

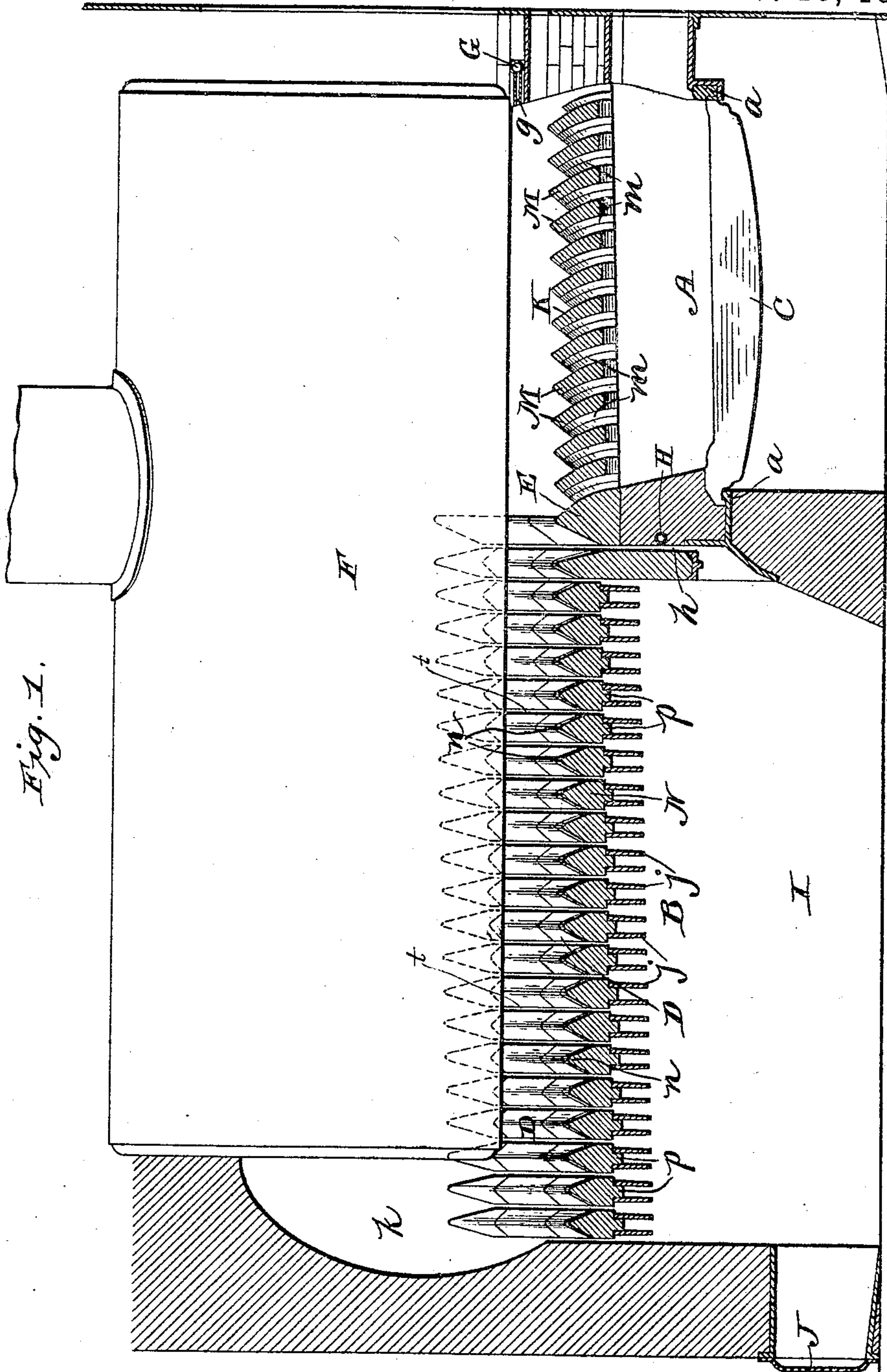
(No Model.)

3 Sheets—Sheet 1.

W. McCLAVE.
BOILER FURNACE.

No. 529,292.

Patented Nov. 13, 1894.



Witnesses
J. C. Lawrence
A. E. Penwick

Inventor
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his Attorney.

