No. 812,072. PATENTED FEB. 6, 1906.

W. McCLAVE.

FURNACE COMBUSTION CHAMBER STRUCTURE.

APPLICATION FILED AUG. 24, 1905.

3 SHEETS—SHEET 1.

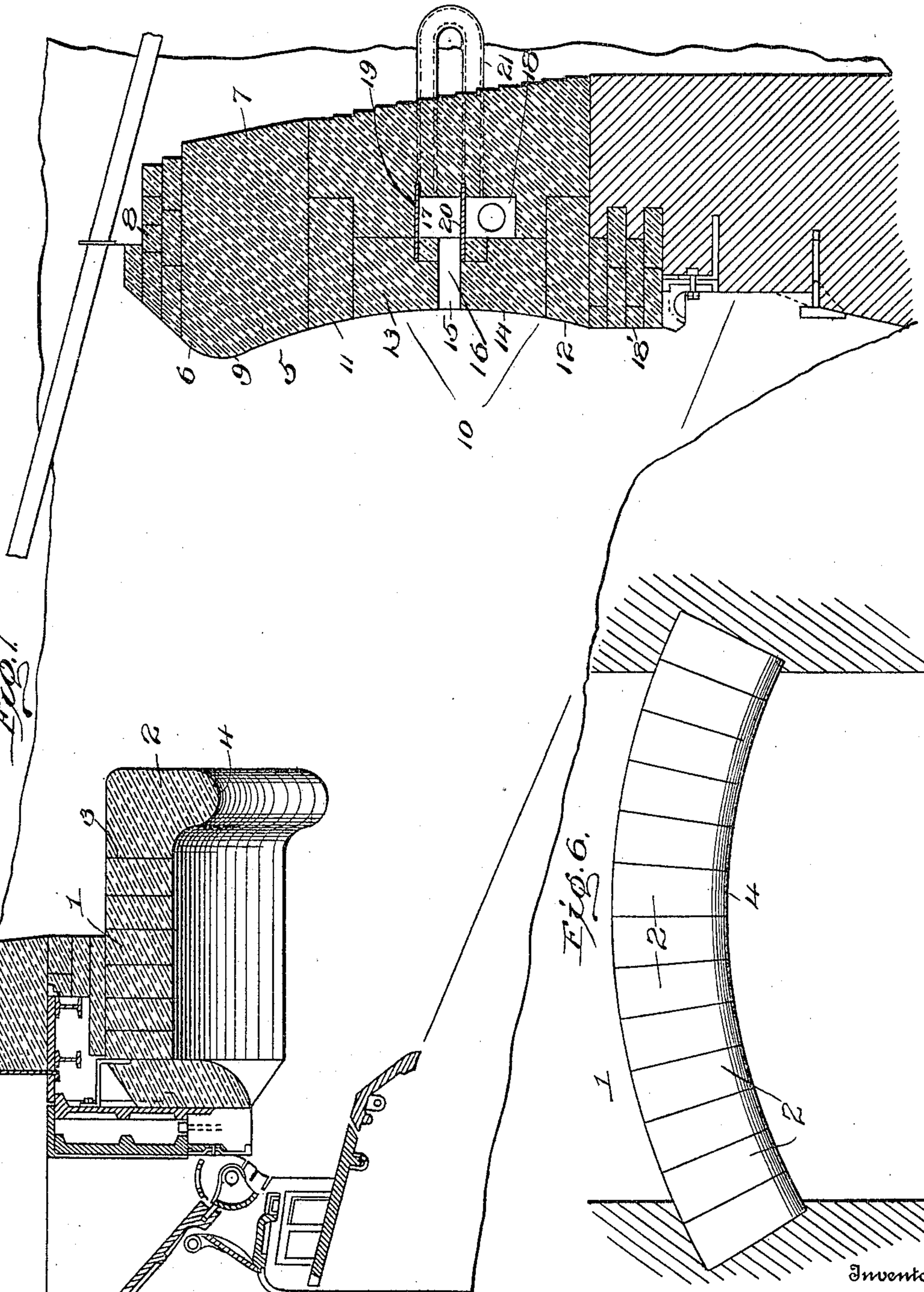

Fig. 1.

