

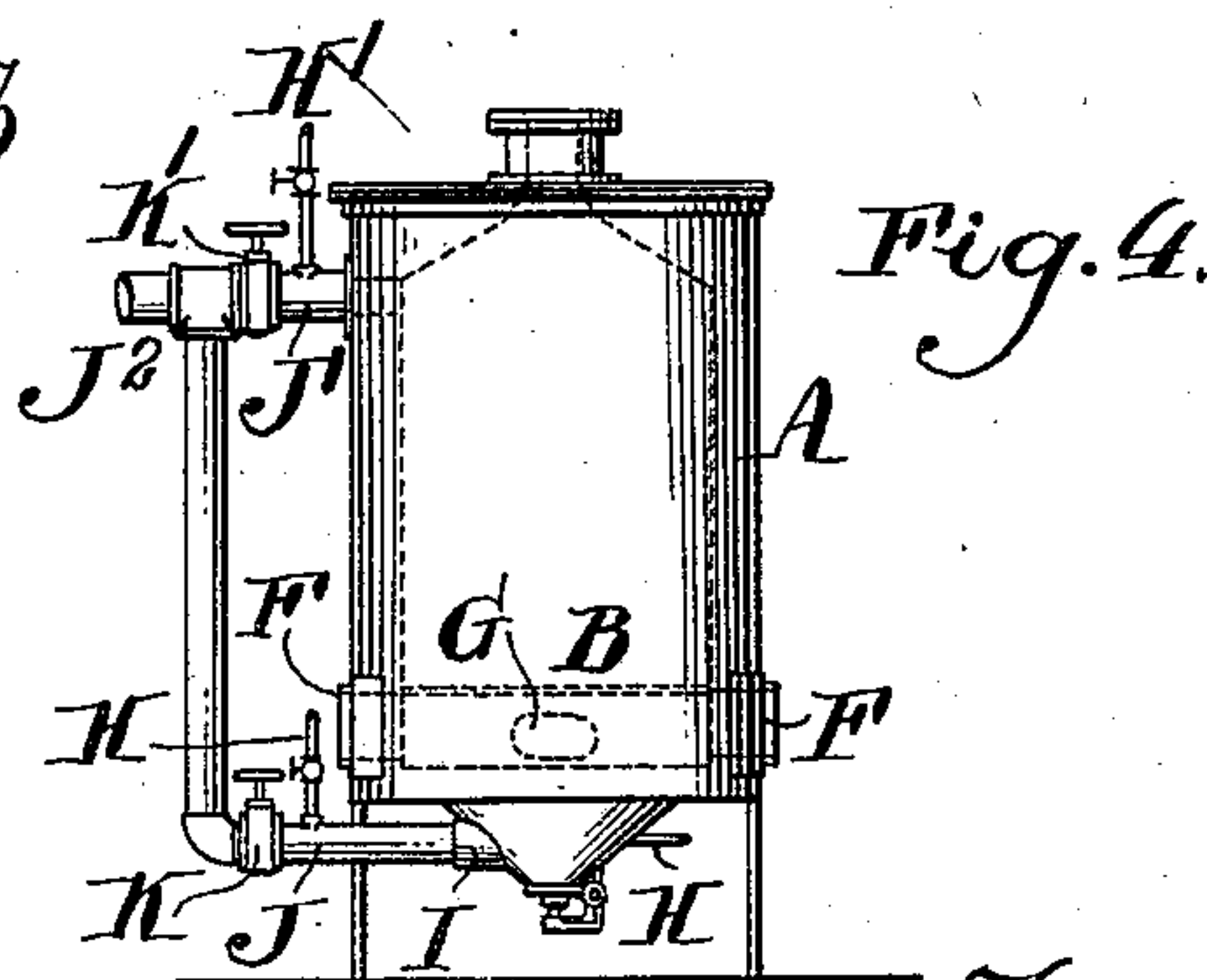
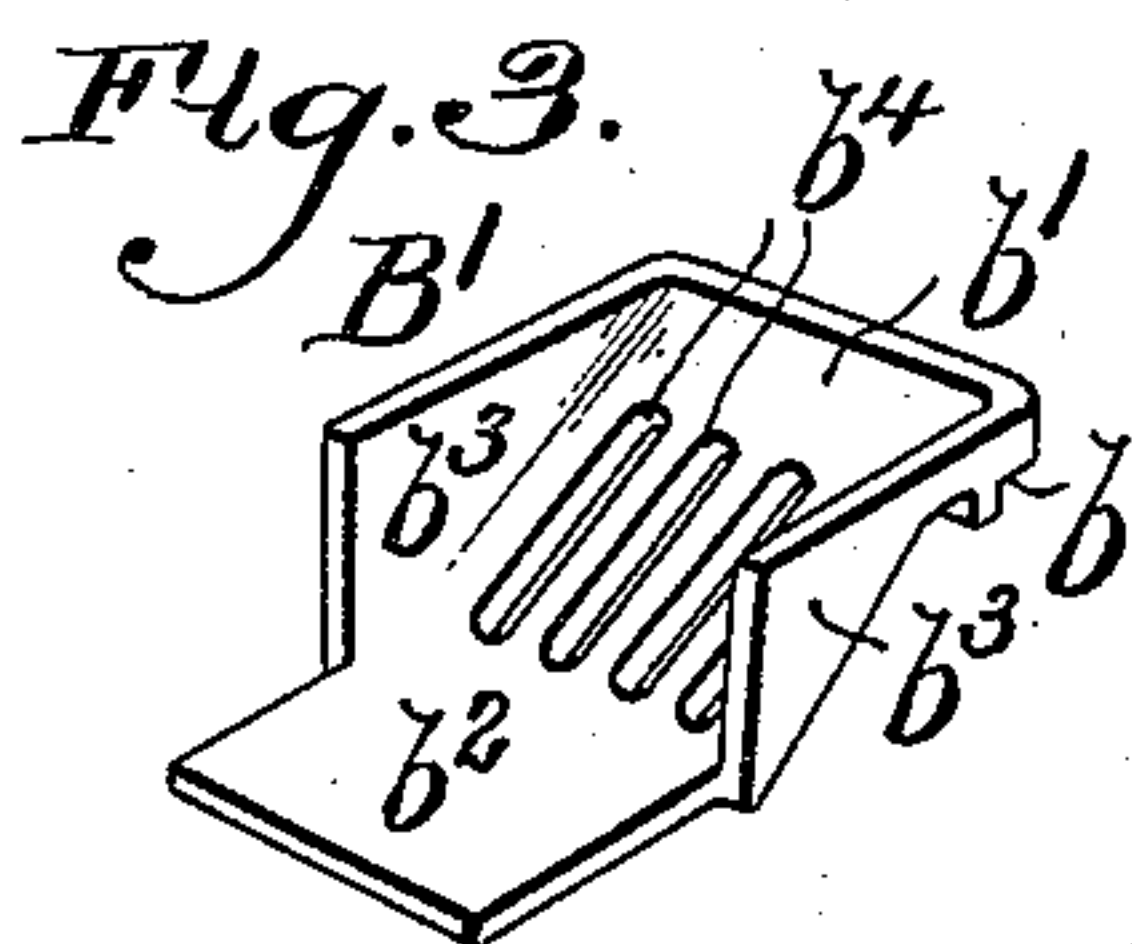