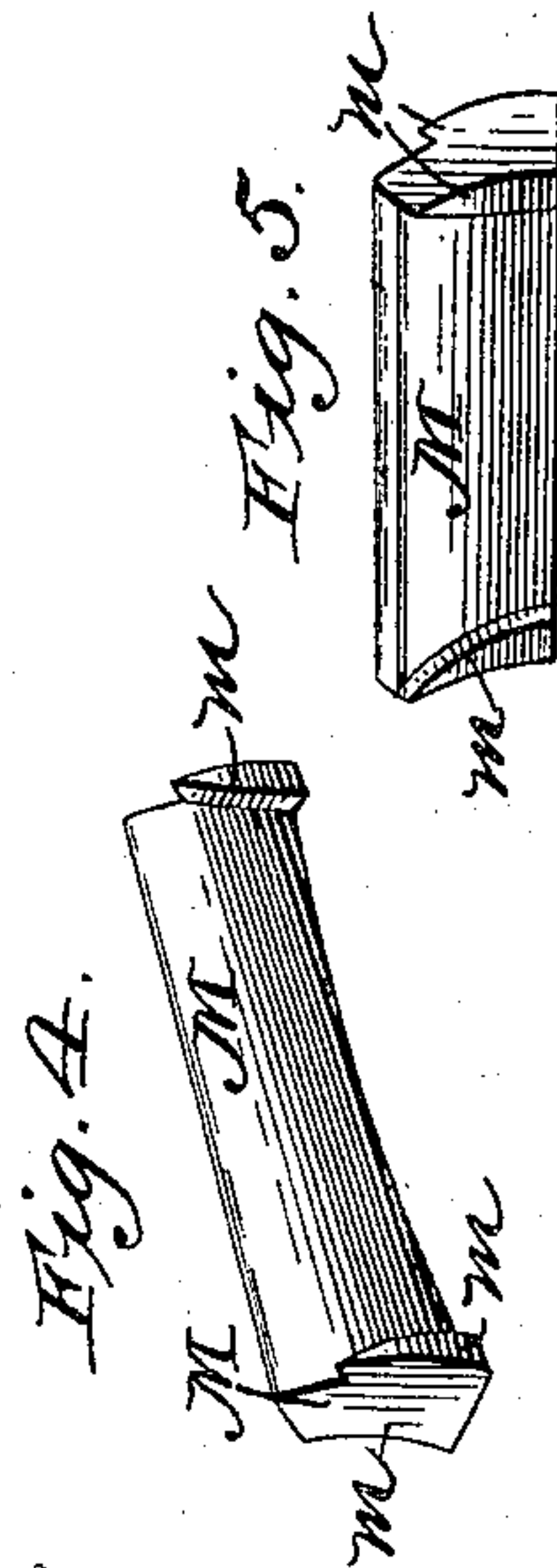
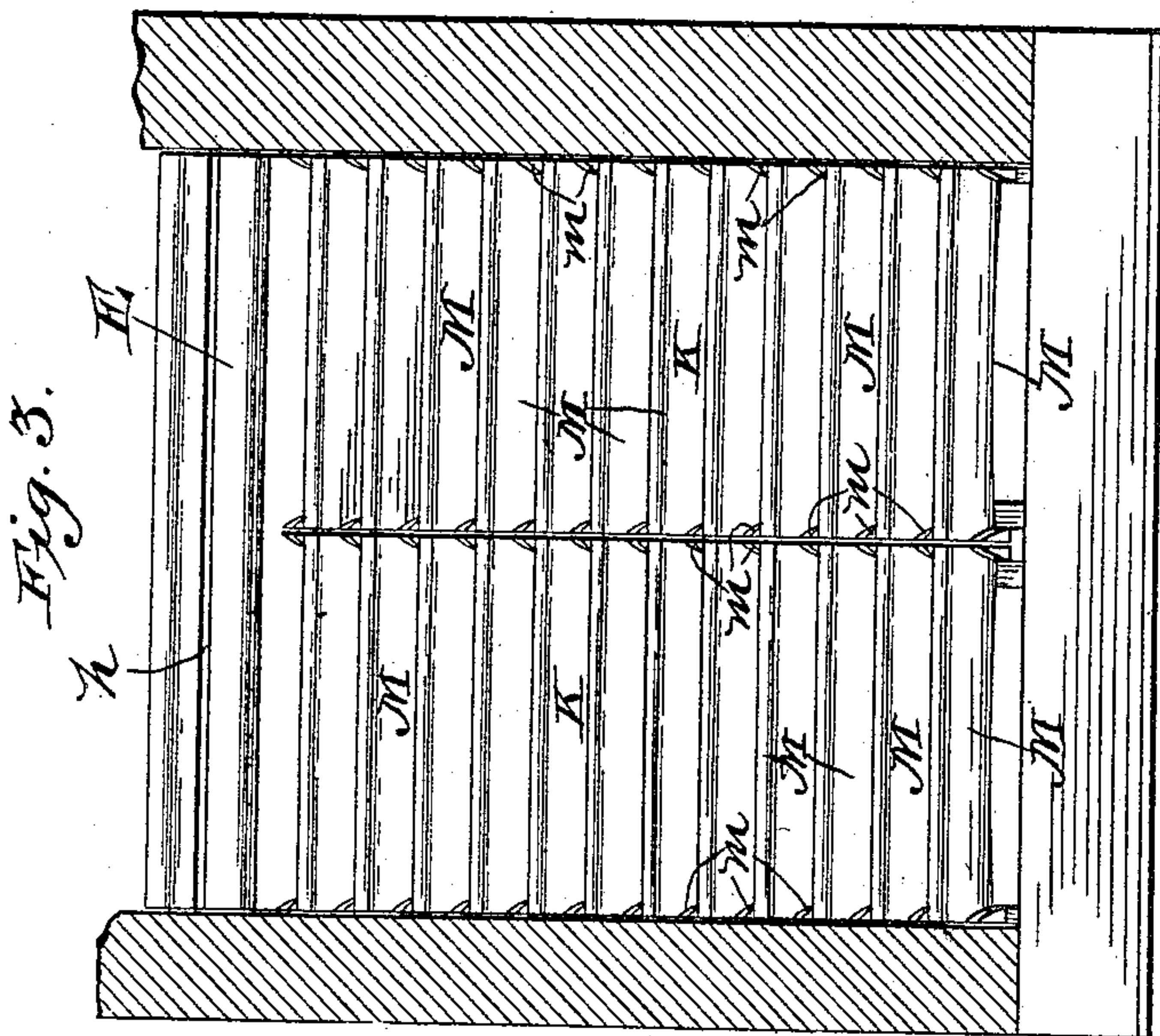
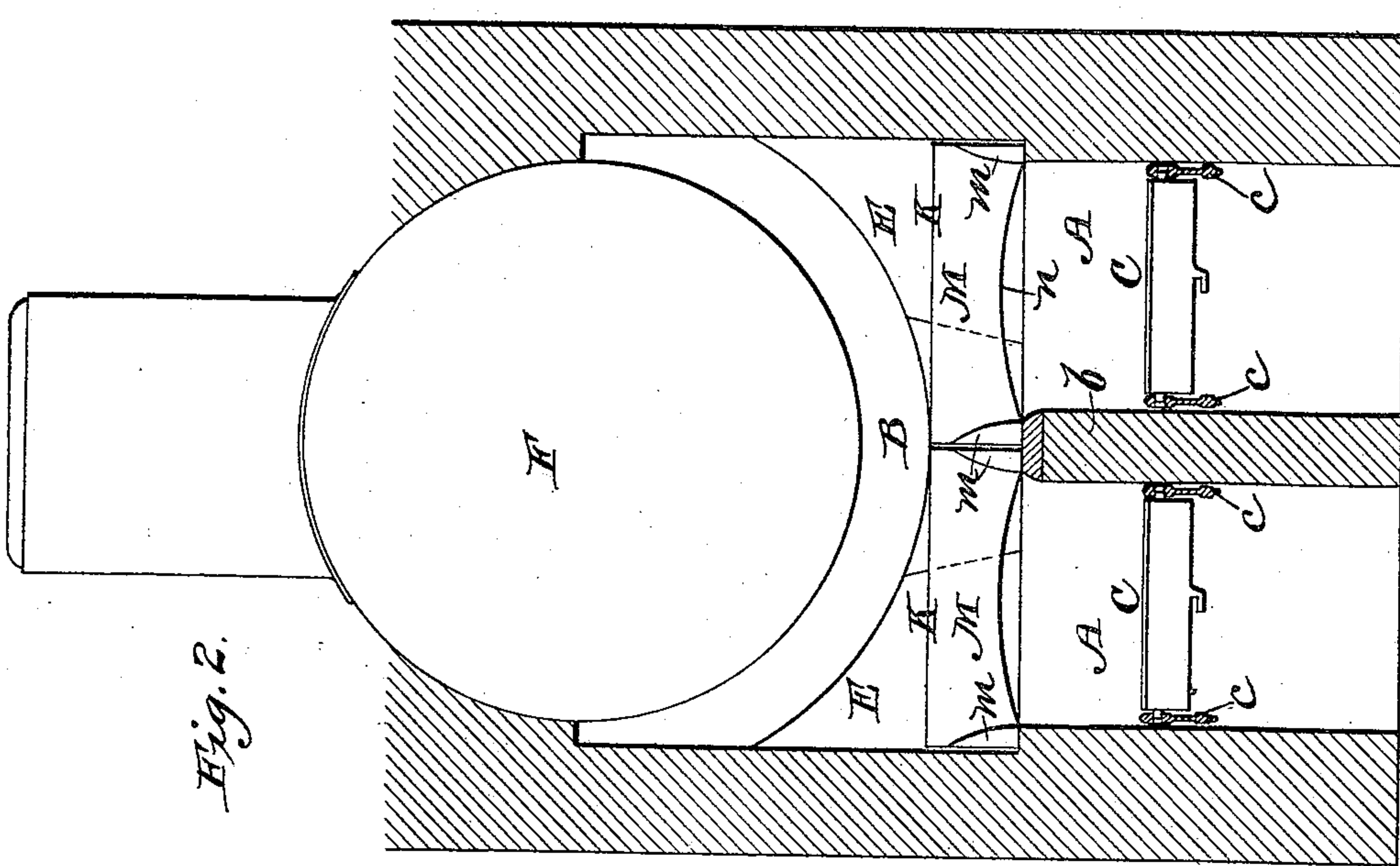
