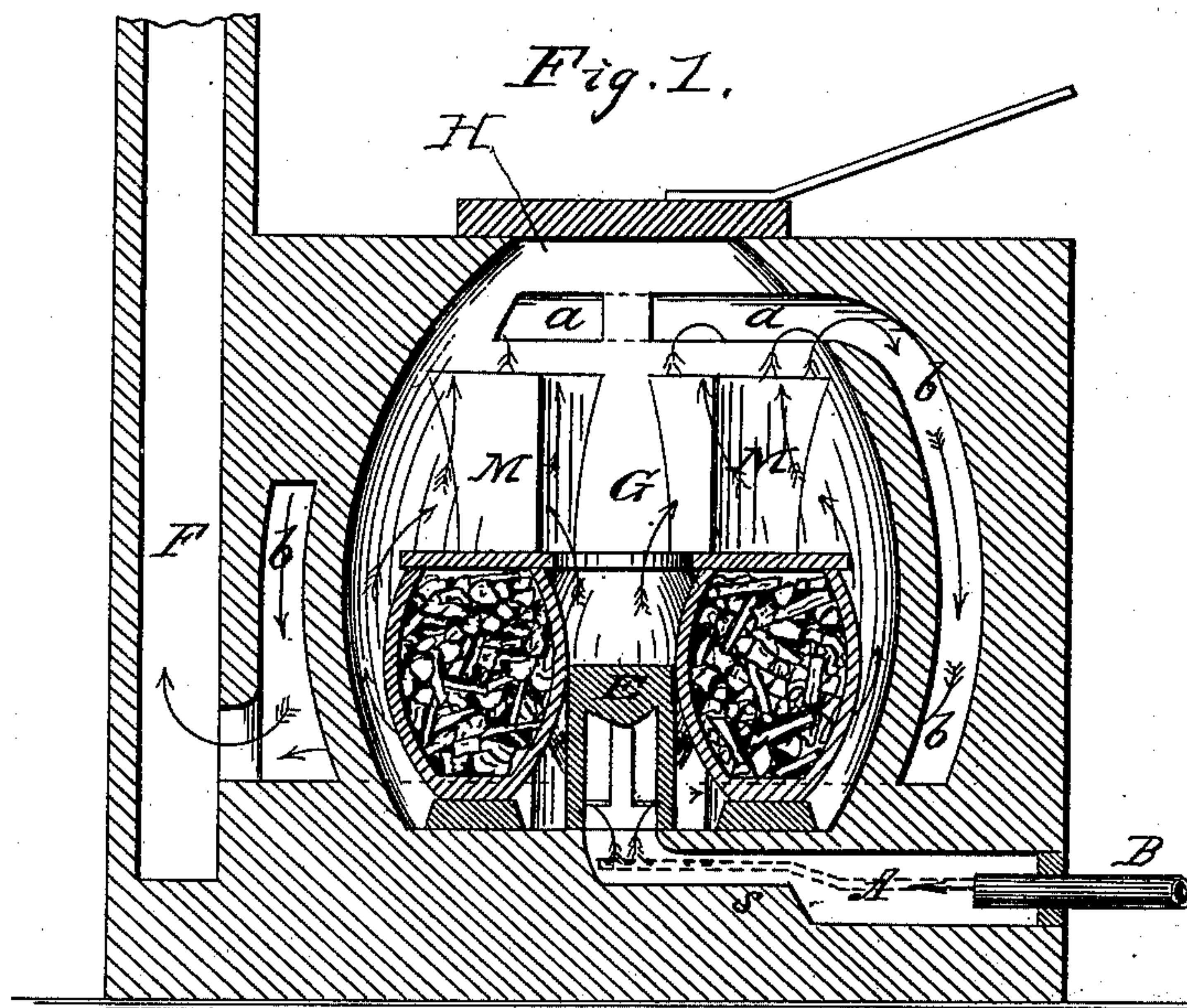
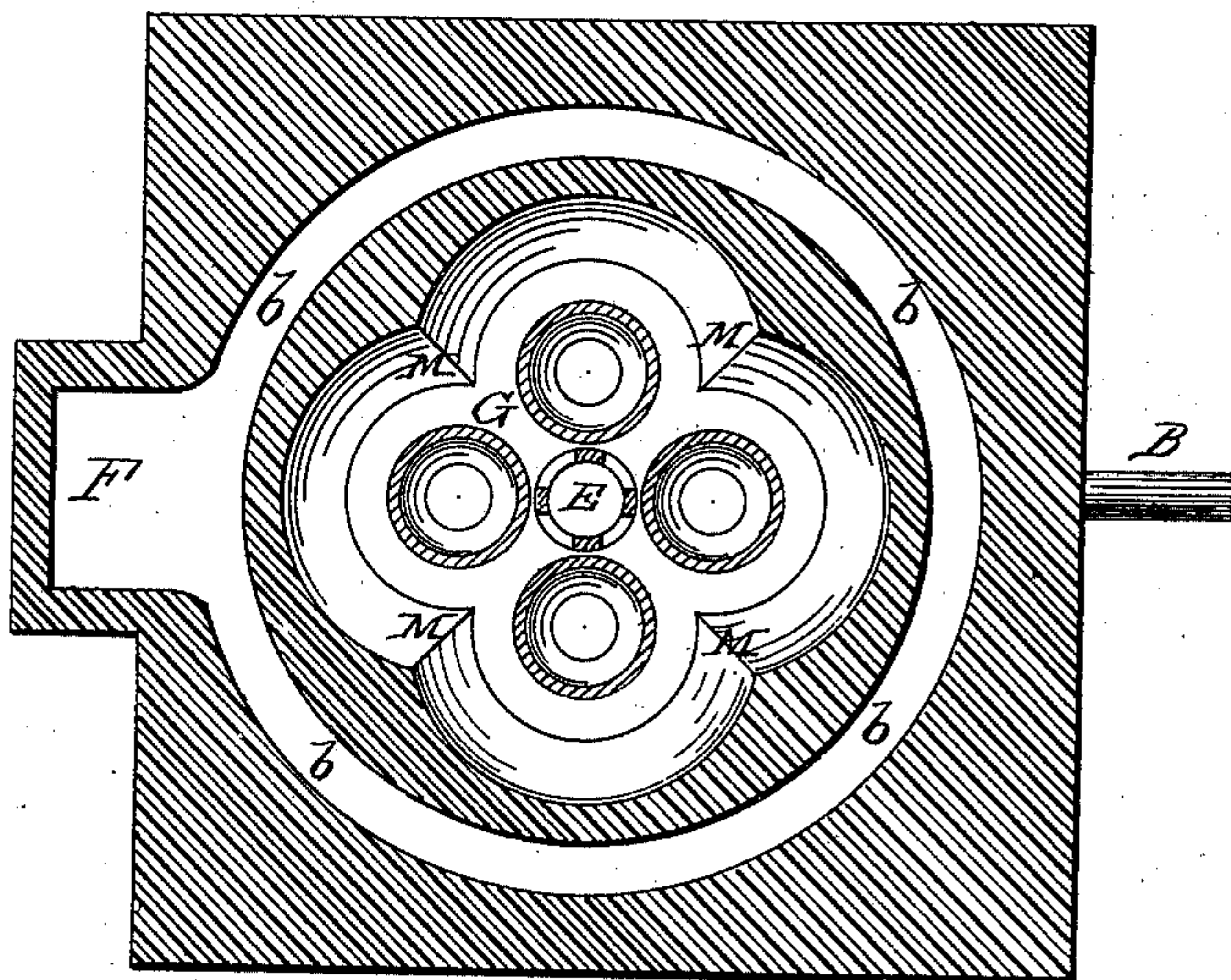
