

No. 897,834.

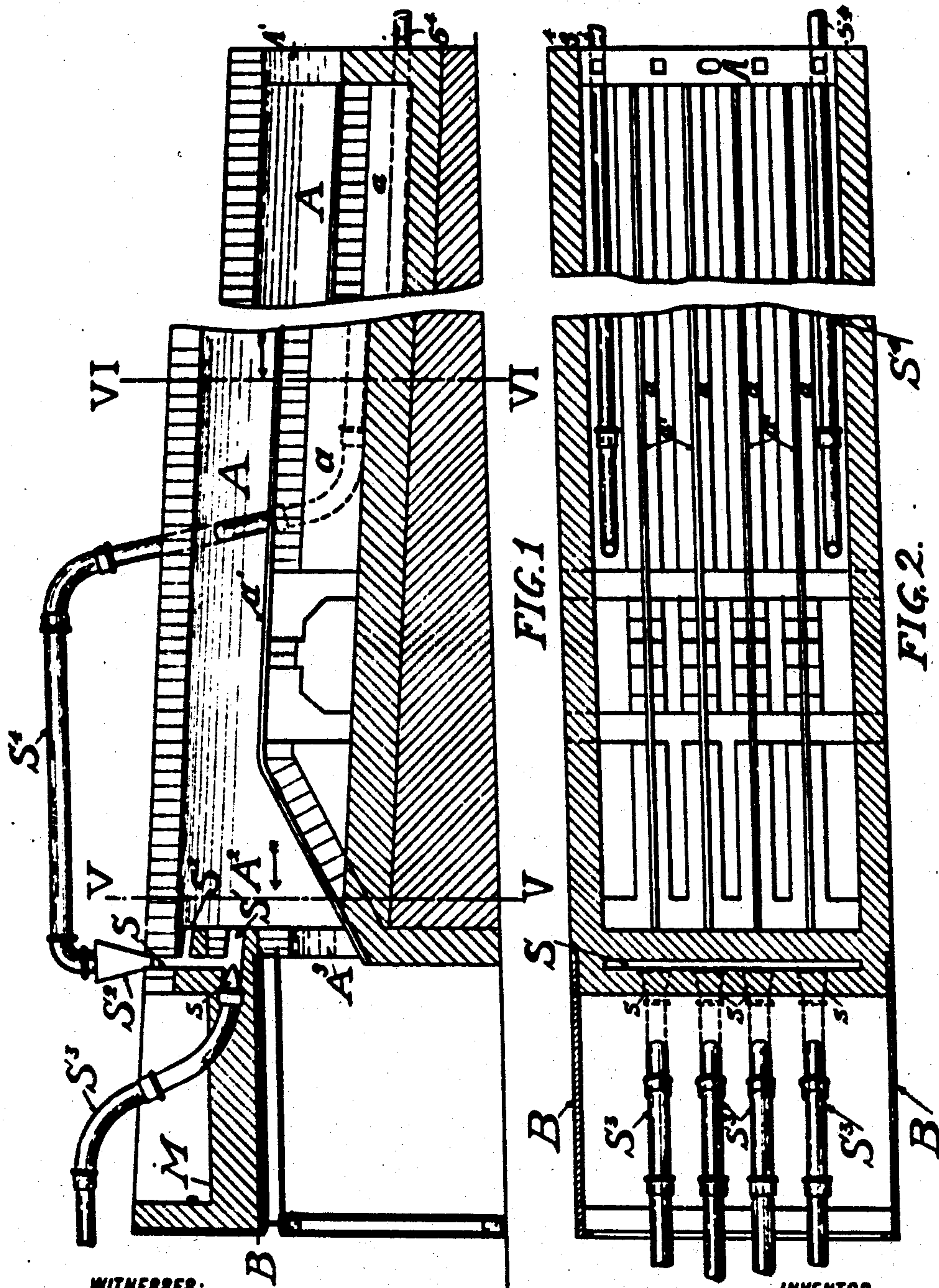
PATENTED SEPT. 1, 1908.

C. J. F. JOHNSON.
METHOD OF HEATING BILLETS.

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APPLICATION FILED JAN. 31, 1900.

2 SHEETS-SHEET 1.



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3 SHEETS—SHEET 2.

