No. 627,924. Patented June 27, 1899.

C. J. GUSTAFSON & A. P. GAINES.

BOSH PLATE.

(Application filed June 10, 1898.)

(No Model.) 2 Sheets—Sheet 1.

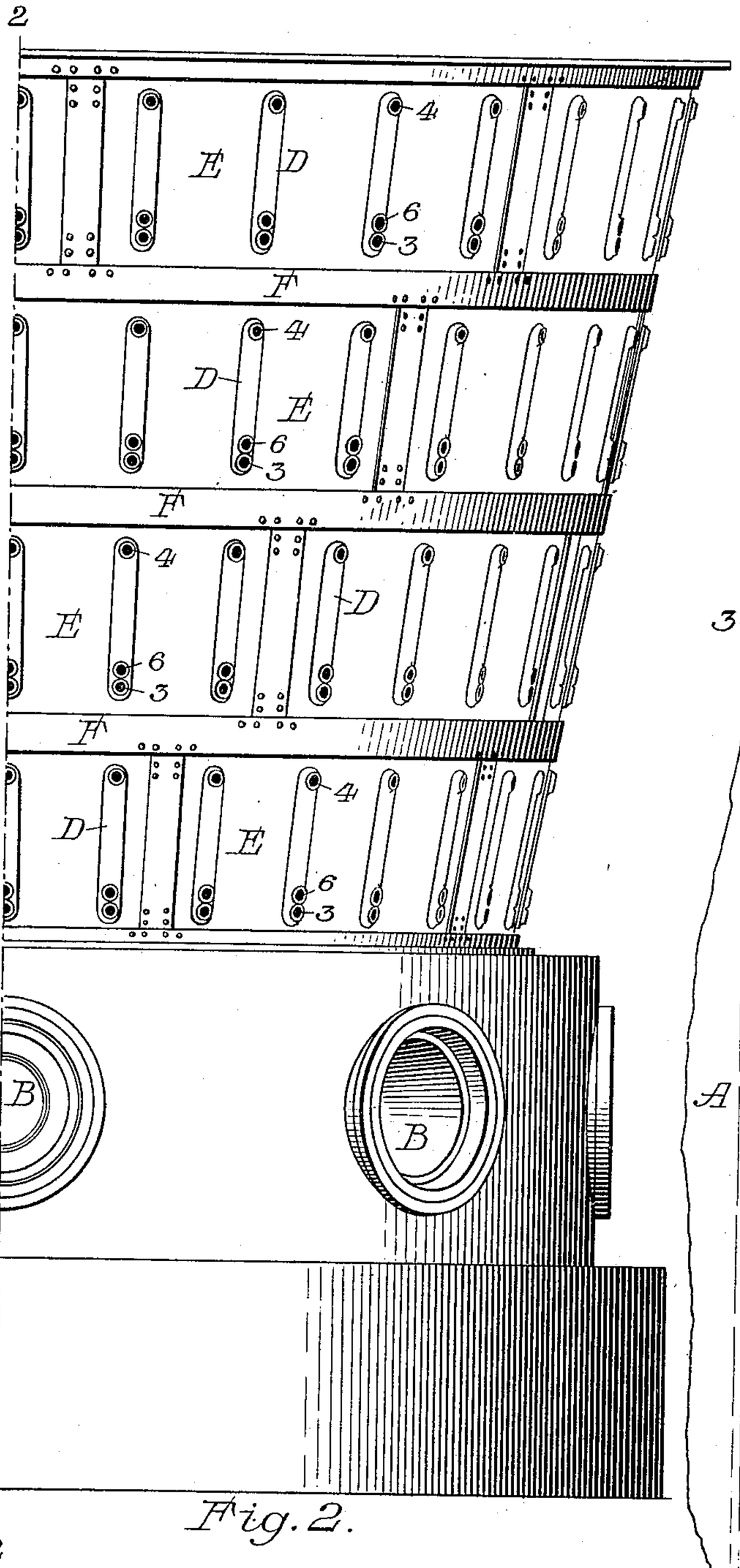

Fig. 2.