Fig. 2.

Fig. 6.

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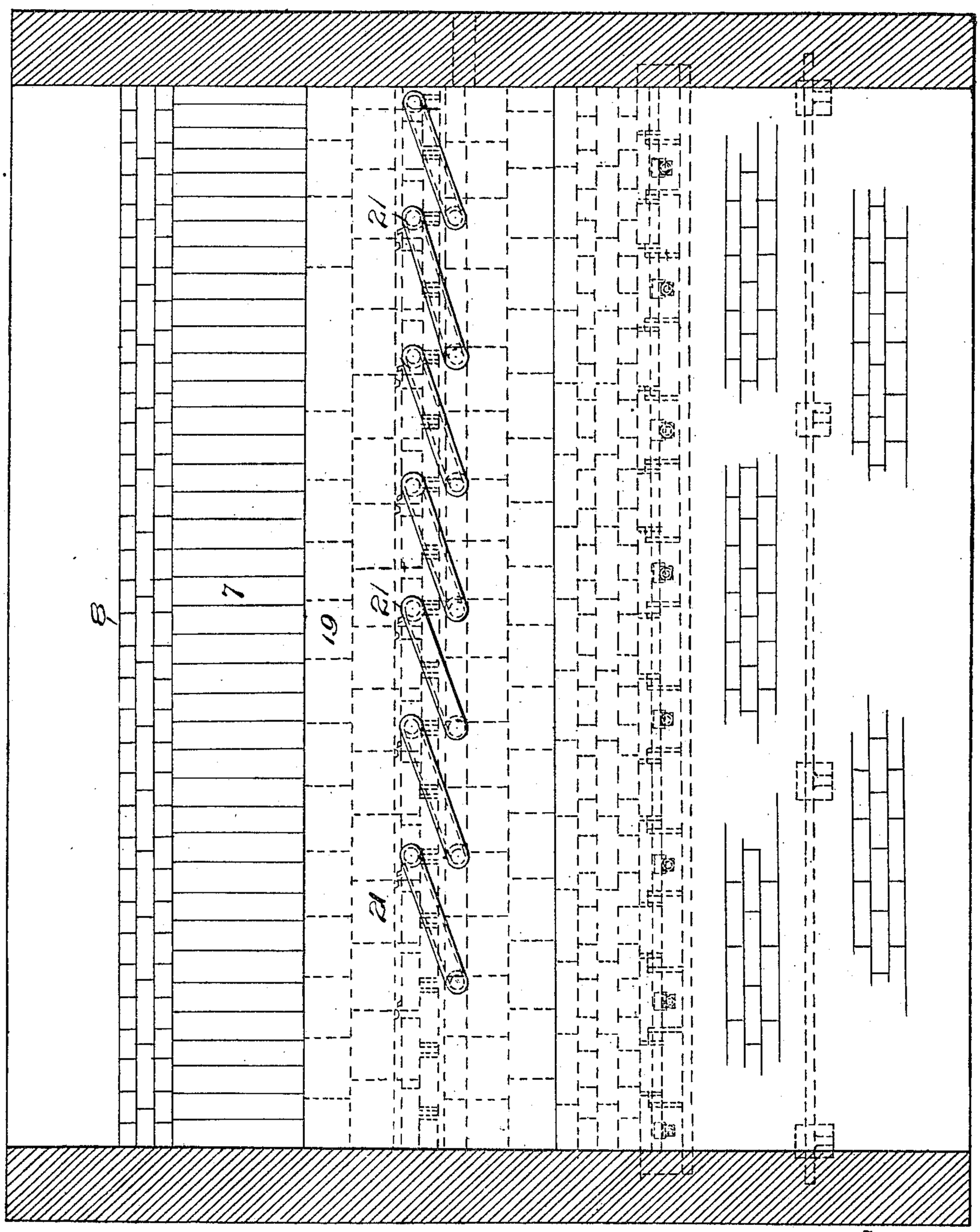

Fig. 2.

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3 SHEETS—SHEET 3.