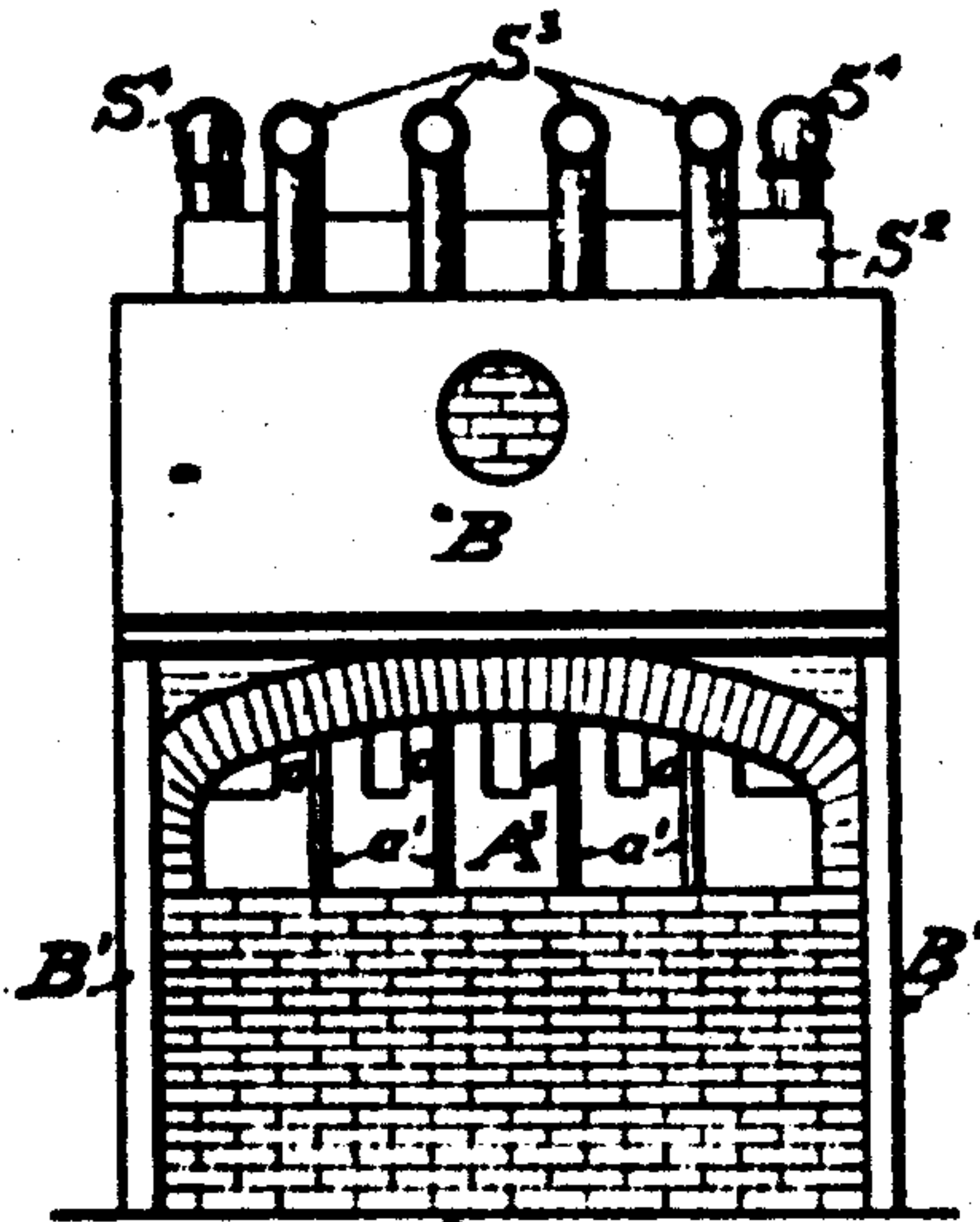


FIG. 3

