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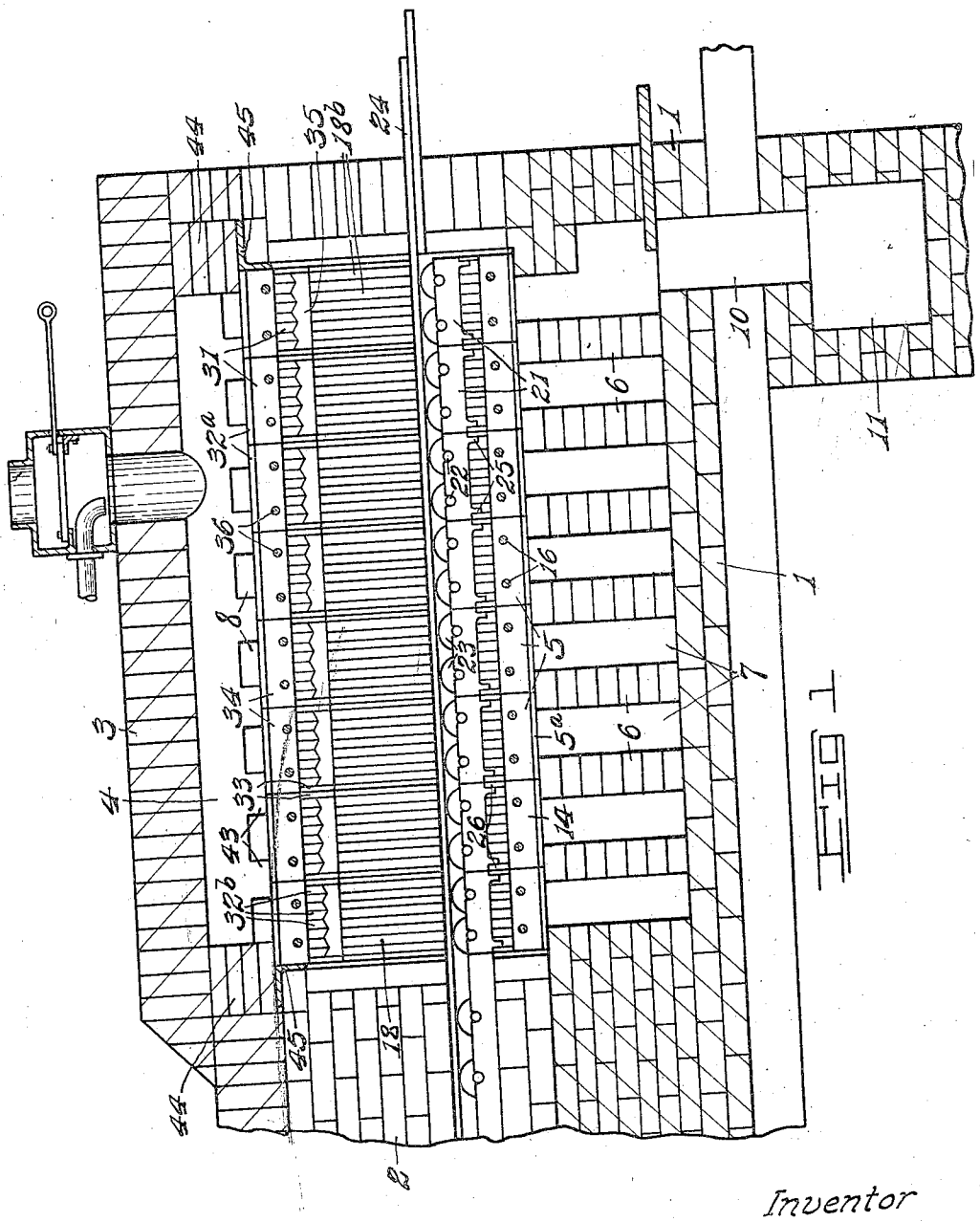
Dec. 23, 1924.