Fig. 5.

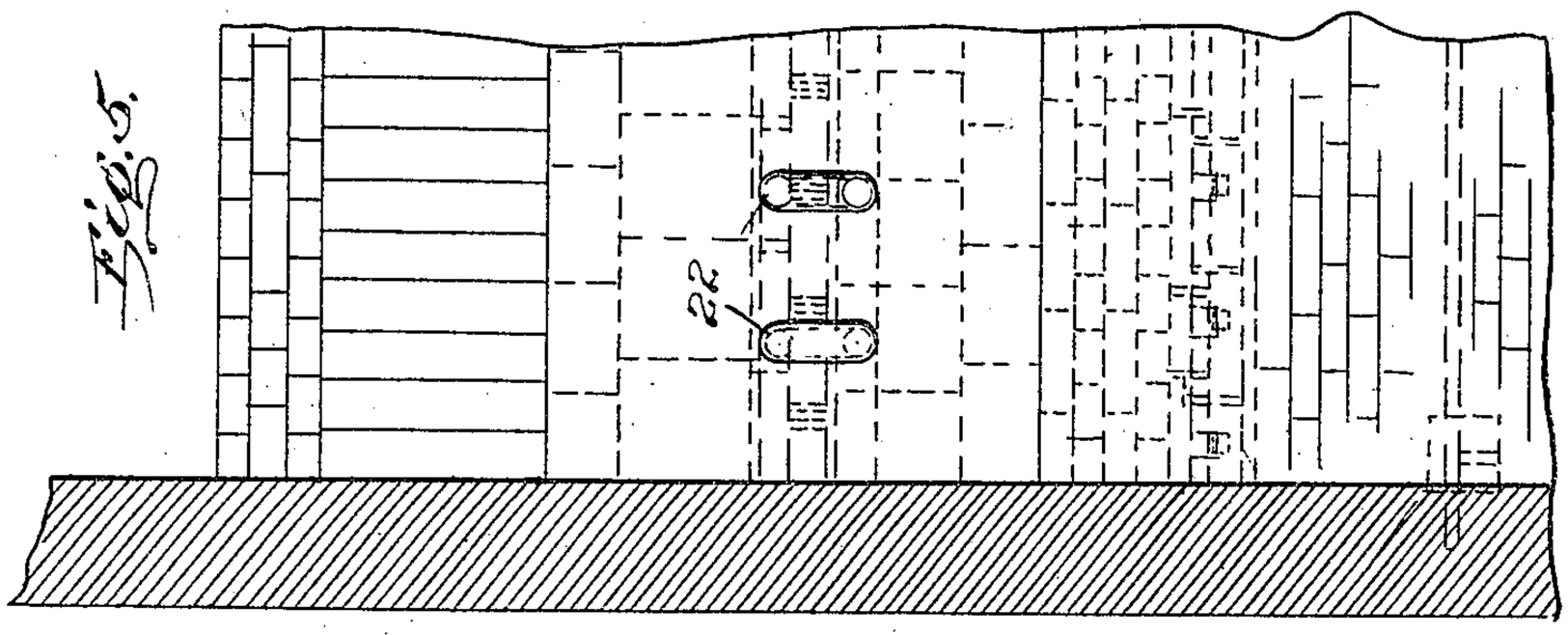


Fig. 3.