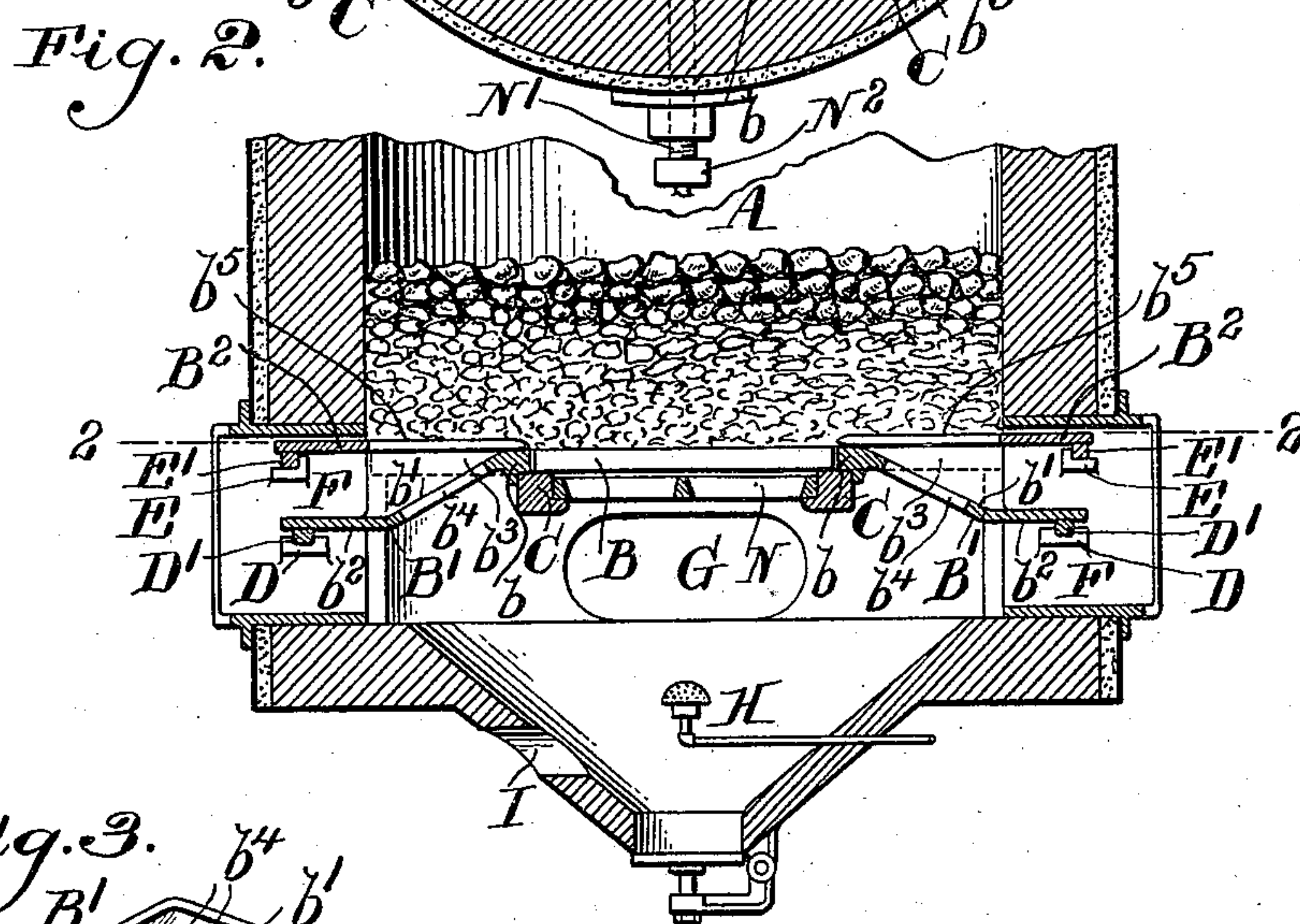
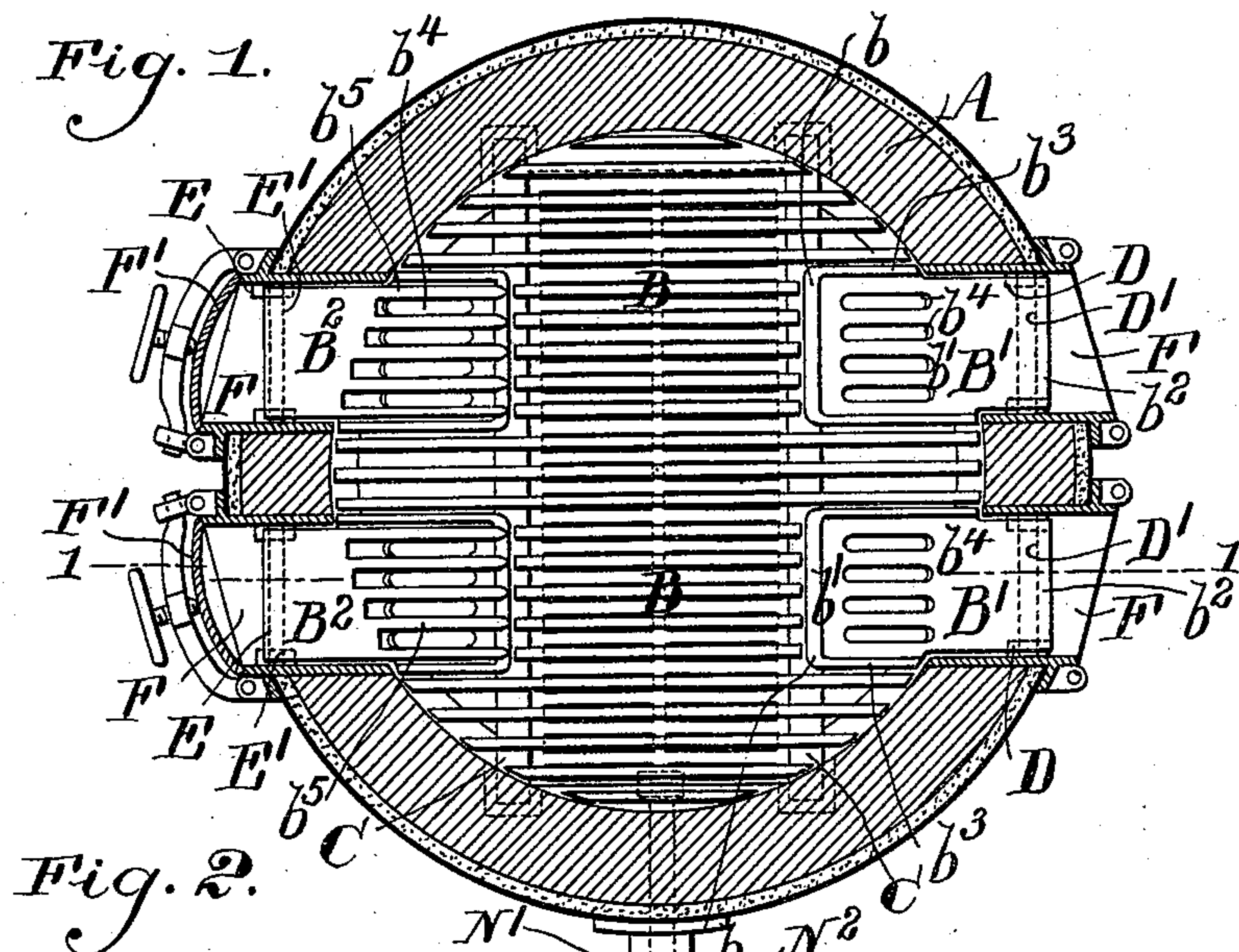
(No Model.)