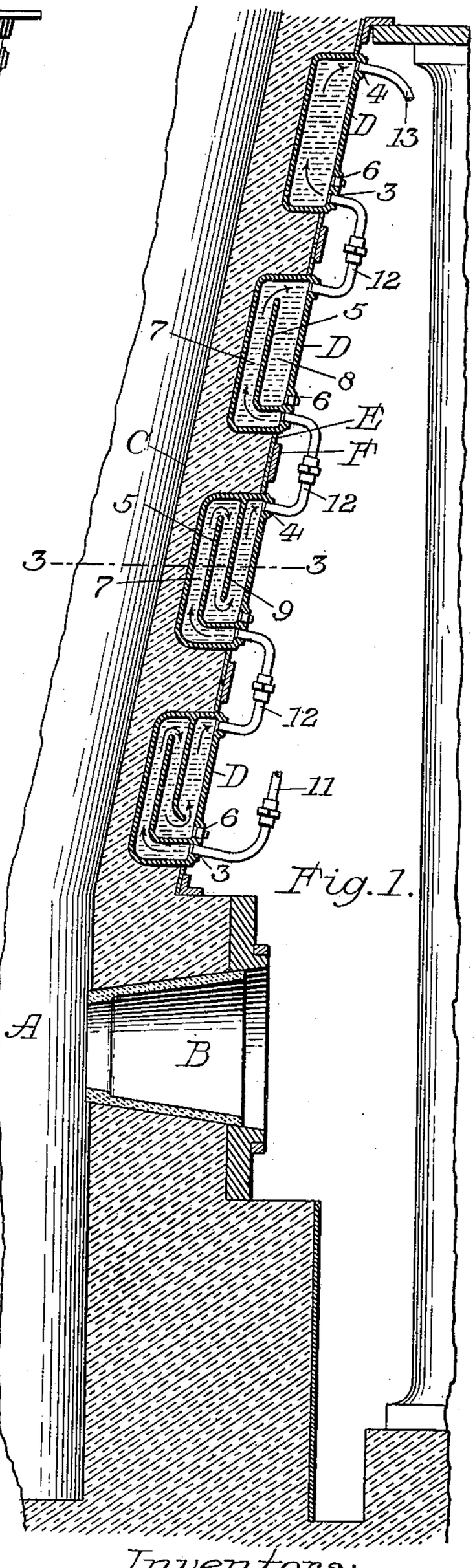

Fig. 1.

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(No Model.) 2 Sheets—Sheet 2.

Fig. 3.