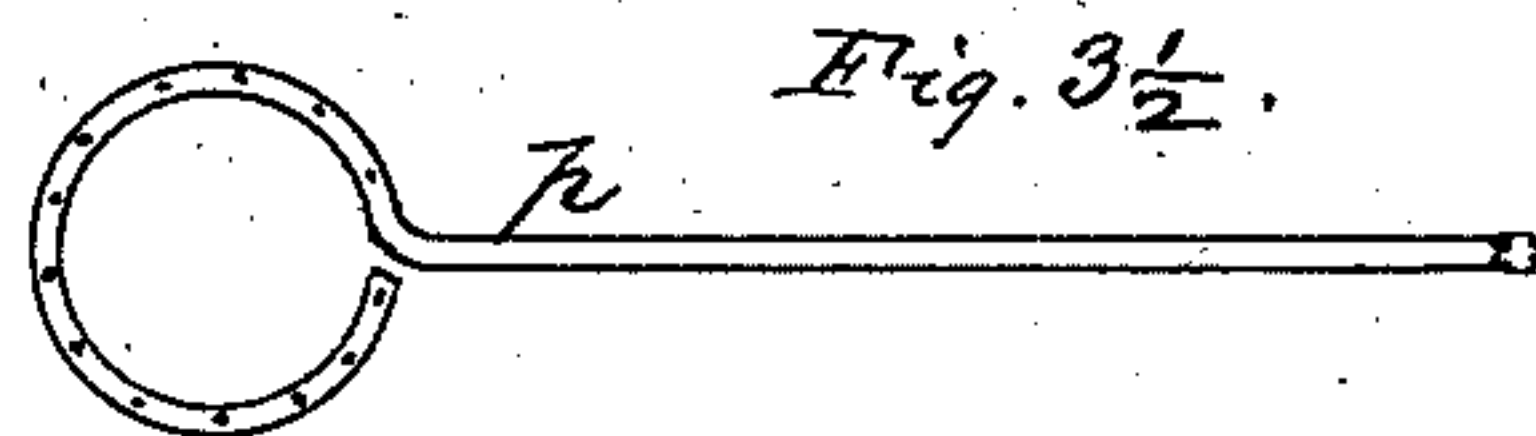


