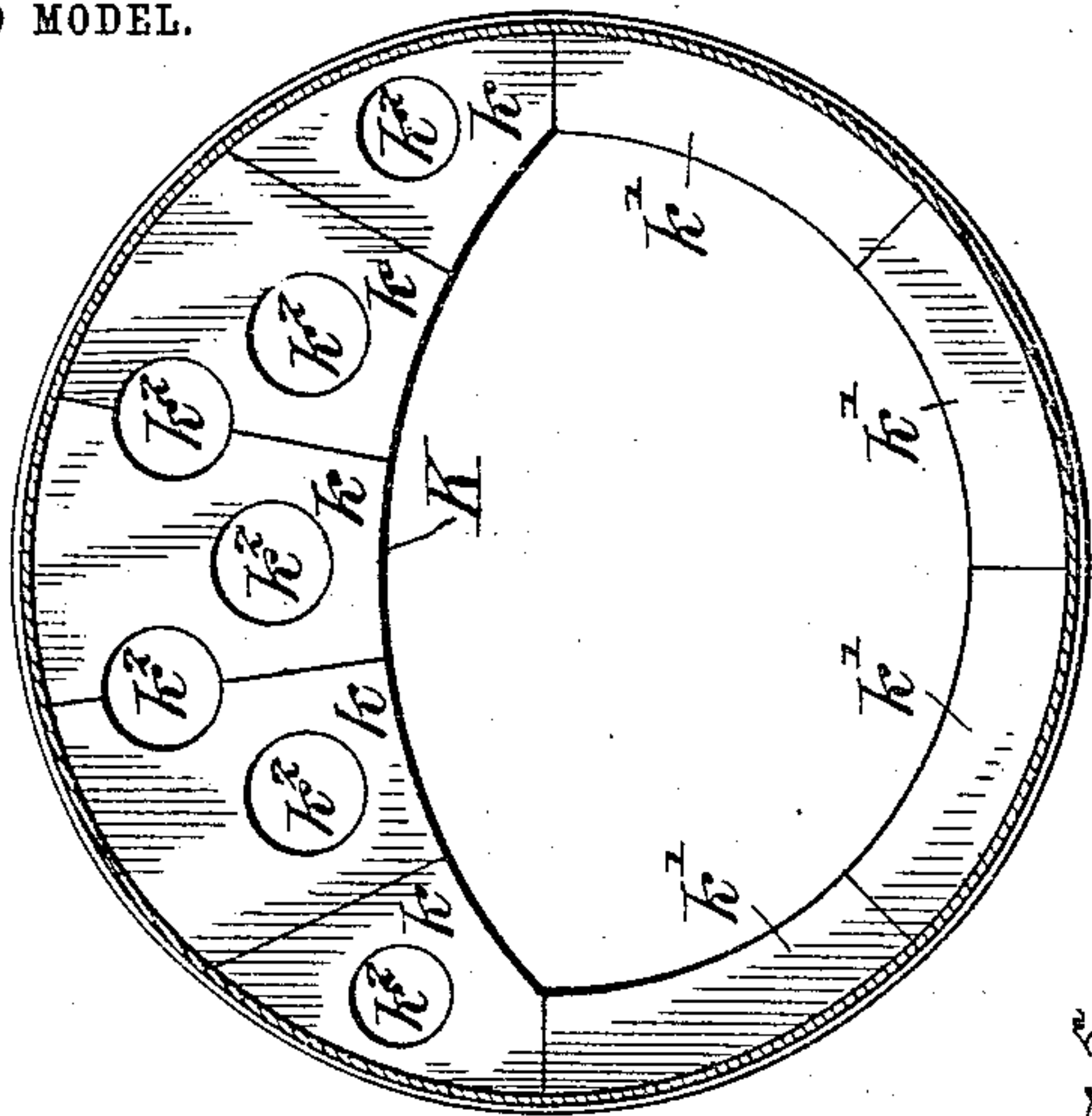


Fig. 3.