5 Sheets—Sheet 1.

F. THUMAN.  
GAS GENERATOR.

No. 557,243.

Patented Mar. 31, 1896.



**WITNESSES:**

Henry Daring  
D. Stewart

**INVENTOR:**

Frederic Thuman  
by his atty  
Francis T. Chambers

(No Model.)

5 Sheets—Sheet 2.

F. THUMAN.  
GAS GENERATOR.

No. 557,243.

Patented Mar. 31, 1896.

Fig. 5.

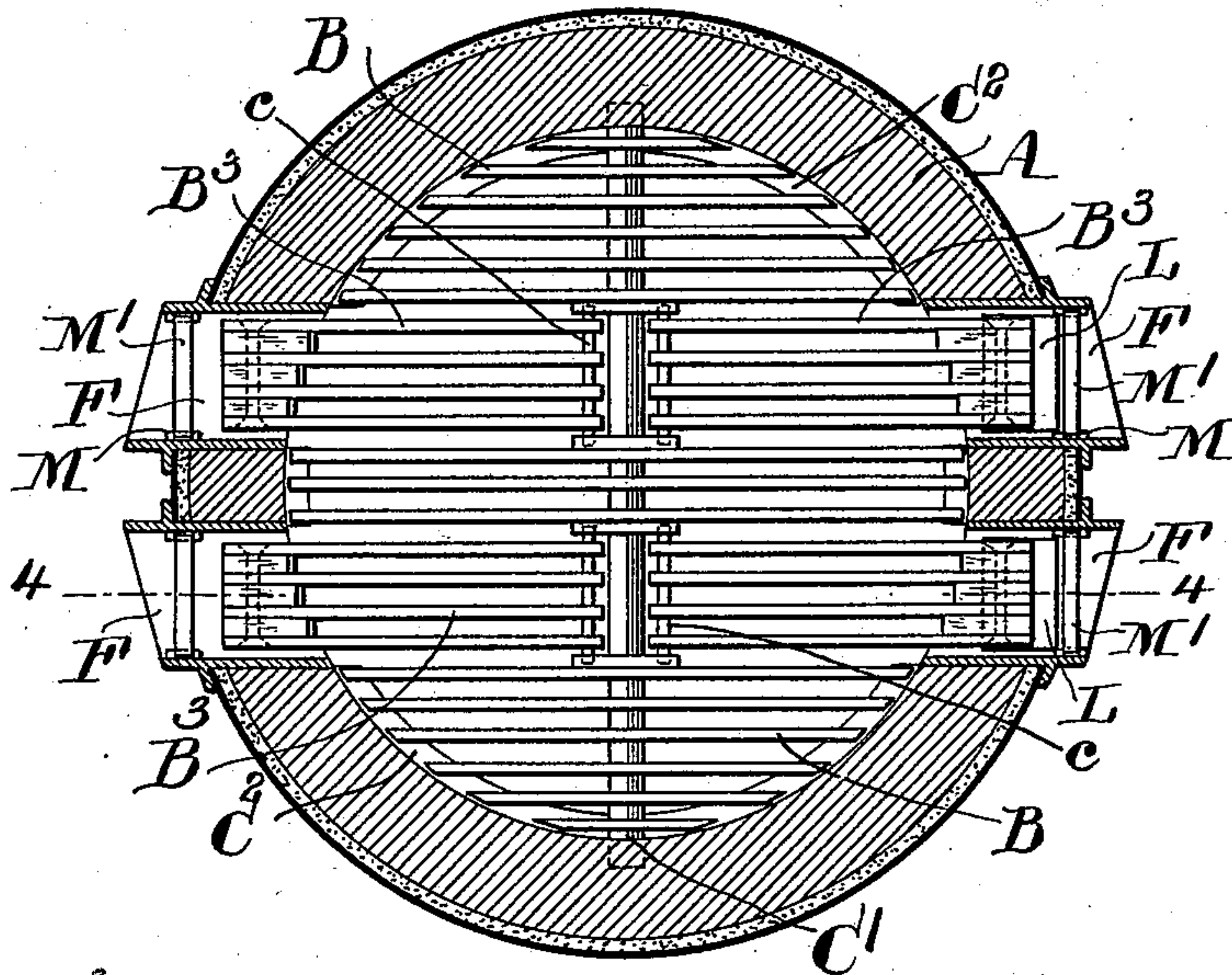
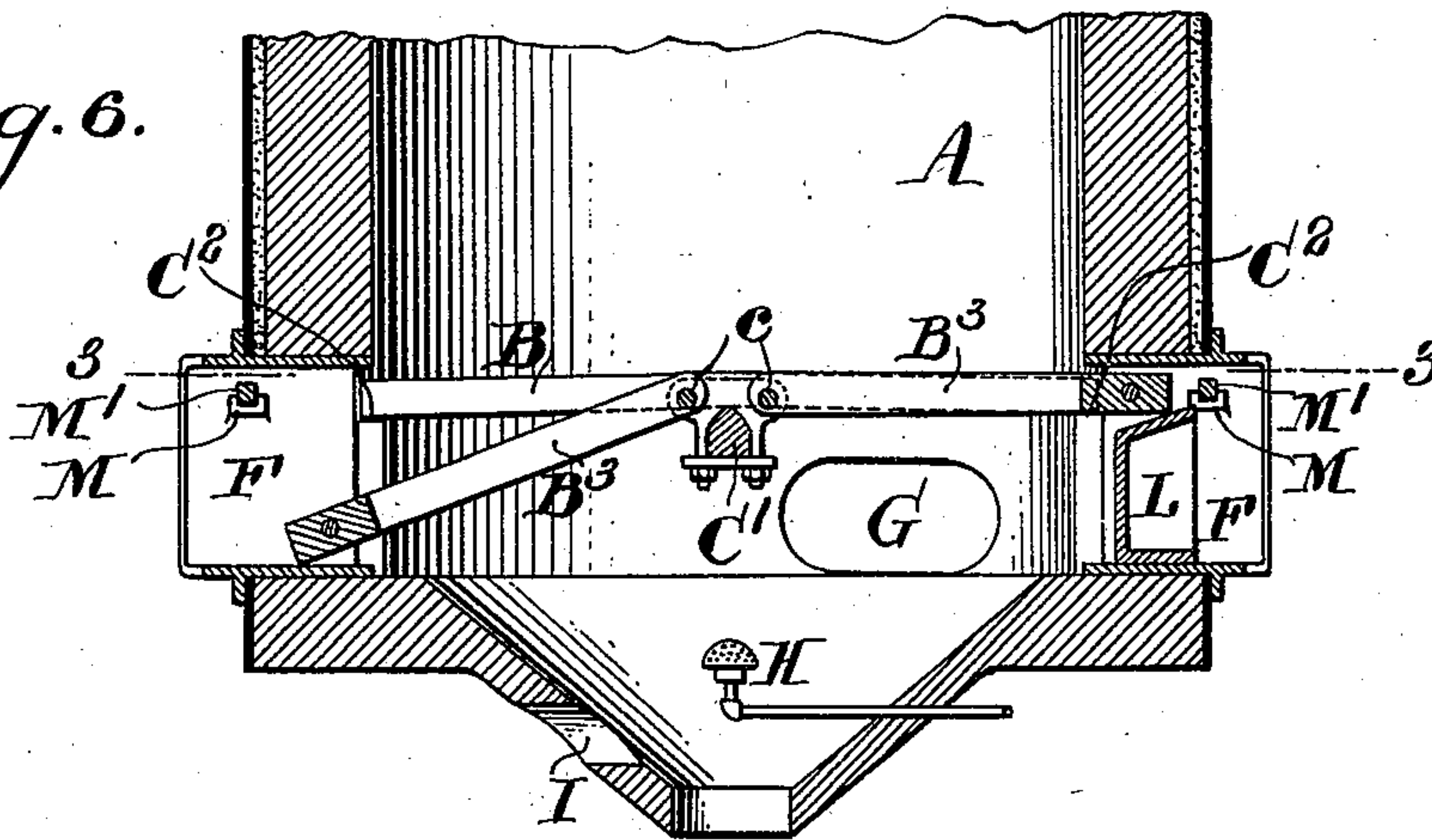


Fig. 6.