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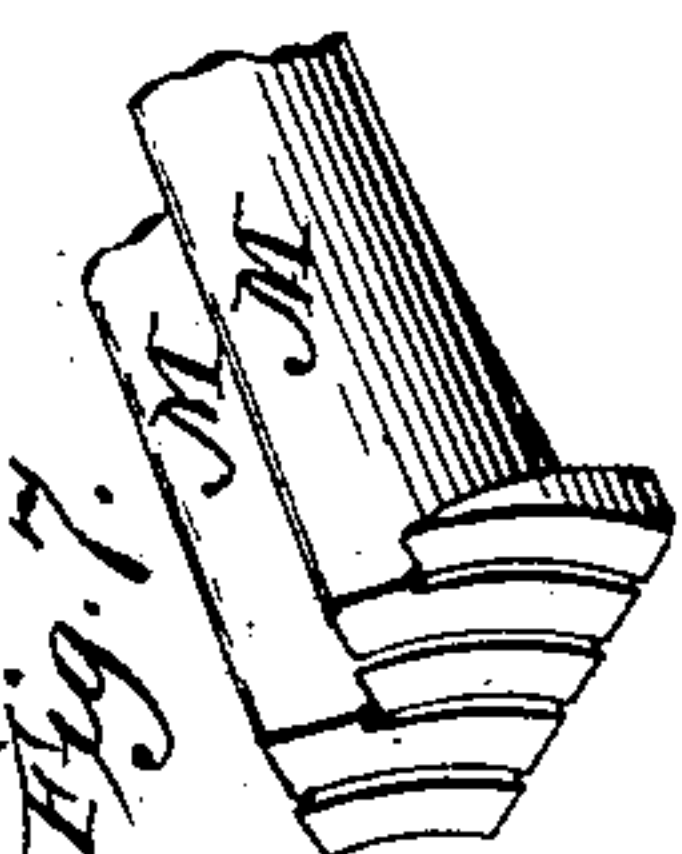
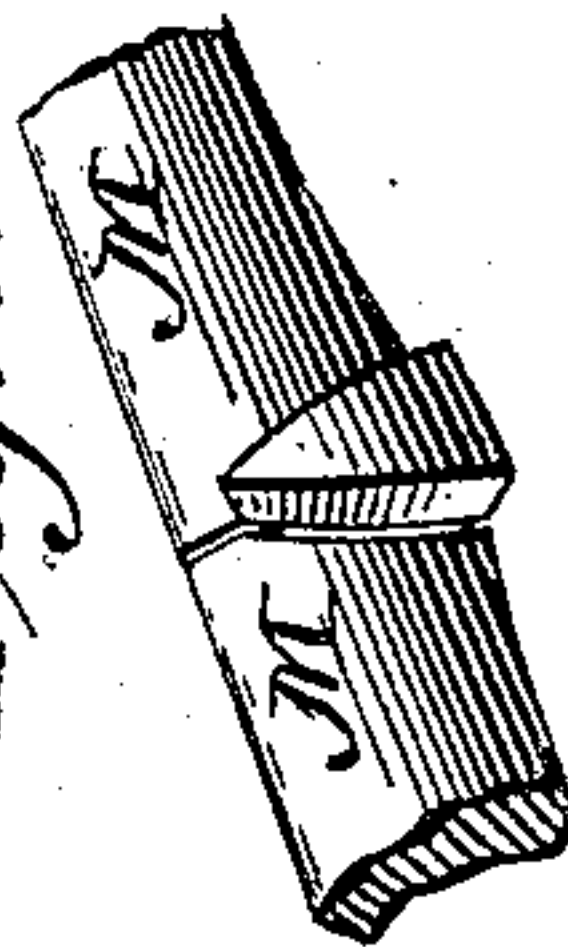


