C. W. MUNSON.

SMELTING FURNACE.

APPLICATION FILED NOV. 6, 1905.

983,833.

Patented Feb. 7, 1911.

2 SHEETS—SHEET 1.

Fig. 1.

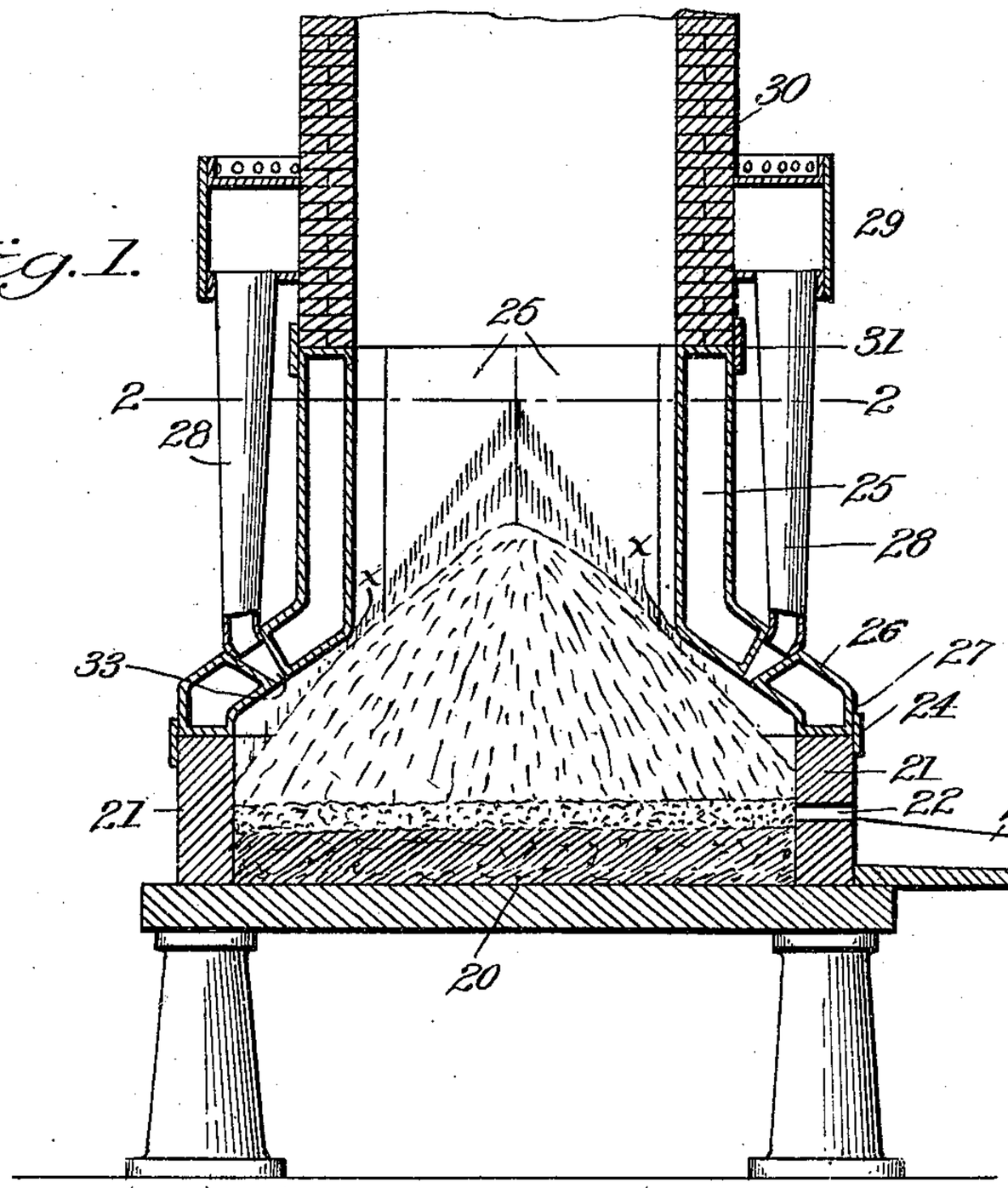
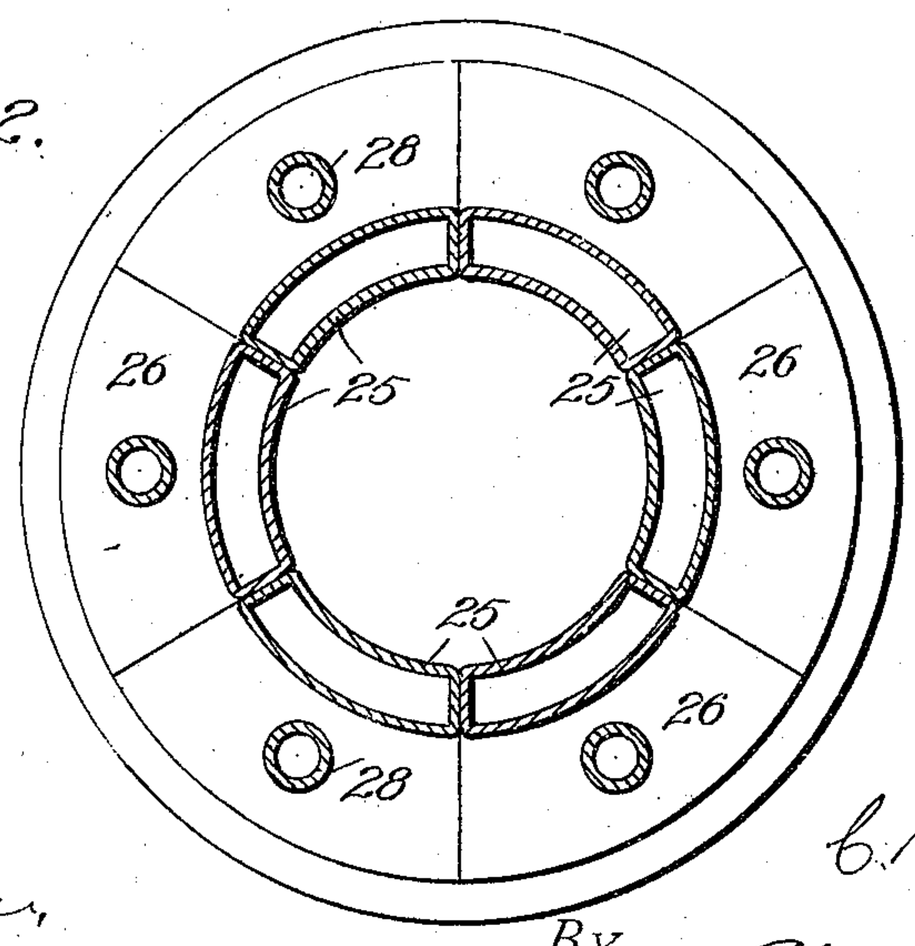