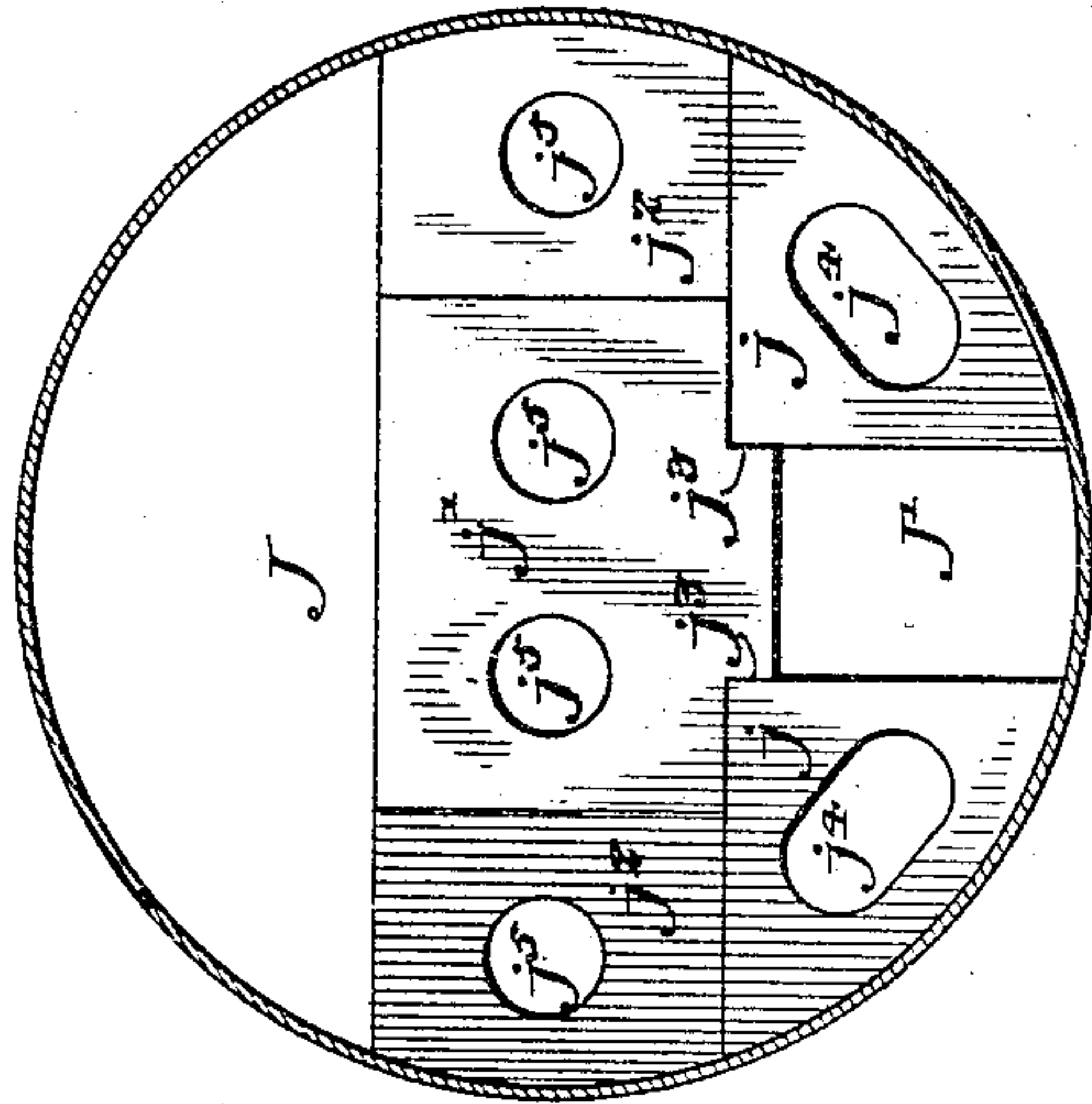


Fig. 5.