Fig. 6.



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(No Model.)

3 Sheets—Sheet 3.

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Fig. 9.

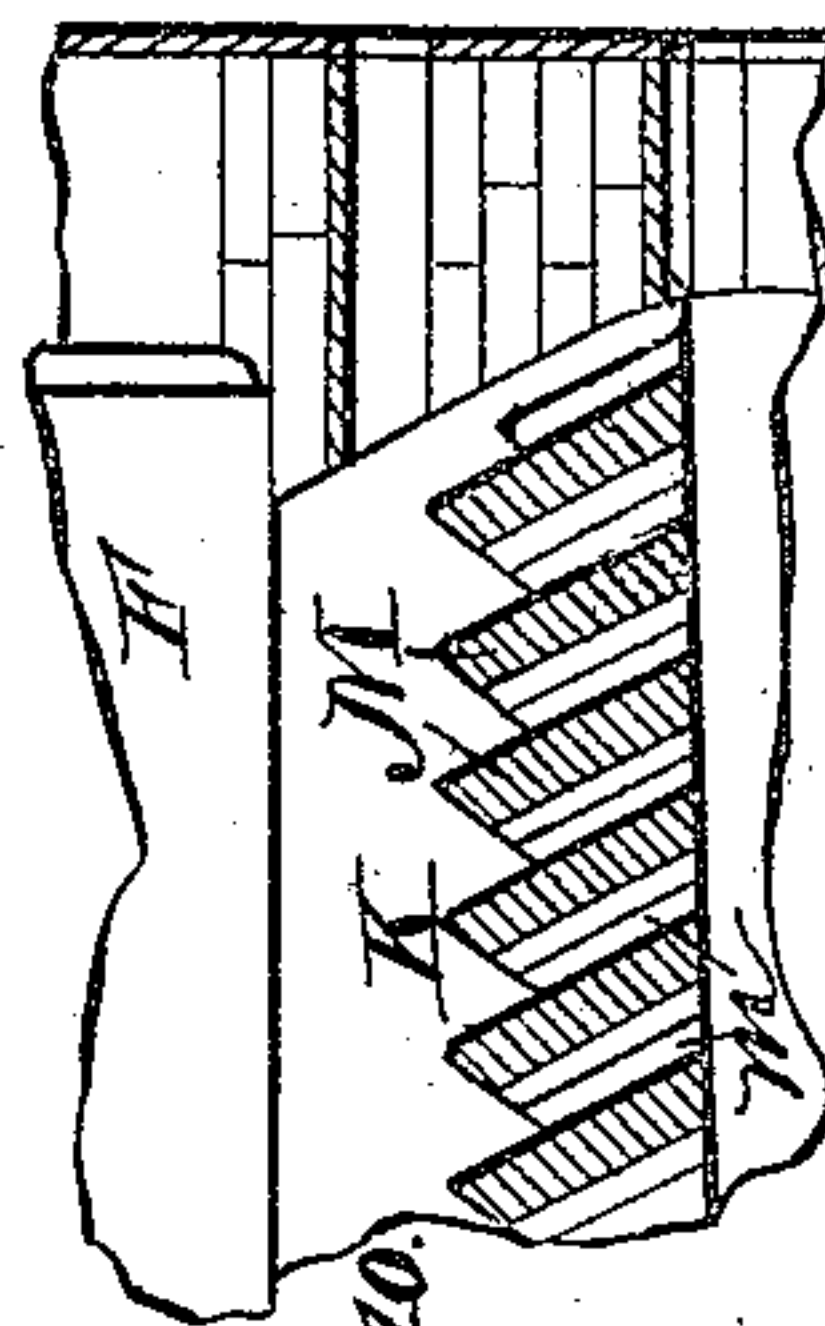
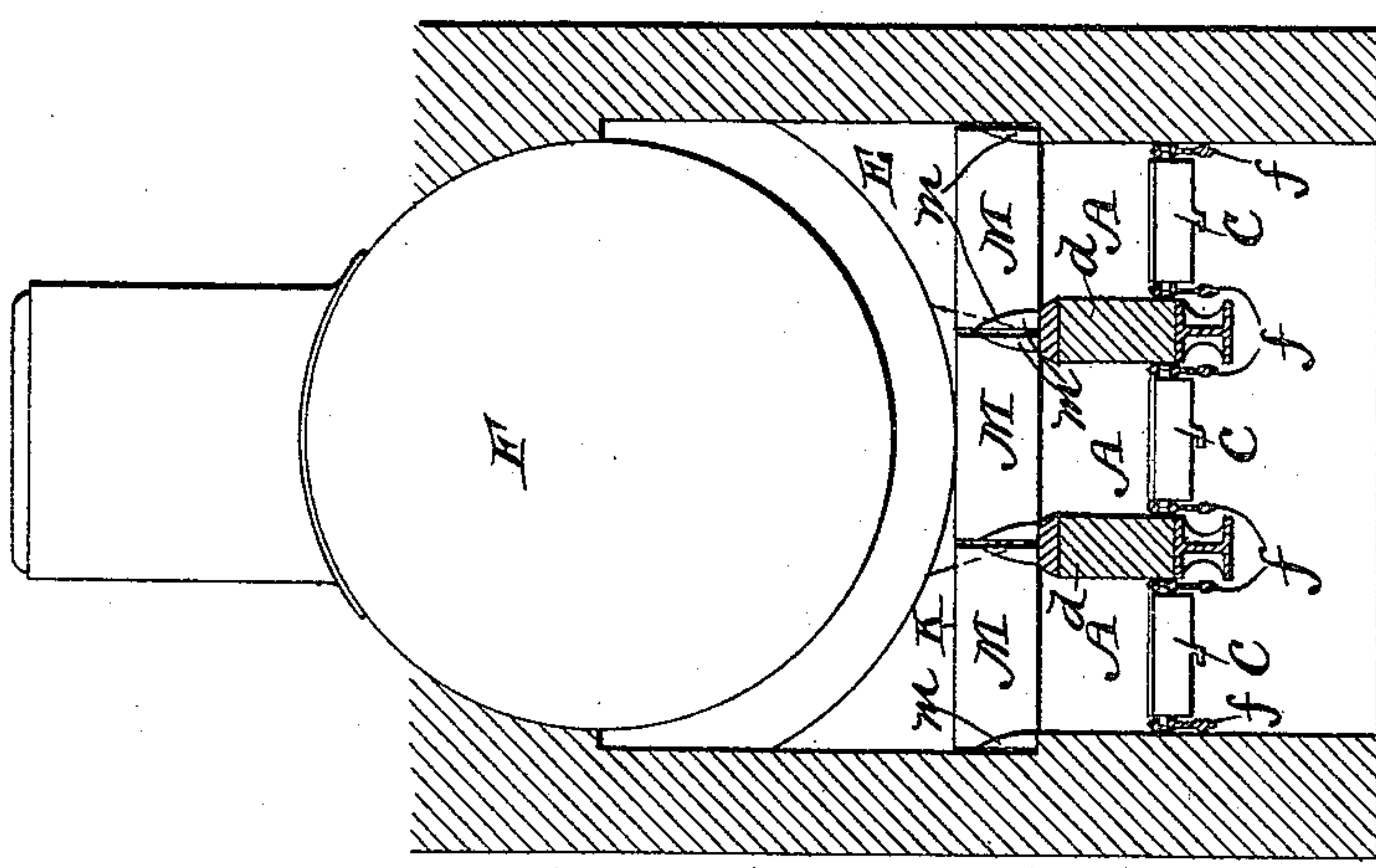


Fig. 8.