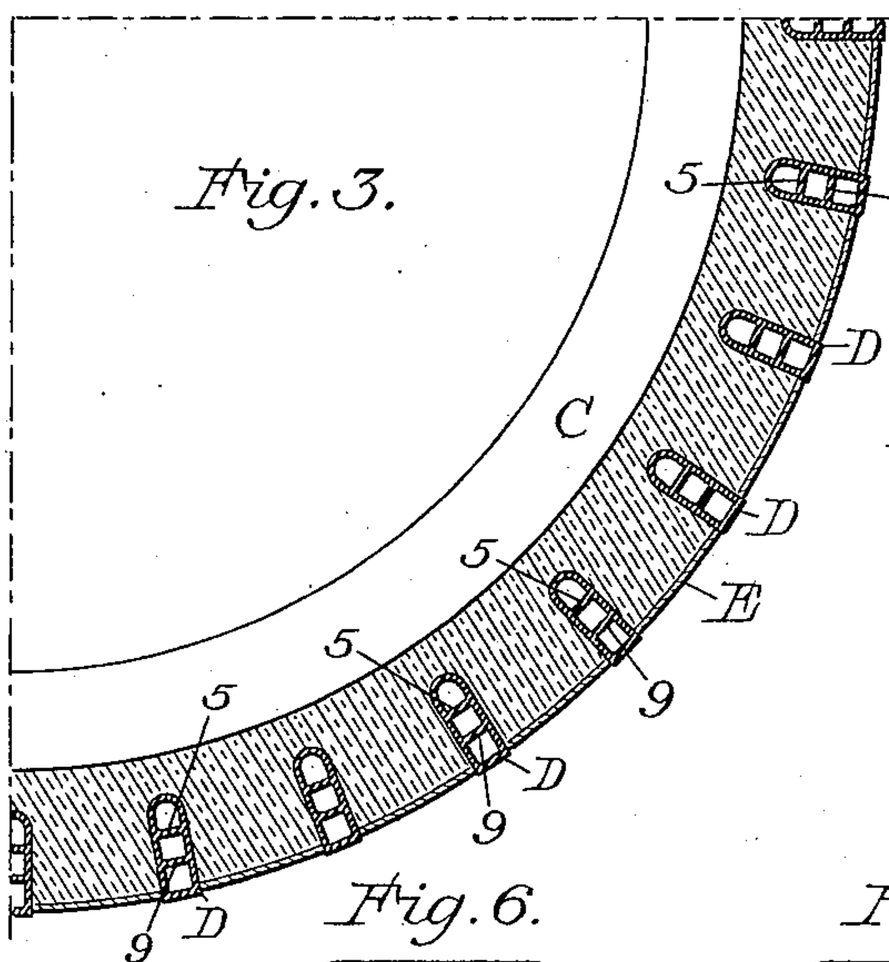


Fig. 4.

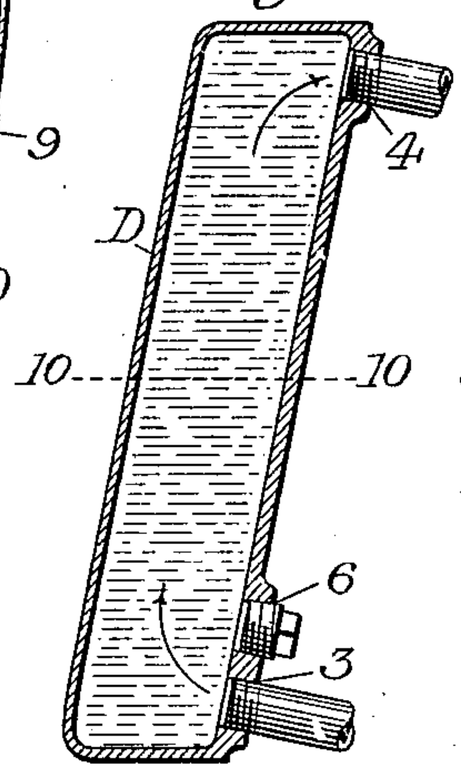


Fig. 5.

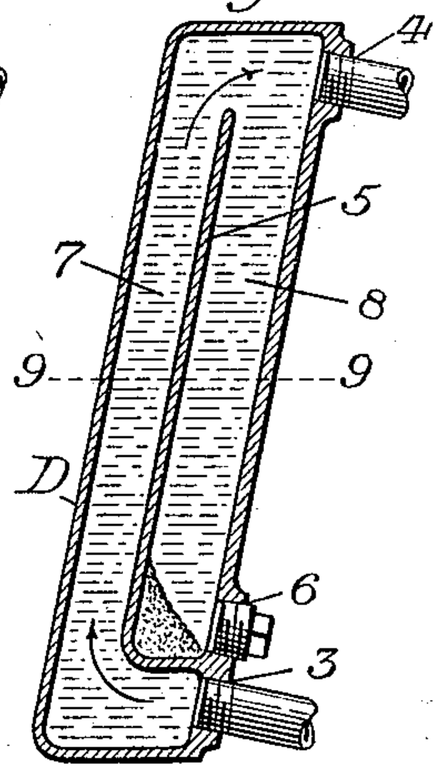


Fig. 6.