Fig. 2.



WITNESSES:

C. W. Walker.

J. T. Walker.

INVENTOR

C. W. Munson

BY

A. W. Harrison

Attorney

C. W. MUNSON.

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2 SHEETS—SHEET 2.

Fig. 4.

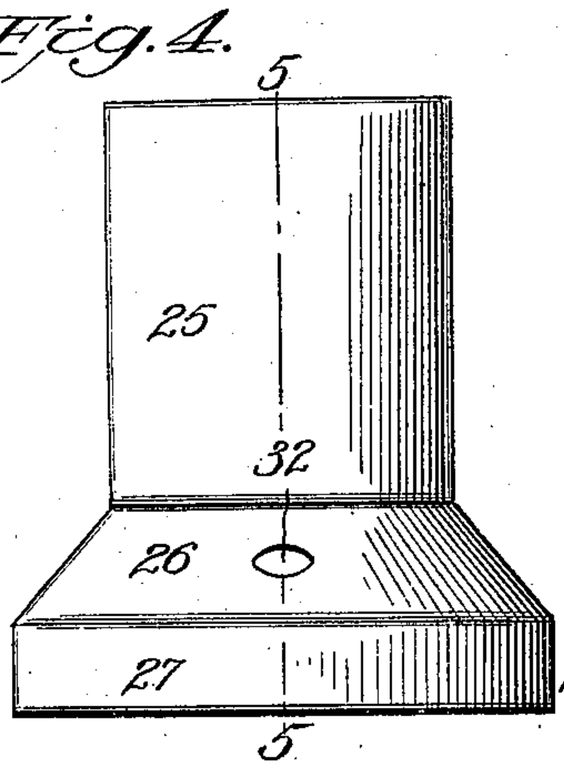


Fig. 5.