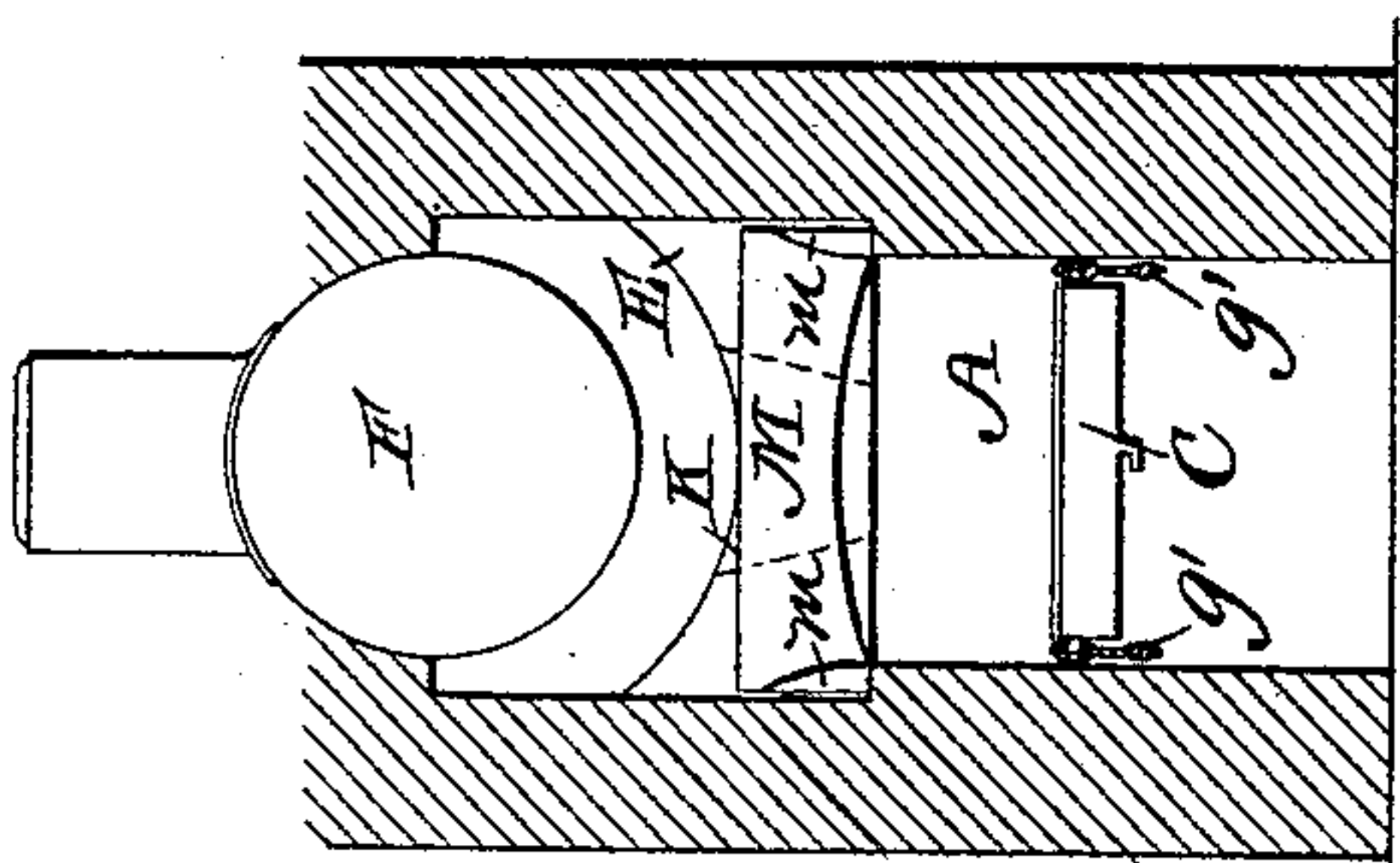


Fig. 12.