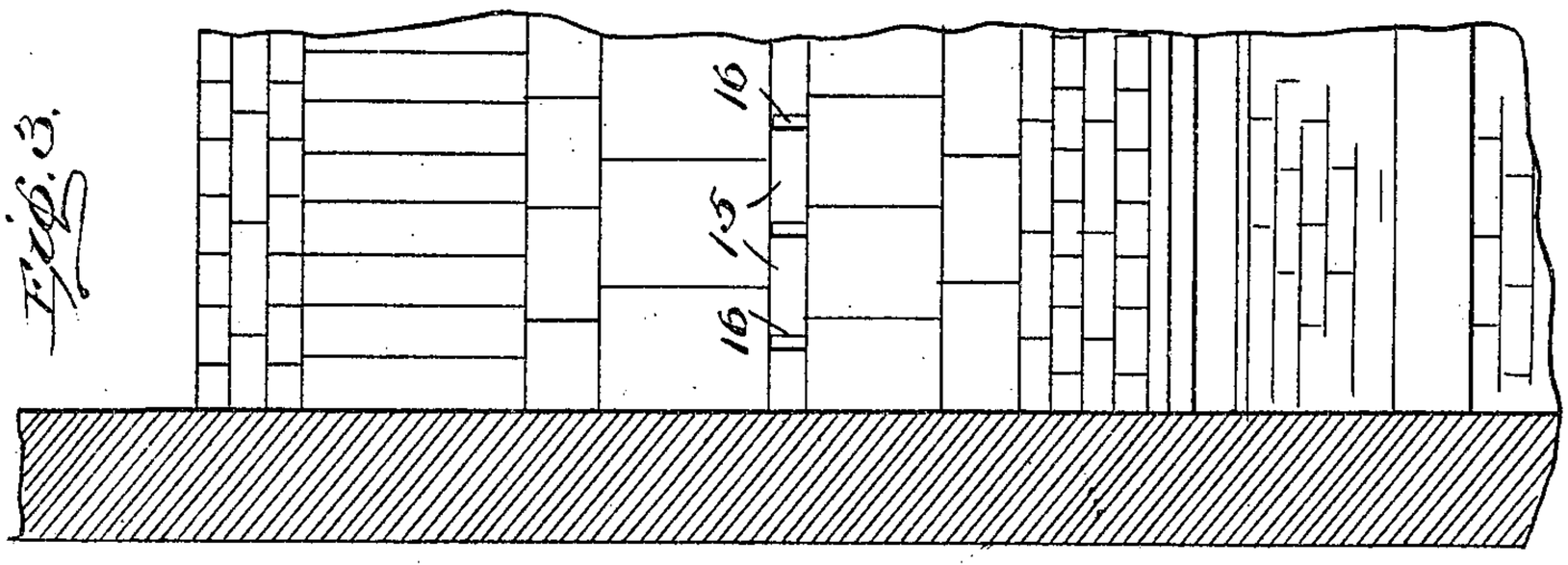
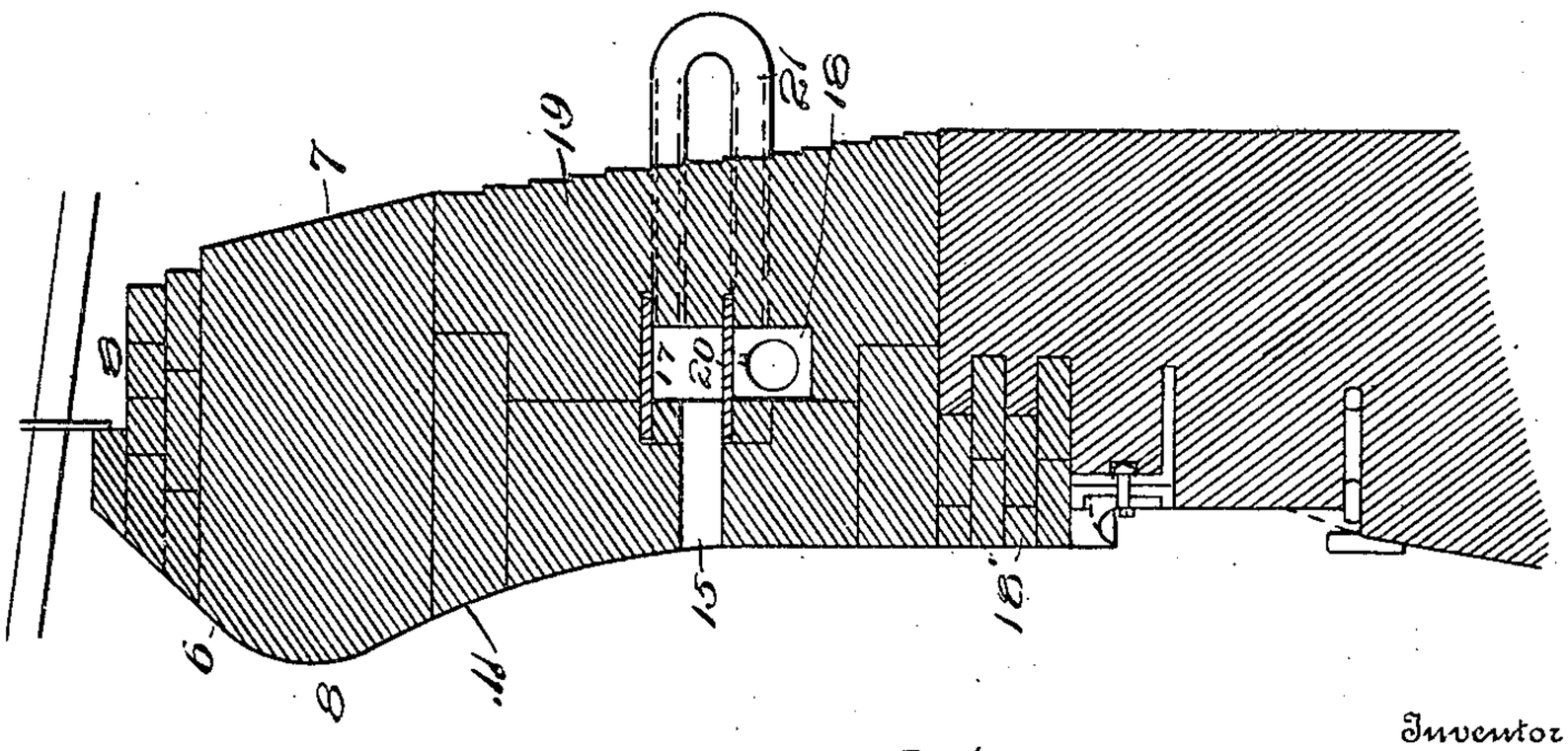