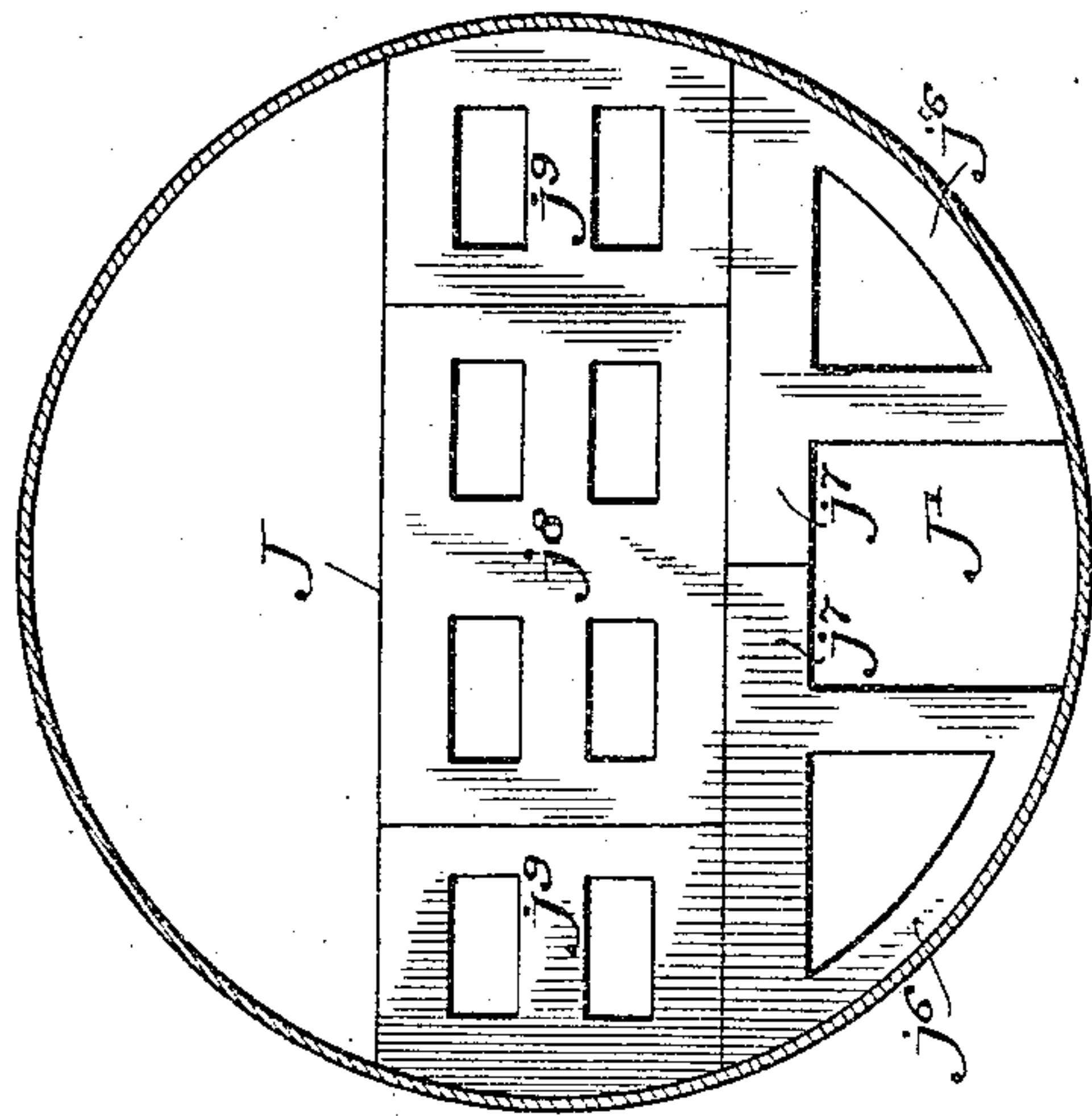