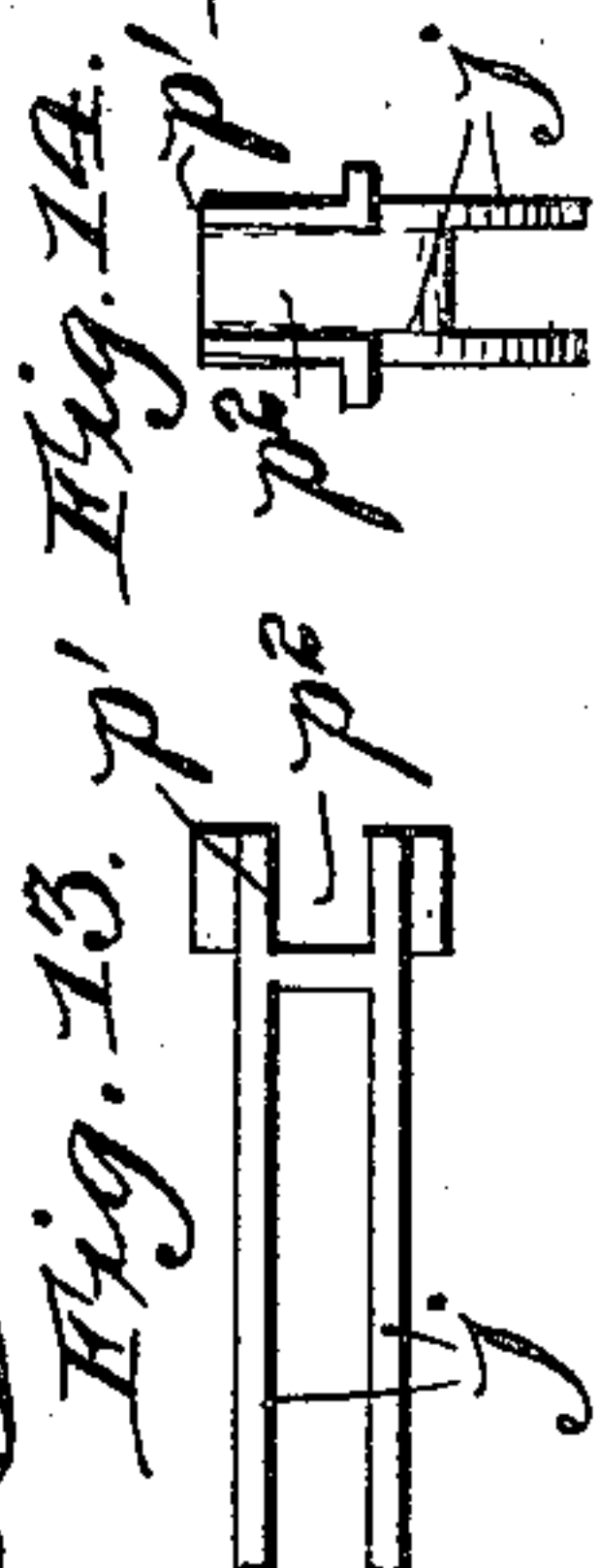
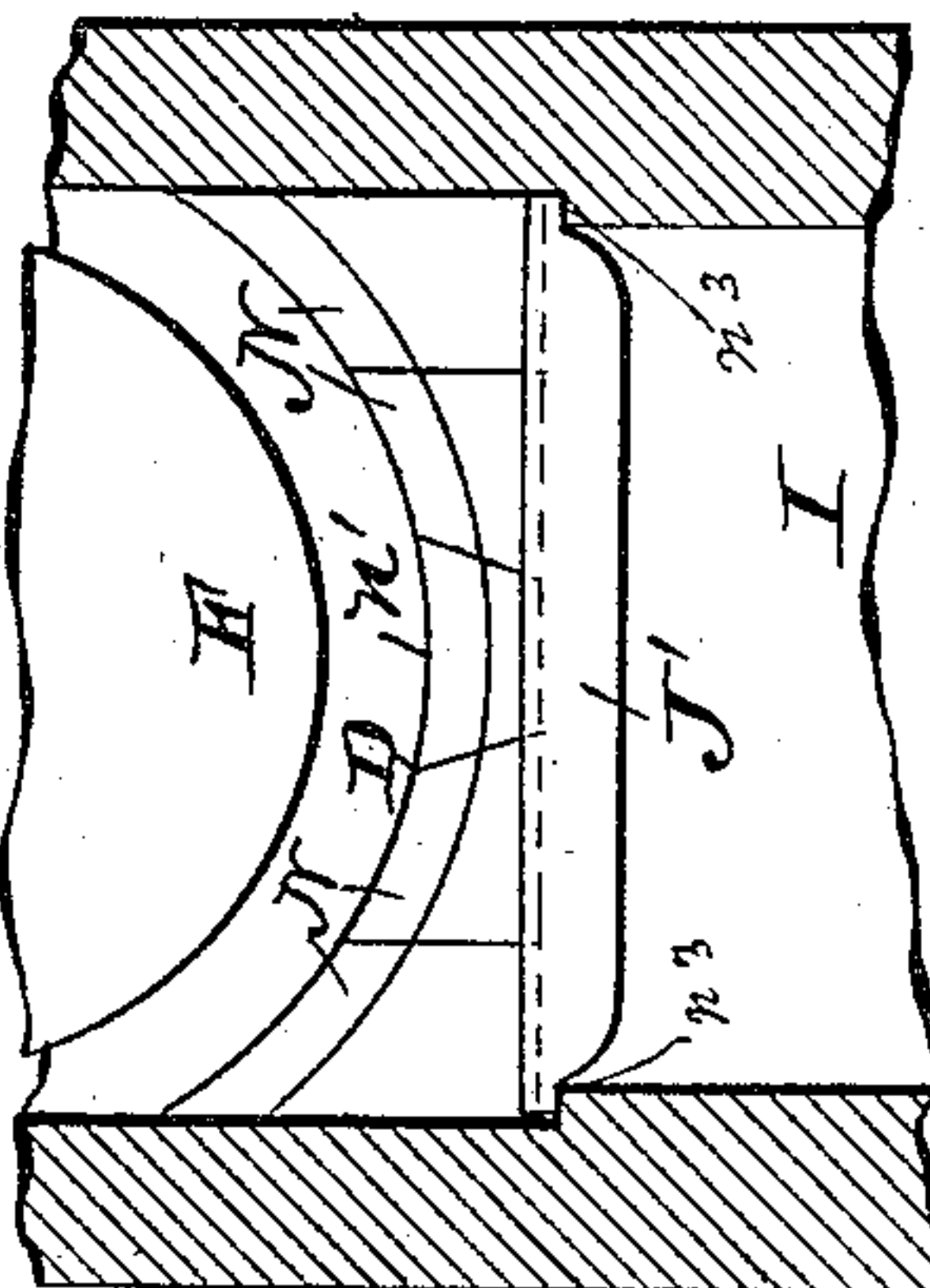
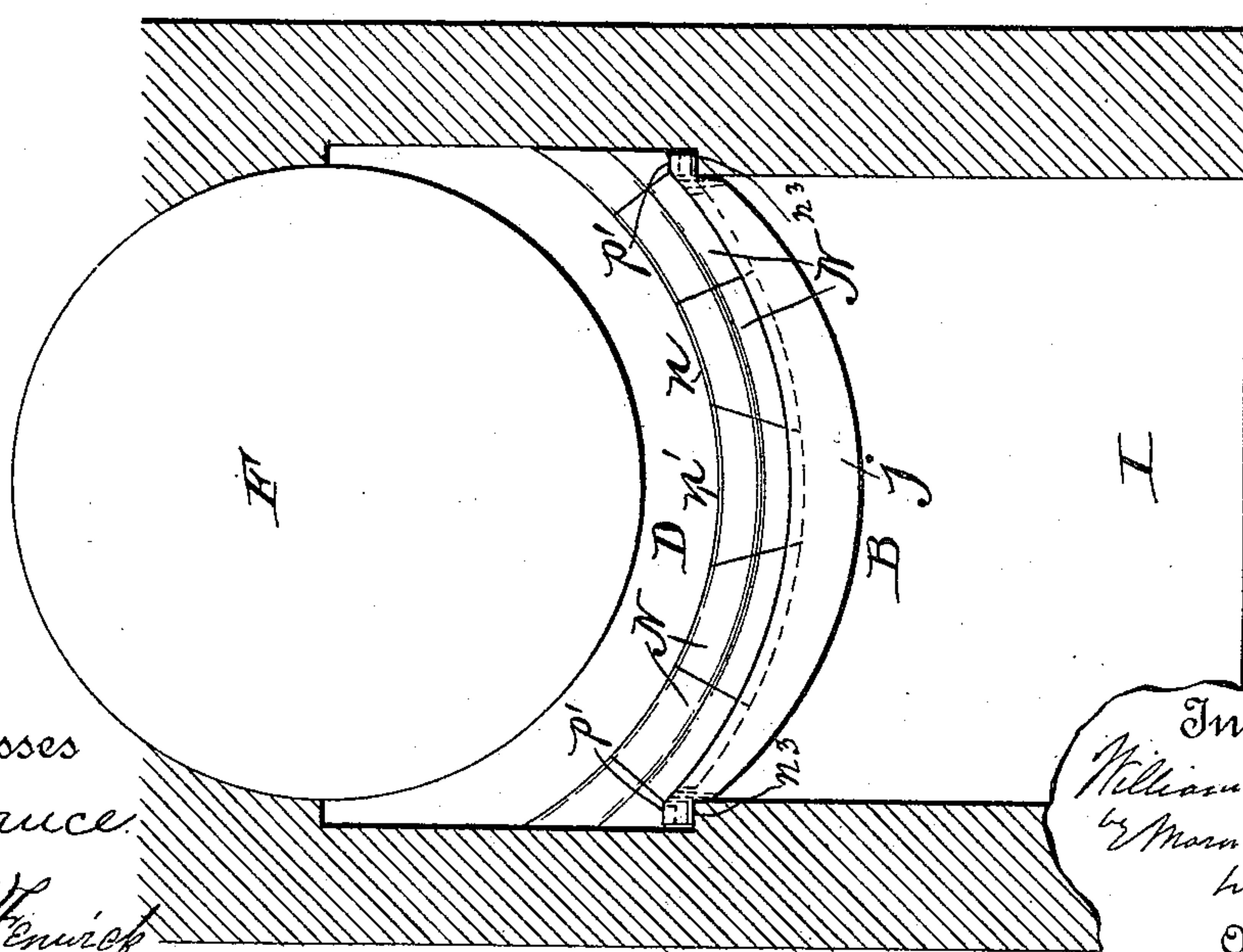


Fig. 11.



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UNITED STATES PATENT OFFICE.

WILLIAM MCCLAVE, OF SCRANTON, PENNSYLVANIA.