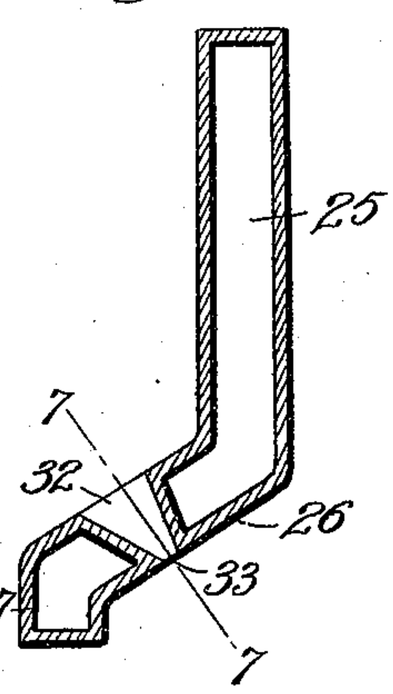


Fig. 6.

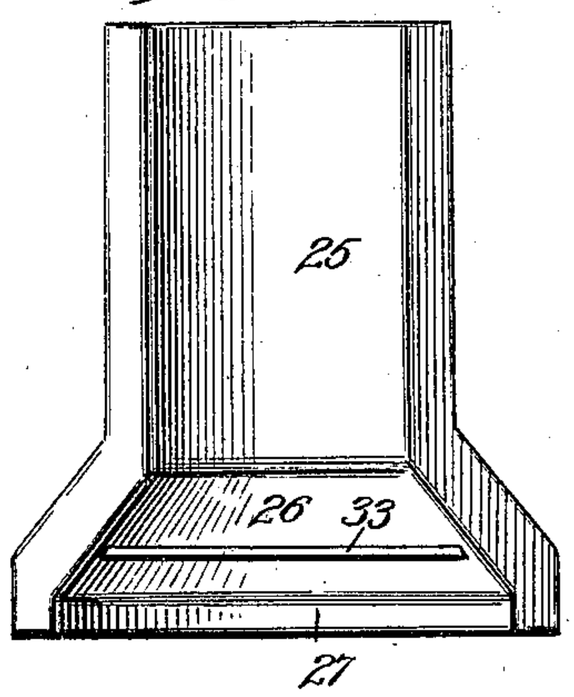


Fig. 3.