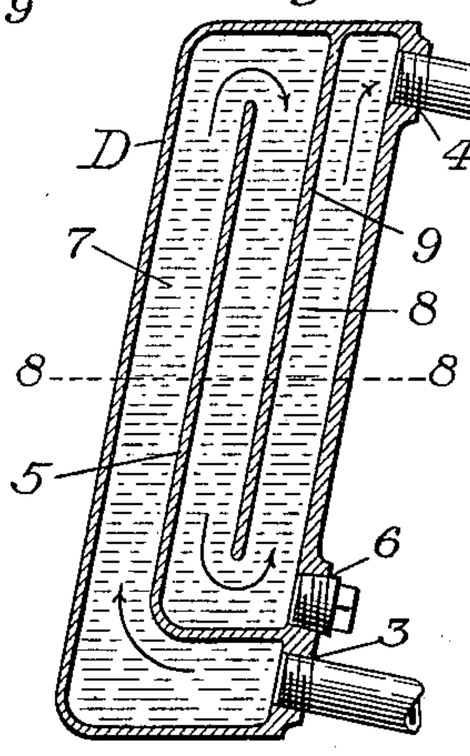


Fig. 7.

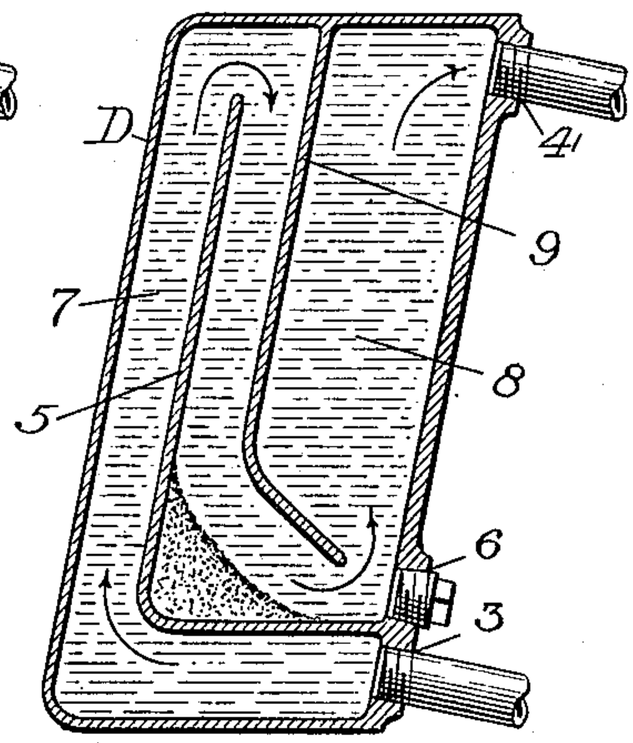


Fig. 14.

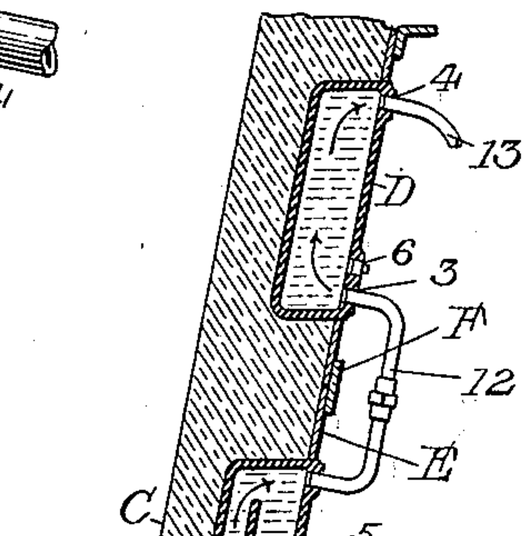


Fig. 8.

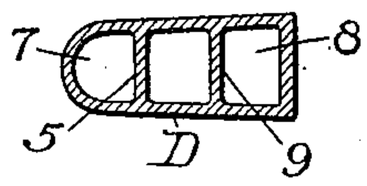


Fig. 9.

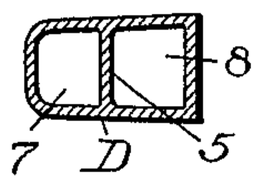


Fig. 12.