R. S. ROBERTSON.  
Hydrocarbon Furnace.  
No. 216,459. Patented June 10, 1879.



*Fig. 2.*



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Fig. 3.

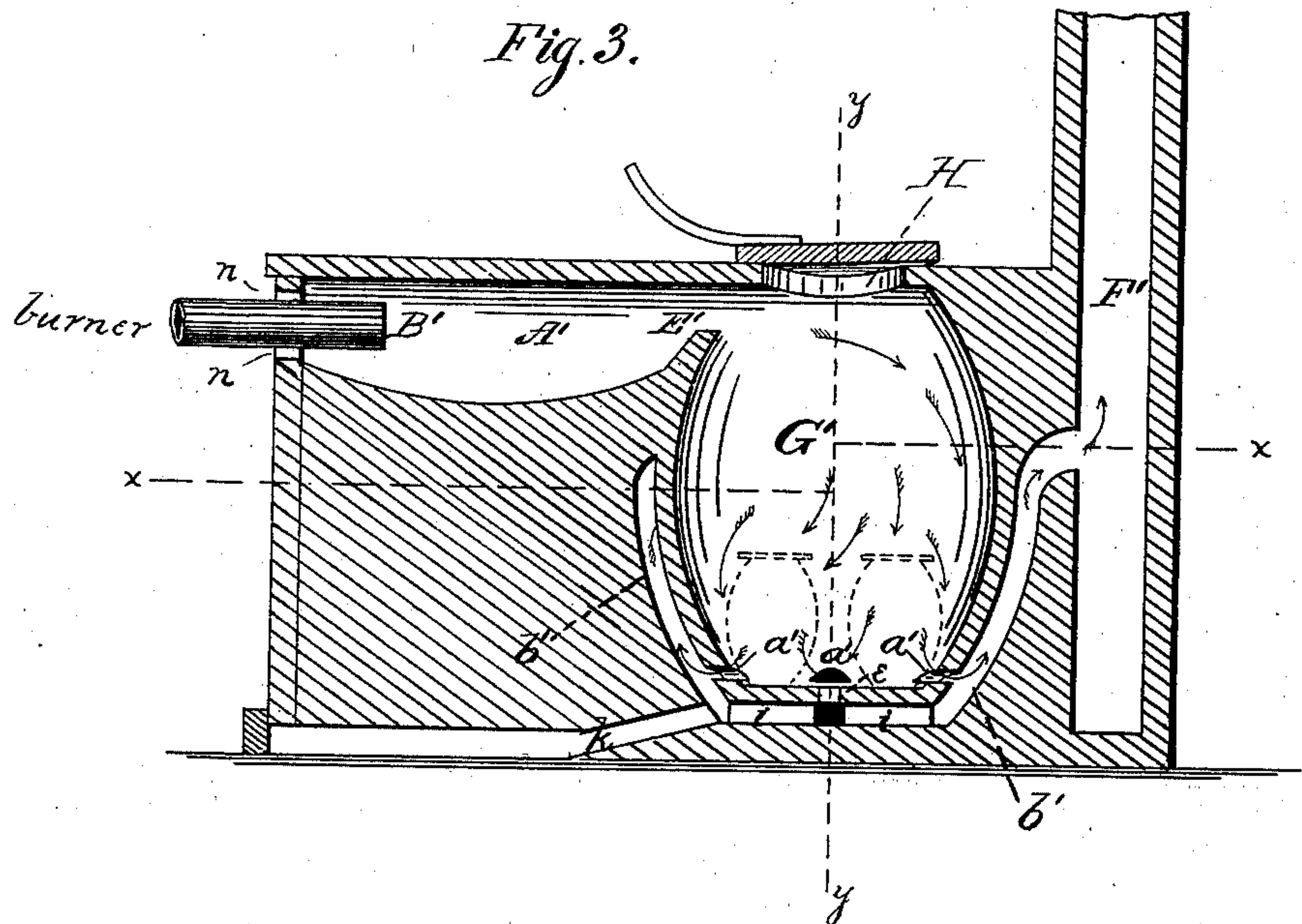


Fig. 4.