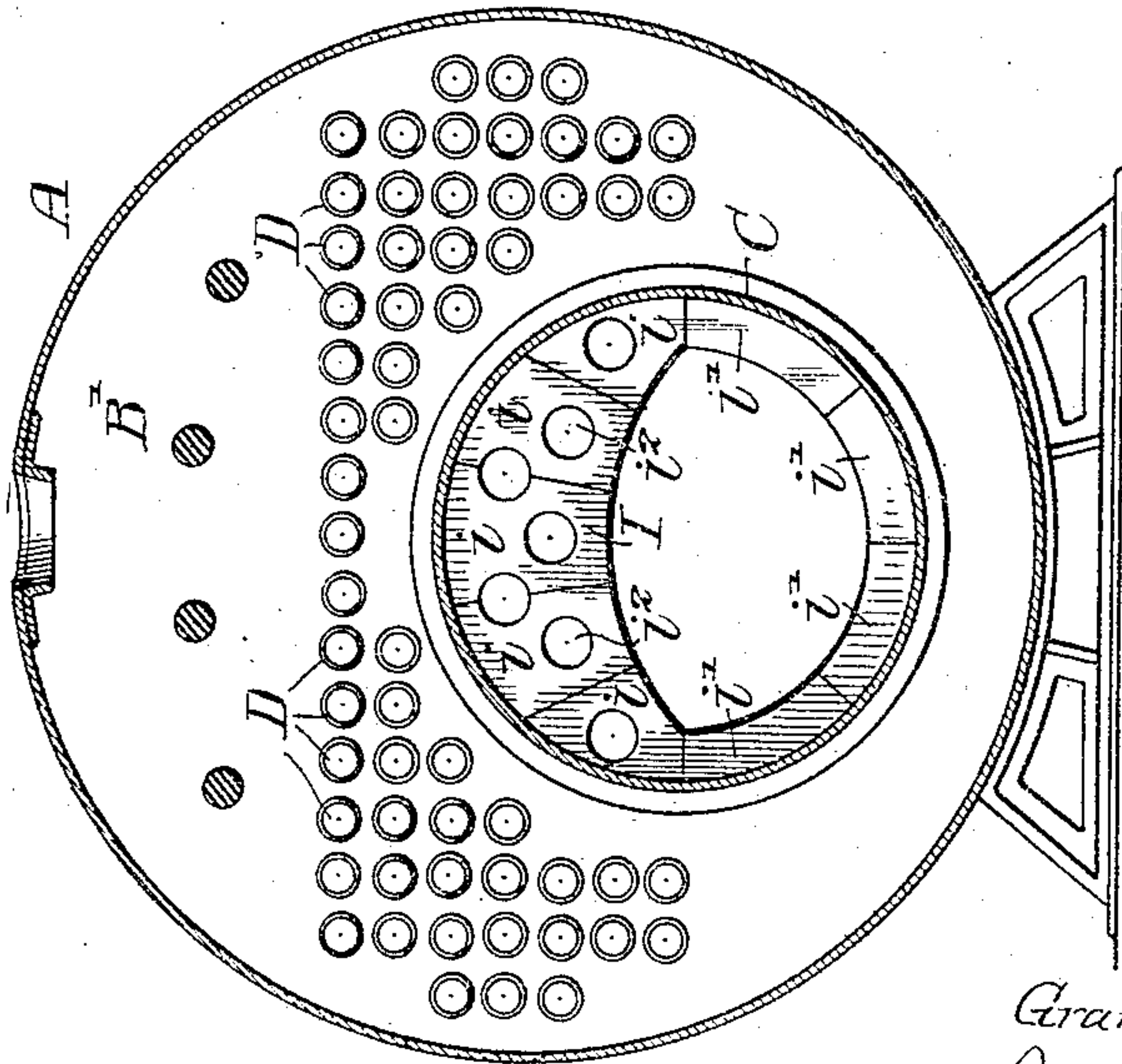