Fig. 4.



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UNITED STATES PATENT OFFICE.

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FURNACE-COMBUSTION-CHAMBER STRUCTURE.

No. 812,072. Specification of Letters Patent. Patented Feb. 6, 1906.

Application filed August 24, 1905. Serial No. 275,669.

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 Furnace-Combustion-Chamber Structures; 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.

This invention relates to improvements in furnace structures, and particularly to the structure of the combustion-chambers or fire-boxes of furnaces.

It is the object of the invention, among other things, to provide a furnace with such a structure above the grate or fuel-bearing surface that the heat developed by the initial combustion of the fuel will be concentrated upon the mass of the fuel sufficiently to produce a thorough burning of the same, and the heat units and volume of products of combustion as they escape from the combustion-chamber will be sufficiently crowded to produce a strong concentration of the heat upon the boiler or other mechanism which is being heated in the structure.

It is also the object of the invention to so construct the arch and the bridge-wall that the portions thereof which are subjected to the most severe heat will not be drawn apart and weakened.

It is a further object of the invention to utilize the heat units of the products of combustion which pass over the bridge-wall for heating air, which is then delivered to the combustion-chamber for insuring the burning of gases and the prevention of smoke.

With these and other objects in view the invention comprises certain novel constructions, combinations, and arrangements of parts, as will be hereinafter fully described and claimed.

In the accompanying drawings, Figure 1 represents a vertical longitudinal section through the upper structure of a furnace combustion-chamber, illustrating the features of the present invention. Fig. 2 is a rear elevation of the bridge-wall of such a furnace, the side walls being shown in section. Fig. 3 is a detail view, partially in section and partially in elevation, showing a part of the front face of the bridge-wall. Fig. 4 is a detail sectional view through the bridge-wall of the furnace, the lower portion of its front face being made vertical. Fig. 5 is a detail view, partially in section and partially in elevation, showing a part of the rear face of the bridge-wall and showing a different manner of arranging the air-heating tubes. Fig. 6 is a detail view showing the inner edge of the front arch.