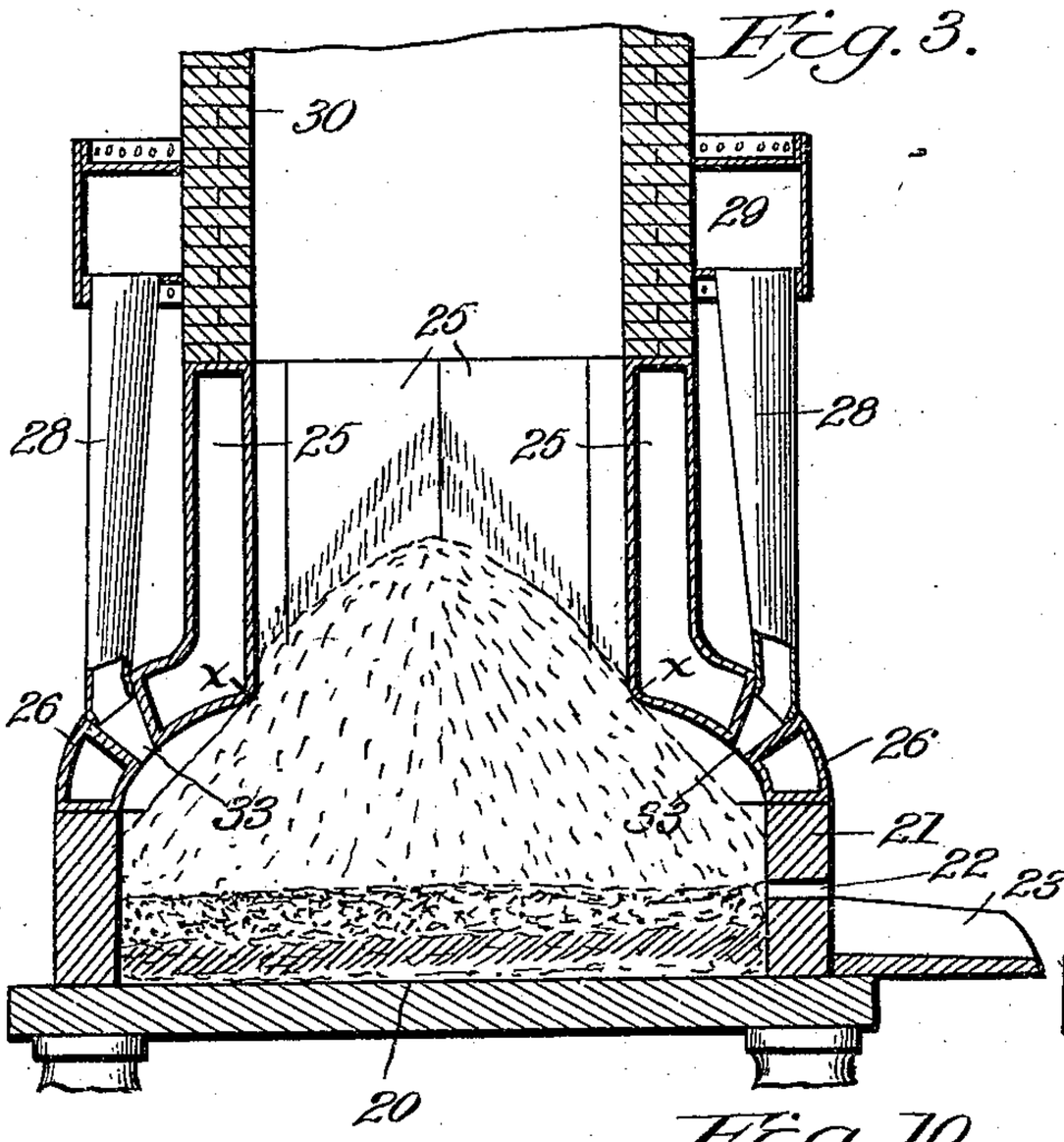


Fig. 7.

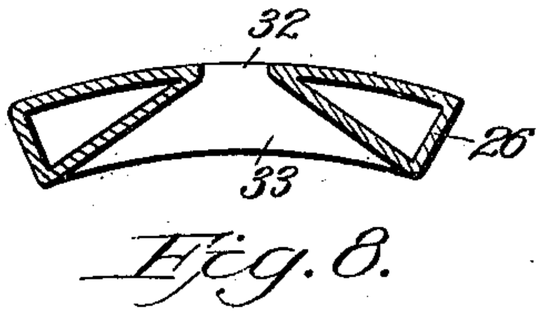


Fig. 8.

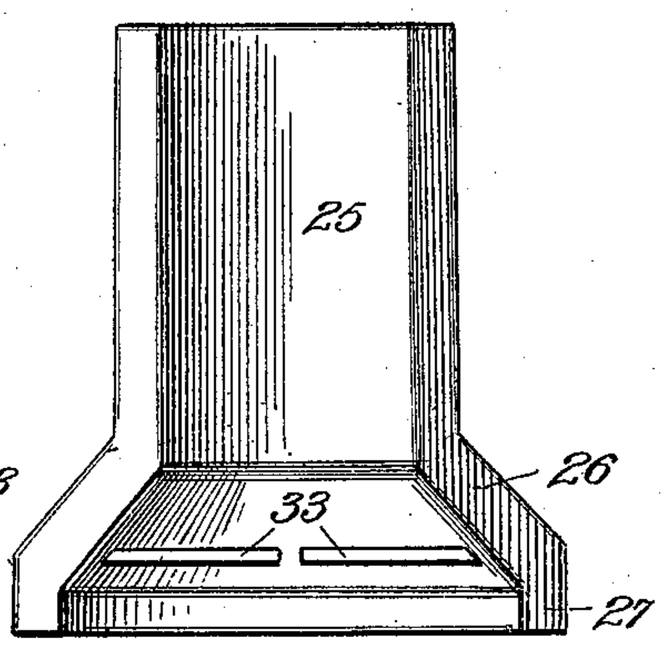


Fig. 10.