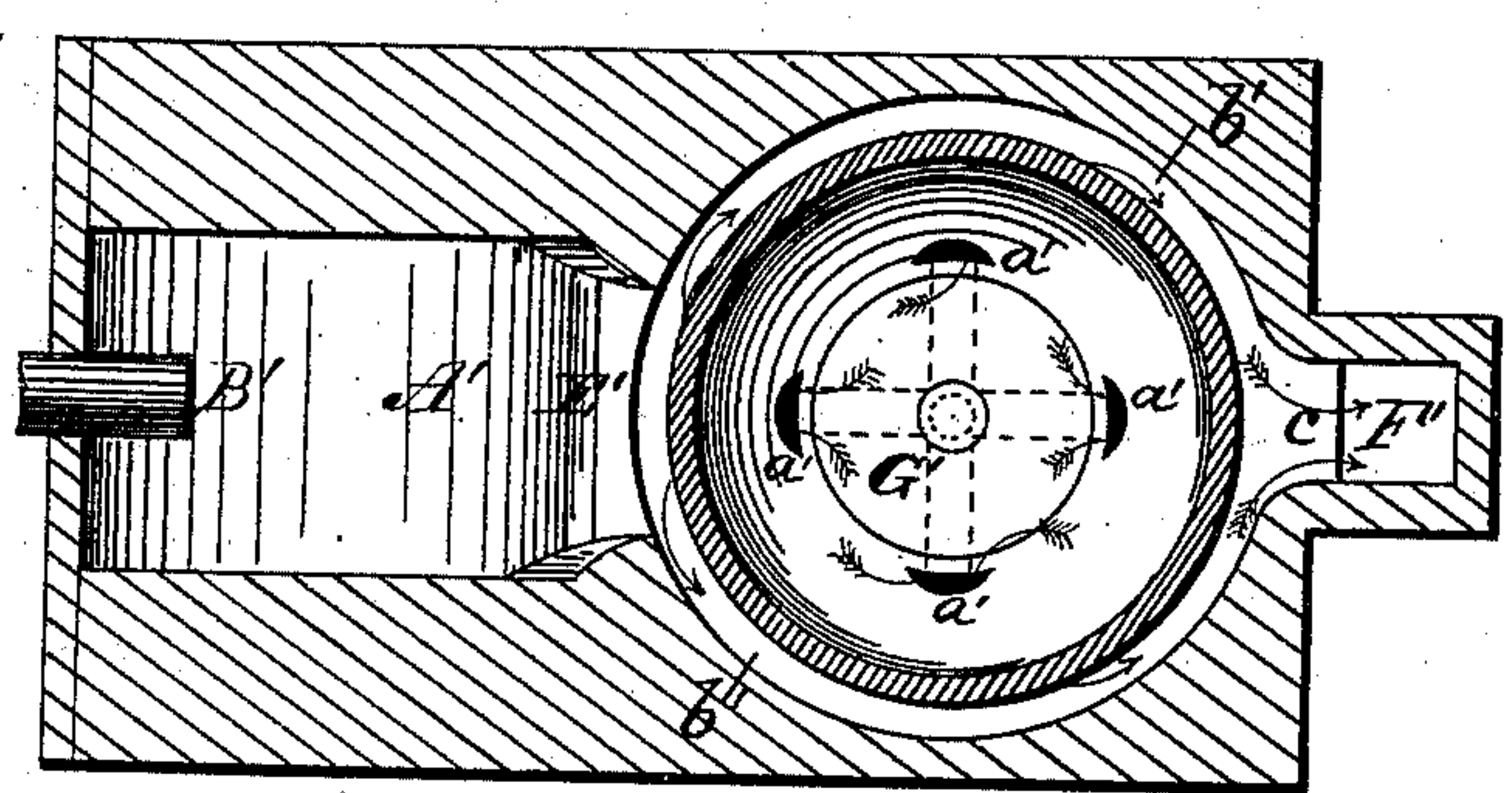


Fig. 5.