WITNESSES:  
Henry Drury  
Shaw &

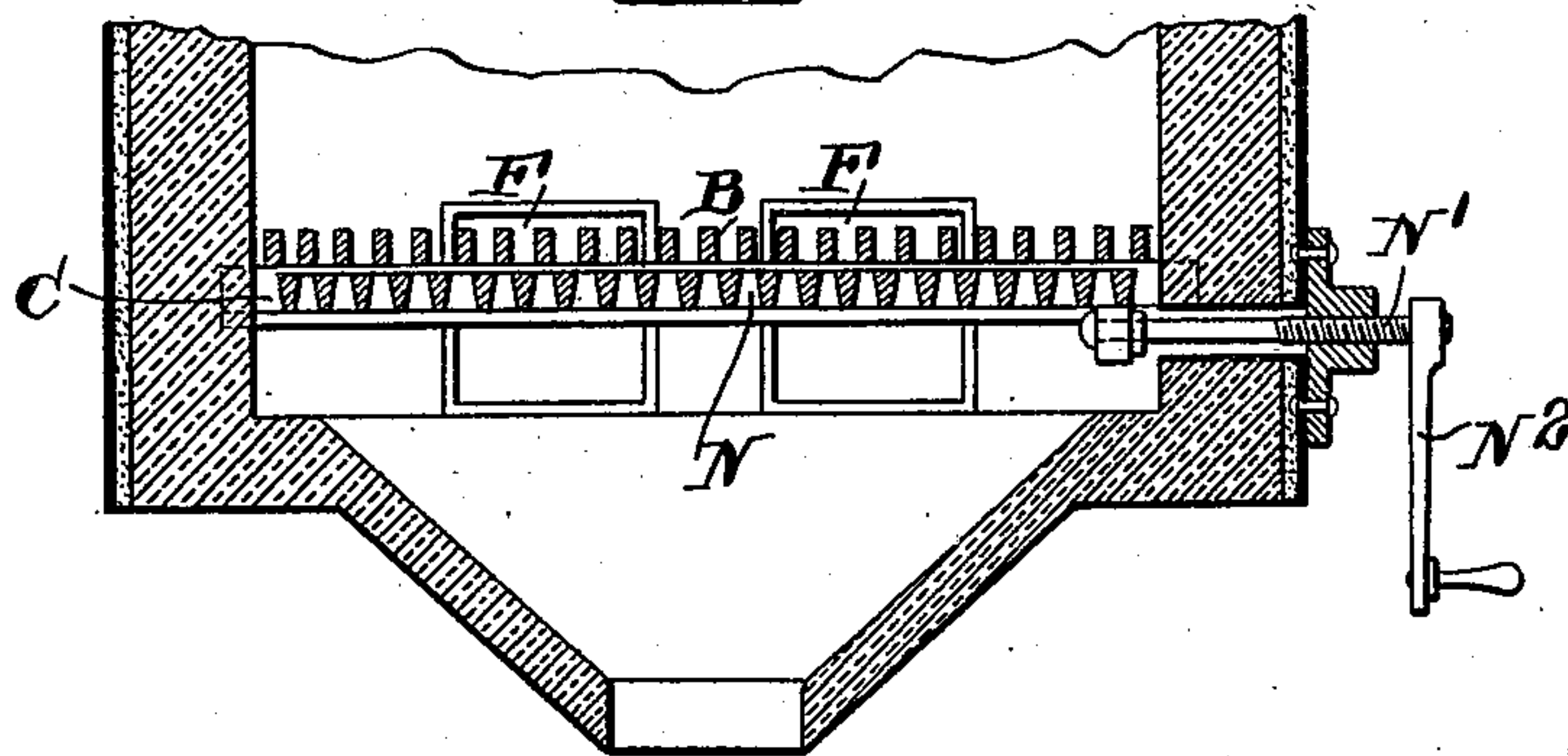
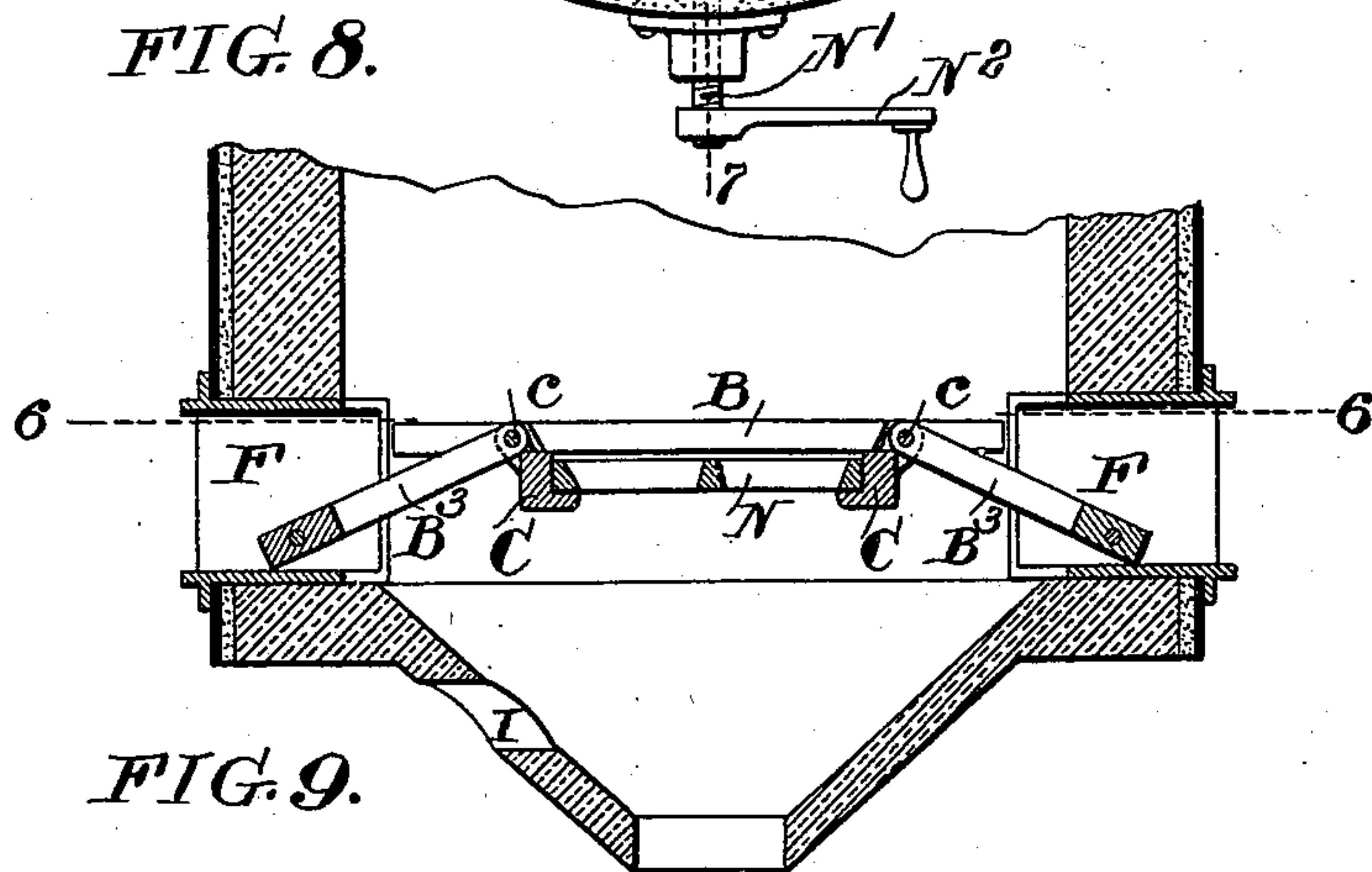
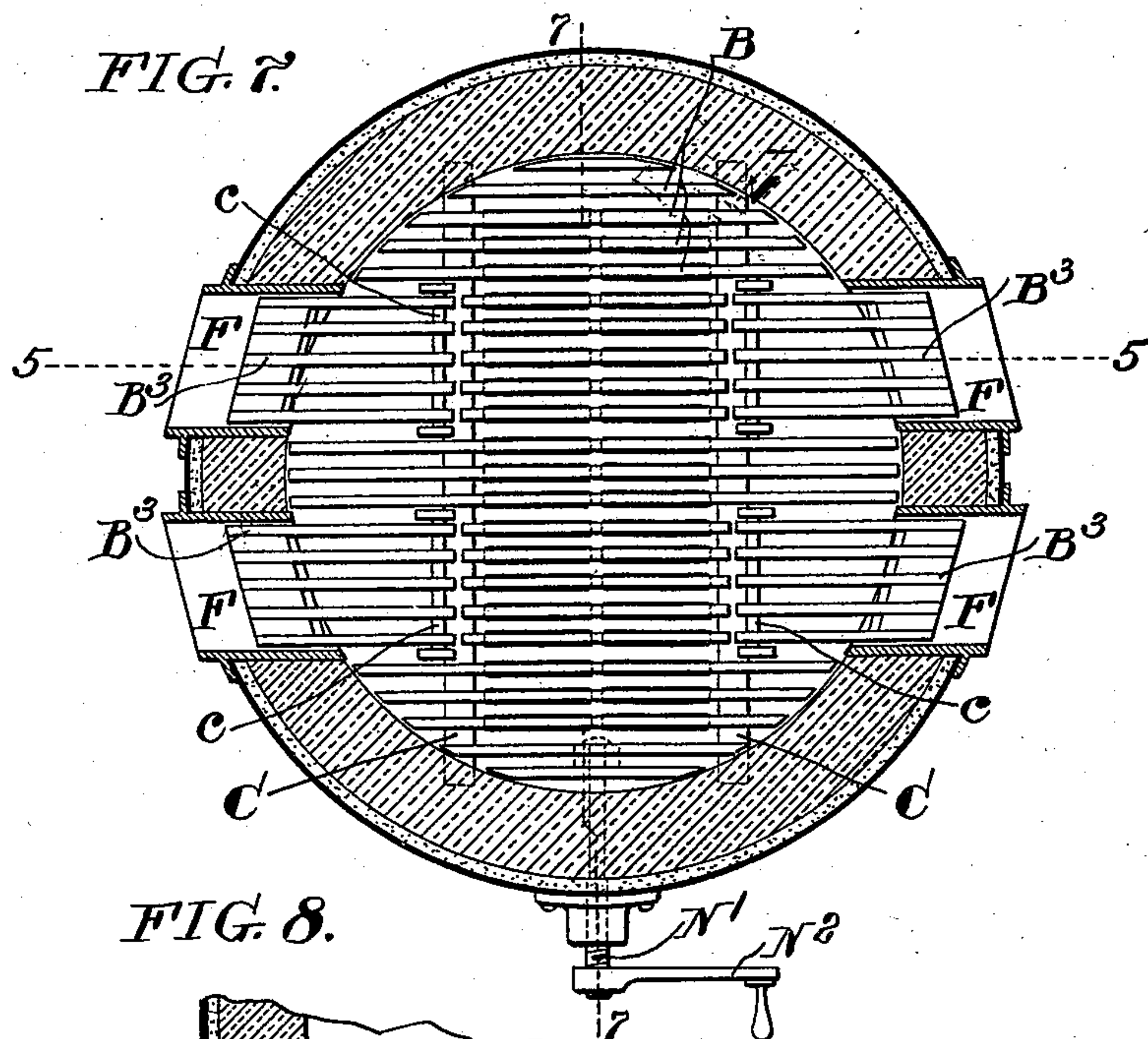
INVENTOR:  
Francis Thuman  
by his atty.  
Francis T. Chambers



F. THUMAN.  
GAS GENERATOR.

No. 557,243.

Patented Mar. 31, 1896.



WITNESSES:  
Henry D. Dwyer  
D. Kewat & Co.

INVENTOR:  
Frederic Thuman  
by his atty.  
Francis T. Chambers

(No Model.)

5 Sheets—Sheet 4.

F. THUMAN.  
GAS GENERATOR.

No. 557,243.

Patented Mar. 31, 1896.

FIG. 10.