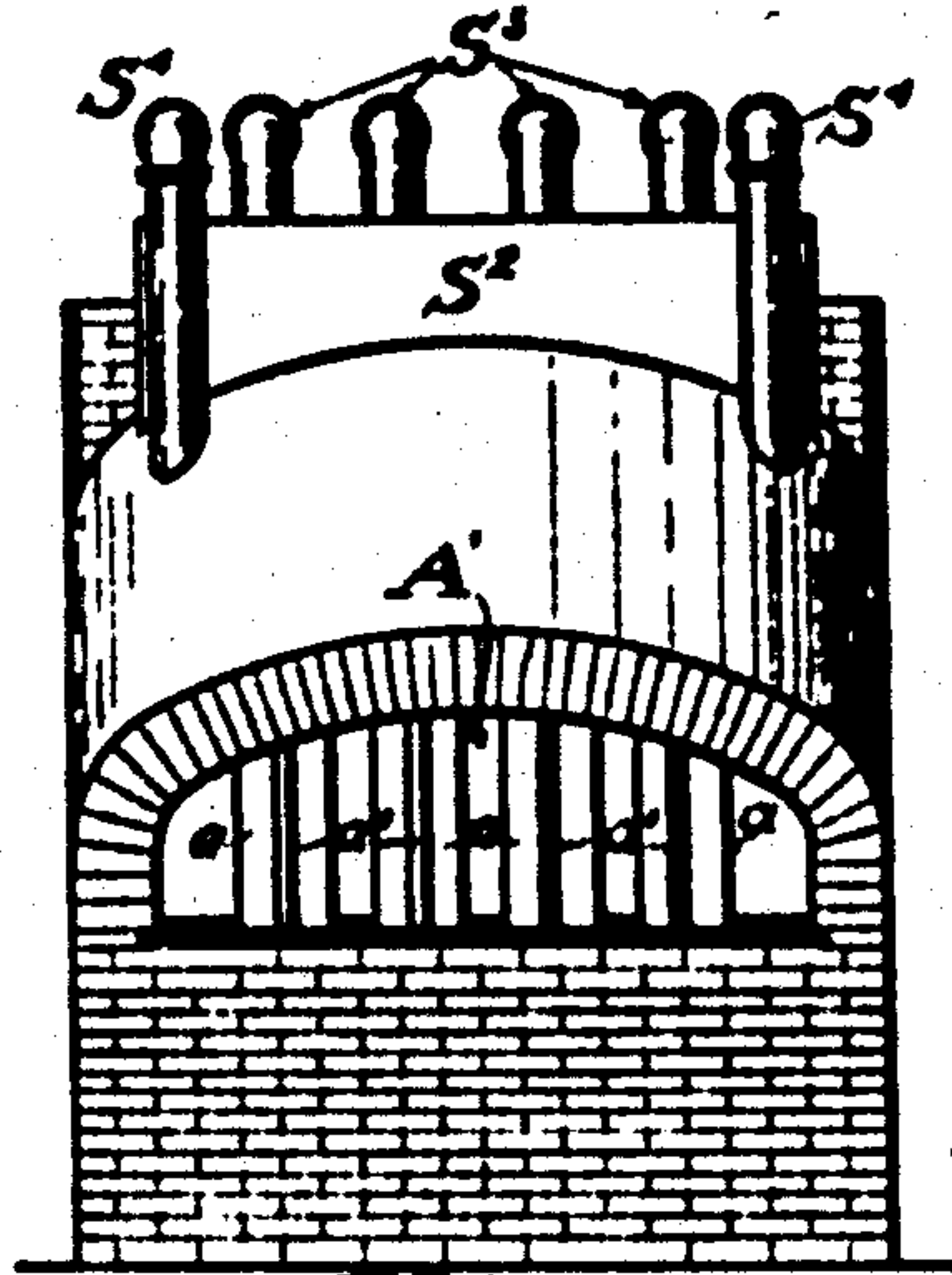


FIG. 4

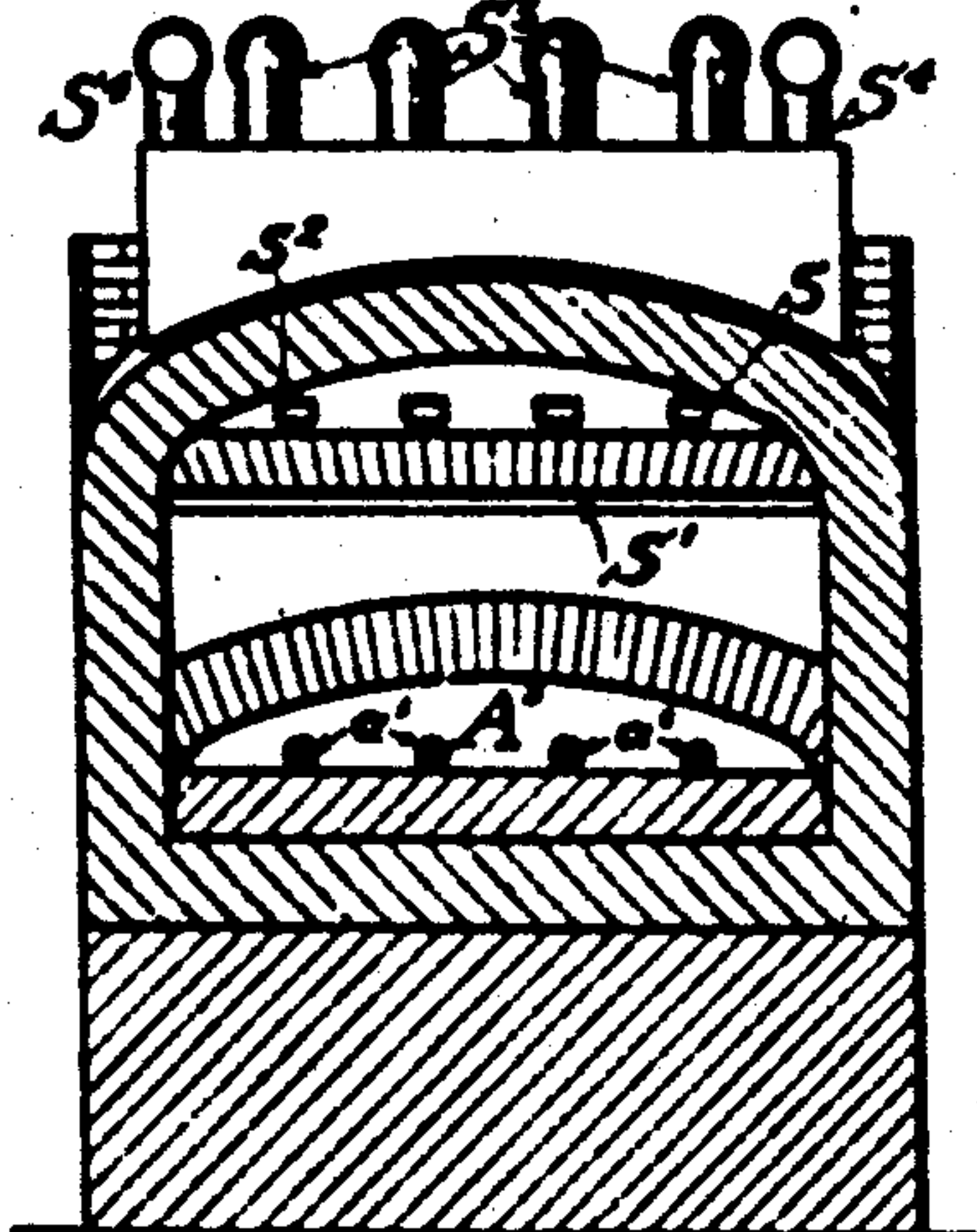