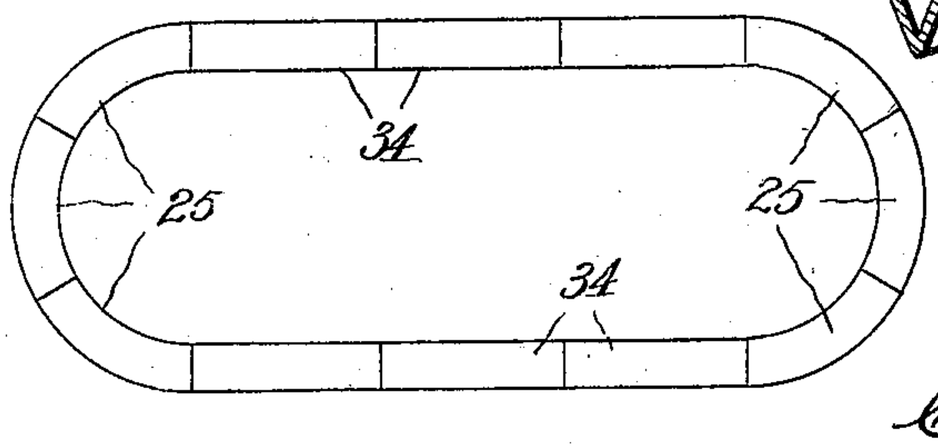
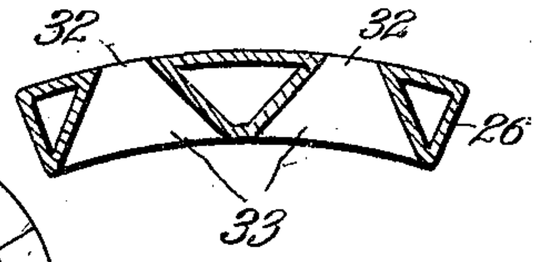


Fig. 9.



INVENTOR

C. W. Munson

WITNESSES:

C. H. Walker.

J. T. Walker.

BY

A. W. Harrison

Attorney

UNITED STATES PATENT OFFICE.

CORYDON WILLARD MUNSON, OF TOLEDO, OHIO, ASSIGNOR, BY MESNE ASSIGNMENTS, TO C. W. MUNSON, TRUSTEE.

SMELTING-FURNACE.

983,833. Specification of Letters Patent. Patented Feb. 7, 1911.

Application filed November 6, 1905. Serial No. 286,009.

To all whom it may concern:

Be it known that I, CORYDON W. MUNSON, a citizen of the United States, residing at Toledo, in the county of Lucas and State of Ohio, have invented new and useful Improvements in Smelting-Furnaces, of which the following is a specification.

This invention relates to the smelting of sulfid ores, and particularly to such smelting as described in the U. S. Patent 746,970 granted Dec. 15, 1903 to J. W. MacDonald.

One of the objects of my invention is to so confine the fusing zone of flame which envelops the inclined sides of an ore-charge heap that is being smelted by a hot blast, that the zone of incandescence will be uniform about and into the base of the heap and for some distance up its sides, and so that the hot blast will sufficiently penetrate the surface to combine with the gases given off by the sulfur to enable the fusing process to be continuous under repeated charges of small quantities of ore with little or no extraneous fuel.

Another object is to protect the delivery end of the twyers from liability of being clogged or having their efficiency otherwise impaired.

Another object is to provide an improved form of twyer to enable a practically continuous and evenly distributed blast to be directed against the ore and encircling the ore body in the furnace instead of being directed in separated locations, as with the present type of twyers.

Another object is to provide an improved furnace having an enlarged hearth area, thus greatly increasing its capacity, with twyers arranged to direct the blast downward at an angle to the inclined sides of the heap of the ore-body or charge near the base thereof.

Another object is to provide an improved furnace with walls made up of removable sections of special design adapted to be used in smelting ores under the process herein described.

To these ends, the invention consists in the construction and combination of parts substantially as hereinafter described and claimed.