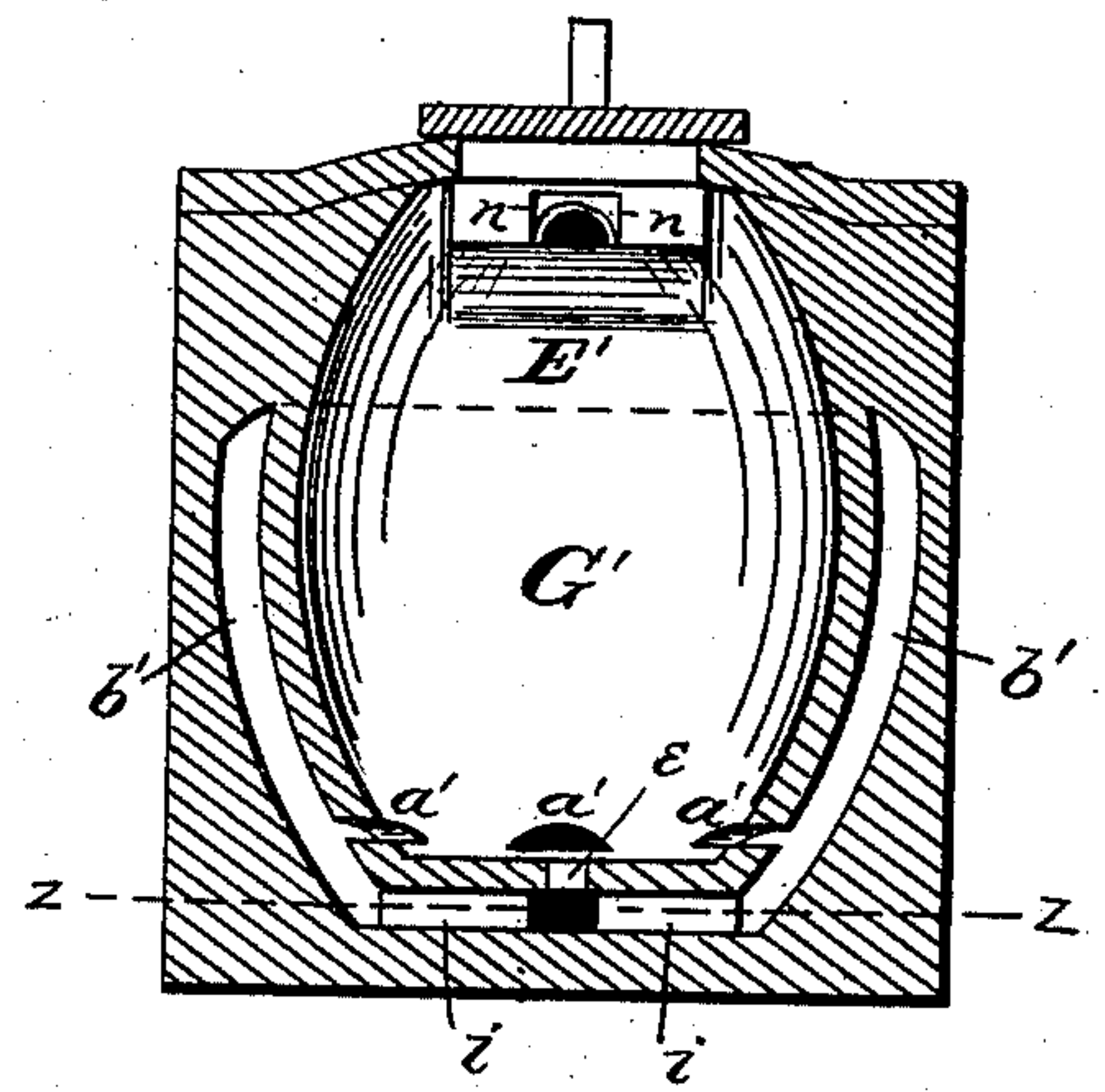