The present invention involves the structure of the upper portion of a combustion-chamber or fire-box for a furnace and particularly the formation of the bridge-wall and front arch. As shown in the drawings, the front portion of the fire-box is provided with an arch 1, which extends from side to side in the furnace-closure and is constructed of fire-brick, the inner edge of the said arch, which extends toward the mass of burning gases and other products of combustion, being protected by a thickened overhanging portion 2. The edge portion 2 is preferably made of comparatively large integral tile-bricks, the said tile-bricks extending forwardly against the inner edge of the ordinary arch-brick, as at 3, while their rear edges extend downwardly below the inner surface of the arch, as indicated at 4. In using the ordinary fire-brick in an arch in this portion of a furnace it is frequently found that the excessive heat in the fire-box tends to draw the bricks of the arch apart and pull them toward the central portion of the fire-box. The edge tiles 2 are of such size that they form a confining edge which prevents the bricks of the arch 1 from being drawn out of place and of course maintains the whole arch in its proper and effective position. As shown in Fig. 6, the tile-bricks 2 are preferably tapered from the top downwardly, so as to secure a proper keying effect in the arch, the whole arch forming a rigid fire-resisting edge for the main arch. The body portion of the tile-brick, it will be observed, is made wider than the lower edge, so as to give stability to the edging of the arch opposite the brick forming the main body portion thereof. The lower edges of the bricks 2 extend downwardly a sufficient distance at 4 to provide a retaining portion which serves to hold a sufficient body of heat over the front portion of the grate to secure a proper coking action in the new fuel as it is fed upon the said plate and grate. Coöperating with the arch thus formed is the bridge-

wall 5, which is preferably extended to a considerable height and is provided with an upper overhanging portion 6, formed of tile-bricks which are made quite large and which extend into the wall structure sufficiently far to have the preponderance of weight of said bricks so disposed that the forward edges or ends thereof will not tend to tip or lean forward toward the center of the combustion-chamber. The bricks or blocks 7, forming this portion of the bridge-wall, are, in fact, generally made to extend entirely through the bridge-wall structure, as illustrated in Fig. 1. The portions 6 of the wall formed of these bricks or blocks will thus remain in position of their own weight, and any additional bricks which may be built up above the portions 6—as, for instance, at 8—will further anchor and hold the portions 6 in position. The front edges of the bricks or blocks 7 are preferably rounded, as at 9, and the lower portion of said edges forms a part of a transversely-extending partially-cylindrical surface 10, which forms the front face of the bridge-wall. The said front face of the bridge-wall is formed upon a cylindrical arc, which is preferably struck from a point as a center which is located approximately near the center of the mass of fuel upon the grate-surface in the combustion-chamber. By this formation the heat units which strike the face of the bridge-wall are to some extent thrown back upon and concentrated in the mass of fuel at the point where it is desirable to secure a thorough combustion. The curved front face of the bridge-wall below the ridge formed at 9 by the curved projecting portions of the blocks 7 is formed of quite large blocks 11, 12, 13, and 14. Of these blocks 11 and 12 are generally made so as to be interchangeable, while 13 and 14 are also made interchangeable. Between the blocks 13 and 14 spacing blocks or bricks 15 are placed, and the said spacing blocks or bricks are set slightly apart, so as to form small crevices or passages 16 between them, the said crevices or passages communicating with an air-feeding duct 17 within the bridge-wall. To the rear of the blocks or bricks 11, 12, 13, and 14 the bridge-wall is usually built of the ordinary fire-resisting brick used in furnace structures. Below the blocks or bricks 12 the base portion, as 18′, is constructed of any suitable or ordinary material.