FIG. 5

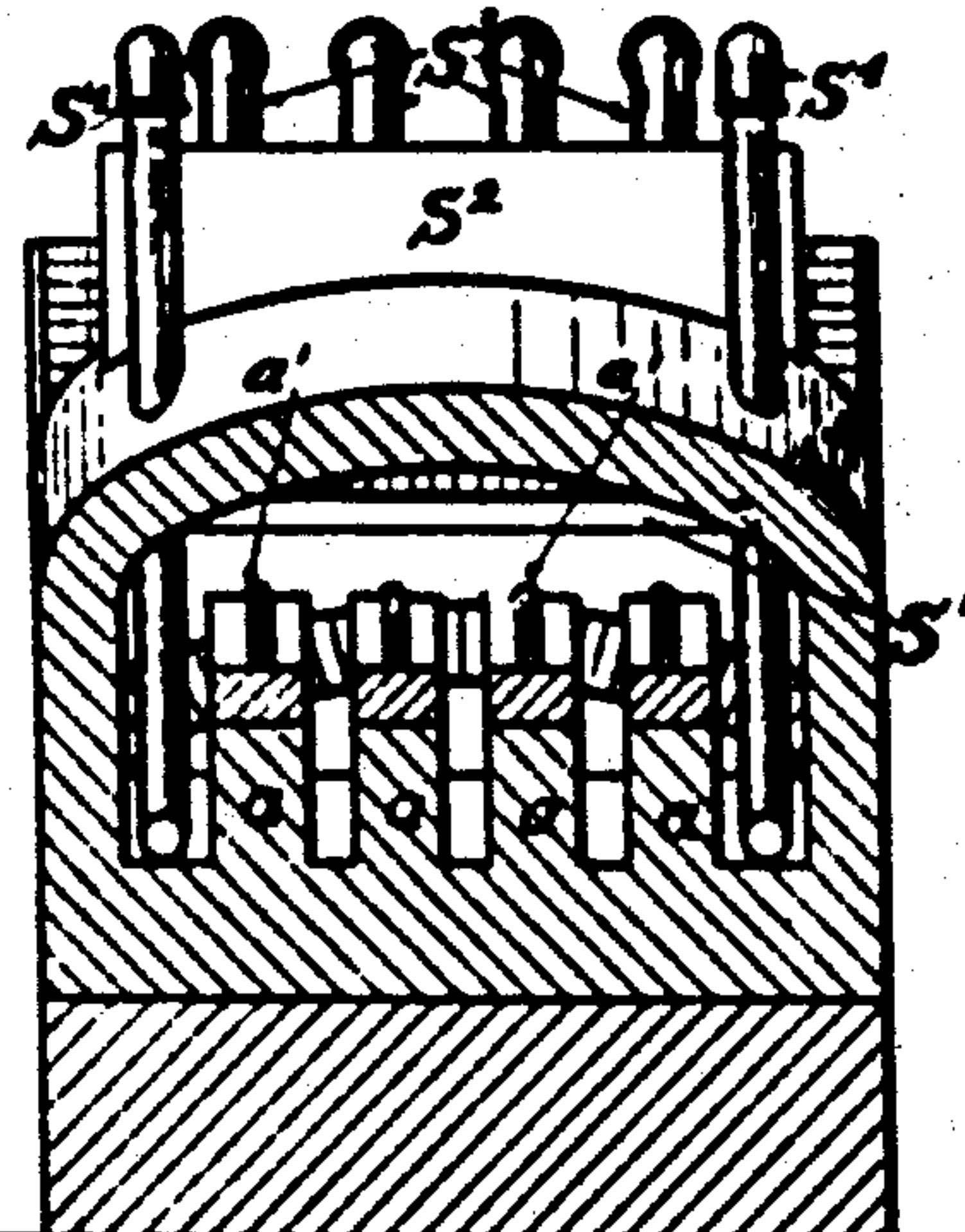


FIG. 6