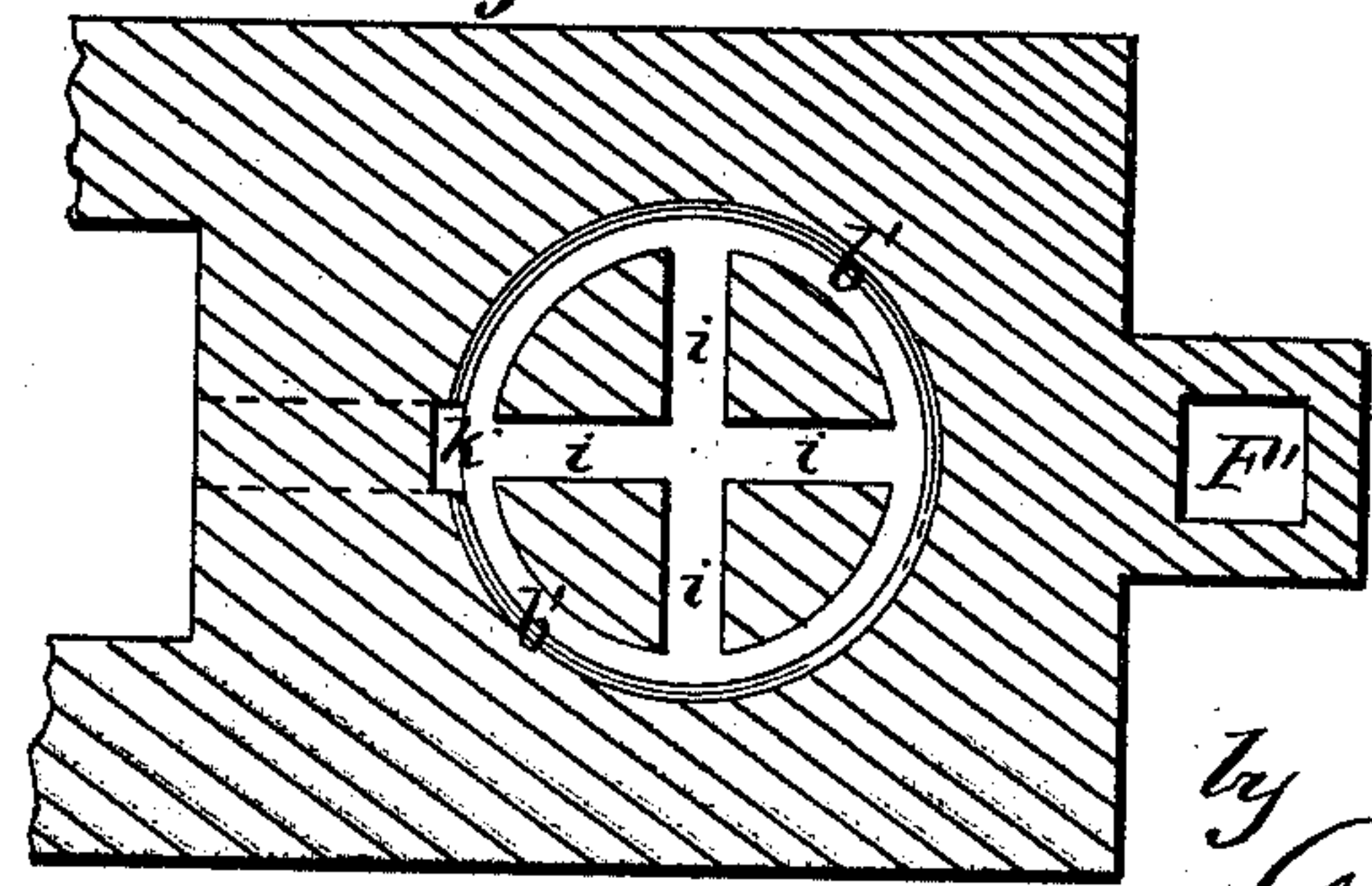