In addition to the curved overhanging shape of the front of the bridge-wall the said bridge-wall is also constructed so as to make it possible to deliver heated air to the combustion-chamber at a point a suitable height upon the bridge-wall front to insure the proper mixing of additional oxygen with the products of combustion for preventing the escape of smoke from the combustion-chamber. This structure embraces the arrangement of a transversely-extending duct 17 and 18, arranged in the central portion of the bridge-wall and preferably just to the rear of the blocks 13 and 14, which face the central portion of the bridge-wall. The ducts are preferably arranged one above the other and are provided with top plates 19 and 20, which support the brickwork above the ducts and divide the upper and lower ducts from each other. Communication is established between the ducts by means of a series of pipes 21, the said pipes being bent approximately U-shaped and extending through the brickwork at their lower ends to the duct 18 and at their upper ends to the duct 17. Air which is forced into the duct 18 will pass thence through the pipes 21 into the upper duct 17. The upper duct 17 is located opposite the inner ends of the crevices 16 between the blocks 15, so that the air which is forced into the ducts 17 will be delivered through the crevices 16 into the combustion-chamber. The air is usually forced by means of a steam, fan, or other blower or air-forcing means into one or both ends of the duct 18 and becoming partly heated therein thence passes through the pipes 21, which carry the air a sufficient distance to the rear of the bridge-wall to subject the same to the downwardly-rushing column of flames, which pass over and back of the bridge-wall, the air then being conducted into the duct 17 for distribution through the crevices 16. The air thus becomes highly heated and is introduced into the combustion-chamber at a point where it will intercept and mingle with any smoke or products of combustion which may escape from the mass of fuel upon the grate-surface, and such smoke and products of combustion will thus be provided with ample oxygen for combustion.

The pipes 21 may be arranged in various ways; but they are preferably set obliquely with respect to the ducts 17 and 18, as clearly illustrated in Fig. 2. Thus the lower portion of each pipe 21 is placed considerably to the left of the point at which the pipe enters the duct 17 at its upper end when viewing the bridge-wall from the rear. In arranging the pipes 21 in this manner they are permitted to lap one upon the other, as shown in said Fig. 2, and the air which passes through the said pipes is thus more fully and completely subjected to the influence of the flames and heated products of combustion which pass down the rear surface of the bridge-wall. It is not necessary to the spirit of the invention, however, that the pipes be arranged in oblique form, since it will be evident that they may be placed in vertical planes, as shown at 22 in Fig. 5. When arranging the pipes in vertical planes, they are generally placed closer together, and a greater number of pipes are of course employed.

Although I preferably curve the front face of the bridge-wall to the lower edge of the

blocks 12, I also contemplate forming the said front face of the bridge-wall vertical from the lower edge of the spacing-blocks 15 downwardly, as illustrated in Fig. 4. When forming the bridge-wall in this manner, the upper overhanging portion will still have the effect of concentrating the heat units upon the central portion of the mass of fuel, though perhaps to a less degree than when the bridge-wall is constructed as shown in Fig. 1. The upper overhanging portion of the bridge-wall is, however, the most important part of the structure, since this part of said wall, operating in conjunction with the inner edge of the front arch, contracts the volume of heat units and products of combustion as they pass out of the combustion-chamber. Such contraction tends to intensify the effect of the heat upon the boiler or other structure mounted above.

By forming the most prominent portion of the bridge-wall near the top of large blocks there is no danger of the said blocks separating or dropping forward out of position under the action of the intense heat which passes over the bridge-wall. Of course it will be understood that the blocks 7 need not extend entirely through the bridge-wall structure; but it is desirable to have them extend at least more than half-way through the said wall.

By making the crevices between the spacing-blocks 15 comparatively small with respect to the area of the duct 17 the discharge of the air through said crevices will be in the form of jets having an increased velocity, due to the contraction of the column of air as it finds its way from the duct 17.

It will be evident that the minor details of construction both of the arch and of the bridge-wall may be somewhat altered and changed to suit the dimensions of various furnaces without departing in the least from the spirit of the invention.

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

1. A furnace-combustion-chamber structure, comprising a bridge-wall having a partially-cylindrical portion, the curve of the cylindrical portion being struck on an arc from a point approximately central with respect to the fuel on the grate of said furnace.

2. In a furnace-combustion-chamber structure, the combination of a bridge-wall having its front face curved for concentrating the heat centrally of the furnace-grate and a front arch overhanging the said grate and formed with a downwardly-extending retaining edge adapted to direct gases toward the center of the said grate for coacting with the said bridge-wall for preventing the escape of unconsumed gases.

3. A furnace structure comprising a bridge-wall having a partially-cylindrical front surface, the axis of said cylindrical portion being central with respect to the furnace-grate.