Of the accompanying drawings:—Figure 1 is a vertical sectional view of one form of furnace embodying my improvements. Fig. 2 represents a section on line 2—2 of Fig. 1. Fig. 3 is a view similar to Fig. 1, showing a slightly different form of the shoulder portions of the sections, and also indicating a different height at which the ore body or charge may be maintained during the smelting process. Fig. 4 is a detail outside elevation of one of the interchangeable water-jacketed sections of the furnace, said section having a single twyer, integral with said section. Fig. 5 represents a section on line 5—5 of Fig. 4. Fig. 6 is a detail inside elevation of the section shown in Figs. 4 and 5. Fig. 7 represents a section on line 7—7 of Fig. 5. Figs. 8 and 9 are views similar to Figs. 6 and 7, but illustrating a plurality of twyers in the section. Fig. 10 is a diagrammatic plan view representing an elongated furnace instead of a cylindrical one.

Similar reference characters indicate the same or similar parts on all of the figures of the drawings.

It is well known that smelting furnaces are now built with walls of sectional construction, each section having one or more twyers, but so far as I am aware, the walls of such furnaces are vertical or inclined inward at the hearth section. The feature of novelty in connection with my improved sectional furnace is the shape of the sections by which an enlarged hearth is secured, and with twyers located in those portions of the sections which form the flaring portion of the furnace wall.

A suitably supported hearth is represented at 20, its wall 21 being formed with a discharge hole 22 through which the molten product passes to the spout 23 for tapping it off. This hearth section forms no part of my present invention and may be constructed in any well-known or preferred manner. Its shape, in plan, may be round or elongated as hereinafter described. The vertical portion of the hearth section represented by 21 may however, be formed by extending downward the lower vertical part of the water-jacketed metallic portions of the furnace wall far enough to form the hearth section.

The metallic portion of the furnace is supported on the wall and is composed of a plurality of removable sections each of which is hollow to form a water-jacket. Connections for supplying the sections with water are not shown as they may be any

form such as commonly employed with water-jacketed furnaces. The sections may be secured together and to the wall 21 by suitable means, such as a band indicated at 24 in Fig. 1.

Each water-jacketed section, when constructed as shown in Figs. 1, 2, 4, 5, 6 and 7 comprises an upper portion 25 and a lower portion 26 at an obtuse or other suitable angle thereto, so that when six of such sections are assembled as in Figs. 1 and 2, the lower portion of the chamber inclosed by said sections flares or spreads outwardly, thus giving an enlarged hearth area, with inwardly sloping upper walls at such an angle that when ore is piled on the hearth even to a height that will reach the angle x where the portions 25 and 26 meet, the natural incline of fall of the sides of the pile or heap of ore will not reach the inner surface of said sloping walls. Preferably each section is formed with a lower edge portion 27 to rest on the side 21 of the hearth section, which portion 27 is parallel with the portion 25 although off-set therefrom by the intervening inclined or flaring portion 26, or this part 27 of the section may be extended downward to form the hearth section 21 as above mentioned. Said inclined or flaring portion is formed with a twyer opening (or a plurality of such openings as in Figs. 8 and 9) to receive the air blast through tubes or nozzles 28 from a suitable source of supply of heated air, such as a hot-air box 29 surrounding the brick work part 30 of the furnace resting on the metallic sections. The supply of hot air at the proper temperature may be obtained by means of such apparatus as disclosed in U. S. Patent 720,257 granted Feb. 10, 1903, to Koch and MacDonald. If desired an inclosing band 31 may surround the joint between the upper ends of the metallic sections and brickwork, which band may, of course, be of any height, even to forming a complete jacket for the brickwork.

The outer end of each twyer is preferably round, as at 32, for the connection of the tube 28, and the walls converge vertically (see Fig. 5) and diverge horizontally to the inner end 33 (see Figs. 6, 7, 8 and 9) so that the blast of heated air is in a practically continuous thin stream entirely around the furnace. However, twyers round at both ends may be used if desired.