Fig. 2.



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UNITED STATES PATENT OFFICE.

GRANVILLE KIMBALL, OF CHICAGO, ILLINOIS.

STEAM-BOILER FURNACE.

SPECIFICATION forming part of Letters Patent No. 765,977, dated July 26, 1904.

Application filed September 21, 1903. Serial No. 173,918. (No model.)

To all whom it may concern:

Be it known that I, GRANVILLE KIMBALL, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Steam-Boiler Furnaces; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, and to the letters of reference marked thereon, which form a part of this specification.

This invention relates to furnaces for steam-boilers of the kind known as "internally-fired," or those in which the furnace is located within a horizontal flue contained within the external shell of the boiler, and more particularly to that class of such furnaces in which the furnace-grates occupy the forward or outer portion only of the length of the flue in which they are located, and a space is therefore left between the inner end of the grate or bridge-wall and the rear or exit end of the flue through which the flames and heated products of combustion pass rearwardly from the grate on their way to the rear ends of the return tubes or flues of the boiler or other passages leading to the uptake-flue or stack.

The present invention embraces means in the nature of partial or apertured partitions or deflecting-walls of refractory material located within the boiler-flue and extending across the same in said space between the inner end of the grate and the exit end of said flue and which serve to retard the movement of heated gases and products of combustion through the furnace and by themselves becoming highly heated to promote the combustion of unconsumed volatile matters and to thereby prevent the production of smoke, as will hereinafter more fully appear.

The invention also embraces a ring or annulus of fire-brick or refractory tiles arranged within the flue in such manner as to cover and protect from heat the joint between the flue and the boiler-head at the exit end of the flue.

The invention consists in the matters pointed out in the appended claims.

The accompanying drawings show my in-

vention as applied to a horizontal cylindric internally-fired or "Scotch" marine boiler having a single horizontal flue which contains the furnace and which extends between and is attached at its ends to the opposite boiler-heads and having also a plurality of return-tubes extending between the heads, said flue containing a furnace-grate, which occupies the forward portion thereof only, and having in its details of construction the form of what is known as an "Adamson" flue.

As shown in said drawings, Figure 1 is a view in central longitudinal section of a steam-boiler constructed in accordance with my invention. Fig. 2 is a cross-section thereof, taken on line 2 2 of Fig. 1. Fig. 3 is an enlarged detail section taken through the furnace-flue on the line 3 3 of Fig. 1, showing one of the deflecting-walls in said flue. Fig. 4 is a like enlarged section taken on line 4 4 of Fig. 1, showing the deflecting-wall at the exit end of the flue, this being like that shown in Fig. 2. Fig. 5 is a similar section showing a modified form of the deflecting-wall shown in Fig. 3.

As shown in said drawings, A indicates the cylindric shell of the boiler; B B', the front and rear heads thereof; C, the horizontal flue, which contains the furnace and which extends between and is connected at its ends with the heads B B', and D D are the return-tubes, which extend between the said heads above and at the sides of the flue C.

E indicates a combustion-chamber at the rear end of the boiler, into which the products of combustion pass from the rear end of the flue C and from which the said products of combustion pass to the tubes D D.

F indicates the uptake at the front end of the boiler, with which the tubes E E communicate at their front ends.

G G indicate the furnace-grates, which are located in the forward or front portion of the flue C and which slope rearwardly to a bridge-wall H, which extends across the flue at the rear of the fuel-supporting surface of the grate, as heretofore common.

Within the flue C at the rear of the grate

are located three partial partitions or deflecting-walls I, J, and K. The wall K is shown as located at the rear end of the flue adjacent to the boiler-head B', while the wall I is located at some distance to the rear of the bridge-wall H and the wall J at a point midway between the walls I and K. The alternate walls, as J in one instance and I and K in the other instance, are unlike in the general arrangement of the main or larger openings formed therein or between the same and the walls of the flue, so that they will act to deflect the flames and products of combustion into a tortuous course and will especially act to throw the said flames and products of combustion at one or more points downwardly from the top of the flue, along which they naturally tend to travel. The said deflecting-walls are made or built up of tiles or bricks of fire-clay or like refractory material, so shaped that they will fit and maintain themselves in position within the cylindric interior of the flue.