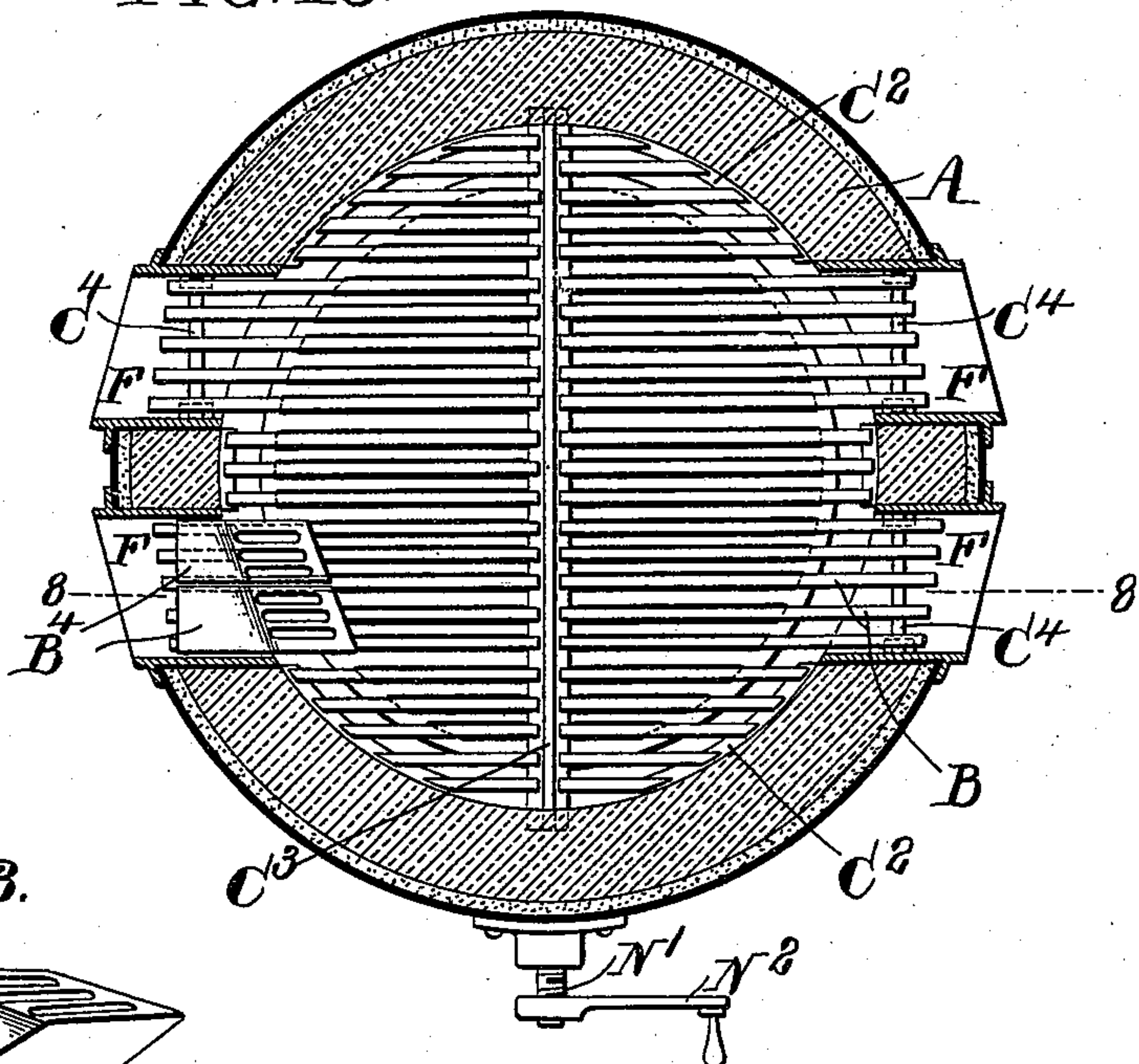


FIG. 13.

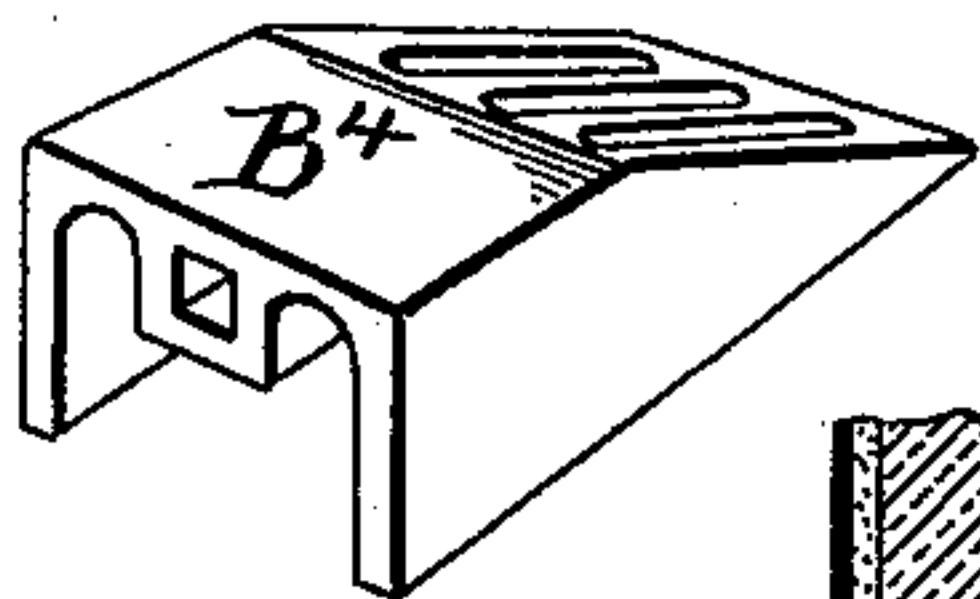


FIG. 11.

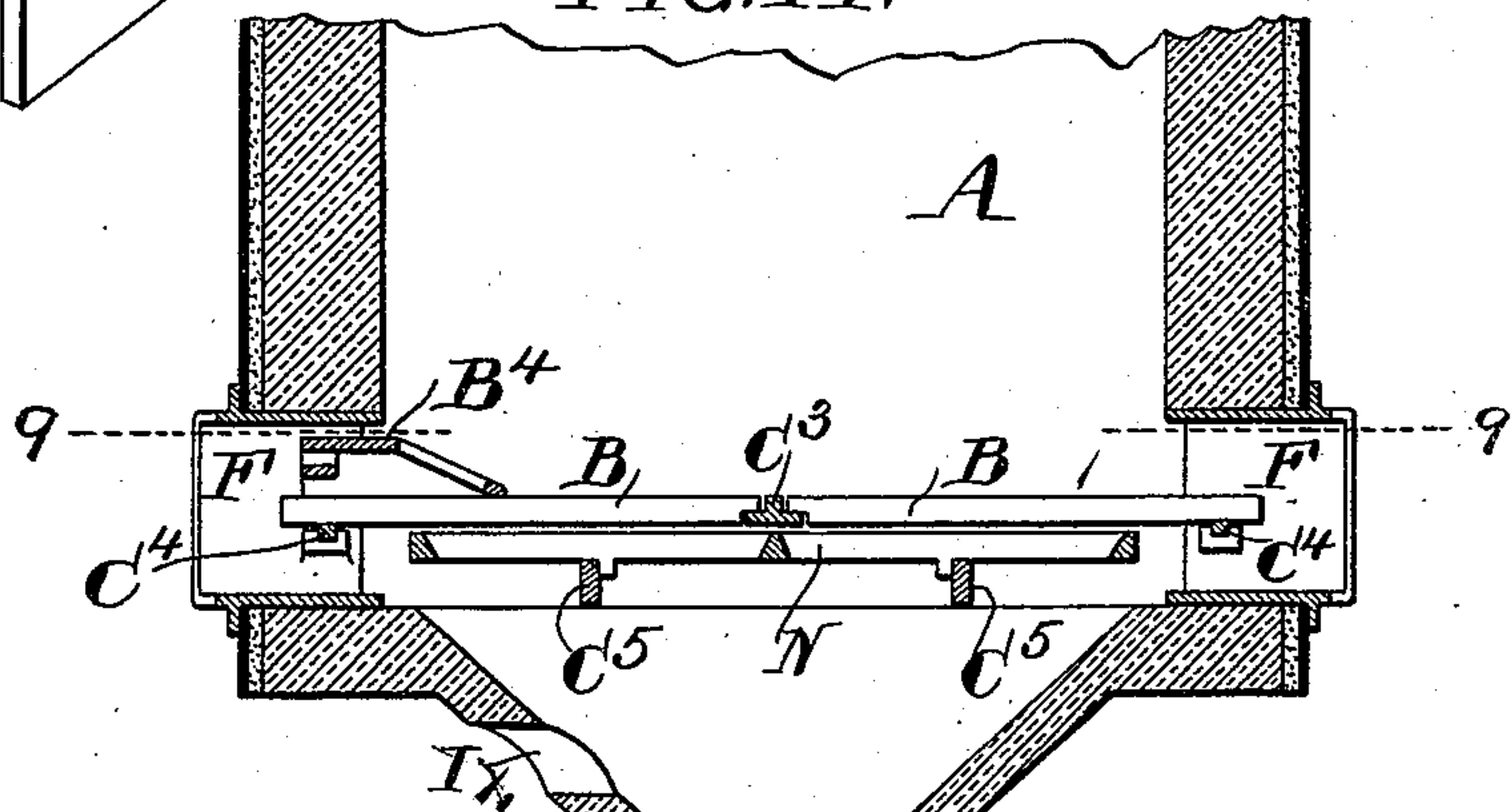
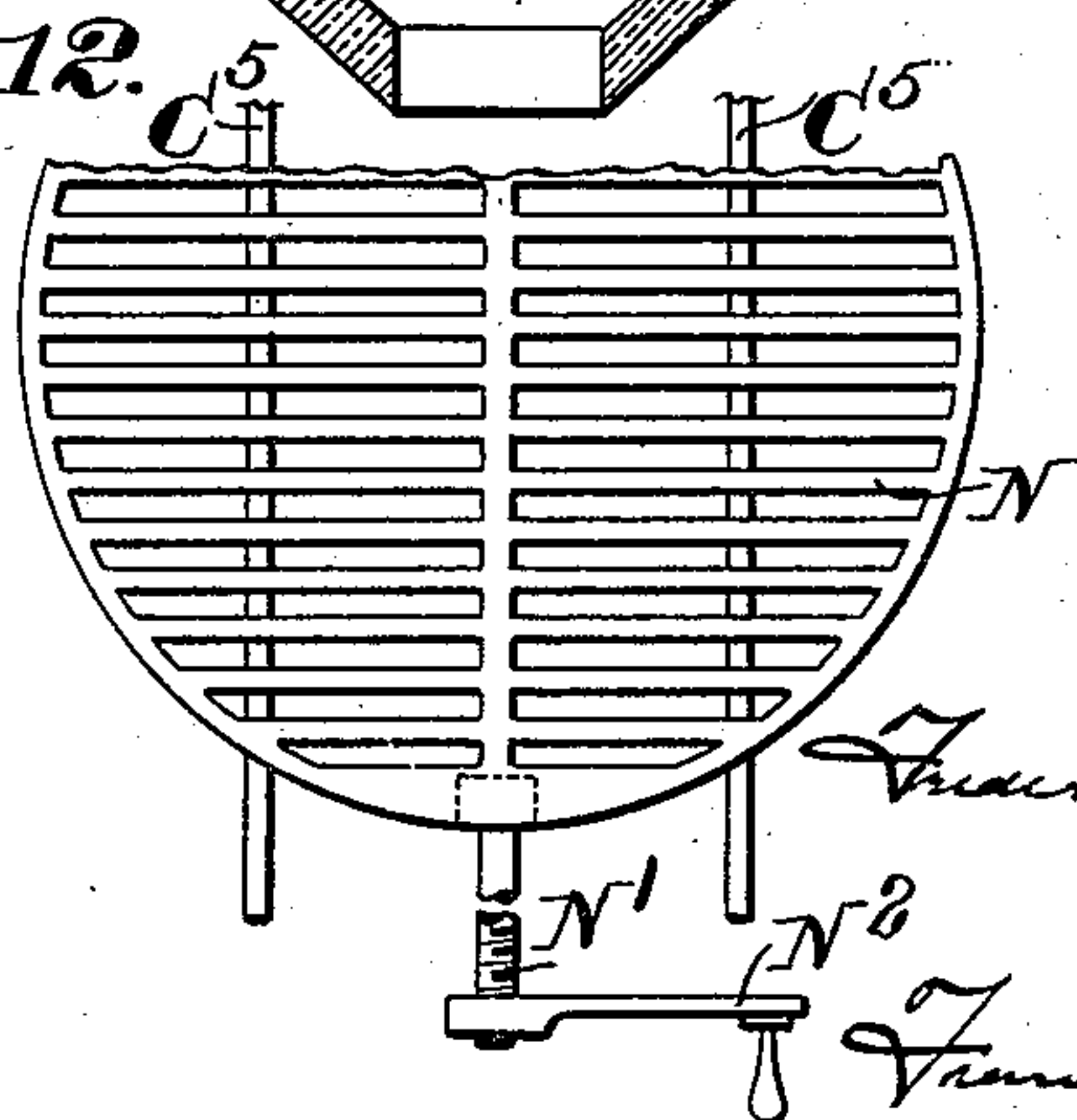