Instead of making the shoulder portions 26 of the water-jacketed sections in the form of straight inclines, they may be more or less concave internally, as indicated in Fig. 3. In other words, the outward and downward flare of these portions 26 may be either as straight or curved inclines. But it is essential that the flare or incline from the angle x shall be greater relatively to the vertical than the natural incline of fall of the sides of the ore body so that when said body is fused and kept supplied with fresh charges in the manner described in said MacDonald patent, there will always be preserved an air space between the surface of the fusing mass and the mouths of the twyers, whether the hearth be supplied with ore to a point below the angle x or even to a point above it as indicated in Fig. 3. If the ores are loaded up into the neck of the furnace, above the angle x, and the blast driven into the air space just inside the twyers, said blast being continuous and encircling the entire ore body, the effect of such blast is to penetrate the surface of the ore body evenly and to be distributed uniformly and carry down the values into the matte or slag, saving a much higher percentage than can be done when there is any deflection of the blast upward, or when penetrating the ore body at separate points from the usual form of round twyers spaced apart. With the air space so confined and encircling the ore-body or charge, the formation of the twyers with widened or laterally elongated inner ends is not indispensable, as the contracted neck of the furnace so confines the air that it is evenly distributed in said space under substantially uniform pressure at all points around the inclined sides of the charge; but I prefer to employ twyers of the form shown and described for several reasons, one being that their widened inner ends cause the blast to effect a more even penetration of the surface upon which it impinges and more uniformly reduce the ore and carry the values down into the matte or slag.

The supply of ore may be given to the furnace by any suitable means or through any suitable opening at the top of the furnace (not shown), the initial charge being preferably made, and the successive small quantities supplied at short intervals in the manner disclosed in the Patent 746,970 above referred to.

If the height of the charge is such that its sides do not reach the neck x, as indicated in Fig. 1, the blast of air and the fusing zone of flame is confined by the inclined surface 26 above the mouths 33 of the twyers so that the mantle of flame approximately follows the inclined sides of the charge or heap and results in greater efficiency than if such blast was blown into a body of ore, covering the twyers opening as is done in usual practice, or was left free to rise, as in Patent 746,970. In this case the special or elongated form of twyer described is of great utility, since the entire set of twyers causes a practically continuous blast around the charge or heap to penetrate the surface and carry down the values.

A special advantage of the preservation

of the confined air space adjacent the twyers is that said twyers are protected from the ore clogging them or the molten mass, which will always flow below them, there being, therefore, no liability of any of said twyers being clogged, or of any of the molten mass running into them, a condition which is a source of much trouble under present practice.

Owing to the construction of the hollow sections which are removable or interchangeable, they may be readily made and shipped and then used in building either a round or oblong furnace. The sections illustrated in Figs. 1 to 9 inclusive are segmental in cross section or horizontally curved so that six of them can be used in making a round furnace. By providing sections which are horizontally straight, as indicated at 34 in Fig. 10, and interposing two series of such straight sections between three curved sections at each end, an oblong furnace of any length may be built up, the brick work and hearth section being, of course, built up to correspond.

With a furnace constructed as described, the surface of the ore-body can never contact with the twyers, so as to obstruct them in any way, because the converging walls formed by the portions 26 of the water-jacketed sections form a neck at *x* that effectually prevents any such spreading of the charge as would enable it to reach the twyers which are inclined inwardly and downwardly through said converging walls.

Having now described my invention, I claim:

1. A smelting furnace comprising a hearth and having side walls formed to maintain a heap of the ore with inclined sides from the base upward, the side walls of the furnace being contracted relatively to the hearth to form a limited and confined air space around and close to the base of the heap, and a plurality of twyers having laterally wide and vertically narrow mouths close together to form practically one narrow twyer extending entirely around the furnace and in position to direct a thin stream of air at the base of the heap of ore.

2. A smelting furnace comprising a hearth and having sectional water-jacketed side walls formed to maintain a heap of the ore with inclined sides from the base upward, the said side walls being contracted relatively to the hearth to form a limited and confined air space around the base of the heap, and a plurality of twyers having laterally wide and vertically narrow mouths close together to form practically one narrow twyer extending entirely around the furnace and in position to direct a thin stream of air at the base of the heap of ore.

In testimony whereof I have affixed my signature, in presence of two subscribing witnesses.

CORYDON WILLARD MUNSON.

Witnesses:

G. E. KEYT,

DOROTHY O. GARWOOD.