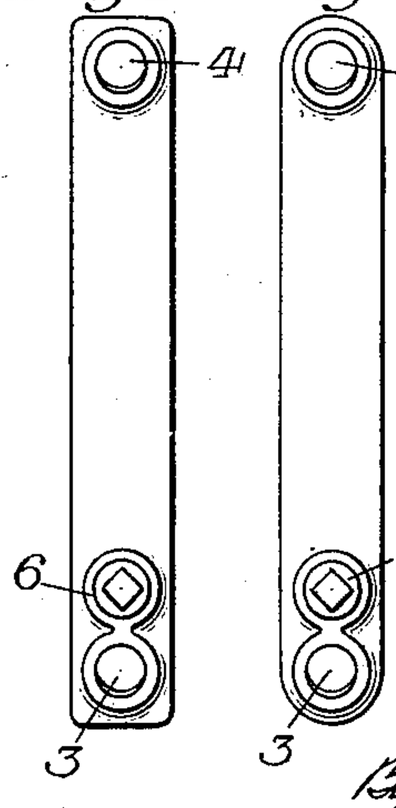
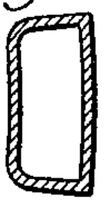


Fig. 13.

Fig. 10.

Fig. 11.



Witnesses:
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By Howson & Howson
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UNITED STATES PATENT OFFICE.

CHARLES J. GUSTAFSON, OF SEQUACHEE, AND AMBROSE PORTER GAINES, OF SOUTH PITTSBURG, TENNESSEE.

BOSH-PLATE.

SPECIFICATION forming part of Letters Patent No. 627,924, dated June 27, 1899.

Application filed June 10, 1898. Serial No. 683,101. (No model.)

To all whom it may concern:

Be it known that we, CHARLES J. GUSTAFSON, residing at Sequachee, and AMBROSE PORTER GAINES, residing at South Pittsburg, in the county of Marion and State of Tennessee, citizens of the United States, have invented certain new and useful Improvements in Bosh-Plates, of which the following is a specification.

Our invention relates to improvements in bosh-plates for blast or other furnaces; and our object primarily is to provide a more perfect circulation of the cooling liquid and to secure a more effective cooling of the bosh-wall of the furnace than has hitherto been attainable in constructions employed for this purpose.

Our invention further consists in the novel construction hereinafter described with reference to the accompanying drawings and more particularly pointed out in the claims.

In the drawings, Figure 1 is a vertical section of one side of a furnace-wall on the line 2 2, Fig. 2, showing the application of our invention thereto. Fig. 2 is an elevation of half a furnace-wall from ground-line to mantle, showing our bosh-plates in position with circulating-pipes removed. Fig. 3 is a transverse sectional plan view of a fourth part of a furnace on lines 3 3, Fig. 1. Fig. 4 is a central vertical section of one form of our bosh-plate. Fig. 5 is a similar view of a modified form thereof. Fig. 6 is a similar view of another modified form. Fig. 7 is a similar view of still another modified form. Fig. 8 is a transverse sectional view on the line 8 8, Fig. 6. Fig. 9 is a similar view on the line 9 9, Fig. 5. Fig. 10 is a similar view on the line 10 10, Fig. 4. Fig. 11 is a similar view of a further modification. Fig. 12 is a front elevation of one form of bosh-plate. Fig. 13 is a similar view of a modification. Fig. 14 is a view of a modified arrangement of bosh-plates.

Referring to the drawings, in which the same reference characters designate the same or corresponding parts in all the views, the letter A indicates the lower part of a furnace in which are placed the usual twyer-openings B and above which is the bosh-wall C.

Our bosh-plates consist, essentially, of a vertically-elongated water-tight chamber D, having an inlet-opening 3 at or near its bottom and in the outer wall thereof and an outlet or discharge opening 4 in said wall at or near the top, through which openings the cooling liquid circulates and in a vertical direction from the bottom toward the top in the bosh-plate when the latter is in position in the furnace-wall. We preferably surround the bosh-wall of the furnace with a metal shell or jacket E, provided with horizontal strengthening-bands F, which shell or jacket is provided with a number of vertically-elongated openings or holes corresponding to the bosh-plates, through which openings the latter may be readily inserted into and removed from the recesses in the furnace-wall, into which the said bosh-plates are seated when in operative position. The recesses have their longest dimensions extending in a vertical direction and their internal walls terminating near the inner face of the furnace-wall, and the bosh-plate has an outer contour conforming to the recess in which it is seated.