4. A bridge-wall structure comprising a wall formed with a discharge-opening leading into the combustion-chamber of the furnace, an air-passage being formed within said wall, and a tube extending from said passage through the rear portion of the wall and to a point supplying air to said discharge-opening.

5. In a furnace-combustion-chamber structure, the combination with a bridge-wall having a plurality of passages arranged therein, one of said passages adapted to be supplied with air, of a pipe leading from one of said passages to a point for being supplied with heat from the combustion-chamber, and extending to the other of said passages, means of communication being provided between said other passage and the combustion-chamber.

6. In a furnace-combustion-chamber structure, the combination with a bridge-wall formed with openings leading into the combustion-chamber, a passage being formed in the bridge-wall communicating with said discharge-openings, a plurality of pipes communicating with said passage and extending beyond the bridge-wall to a point for being heated, and means within the bridge-wall for supplying air to said pipes.

7. In a furnace-combustion-chamber structure, the combination with a bridge-wall, provided with a plurality of air-passages, and means of communication between one of said passages and said combustion-chamber, of a U-shaped tube connecting said passages and extending to a point for being subjected to the action of heat from the combustion-chamber.

8. A bridge-wall structure for furnaces, comprising blocks arranged in proper relation and having their front edges curved to form a partially-cylindrical surface upon the front of the wall, the axis of said partially-cylindrical surface lying near the center of the combustion-chamber of the furnace and an overhanging ridge made up of anchored blocks arranged near the upper edge of said bridge-wall.

9. In a furnace-combustion-chamber structure, the combination with a hollow bridge-wall divided into passages, and pipes connecting said passages and extending beyond the rear face of the bridge-wall, means of communication between one of said passages and the combustion-chamber being provided, and means for supplying air to the other of said passages being also provided.

10. In a furnace combustion-chamber, the combination with a hollow bridge-wall divided into passages, means being provided for supplying air to one of said passages, and the other of said passages being provided with a discharge means communicating with the combustion-chamber, of a tube connect-

ing said passages and extending beyond the face of the bridge-wall, that portion of said tube extending beyond the wall being arranged in an inclined plane.

11. A bridge-wall structure made up of fire-resisting bricks and blocks, said bricks and blocks being arranged to form air-ducts properly separated from each other, spacing-blocks arranged in the face of the bridge-wall adjacent to the fire-box of the furnace, the said blocks being slightly separated to form outlet-passages for one of the ducts in the bridge-wall, and pipes connecting the ducts and extending to the rear of the bridge-wall for subjecting the air which passes through the same to the action of the products of combustion.

12. A bridge-wall structure for furnaces having upper and lower interchangeable blocks, spacing-blocks mounted between the interchangeable blocks and separated to form passages between them, an air-duct being formed in the bridge-wall to the rear of the spacing-blocks, air-conducting pipes extending from the said duct outwardly through the rear face of the bridge-wall and thence backwardly into the bridge-wall structure, the said bridge-wall being provided with a second lower duct communicating with the said pipes.

13. An air-feeding bridge-wall for furnaces, comprising a series of interchangeable facing-blocks, overhanging heat-directing blocks mounted above the said facing-blocks, transverse air-feeding ducts being formed in the bridge-wall to the rear of the said facing-blocks and having outlet-passages extending between the facing-blocks, looped pipes connecting the said ducts and arranged diagonally with respect to the ducts, the looped portions of the pipes extending to the rear of the bridge-wall for receiving the effect of the column of heated products which sweep downwardly over the bridge-wall.

14. A bridge-wall structure for furnaces comprising upper and lower interchangeable blocks, spacing-blocks interposed between the interchangeable blocks, and means for directing heated air to the combustion-chamber between the interchangeable blocks.

15. A bridge-wall structure for furnaces, the combination of upper and lower interchangeable blocks, partially inclosing an air passage-way, blocks interposed between said interchangeable blocks and spaced apart for affording a passage between said passage-way and the combustion-chamber, and means for supplying heated air to said passage-way.

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

WILLIAM McCLAVE.

Witnesses:

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