Fig. 6.



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# UNITED STATES PATENT OFFICE

RICHARD S. ROBERTSON, OF PITTSBURG, PENNSYLVANIA.

## IMPROVEMENT IN HYDROCARBON-FURNACES.

Specification forming part of Letters Patent No. **216,459**, dated June 10, 1879; application filed January 27, 1879.

*To all whom it may concern:*

Be it known that I, RICHARD S. ROBERTSON, of Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented certain new and useful Improvements in Hydrocarbon-Furnaces; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use it, reference being had to the accompanying drawings, which form part of this specification, in which—

Figure 1 is a vertical longitudinal, and Fig. 2 a horizontal, section of my invention. Fig. 3½ is a special burner for my furnace for benzine. Fig. 3 is a longitudinal vertical section of a modification. Fig. 4 is a section on line *xx* of Fig. 3; Fig. 5, a vertical section on line *yy* of Fig. 3; and Fig. 6 a plan section on line *zz* of Fig. 5.

This invention relates to metallurgical furnaces of that class in which the heat is produced by the combustion of hydrocarbons; and it consists in the construction of a metallurgical furnace provided with a hydrocarbon-burner, and having the flame-inlet at one extremity, and an outlet at the opposite extremity, communicating with and leading the flames and heat through a circulating-flue surrounding the side walls of the furnace, whereby the waste heat is caused to heat the walls and counteract the effect of radiation from the contents of the furnace, substantially as hereinafter fully described and claimed.

In the drawings, which represent a steel-melting furnace, *G* designates the melting-chamber, in which the pots are placed; *A*, the combustion chamber or flue, into which projects a hydrocarbon-burner, *B*, chamber *A* entering the foundation from one side and curving upward into the melting-chamber at the middle of its base, where it opens into a cage or deflector, *E*, which serves two purposes. Having its top closed and openings in its sides, it acts as a deflector or bridge to deflect the flames and heat outwardly to the pots or other contents, and, being flat on top, it serves as a stand or pedestal for an extra pot.

Flue *A* is provided with a breast, *s*, opposite the mouth of the burner *B*, to receive the impact of the jet of flame and break it up

previous to entering the melting-chamber. The melting-chamber of the figure is of the usual four-pot description, being capable, however, by reason of pedestal *E*, of accommodating five pots. Its general form is egg-shaped; but I construct it with four vertical ribs, *M*, projecting from its sides, and so located relatively to the four openings in the sides of bridge or deflector *E* that the flames on passing out of these openings will impinge upon the edges of the ribs *M*, which divide them and cause a complete circulation around the pots, which are set in the recesses formed by the ribs.

An annular flue, *b*, is constructed about the walls of chamber *G*, and communicating therewith through openings *a*, made at or near that end of the chamber which stands vertically farthest from the combustion flue or chamber *A*. Openings *a* may be located as desired; but I prefer to close up the upper rear portion of flue *b*, and so cause the flames and heat to pass off at side and front openings, *a*, whereby they must pass around the chamber before reaching the stack *F*.