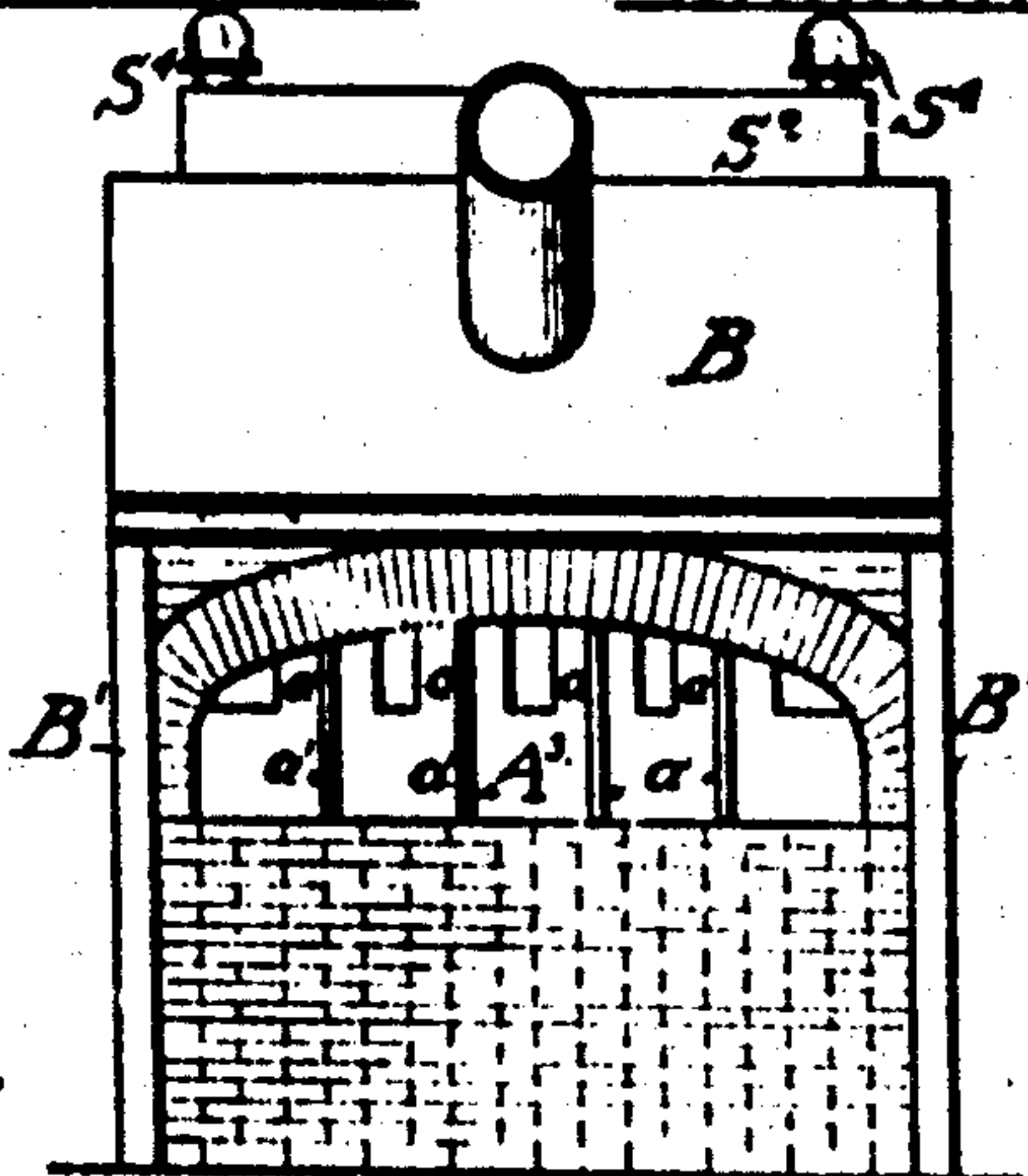


FIG. 7

WITNESSES:

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3 SHEETS—SHEET 3

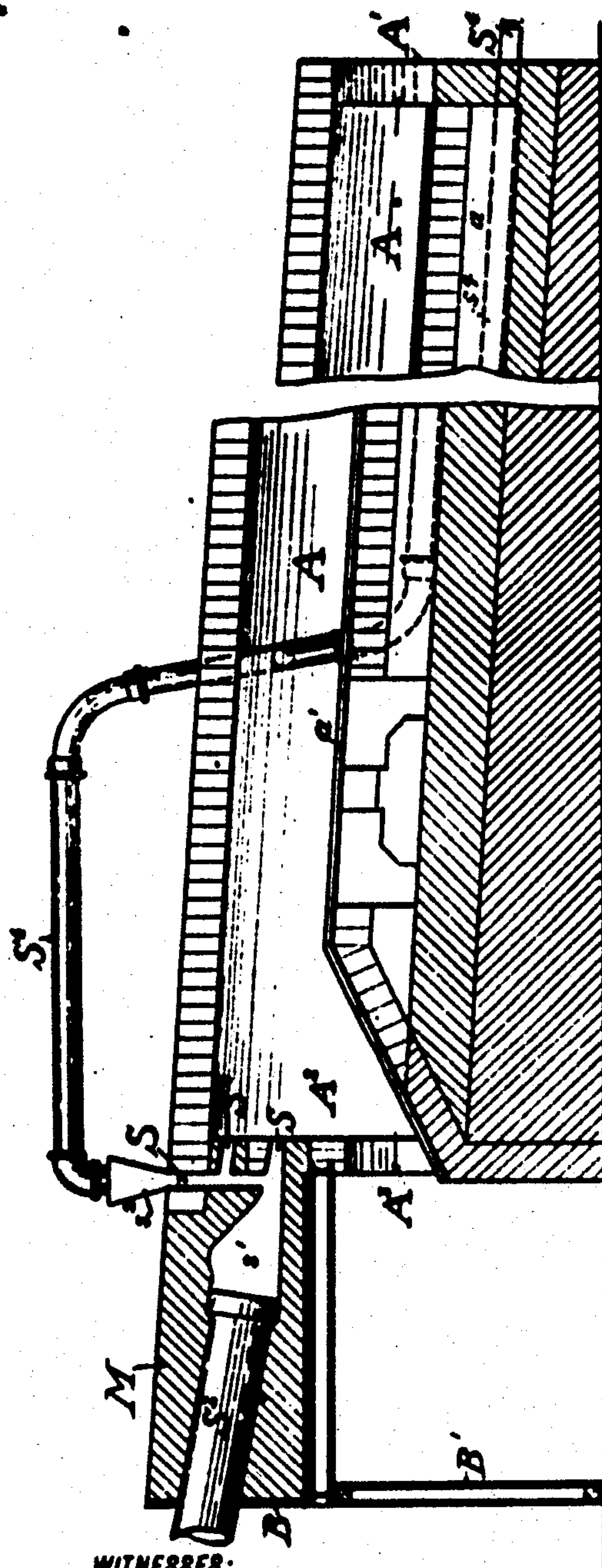


FIG. 8

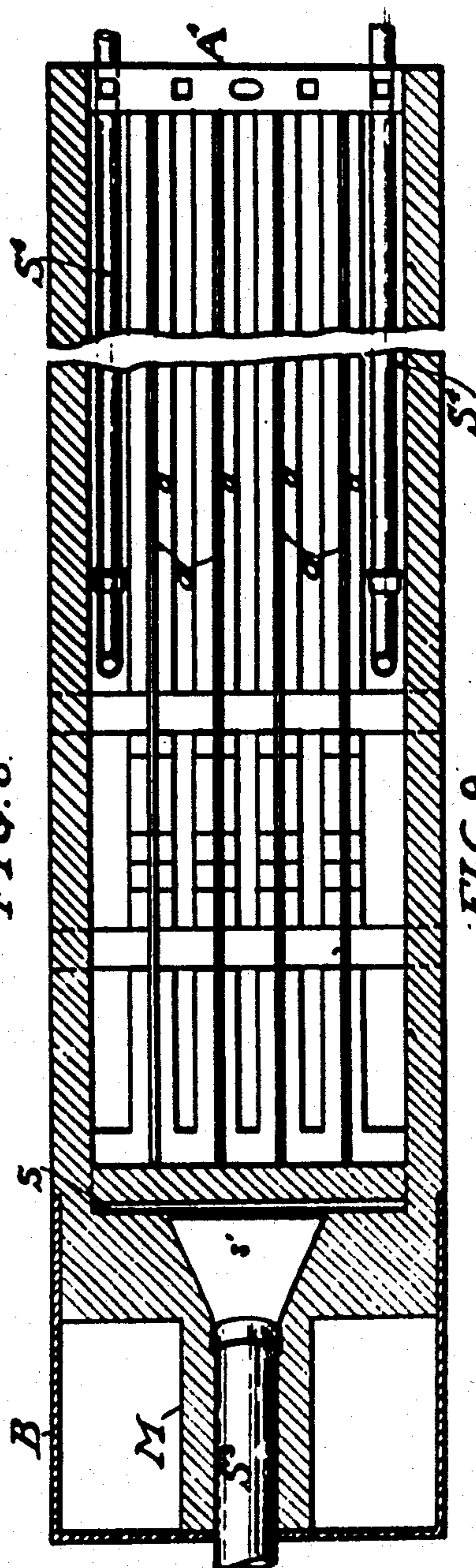


FIG. 9

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UNITED STATES PATENT OFFICE.