BOILER-FURNACE.

SPECIFICATION forming part of Letters Patent No. 529,292, dated November 13, 1894.

Application filed June 29, 1894. Serial No. 516,043. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM MCCLAVE, a citizen of the United States, residing at Scranton, in the county of Lackawanna and State of Pennsylvania, have invented certain new and useful Improvements in Boiler-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 appertains to make and use the same.

My invention relates to boiler furnaces, and consists first, in an improved construction of the chamber in which the fire bed or grates are constructed, and second, in an improved construction of flame bed in rear of the grate or fire-bed chamber, whereby improved and important results are obtained, all as will hereinafter be described and specifically claimed.

In the accompanying drawings, Figure 1, is a vertical longitudinal section of a boiler furnace having a single fire bed with single ash pit beneath it, with my improvements embodied in the same; the boiler in this view being shown in elevation. Fig. 2, is a cross section through the fire box of a boiler furnace having two fire beds; showing my improvements embodied in the same. The boiler in this view is shown in end elevation. Fig. 3, is a broken horizontal section of Fig. 2, the boiler being removed. Fig. 4, is a detail perspective view of a single tile, brick, or plate of the type shown in Fig. 1. Fig. 5, is a detail perspective view of the opposite side of the tile or brick shown in Fig. 4. Figs. 6 and 7, are perspective views of modified forms of tile or brick used over the fire bed. Fig. 8, is a cross section showing the arched tile or brick over a single fire bed. Fig. 9, is a cross section showing a straight bottomed tile or brick over a triple fire bed. Fig. 10, is a broken detail longitudinal section, showing a modified form of tile or brick. Fig. 11, is a cross section of the furnace through the flame bed shown in Fig. 1. Fig. 12, is a similar section to Fig. 11, showing a modified form of supporting bar for the tile or brick of said bed, and Figs. 13 and 14, are detail views of the supporting bars shown in Figs. 1 and 11.

A, is that portion of the boiler furnace in which the grate or grates C, are applied, and

B, that portion of the same in which the flame bed D, is formed.

E is the bridge wall; F, the boiler; G, an air inlet pipe with jet branches *g*, leading into the combustion chamber just above the grate or grates; H, a horizontal, transverse air-inlet pipe with apertures in its rear side in communication with a space *h*, formed in the bridge wall.

I, is a soot and débris pit formed beneath the flame bed, extending from the base of the furnace wall to the flame bed, and J, is a door or entrance opening through which the accumulation of soot and débris in the pit I, are removed.

The grate, or grates C, may be arranged on supports *a*, of the style shown in Fig. 1, or between a partition wall *b*, and upon supports *c*, as shown in Fig. 2; or between half partition walls *d*, mounted upon supports *f*, as shown in Fig. 9; or between the side walls of the furnace and upon supports *g'*, as shown in Fig. 8; and the flame bed D, may be arranged on arched supporting bars *j*, or flat supporting bars *J'*.

The style of furnace, and the grate or grates, and means for supporting the grate or grates, as well as the particular form of means for supporting the flame bed, may be varied as circumstances require.

As an improvement in the construction of the fire bed chamber, and the flame bed of boiler furnaces of the types shown, or other analogous types, I provide an easily removable, open work, self cleaning, deflecting partition K, over the fuel bed, or grate or grates C; and an easily removable, self cleaning, open work partition D; both of said partitions being practically horizontal, having, preferably, only a slight inclination from the front to the rear wall of the furnace, such inclination giving greater freedom for the expansion and circulation of the highly heated products of combustion in their passage from the fire bed into the space *k*, leading into the return flues of the boiler. These partitions are directly under the boiler, and a sufficient distance above the grate, and below the boiler, to effect the purpose presently explained. The partition K, in the fire chamber portion A, of the furnace, is formed of some suitable refractory

material, such as long, stout, and deep fire clay tiles or bricks; or long, stout, and deep metal blocks or plates, in form of bricks or tiles. These tiles or bricks are designated 5 by the letter M, in the drawings, and their purpose is to deflect some of the radiant heat of the fire bed, back upon the surface of said fire bed itself, in order to produce better combustion in the fuel, and thereby maintain a 10 higher temperature in the bed of fuel, than can be maintained in the same when the surface of the bed is exposed directly to the cooling influences of the comparatively low temperature of the boiler above it, and thus obtain flame and gases of a higher temperature, 15 to ultimately come in contact with the heating surfaces of the boiler.

The type of brick employed in constructing the partition K, are, preferably, of the 20 curved form shown in Figs. 1, 2, 3, 4, 5, 6 and 7, but they may be of the straight form shown in Fig. 10. The tile or brick M, whatever may be their shape, are provided with spacing lug portions *m*, at their ends; or are spaced 25 by separate corresponding portions, and by means of these lugs or portions, the tiles or bricks are kept at equal distances apart along the fire bed chamber, and thus a free flow of the flame from the fire bed through the partition K, is insured. 30

The tiles or bricks are of sufficient thickness and depth to withstand the heat, and are placed crosswise so as to span across the fire transversely; and they are set edgewise, at 35 such an angle that they overhang and cover the spaces between themselves, but do not seriously obstruct the spaces leading into the upper portion of the combustion chamber of the fire box.

40 The spacing attachments or devices by which the bricks or tiles are held apart and in position on their supports, are, preferably, made on the tiles or bricks themselves, in such a manner that half of the width of the 45 space at the extreme ends of the tiles or bricks, is filled by a half projection of tapering shape, (see Fig. 1) formed on one tile or brick, and by a half projection, also of tapering shape, formed on another tile or brick— 50 the halves abutting against one another, and leaving a space the whole length of the tiles or bricks, less than that occupied by the half projections, for the flame to pass through. The projections are tapered from 55 the base to the top, so as to shed the soot and flying debris; or each projection can be made of a single double tapered piece, and the same fitted in corresponding recesses in the ends of the tiles, or bricks, as represented in Fig. 60 6; or the projections which are placed on supports of the side wall, may be formed either integral with the tiles or bricks, as in Figs. 2 and 4, of the drawings, or separate from the same as in Fig. 7, in which latter construction, 65 gains are formed in said ends of the tiles or bricks, as shown, to keep the projections in position.

In applying my invention to small boiler furnaces, the tiles, bricks, plates, or blocks may span the entire width of the furnace as 70 shown in Fig. 8, but when the boiler furnace is of larger size, it may be divided into two or more furnaces, in which case some of the ends of the tiles, bricks, plates or blocks will rest on division walls, either as illustrated in Fig. 75 2, or Figs. 8 and 9.

The brick or tile may be arched on their under side or made straight, as illustrated in Figs. 1, 4, 8 and 9. The arched form is preferable, as it lightens the weight of the tile at 80 the center of the span and will therefore be less liable to give way at that point.