We preferably provide the outer wall of each bosh-plate with a washout-opening 6, normally closed by a suitable plug and located near the inlet-opening 3, such washout being advantageous when the nature or condition of the circulating liquid is such as to cause deposits or sediment to accumulate in the bottom of the plate. By this means such sediment may be removed without disconnecting the circulating or inlet and outlet pipes.

The bosh-plates are arranged in horizontal courses, a series of plates forming each course, and the plates in successive courses form vertical columns, in which the several plates are connected by circulating-pipes 12, the main inlet-pipe 11 being connected to the inlet-opening of the lowermost plate of the column and the discharge-pipe 13 to the outlet-opening of the uppermost plate thereof. When the diameter of the bosh varies, increasing from bottom to top, as it usually does, the distance between adjacent plates in successive courses increases from the bottom upwardly, as shown in Fig. 14.

It will be seen that the plates are located in

different horizontal planes and that the tops of the lower plates are connected with the bottoms of the plates above, so that the circulation of the cooling liquid is from the bottom upwardly through the series of plates in successive horizontal planes, and this is the essential feature of the arrangement in employing successive horizontal courses of plates, whether the connected plates form a strictly vertical column or one which extends in a diagonally vertical direction.

These bosh-plates are preferably cast of copper or bronze and may be unobstructed internally, as shown in Fig. 4, or they may be provided with any suitable number of diaphragms or baffle-plates, as shown in Figs. 5 to 7, and they may vary in form of cross-section, width, depth, or thickness, without departing from the essential feature of our invention. When the furnace-wall is very thin, the plates may be reduced in thickness—that is, in the direction of the diameter of the furnace when in position thereon—and the inner wall concaved, as shown in Fig. 11.

When the circulating liquid contains much solid matter, we prefer to provide the bosh-plate with one or more internal diaphragms or baffle-plates so located as to form a settling-chamber and to contract the circulating-channel within the bosh-plate, thereby insuring a sufficiently rapid circulation of the current at the internal face of the plate where the heat is most intense and therefore most important to secure the best cooling effect. One form of this construction is shown in Fig. 5, where the numeral 5 indicates a baffle-plate or diaphragm extending from the outer wall of the bosh-plate above the inlet-opening 3 toward the internal face thereof, thence upwardly, and terminating slightly below the top of the bosh-plate. This baffle-plate or diaphragm divides the plate into two chambers 7 and 8. The former serves as the circulating-channel for the current of liquid, while the latter constitutes a settling-chamber for the sediment or solid matter which is precipitated from the current as its direction is abruptly changed at the top of the bosh-plate and passes over the end of the baffle-plate to the discharge-opening 4, the body of water within the chamber 8 being comparatively quiet, so that the settling is facilitated. The sediment gradually accumulates at the bottom of the chamber 8 and is readily removed through the wash-out-opening 6.

When our bosh-plate is used in furnaces having thick walls and thickness of the plate will admit, two or more of such baffle-plates may be used, such as shown in Figs. 6 and 7, where it will be seen that a baffle-plate 9, depending from the top of the bosh-plate, is interposed between the baffle-plate 5 and the outer wall of the bosh-plate, thus forming a circuitous channel for the liquid in its passage from the inlet to the discharge opening and affording better opportunity for settling. The baffle-plate 9 may be bent toward the outer wall of the bosh-plate, as shown at 10, Fig. 7, thereby enlarging the chamber for the reception of the sediment, where the conditions will admit of such formation.

In Fig. 12 the outer contour of the plate, conforming to the contour of the chamber, is shown as substantially rectangular with slightly-rounded corners, while in Fig. 13 the top and bottom are formed on curved lines, and while either form may be used the latter is preferable because of its greater strength and the less resistance offered to the passage of the cooling liquid through the plate and, further, because the excessive accumulation of sediment at the corners of the chamber is prevented.