CARL J. F. JOHNSON, OF CLEVELAND, OHIO, ASSIGNOR OF ONE-HALF TO CHARLES BERG, OF CLEVELAND, OHIO.

METHOD OF HEATING BILLETS.

No. 897,834.

Specification of Letters Patent.

Patented Sept. 1, 1908.

Original application filed September 14, 1905, Serial No. 278,374. Divided and this application filed January 31, 1906. Serial No. 298,768.

To all whom it may concern:

Be it known that I, CARL J. F. JOHNSON, a citizen of the United States, resident of Cleveland, county of Cuyahoga, and State of Ohio, have invented a new and useful Improvement in Methods of Heating Billets, of which the following is a specification, the principle of the invention being herein explained and the best mode in which I have contemplated applying that principle, so as to distinguish it from other inventions.

My invention relates to methods of heating steel billets and the like in reheating furnaces such as are commonly employed in connection with steel rolling mills.

The object of my invention is to effect a uniform and thorough heating of such material, as for instance, billets with a minimum expenditure of fuel.

Such invention consists of steps herein-after fully described and specifically set forth in the claims.

The annexed drawings and the following description set forth in detail one mode of carrying out the invention, such disclosed mode constituting but one of various ways in which the principle of the invention may be used.

In said annexed drawings: Figure 1 represents a vertical longitudinal cross-section of a furnace constructed with a view to carry out my improved method, such furnace being shown as adapted to burn natural gas as fuel. Fig. 2 represents a horizontal longitudinal cross-section of the same; while Figs. 3 and 4 are front and rear elevations thereof, respectively. Figs. 5 and 6 are vertical transverse cross-sections thereof taken upon lines V—V and VI—VI, respectively, in Fig. 1, parts of the furnace appearing in elevation as well. Fig. 7 represents a front elevation of a furnace embodying my improved construction as adapted for the burning of artificial gas; while Figs. 8 and 9 are respectively a vertical longitudinal cross-section and a horizontal longitudinal cross-section of the same.

The subject-matter of this application has been divided out of my prior application for United States Letters Patent for an improvement in billet heating furnaces, filed Sept. 14, 1905, Serial No. 278,374.

While the furnace chosen for the purposes of this description is of the particular type designed for heating billets, it is evident that

the method illustrated in its operation is equally capable of employment in any of the various kinds of reheating furnaces utilized in connection with steel rolling mills. So, too, while the fuel employed here is gas, either natural or artificial, I do not mean to imply thereby that my method is incapable of adoption where other fuels are burned.

The billet-heating furnace, illustrated in the several figures of the drawings, is of the "continuous" type, in which the billets are introduced into the heating chamber, designated by A, at the end A' farthest removed from the portion A² where the gas burner is located. This heating chamber A is of the usual elongated form and is inclined downwardly from burner-end A² to opening A'. Extending its entire length are parallel dwarf walls *a* built up from the chamber floor and inclined at the same angle as such floor until near the portion A² of the chamber where they slant sharply in the opposite direction and lead to the discharge opening A' of the chamber. Water-cooled skid pipes *a'*, which are laid along the tops of dwarf walls *a*, prevent injury of the walls as the billets are skidded along. Such movement of the billets along skid pipes or ways *a'* is accomplished by means of a hydraulic ram, or similar pushing agent, not shown, which is located opposite to end A' of the heating chamber.

In the operation of the furnace the billets are introduced into the heating chamber at the end A' and are forced by the hydraulic ram to travel gradually up the incline on the pipe skids *a'*, the advance being through zones of constantly increasing temperature until the highest temperature is reached in the portion A² of the chamber. As the billets successively arrive at the point where the dwarf walls and pipe skids borne thereon slope in the opposite direction, they roll over and thus expose to the heat the darker and colder spots where they had previously rested on the pipes, and are finally discharged onto the floor or a table ready to be transmitted to the rolls.

As previously stated, my invention has particular reference to the manner of heating a furnace of the character just described, there being nothing novel set forth in the description above given. And as has also been indicated, the fuel that my improved furnace is designed to employ is gas, either

natural or artificial, only a slight alteration, and one easily made in practice, being required to change from the one to the other.

The burner is located at the forward and upper end of the heating chamber, the ignited gases being admitted into the chamber through openings arranged as hereinafter described. The various parts of the burner are supported in suitable masonry work M built upon a box-like platform B made of steel plates and resting upon posts B'. In this masonry, near where it abuts against the end of the furnace structure proper, is provided a narrow vertical passage or slot S, Figs. 1 and 2, and 8 and 9. At its lower end this passage communicates with a similar passage or slot S' disposed at approximately right angles thereto, Figs. 1 and 8, and opening along its entire length into the forward end A' of the heating chamber A, Figs. 5 and 6. As shown in Figs. 1 and 8, this slot has a slight downward inclination from the line of its junction with the vertical slot S, so as to be on a line, and substantially parallel, with the skid pipes along which the billets are advanced. Above the slot S' in a line parallel therewith is a series of apertures S'', also communicating with vertical slot S and downwardly inclined therefrom, Figs. 1, 5 and 8.