FIG. 12.



WITNESSES:

Henry Denny  
D. Hewat

INVENTOR:

Frederic Thuman  
by his atty  
Francis J. Chambers



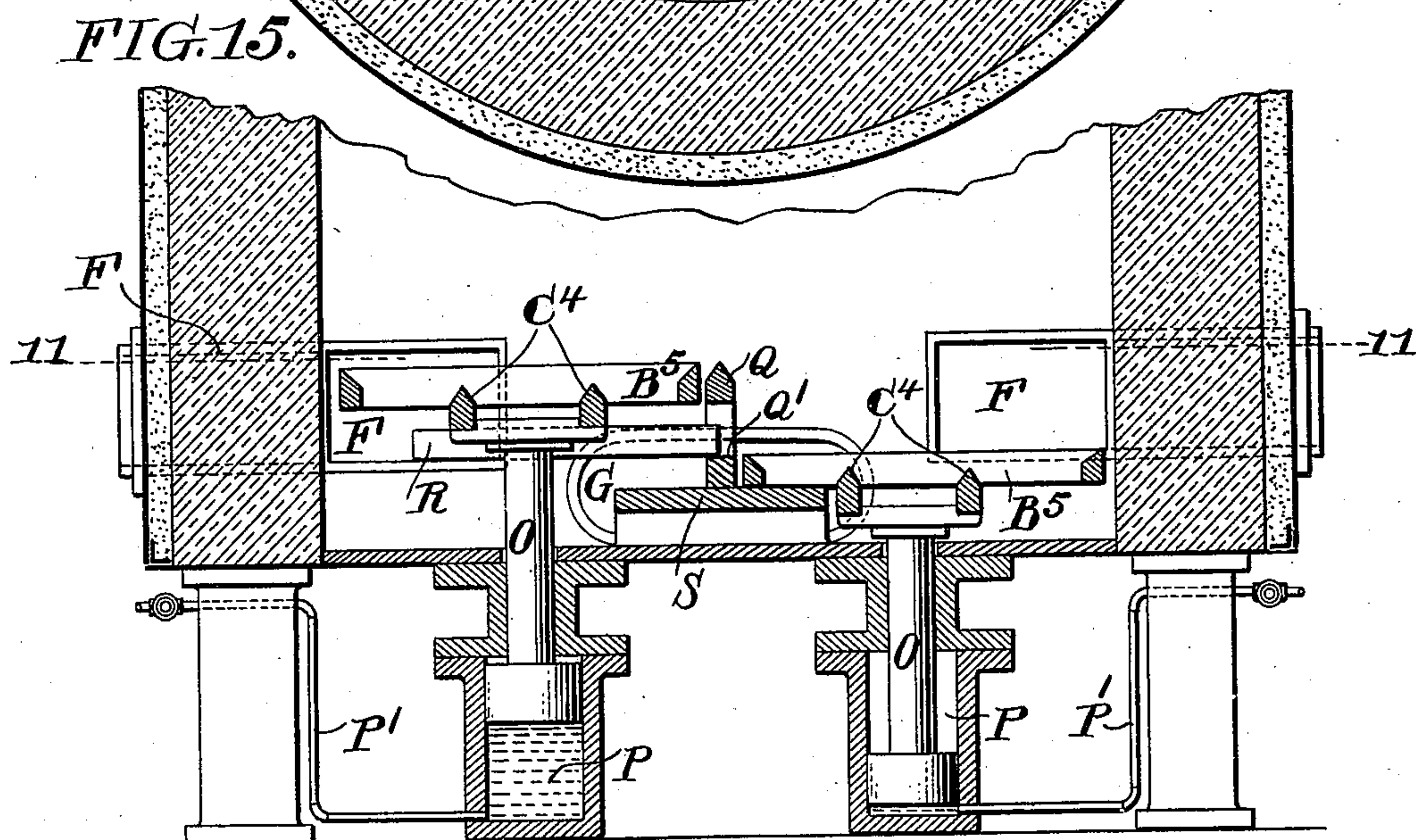
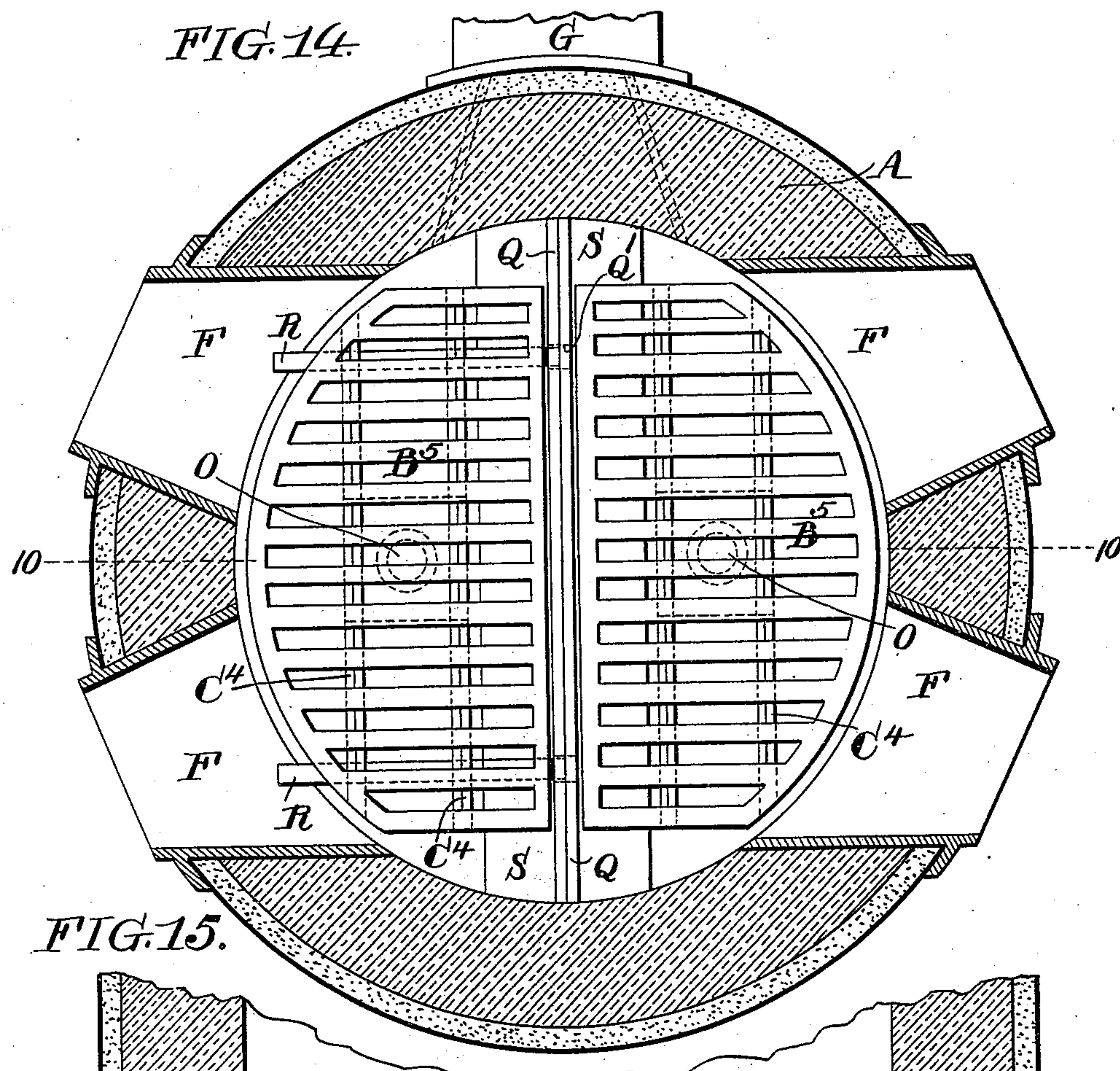
(No Model.)