Any of the forms of bosh-plates shown in the drawings and herein described may be used in all the courses, if desired, or any two or more of the modified forms may be used in the same wall, as shown in Fig. 1. In order to provide, however, for perfect interchangeability of the plates in all positions in the same furnace, only one of the various modifications disclosed would be used.

In order to obtain a more decided cooling effect at the lower positions of the furnace-wall just above the twyer-line where the heat is most intense, the vertical distance between adjacent plates may be proportionately reduced between the lower courses and increased between the upper courses, as shown in Fig. 14, without necessitating any change whatever in the form of plate. In the majority of furnaces, however, it is believed that in view of the lower temperature and higher pressure of the cooling liquid entering the lower courses as compared to the gradually-rising temperature and decreasing pressure of the same liquid in the upper courses bosh-plates of uniform dimensions, uniform vertical spacing, and uniform design will effect the desired graduated cooling effect upon the furnace-wall, and in the usual form of furnace (shown in Fig. 2) it will be observed that the arrangement of the plates in vertical columns contributes to this effect, for with the same number of plates in each course the horizontal spacing between adjacent plates is closer at the bottom or lower courses than in the upper courses, this distance varying gradually as the diameter of the bosh-wall varies from bottom to top and approximately as the heat inside the furnace-wall varies.

In addition to obtaining a more thorough and effective circulation for the cooling fluid through the plates by the vertical arrangement of bosh-plates we also obviate any tendency on the part of the furnace-wall to become burned out in horizontal cavities or recesses between adjacent layers or courses of bosh-plates when laid horizontally, thus forming shelves, on which the descending stock frequently lodges, or forms a "scaffold," to the great detriment both in quality and in quantity of output, and often causing entire destruction of coolers and twyers. By the use of

our vertical bosh-plates these horizontal cavities between adjacent courses of plates are entirely eliminated, and even if spaced too far apart horizontally such cavities as might be formed in a furnace in which our vertically-arranged bosh-plates are used will be in form of vertical troughs or flutes, offering no serious obstructions and presenting no ledges or horizontal projections for the lodgment of any of the contents of the furnace during the operation of the furnace. Furthermore, by the use of our vertical bosh-plates a very slight upper surface is subjected to the weight of the masonry forming the bosh-wall, which may thus be self-supporting independent of the bosh-plates by forming continuous unbroken columns between adjacent columns of bosh-plates from top to bottom and imposing practically none of its weight upon any of the bosh-plates, which may therefore be easily withdrawn and inserted without the least damage to the walls, and no arching of walls over plates is necessary. Again, a stronger and more effective air-tight construction of bosh-wall is facilitated by the use of our vertical bosh-plates, as they are especially well adapted for use in combination with an iron or steel shell or jacket having corresponding openings, through which the vertical plates may be inserted and an air-tight joint made with this steel shell or jacket, which thus offers a safe and substantial support to the bosh-wall until completely worn or burned out, and, finally, by the use of our plates they may be put in any position in the same furnace or in any furnace without regard to the difference in diameters, as only one pattern is necessary for furnaces of varying diameters or for different vertical positions in the same furnace, whether the same enlarges in diameter from bottom to top or not. This interchangeability of the plates is of great advantage when it becomes necessary to remove and replace any plates in position either for repairs or for washing out.

We do not herein claim the broad feature of a series of bosh-plates each with its height so much greater than its width that no bridge, arch, or modified construction of furnace-wall shall be required over the bosh-plate opening to support the superincumbent masonry, with means for introducing a cooling medium into said plates, because this subject-matter is the sole invention of Charles J. Gustafson and is claimed in an application for a patent filed by him May 26, 1899, Serial No. 718,438.

We claim as our invention—

1. The combination with a furnace having a recess in its wall with its longest dimension vertical and terminating at or near the inner wall of the furnace, of a vertically-elongated closed box or chamber seated in said recess and having an inlet-opening near the bottom and an outlet-opening near the top, an inlet-pipe connected to said inlet-opening, means for forcing water under pressure through said inlet-pipe, and a baffle-plate extending from the front wall of the box toward the rear wall of the same and then upwardly, whereby a contracted passage is formed between the vertical portion of the plate and the rear wall of the box, substantially as described.