Gas is admitted to the passage S' through suitable nozzles embedded in masonry work M and connected with the supply main S''. When natural gas is employed I have found it advantageous to employ a plurality of such nozzles s mounted in the manner clearly indicated in Figs. 1 and 2. Where, however, the artificial product is used, a single large nozzle s' of the form shown in Figs. 8 and 9 gives the best results. The burner is designed with a view to facilitate the removal of one style of nozzle and the substitution of the other to meet the exigencies that frequently arise in the supply of gaseous fuel. Thus it is merely necessary to remove from the box platform B the masonry M inclosing one type of burner and to erect the other in its place, the furnace structure being undisturbed.

The air required to form a combustible mixture with the gas is admitted to slot S' through slot S. The details of such air supply comprise a closed, laterally elongated funnel or hopper structure s' fitted into the outer opening of slot S. Connected therewith are air supply pipes S'' through which the air is forced under suitable pressure. These pipes S'', of which there are preferably two, as shown, lie for a portion of their course within heating chamber A, being conveniently disposed between the side walls of such chamber and outer dwarf walls a, Figs. 2 and 9. By this arrangement of the pipes, instead of embedding them within the walls or floor-foundation of the furnace as has heretofore been the practice, they are rendered readily accessible for the purpose of making

alterations or repairs. They are at the same time exposed to the heat of the furnace chamber and the air is thus raised to the proper temperature without the employment of extraneous heating means. The effect of the funnel or hopper s' is to render the pressure of the heated air, thus forced into the burner, uniform across the entire length of vertical slot S.

From the manner in which horizontal slot S' and apertures S'' are connected with vertical slot S it is evident that only a portion of the air will be forced down the entire length of such slot S to mingle with the gas from nozzles s or nozzle s', to thence escape through slot S' and be ignited. The size of the openings provided for the passage of the gas and air must be proportioned with the pressures employed so as to produce a properly combustible mixture. The remainder of the air escapes into the heating chamber through the apertures S'' situated, as has been explained, above the opening of horizontal slot S'.

It is to the effect produced by the admission of the air above the ignited gaseous mixture issuing from slot S' to which I desire to call particular attention. Such incandescent gases are discharged in a downward direction, by virtue of the downward inclination of slot S', so as to pass below as well as above the billets as they advance along the dwarf walls a. The tendency, however, of heated vapors to rise would cause the hottest portions of such gases, as soon as the effect of the initial downward discharge was lost, to flow along the ceiling of the chamber instead of around the billets, and much of the heating effect would thus be wasted. I have found that the introduction of a blast of air just below the ceiling of the chamber and above this blast of incandescent gases, very effectively blankets and directs the latter and, by preventing their rising, prolongs their confinement to the lower portion of the chamber. Such a blast of air I produce by the employment of apertures S'', the effect being heightened by having the air at a high enough temperature to prevent its having an undue cooling effect and by also imparting to it an initial downward direction. The heat produced by the combustion of the fuel is thus utilized to the fullest extent, and the economy thus effected in the operation of a reheating furnace is a very important item in the operation of steel rolling mills.

Having thus described my invention in detail, that which I particularly point out and distinctly claim is:

1. The method of heating billets and the like, which consists in advancing the same through a furnace-chamber; in discharging into said chamber in a downwardly inclined direction a blast of igneous vapors, and conveying a blast of heated non-combustible

gases under pressure to said chamber so that it will extend above said first named blast in order to blanket and direct same to the lower portion of the furnace-chamber.

5 2. The method of heating billets and the like, which consists in advancing the same through a furnace-chamber in one direction and in discharging into said chamber in the opposite and downwardly inclined direction
10 a blast of commingled igneous vapors, and above such blast and in a downwardly inclined direction a second blast of heated non-combustible gases under pressure so that the latter will extend above the first named blast
15 in order to blanket and direct same to the lower portion of the furnace-chamber.

3. The method of heating billets and the like, which consists in advancing the same

through the lower portion of a furnace-chamber in one direction and discharging into said chamber in the opposite and downwardly inclined direction a blast made up of ignited mixture of combustible gases, and conveying under pressure a blast of heated air so that it will extend above said first named blast and in a downwardly inclined direction whereby the direction of said first blast is conveyed and maintained along the lower portion of said chamber, substantially as described and for the purposes set forth. 20 25 30

Signed by me this 15th day of January 1906.

CARL J. F. JOHNSON.

Attested by-

D. T. DAVIES,
JNO. F. OBERLIN.