The flame bed D, is constructed of fire brick, as N, set at equal distances apart on their supporting bars so as to leave cleaning spaces 85 *t*, between them, and they have their upper surfaces hipped as at *n*; and their upper edges are slightly concaved as at *n'*. These bricks are placed in rows upon suitable supports *j*, which may be either concave iron bearing 90 bars *j*, as shown in Figs. 1 and 11; or straight iron bearing bars *J'* as shown in Fig. 12; or they may be made of tubing, so as to allow water to flow through them to a feed water heater. When said supports are straight, the 95 brick will be required to be made of different forms and height, so as to produce the desired concave flame flue as illustrated in Fig. 12. The hip surfaces *n*, may run either at right angles to or parallel with the boiler, but it is 100 preferable to place them as shown, as this arrangement facilitates the intermingling of oxygen with the gaseous combustibles, as well as insures the holding of the flame up to the boiler. The ends of the bearing bars *j*, *J'*, 105 may rest upon projecting ledges *n*³, built on the side walls as shown or otherwise suitably arranged. The bottom edges of the bricks may be tongued as indicated at *p*, so as to project down between the members of the 110 bearing bar, or they may be grooved to straddle the same. It will be observed that the bricks of the flame bed are concave on their upper sides, and adjoin on oblique and radial lines, and that they form a segmental concave surface beneath and partly around the 115 boiler; and by being thus adjoined they can be readily knocked out for repairs, and as readily replaced. The extreme bricks at each edge of the concave rest on extensions *p'*, of 120 the bars, and also are tongued in the spaces *p*², at the ends of the bars, as will be understood by referring to Figs. 11, 13 and 14. The flame-bed portion of the furnace, has a commodious soot and debris pit I directly beneath 125 the flame bed, and into this pit the soot and fine debris or flying ashes deposit, the same passing down into the pit I through the spaces *t*, formed between the bricks, and also between their supporting bars, and by this 130 means the flame bed is rendered self cleaning.

In order to supply air to the fire chamber portion of the furnace above the partition, the air pipe G, is provided, and the air com-

ing in through this pipe and its branch nozzles, will aid in promoting combustion of the gases in said portion of the fire chamber; and in order to supply air at the bridge wall E the air pipe H, is provided, and air coming in through this pipe and its jet passages, will aid in promoting the combustion in the flame flue above the flame bed. The air pipes may not be necessary, and other means of aiding the combustion may be adopted without departing from my invention.

It is well known in practice that coal fuels will burn better under a brick arch than when directly exposed to the heating surfaces of a boiler above, because of the comparatively low temperature of the boiler, against that of the temperature of good combustion; and, especially is this true, with respect to small anthracite and bituminous fuels, such as culm, bird's-eye, buckwheat, and bituminous slack, and the like; and many devices have from time to time been resorted to with this fact in view—such as solid brick arches built up against the boiler; solid masonry brick arches built partly over the fire with return flame space between the top of the arch and bottom of the boiler. Flat tiles have also been used to partly cover the fire in the same way; and brick arched furnaces have been built outside the boiler furnace proper. All such contrivances have been found more or less objectionable, for, in the first instance, too much of the heating surface of the boiler is practically lost, and the brick must be torn out when the boiler requires repairing. In the second instance, the same trouble arises as to the necessity of tearing out the masonry to repair the boiler, and the top of the arch requires to be cleaned quite often to free it from the soot and ashes which rapidly accumulate thereon, and this last named objection is equally true when flat tile are placed horizontally or nearly so, while in the case of an outside furnace, the main objections are the extra room required, extra expense of building the structure, together with the heat lost by radiation through the top of the arch into the outside air.

The several objections named are obviated by my invention, as the substitute for a brick arch is built in the furnace proper, and located so as to provide an adequate combustion chamber between it and the boiler, and which can be easily removed at any time when the boiler may need repairing. Again the inclined surfaces of the tiles or plates by overhanging the spaces through which the flame passes, serve to intercept or deflect back a portion of the radiant heat from the fire, which keeps the temperature of the fuel on the grate much higher than when the fuel is exposed to the cooling influences of the boiler, thereby producing better combustion in the fuel on the grate, and, therefore, ultimately furnishing a hotter flame and gas to come in contact with the heating surfaces of the boiler.

By my invention an increased heating surface in the great chamber, with which the gases from the fuel bed must come in contact before they reach the combustion chamber under the boiler, is provided. Again, the numerous divisions made by the tiles or plates, assist combustion materially, in that they break up the volume of gas as it rises from the fuel in a large number of parts, thus furnishing means for more thoroughly intermingling the oxygen and gaseous combustibles.

By the second part of my invention the hot flame and gases produced, are held up close to the boiler, and the flame bed is self cleaning and easy of repair.

It will be understood that both features of my invention can be used in one boiler, or separately when required; and in fact some boiler construction would require only one part of the invention, namely, that which furnishes the deflecting covering over the fuel bed. The locomotive type of boiler and some water tube boilers are among the classes which would not require more than the first part of my invention; and in some of such constructions it may be necessary to incline the tiles or plates toward the front end of the boiler, instead of toward the rear. Again the second part of my invention would be useful in holding the burning gases up against the boiler even when the first part of my invention is not used in the fire grate chamber of the boiler furnace.

What I claim is—

1. In a boiler furnace, one or more series of heat deflecting, readily removable tiles, bricks, or plates of about uniform size and shape, made of a refractory material, placed on suitable supports, and spanning the fuel bed, and located at a suitable distance above the same, and at such distance below the boiler as to form an adequate combustion chamber between their top edges and the boiler, said tiles, bricks or plates, having suitable flame spaces between them, and placed on their edges, and at such an angle as to practically overhang and cover the said flame spaces, but not to seriously obstruct or close the flame ways, and also so formed that their upper edges will shed the soot and fine ashes, and thus allow the same to descend through the spaces, instead of resting and accumulating on the tiles, bricks or plates, substantially as described.

2. In a boiler furnace, a brick flame bed under the boiler, between the bridge wall and rear end of the boiler, constructed of readily removable bricks having hipped upper surfaces of a sufficient angle to prevent soot and fine ashes from resting and accumulating thereon, and placed in rows on suitable supports, and spanning a soot pit beneath them, and said rows of bricks having spaces between them of sufficient width to allow the soot and fine ashes to pass and fall into the soot pit below, and having their apex lines substantially

concentric with the boiler, and at a suitable distance below the same to form an adequate flame way for the burning gases, substantially as described.

- 5 3. The combination in a boiler furnace, of the partition K, formed of spaced tiles, set to overhang the spaces which are between them, and the partition B formed of spaced brick which constitute the flame bed, said flame bed

having a soot or ash pit beneath it, substantially as described.

In testimony whereof I hereunto affix my signature in presence of two witnesses.

WILLIAM MCCLAVE.

Witnesses:

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H. J. GREEN.