2. The combination with a furnace having a recess in its wall with its longest dimension thereof in a vertical direction and terminating at or near the inner face of said wall, of a bosh-plate consisting of a vertically-elongated closed box or chamber, substantially conforming to the shape of, and seated in, said recess, whereby the superposed furnace structure is practically self-supporting and independent of the bosh-plate, said bosh-plate being provided with an inlet-opening near the bottom and an outlet-opening near the top, an inlet-pipe connected to said inlet-opening and arranged to direct the incoming liquid against the inner wall of the box, and means for forcing water under pressure through said inlet-pipe, whereby the water is caused to pass upwardly against the inner face of the box, substantially as described.

3. The combination with a furnace having a series of recesses located at different heights in the furnace-wall thereof, of a series of bosh-plates seated in said recesses, each of said plates consisting of a vertical elongated closed box or chamber, and each of said plates being provided with an inlet-opening at or near its lower end, and an outlet-opening at or near its upper end, a circulating pipe or pipes connecting the upper ends of the plates below to the lower ends of the plates above, and an inlet-pipe connecting the inlet-opening of the lower plate with a source of water-supply, said inlet-pipes of each plate being arranged to discharge the cooling liquid directly against the inner wall of the plate, and means for forcing the liquid under pressure through the said inlet-pipes, whereby it is caused to circulate through the series of plates from the bottom upwardly and the incoming liquid in each plate is caused to pass upwardly against the internal wall of said plate, substantially as described.

4. The combination with a furnace, of a metal shell or jacket covering the external wall of the furnace and provided with a series of vertically-elongated openings, a series of recesses in the furnace-wall registering with said openings, and a series of vertically-elongated closed bosh-plates conforming substantially to the shape of said recesses, and having inlets near their bottoms and outlets near their tops, said plates being removably inserted through the openings in the shell or jacket and seated in said recesses, and pipes connecting the tops of the lower plates with the bottoms of the plates above, said pipes being arranged to discharge the liquid against the internal walls of the bosh-plates through the lowest pipe of the series so that it will pass upwardly through the series, substantially as described.

5. The combination with a furnace-wall

having a recess therein whose longest dimension extends in a vertical direction, and having a cross-section whose longest dimension extends from the outer toward the inner face of the wall, of a bosh-plate consisting of a closed box, or chamber, seated in, and conforming to the shape of, said recess, an inlet-pipe connected to the bottom of said plate, and an outlet near the top thereof, a deflecting-partition extending from the outer face of the bosh-plate above the inlet and upwardly toward the top of said chamber, and dividing the bosh-plate into vertical chambers through the inner one of which the liquid is caused to pass from the inlet upwardly against the inner wall and through the outlet, the outlet-chamber forming a settling-chamber for sediment, substantially as described.

6. The combination with a furnace-wall having a series of vertically-elongated recesses therein located at different heights in said wall, of a series of vertically-elongated bosh-plates located in said recesses in different horizontal planes, each of said plates having an inlet at the bottom and an outlet at the top, and a baffle-plate extending from the outer wall of the plate above the inlet and upwardly toward the top of the plate forming a circulating-chamber on one side of said partition adjacent to the internal wall of the plate and a settling-chamber on the other side of said partition, with pipes connecting the tops of the lower plates with the bottoms of the plates above, and means for introducing a cooling liquid under pressure through the bottom of the lower plate, whereby a circulation of the cooling liquid upwardly through the series of plates is obtained.

In testimony whereof we have signed our names to this specification in the presence of two subscribing witnesses.

CHARLES J. GUSTAFSON.
AMBROSE PORTER GAINES.

Witnesses as to C. J. Gustafson:
WILLIAM C. HILL,
LOUISE H. HILL.
Witnesses as to A. P. Gaines:
JAS. L. GAINES,
W. E. CARTER.