5 Sheets—Sheet 5.

F. THUMAN.  
GAS GENERATOR.

No. 557,243.

Patented Mar. 31, 1896.



WITNESSES:

Henry D. Dwyer  
G. H. Swartz

INVENTOR:

Frederic Thuman  
by his atty  
Francis T. Chambers



# UNITED STATES PATENT OFFICE.

FREDERIC THUMAN, OF EVANSVILLE, INDIANA, ASSIGNOR TO HUMPHREY & GLASGOW, OF NEW YORK, N. Y., AND LONDON, ENGLAND.

## GAS-GENERATOR.

SPECIFICATION forming part of Letters Patent No. 557,243, dated March 31, 1896.

Application filed December 13, 1895. Serial No. 571,989. (No model.)

*To all whom it may concern:*

Be it known that I, FREDERIC THUMAN, a citizen of the United States, and a resident of Evansville, in the county of Vanderburg, in the State of Indiana, temporarily residing in London, England, have invented a certain new and useful Improvement in Gas-Generators, of which the following is a true and exact description, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to gas-generators of the kind in which gas is generated by passing air or steam through a previously-heated mass of carbonaceous fuel, and it has particular reference to the construction of the grates upon which the fuel mass is supported in the generator and to the combination of the grates with the generator.

As heretofore constructed generators of the kind referred to have been provided with cleaning-doors extending through the walls above the level of the grate-surface. Usually these doors open both above and below the grate-surface, so as to give access at the same time to the ash-chamber and to the top of the grate, access to the grate being necessary for the introduction of the cleaning-tools and the extraction of the clinker and ash. Much trouble has been found to ensue from this construction, particularly in water-gas generators, in which steam is from time to time reversed in its direction of passage through the fuel. The principal mischief is the tendency to fuse away the fire-brick lining of the generator immediately over the cleaning-doors, and this is caused by unequal distribution of the air-blast and steam and by the lodgment of fuel in the fire-door openings.

The object of my invention is to avoid the mischief and mischievous tendencies mentioned, and this I accomplish by supporting my grate normally substantially at the level of the top of the cleaning-doors, and at the same time so constructing the grate that it can be retracted or removed in such a manner as to give passage through the cleaning-doors to tools and clinker. It is not obviously necessary to move the entire grate-surface for this purpose, and I therefore preferably construct the grate in sections, some of which, registering with

the cleaning-doors, can be moved in such a way as to give the necessary opening through the doors to the top of the grate.

The further purpose of my invention is to provide a means of removing all the clinker and ash from the fuel-bed with the removal of the least possible amount of valuable fuel from the generator. As grates have heretofore been constructed large quantities of valuable fuel have been allowed to fall through the spaces of the grate-bars into the ash-chamber during the process of cleaning the fire and were subsequently withdrawn with the ash, thus decreasing the fuel economy. To avoid this, I have in my invention provided a means of closing at will the spaces between the grate-bars of the fixed portions of the grate. This I accomplish by means of a secondary movable grate or grid so constructed that its bars can be made to close the spaces of the upper primary grate during the period of cleaning the fire and can be retracted during the time that the generator is in action. Descriptions of this movable secondary grid are given in the accompanying specification.

Reference is now had to the drawings, which illustrate convenient and practicable constructions embodying my invention, and in which—

Figure 1 is a plan view of the lower part of a water-gas generator embodying my invention in what I believe to be its most convenient form and taken on the cross-sectional line 2 2 of Fig. 2; and Fig. 2 is an elevation of the same part of the apparatus, taken on the section-line 1 1 of Fig. 1. Fig. 3 is a perspective view of one of the pockets B' shown in Figs. 1 and 2. Fig. 4 is an elevation, on a small scale, of a water-gas generator having connections for the reversal of the steam. Fig. 5 is a plan view on the section-line 3 3 of Fig. 6, showing the bottom of a modified form of apparatus; and Fig. 6, an elevation on the section-line 4 4 of Fig. 5. Fig. 7 is a cross-section on line 6 6 of Fig. 8 of a modified construction, Fig. 8 being a section on line 5 5 of Fig. 7, and Fig. 9 a section on line 7 7 of Fig. 7. Fig. 10 is a section on line 9 9 of Fig. 11 of another modification, Fig. 11 being a section on line 8 8 of Fig. 10, and Figs. 12 and 13 details of construction. Fig. 14 is



a section on line 11 11 of Fig. 15 of still another modification, and Fig. 15 is a section on line 10 10 of Fig. 14.

A in each of the figures indicates the generator, and in Fig. 4 the generator is shown as provided with air-blast inlet G situated below the grate, (indicated at B.) Gas-take-off pipes lead from both the bottom and top of the generator, and are indicated at J and J', valves K and K' being provided in each pipe and both pipes connecting with a common take-off J<sup>2</sup>.

H and H' indicate steam-pipes connecting, respectively, with the conduits J and J' and by which steam can be turned in at the bottom or top of the generator. This is the type of apparatus in which my improvements are peculiarly valuable; but it will be understood that my invention is also adapted for use and is to be advantageously used with water-gas generators in which the air and steam is passed through the fuel only in one direction and also with fuel-gas generators.

F, F', &c., indicate cleaning-doors leading into the ash-chamber below the normal working position of the grate, and which doors, as I have above explained, usually extend for some distance above the grate to give passage to cleaning-tools and for the removal of clinker and ash.

In Figs. 1 and 2 the grate is shown as made up of parts or sections B, B<sup>2</sup>, and B', in Figs. 5, 6, 7, 8, and 9 as made up of the sections B and B<sup>3</sup>, in Figs. 10 and 11 of sections B and B<sup>4</sup>, and in Figs. 14 and 15 of sections B<sup>5</sup>, B in all cases indicating a fixed grate-section, while the portions marked B', B<sup>2</sup>, B<sup>3</sup>, B<sup>4</sup>, and B<sup>5</sup> are movable.

The normal level of the grate, at least when it registers with the cleaning-doors, and preferably throughout, should in all cases be substantially that of the top of the cleaning-doors F, so that in operation the fuel-charge lies above the level of the tops of these doors, and in order to permit of the insertion of cleaning-tools and the extraction of clinker and ash the grate must be retractable to such an extent as will secure an opening of the required size for this purpose through the doors and onto the upper surface of the grate. I accomplish this in the construction shown in Fig. 1 by making the portion of the grate indicated at B fixed, while the portions registering with the cleaning-door are made retractable. As shown, I provide supporting-bars C C, extending across and below the stationary grate-surface B, and on these bars I rest the inner ends of grate-sections B<sup>2</sup>, the outer ends of which extend into the cleaning-doors and are supported on cross-bars E' resting on ledges E formed in the sides of the door-openings. Of course any convenient means may be employed for supporting the outer ends of the sections B<sup>2</sup>; but the use of removable cross-bars E', as shown, is desirable, because by drawing these bars backward out of the lugs E the outer ends of the sections B<sup>2</sup> are

allowed to fall down, giving at once access to the fire above the grate over the top of the sections B<sup>2</sup> through the door-openings. The portions of the grate-sections B<sup>2</sup> which extend within the generator-chamber are made up of grate-bars, as indicated at b<sup>5</sup>, while the outer portion, which normally lies in the door-opening, should consist of a flat plate, as shown.

When, as in the construction shown in Figs. 1 and 2, I make the movable grate-section removable, it is advisable to supply supplemental means for sustaining the portion of the charge normally lying above the removable sections when they are withdrawn, and what I may call the "pockets" B' are provided for this purpose. These pockets rest at their inner ends b upon the cross-bars C and at their outer ends b<sup>2</sup> on cross-bars D', supported on ledges D formed or fixed to the sides of the cleaning-doors. The bottoms b' of the box slope downward, as shown, and are preferably provided with slots, as shown at b<sup>4</sup>, and with side walls, as indicated at b<sup>3</sup>. It will be obvious, of course, that these pockets will support the fuel when the sections B<sup>2</sup> are withdrawn and that cleaning-tools can readily be passed through the door over the tops of the pockets and clinker and ash removed from the grate through them. After the grate has been properly cleaned the bars E' are replaced in position and the sections B<sup>2</sup> can then be driven over the bars to their normal operative position, as indicated in Fig. 2. The portion of the fuel lying in the pocket below the removable section being withdrawn before the doors F' are secured over the openings, it will be seen that the sloping bottom b' of the pockets will guide the front ends of the movable sections to position, while the side walls b<sup>3</sup> will also serve as guides, preventing a lateral displacement. It will also be evident that as the air has free access to the back of the pocket B', and thence to the under side of the movable sections B<sup>2</sup>, the draft will be evenly distributed over the entire grate-surface even if the slots b<sup>4</sup> are not provided in the bottoms of the pockets.