In the case of the wall I, which is nearest the grate, the main part of the same constitutes, in effect, an arch or hanging bridge-wall which is in contact with and spans the top of the flue. The main part of said wall I consists of arch brick or voussoir-shaped tile $i\ i$, which constitute an arch which spans the top of the flue and which is supported at its ends on an inverted arch consisting of relatively narrow curved brick $i' \ i'$, which rest in the concave bottom of the flue, the arch brick $i\ i$ and $i' \ i'$ together forming a complete annulus or ring which fits the inner surface of the flue. The arch formed by the fire-brick $i\ i$ fits at its upper edge against the top of the flue and preferably occupies the upper half of the flue, so that its upper edge forms a half-circle, the bottom edge thereof being preferably only slightly curved or nearly flat. The inverted arch formed by the brick $i' \ i' \ i'$ is relatively narrow, so that the aperture formed between the same and the main arch above it is principally below the center of the flue.

The wall I, formed by the arch brick, as described, is preferably provided with a plurality of holes $i^2 \ i^2$, some of which are shown as formed entirely in the individual bricks and others partially in one brick and partially in an adjacent one. Said holes $i^2 \ i^2$ serve to permit a portion of the flames and products of combustion to pass through the arch or depending part of the wall I.

The deflecting-wall J, Fig. 3, is supported on and rises from or extends across the bottom of the flue and terminates at a considerable distance below the top of said flue, so that the principal opening formed thereby is above the center of the flue, the body of the said wall being opposite the principal opening in the wall I. Said wall J is built up of tile or fire-brick and has in its bottom part or edge a central opening J', which leaves the bottom of the flue uncovered beneath the central part

of the wall. Said opening J' enables dust and ashes which may accumulate in the bottom of the flue to be scraped along the same part of said wall J to the rear end of the flue in cleaning the latter. The said wall J, as shown in Figs. 1 and 3, consists of two sector-shaped tile or brick $j\ j$, which rest and fit upon the downwardly-sloping curved sides of the bottom part of the flue, and a row of bricks $j' \ j^2$, which rest on top of the bricks $j\ j$. The center brick j' of said row spans the space between the sector-shaped brick $j\ j$ and is provided with a central part which projects downwardly between the latter and forms two outwardly-facing shoulders $j^3 \ j^3$, which serve to hold the sector-shaped brick at a proper distance apart. The space between the said sector-shaped bricks $j\ j$ forms the central opening or aperture J', above referred to. The wall J is shown as provided with circular holes $j^4 \ j^4 \ j^5 \ j^5$ for the passage of a portion of the flames and products of combustion through said wall. The lowermost holes $j^4 \ j^4$ are formed in the sector-shaped brick j , while the uppermost holes are formed in the upper brick j' and j^2 .

Fig. 5 shows a somewhat different form in which the bricks constituting the wall J may be made. In this case the lowermost bricks $j^6 \ j^6$ are of sector shape and skeleton form and have at their upper edges inwardly-extending arms $j^7 \ j^7$, which meet at the center of the flue. The upper row of brick in this instance consists of a central rectangular brick j^8 and two end bricks $j^9 \ j^9$, both of which are shaped to form rectangular holes, of which the central brick has four and the end ones two each.

The wall or arch K is shown as made like the partition I, above described, consisting of arch brick $k\ k\ k$ and curved brick $k' \ k'$, which latter form an inverted supporting-arch, and having holes $k^2 \ k^2$ in the arch brick $k\ k$.