The hydrocarbon-burner *B*, of any kind, being supplied with heated or cool air, as found most suitable to the purpose, is ignited, and projects an intensely-hot flame-tongue through chamber *A*. It is broken up by breast *s*, and then passes up into the deflector *E*, where it is further divided and caused to pass out laterally into the melting-chamber *G* and strike the ribs *M*. These again cut the flames and force them to pass around the pots and heat their contents from all sides. From this the flames find free passage upwardly, heating the upper portion of the chamber intensely, and then pass, at openings *a*, into the annular flue *b*, through which they circulate around the exterior of chamber *G*, and finally pass to the stack.

It will thus be seen that this final exterior circulation of the flames and heat-currents serves to heat the walls of the melting-chamber, keeping them so hot as to absorb none of the heat from the interior, and hence the full heating power of the flames in the chamber is concentrated upon its contents, and the maximum calorific effect is attained.

It is obvious that the relations may be in-



verted, as shown by the modification exhibited in Figs. 3, 4, 5, and 6. Here I introduce the burner B' at the upper part into the combustion-channel A', where the flames are broken against the breast or bridge E' and spread downwardly over the whole interior of chamber G'. Circulating throughout this the flames pass, by openings *a'* at or near the bottom, into the annular flue *b'*, as before, circulate through it, and heat the walls of chamber G', and finally pass to the stack F'. Air may be fed to the burner at openings *n*, if desired. I find it convenient in this modification to make a central opening, *e*, in the bottom, which passes down into cross-flues *i*, thence into flue *b*, and communicates with a cleaning-flue, *k*. Two purposes are in view: to provide an extra central flue for the flames and heat, if found desirable, and to provide means of removing the pieces and contents of a broken pot in case of accident. In this modification the vertical ribs M may be applied also, if desired; and when they are applied to either form it is advisable to make the draw-hole H square or rectangular, with the corners immediately above the recesses formed between the ribs to facilitate the placing and withdrawing of the pots without making the hole H so large as to be likely to chill the furnace when uncovered.

My invention admits of various uses, and is not limited to the employment of any particular kind of hydrocarbon-burner. It has great heating power, since all the available heat is at once and directly applied, without waste or loss, to the contents, the walls of the heating-chamber being highly heated by the waste products of combustion passing around them in the exterior annular flue.

The furnace may be made to contain, normally, three, four, five, or other number of pots, with ribs to correspond, and in every case room for one pot more is made by the deflector-stand E, the extra pot standing up high and receiving the heat and flames after they rise from the other parts.

As benzine and the lighter hydrocarbons vaporize more readily, I prefer, when using them, to adapt my burner accordingly. This I do by making an extension, *p*, to the burner, as shown by dotted lines in Fig. 1, which passes to the opening in the bottom of furnace, where it terminates in a perforated ring, as in Fig. 3½. I thus waste no heat in the combustion-channel, but project the flames straight upwardly into the deflector.

I claim as my invention—

1. A metallurgical furnace provided with a hydrocarbon-burner, and having the flame-inlet at one extremity and an outlet at the opposite extremity, communicating with and leading the flames and heat through a circulating-flue surrounding the side walls of the furnace, substantially as described, whereby the waste heat is caused to heat the walls and counteract the effects of radiation from the contents of the furnace.

2. In a metallurgical furnace, the combination, with the heating or melting chamber thereof, of a circulating-flue communicating therewith and surrounding the side walls of said chamber, to carry off the heat and flames to the stack, substantially as set forth.

3. The combination of the central deflector, E, having side openings, and the vertical ribs M, said ribs having their front edges opposite the openings in the deflector E, substantially as described.

4. The combination of burner B, combustion-chamber A, deflector E, heating-chamber G, flues *a* and *b*, and stack-flue F, substantially as described.

In testimony that I claim the foregoing I have hereunto set my hand this 21st day of January, 1879.

RICHARD S. ROBERTSON.

Witnesses:

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