N indicates a device for closing the openings through the grate while it is being cleaned. It is a grid-like device having openings corresponding to those of the grate and is movable by means of a screw N' and handle N<sup>2</sup> upon slides, here formed on bars C, so as to close the grate-openings while the operation of cleaning is going on and so prevent the loss of valuable fuel through the grate.

G in all the figures indicates the air-blast opening below the grate, and H in Figs. 2 and 6 indicates a steam-pipe leading below the grate.

I is an opening in the ash-chamber into which a gas-take-off pipe J may lead. This take-off would normally be higher up in the ash-chamber.

Referring to Figs. 5 and 6, B, as in the other figures, indicates the stationary por-



tions of the grate, while  $B^3$  indicates the various retractable sections of the grate. In this construction a single transverse supporting-bar  $C'$  extends across the middle of the generator, and to it are clamped hinge-bars  $c$  by means of a clamp such as shown, the inner ends of the section  $B^3$  being hinged to the bars  $c$ , while their outer ends extend into the cleaning-openings  $F$ . In operative position the outer ends of the sections  $B^3$  are thrust upward against the top of the cleaning-door openings, as shown at the right-hand side of Fig. 6, wedge-blocks  $L$  being a convenient means of holding them firmly in this position. On the withdrawal of these wedge-blocks or other supporting devices the outer ends of the sections  $B^3$  will fall down to the bottom of the openings  $F$ , as indicated at the left-hand side of Fig. 6, permitting the entry of tools and the withdrawal of clinker. The entire section of grate on each side of the cross-bar  $C'$  may be hinged, but it will be sufficient to hinge only those portions which register with the cleaning-doors, as shown in the drawings.

$M'$  indicates a movable cross-bar in the upper portion of the cleaning-door, supported on brackets  $M$ , the function of the bar in this construction being to afford a rest to the cleaning-tools.

Referring next to the modification shown in Figs. 7, 8, and 9, it will be seen that stationary portion  $B$  of the grate is supported upon two cross-bars  $C$ , as in Figs. 1 and 2. The movable portions of the grate (indicated at  $B^3$ ,  $B^3$ , &c.) are substantially like the similar portions indicated in Figs. 5 and 6 by the same letter, but rather shorter, being hinged to rods  $c$  secured to the two cross-bars  $C$ . An advantage of this construction is that it permits of the use of the grate-closing device  $N$  shown and described in connection with Figs. 1 and 2, such a use being obviously inconvenient, if not impracticable, with the construction indicated in Figs. 5 and 6.

Referring next to the construction shown in Figs. 10 to 13, in this modification I have indicated stationary grate-sections  $B$  constructed and placed with regard to the cleaning-doors  $F$  substantially as is usual with the grates heretofore used, the grate-bars being supported on a central cross-bar  $C^3$  upon a flange extending out from the body of the generator and indicated at  $C^2$ , while the portions extending into the cleaning-bars are supported on cross-bars  $C^4$ . The advantage of my invention is imparted to this construction of grate by the use in connection with it of retractable portions  $B^4$ ,  $B^4$ , &c., which are thrust in through the openings  $F$  over the top of the grate-bars, forming in themselves at their outer ends a supplemental series of grate-bars which incline upward from the level of the stationary portion of the grate to the top of the cleaning-bars, as shown in the drawings. While I much prefer to raise the whole level of the grate to the top of the cleaning-

bars, the use of these retractable grate-sections  $B^4$  permits the advantage of my invention to be secured in great measure without changing existing apparatus.

Obviously the use of the unbroken stationary grate-surface permits of extended use of the grate-closing device  $N$ , which in this construction can practically close the entire grate, the sliding grid being here shown as supported on cross-bars  $C^5$ .

In Figs. 14 and 15 I have shown still another modification embodying my invention, the grate-surface being here divided into two sections  $B^5$ ,  $B^5$ , each supported upon cross-bars  $C^4$ , which in turn rest upon the top of vertically-movable supports indicated at  $O$  and here constituting piston-rods extending into the cylinders  $P$  and provided with pistons situated inside of the cylinders,  $P'$  indicating conduits through which fluid under pressure is introduced into the cylinders or permitted to flow out therefrom, with the result of either raising or lowering the grate-section resting on the rod  $O$  belonging to the cylinder which is in operation. In the lower position, as shown at the right-hand side of Fig. 15, the grate-section is lowered to the bottom of the cleaning-bar  $F$ , and a cross-bar  $S$  may be conveniently supplied for sustaining the weight of the grate-bar section at that point. On the left-hand side of Fig. 15 the grate-bar section  $B^5$  is shown as elevated to the top of the cleaning-opening, and in order to support it there independently of the pressure in the cylinder  $P$ , I have shown cross-bars  $R$  resting at one end of the bottom of the cleaning-bar  $F$  and at the other end in slots  $Q'$ , formed in a cross-bar  $Q$ , which lies across the center of the generator between the two grate-sections  $B^5$ . Any other suitable means can be employed for lowering or lifting the portions of this form, such as steam-power, screws, or a combination of levers. In this modification of my invention it is obvious that the closing device previously referred to as  $N$  will not be necessary, as the grate or portions of the grate lowered to be cleaned will rest substantially upon the bottom of the ash-chamber, thus making it impossible for any of the fuel to fall through the bars. It offers the advantage of allowing one section of the grate to be lowered at a time. Thus the inner portion of the lowered section is as accessible for the purpose of removing clinker as the outer portion adjacent to the cleaning-doors.

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

1. In combination with a gas-generator having cleaning-doors as  $F$ , a grate situated in said generator and having the portions of its surface which correspond with the cleaning-openings normally flush with the tops thereof but retractable therefrom in order to give access to the top of the grate through said cleaning-openings.



2. In combination with a gas-generator having cleaning-doors F, a grate normally supported at or about the level of the tops of said doors and arranged to be retractable below the level of the door-tops in order to give passage to cleaning-tools and clinker.

3. In combination with a gas-generator having cleaning-doors F, a grate normally supported at or about the level of the tops of said doors and having sections thereof retractable as described, to give passage to cleaning-tools and clinker between the grate and the tops of the doors.

4. In combination with a gas-generator having cleaning-doors F, a grate normally supported at or about the level of the tops of said doors and having retractable sections, the inner ends of which are sustained at said level by fixed supports, and removable supports for the outer ends of said sections whereby said outer ends can be dropped at will to a lower level.

5. In combination with a water-gas generator having cleaning-doors as F, a grate having a fixed portion B supported at or about the level of the tops of the doors and movable portions registering with the doors and capable of being retracted to admit the withdrawal of clinker from the grate.

6. In combination with a water-gas generator having cleaning-doors as F, a grate-section B supported at or about the level of the tops of the doors and grate-sections B<sup>2</sup> adapted to be removed and inserted through the cleaning-doors.

7. In combination with a water-gas generator having cleaning-doors as F, a grate-section B supported at or about the level of the tops of the doors, grate-sections B<sup>2</sup> adapted to be removed and inserted through the cleaning-doors, and pockets B' situated below said sections B<sup>2</sup> and adapted to support the fuel when said sections are withdrawn.

8. In combination with a water-gas generator having cleaning-doors as F, a grate-section B supported at or about the level of the tops of the doors, grate-sections B<sup>2</sup> adapted

to be removed and inserted through the cleaning-doors and pockets B' having inclined bottoms b' extending up to or near the level of the fixed grate-section, situated below said sections B<sup>2</sup> and adapted to support the fuel when said sections are withdrawn.

9. In combination with a water-gas generator having cleaning-doors as F, a grate-section B supported at or about the level of the tops of the doors, grate-sections B<sup>2</sup> adapted to be removed and inserted through the cleaning-doors, and pockets B' having inclined bottoms b' extending up to or near the level of the fixed grate-section, and side walls b<sup>3</sup> extending to or about the same level.

10. In combination with a water-gas generator having cleaning-doors as F, a grate-section B supported at or about the level of the tops of the doors, grate-sections B<sup>2</sup> adapted to be removed and inserted through the cleaning-doors, removable supports as E' adapted to support the rear of the sections B<sup>2</sup> and pockets as B' adapted to support and guide to position the inner ends of said sections.

11. In combination with a water-gas generator having a grate and cleaning-doors F for the removal of clinker and ash from the top of said grate, a movable grid situated below the grate and adapted to open or close the grate-openings at will.

12. In combination with a gas-generator having cleaning-doors as F, a grate situated in said generator and having the portions of its surface which correspond with the cleaning-openings normally flush with the tops thereof but retractable therefrom in order to give access to the top of the grate through said cleaning-openings, and a movable grid situated beneath all or a portion of the grate whereby the grate-openings can be opened or closed at will.

London, December 2, 1895.

FREDERIC THUMAN.

Witnesses:

WILLIAM SKEATE,  
A. W. LOVELL.