In the operation of the furnace made as described the flames and products of combustion passing rearwardly from the grate over the bridge-wall H tend to move along the top surface of the flue, but upon striking the arch or depending deflecting-wall I are deflected downwardly thereby. They then strike the wall J and are deflected so as to pass mainly over the top of the same and are then again deflected downwardly by the deflecting wall or arch K. The said flames and products of combustion are thus compelled to take a tortuous course and are thereby retarded in their movement, with the result of producing more complete combustion of the volatile constituents of the fuel and decreasing the production of smoke. The deflecting-walls, made of refractory material, become highly heated by the passage of flames and heated products of combustion over and through the same, and thereby serve to promote the combustion of the smoke produced by the introduction of

fresh fuel into the furnace. The construction described is therefore highly efficient as a preventative of smoke.

The wall or arch K at the rear or exit end 5 of the flue when made of ring shape, as shown, serves not only as one of a series of deflectors, but also as a means of protecting from injurious heat the joint between the end of the flue and the boiler-head B, and, so far 10 as the performance of this function is concerned, its upper part need not be shaped as shown and it may be of any desired shape, provided it shall extend around the inner surface of the flue and completely cover the end 15 portion of the flue where it is joined to the head. The joint between the flue and the boiler-head is formed by an inwardly-turned cylindric flange *k* on the head B', inside of which the end of the flue is inserted and to 20 which the same is joined by riveting in the usual manner, and the wall K, having the form of a ring of refractory material which fits within the end of the flue over the overlapped parts of the flue and flange *b*, serves 25 to prevent contact of the flames with said parts. By thus protecting the said joint from the direct action of the flames and highly-heated products of combustion its durability is greatly increased and the life of the boiler 30 thereby prolonged.

It is to be understood, however, that an annular wall shaped like the wall K illustrated when located in the rear or exit end of the flue is of advantage otherwise than as a protection to the joint between the flue and boiler-head, even when no other partitions are present in the flue, for the reason that said wall K will act to retard the rearward movement 35 of the products of combustion along the top of the flue, with the result that such products of combustion will be caused to spread to a greater or less extent over the sides and toward the bottom of the flue, with corresponding increase of heating effect.

45 While the invention is shown in the accompanying drawings as applied to a boiler-flue made up of sections according to the plan of the Adamson flue, yet the special form of flue is immaterial, and the features constituting my invention may be applied to a "Fox" 50 or corrugated flue or any other form of flue, either continuous or made up of sections.

While the employment of fire brick or tile made to fit the surface of the flue and each other, as shown and described, is preferred and 55 constitutes a feature of my invention, yet, so far as the broader features of the invention are concerned, it may be carried out without the use of specially shaped or molded fire-brick—as, for instance, walls or partitions adapted 60 to produce the general results set forth may be made of ordinary or standard fire-brick, which may be so laid as to leave spaces corresponding with the holes or apertures illustrated as being formed in or by the special 65 fire-brick which constitute the walls I, J, and K shown in the drawings.

I claim as my invention—

1. The combination with a sheet-metal boiler-flue and its contained furnace, of deflecting-walls in the flue at the rear of the furnace, the alternate walls depending from the top and rising from the bottom of the flue; the depending walls being formed by an upper arch which spans the top of the flue and 75 is provided with a plurality of holes or perforations together with an inverted arch which supports said upper arch and the rising wall consisting of brick or tile shaped to fit each other and the inner surface of the flue and to 80 provide a plurality of holes in said rising wall.

2. The combination with a sheet-metal boiler-flue and its contained furnace, of a deflecting-wall which rests in the bottom of the flue and consists of two sector-shaped brick 85 or tile arranged with a space between them, and a row of brick or tile resting thereon, one of which spans the space between the sector-shaped tiles.

3. The combination with an internally-fired 90 boiler, the furnace-flue of which is joined to the boiler-head by means of an annular flange on the head which overlaps and is secured to the end of the flue of a ring of fire-brick which fits within the said flue and covers the joint 95 between the boiler-head and flue.

In testimony that I claim the foregoing as my invention I affix my signature, in presence of two witnesses, this 17th day of September, A. D. 1903.

GRANVILLE KIMBALL.

Witnesses:

C. CLARENCE POOLE,
J. GERTRUDE BRYCE.