P. EBELING

MUFFLE GLASS FURNACE

Filed Sept. 9, 1921

3 Sheets-Sheet 1



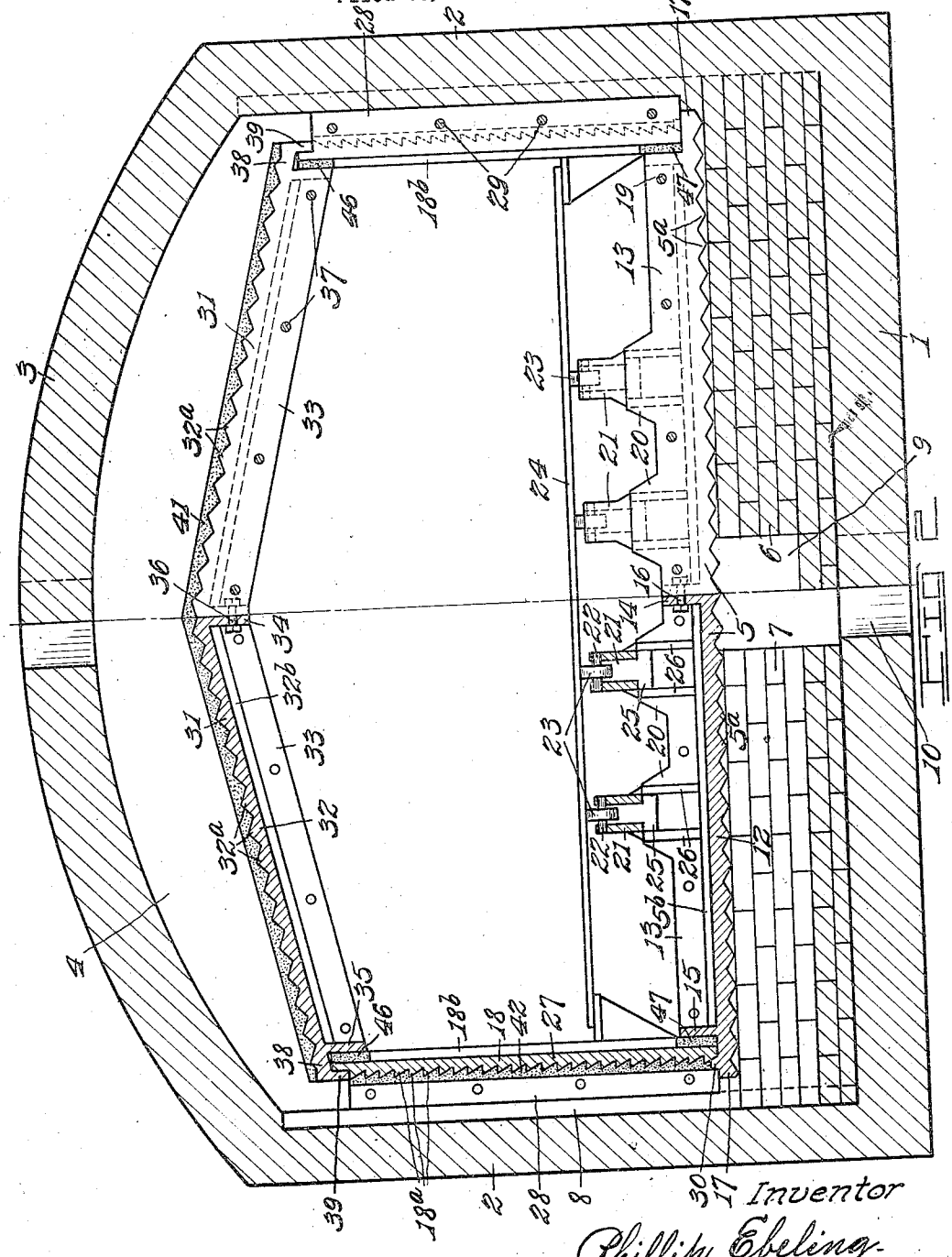
Inventor
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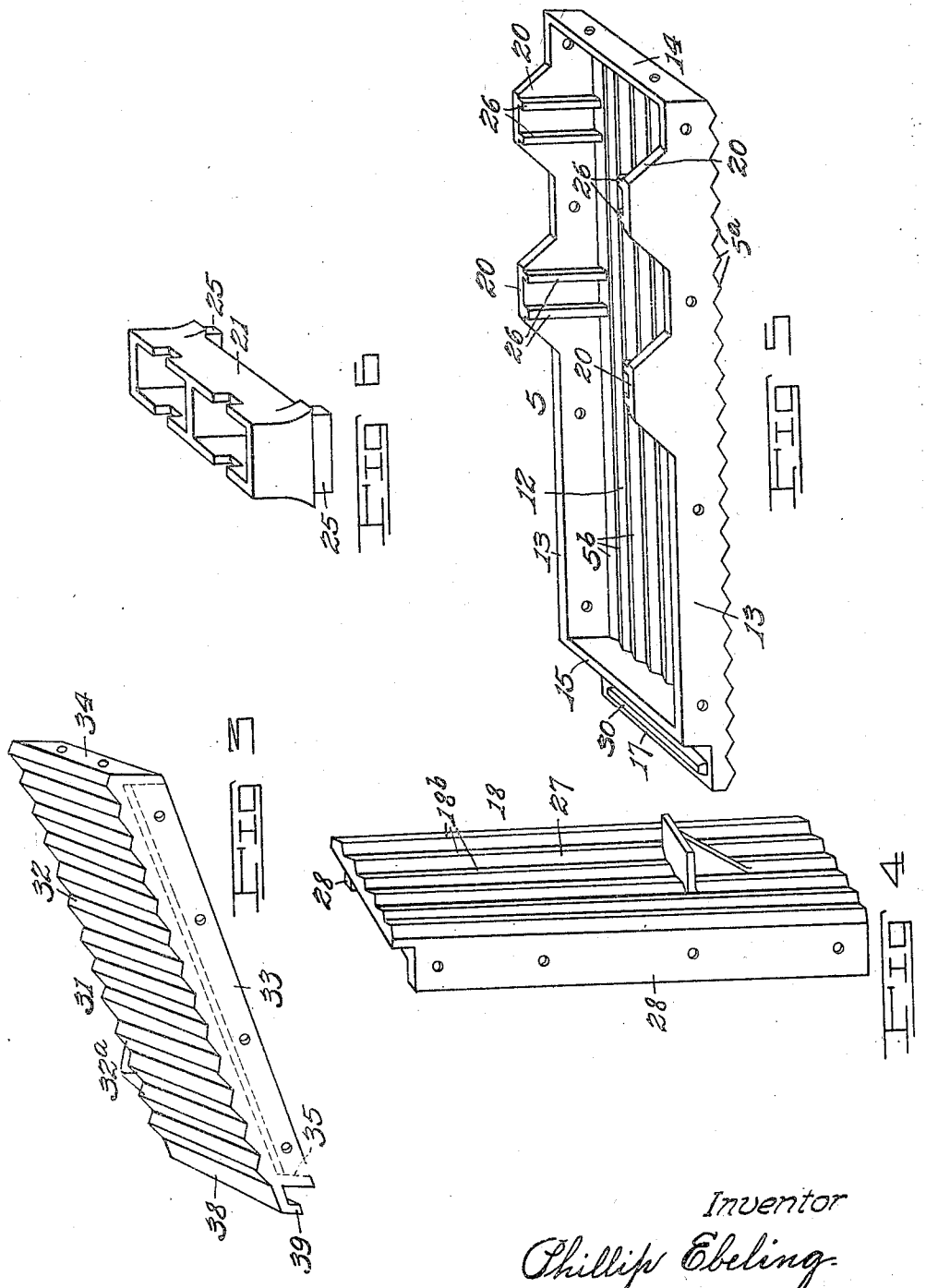
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MUFFLE GLASS FURNACE

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3 Sheets-Sheet 3



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Patented Dec. 23, 1924. 1,520,408

UNITED STATES PATENT OFFICE.

PHILLIP EBELING, OF BELLAIRE, OHIO.

MUFFLE GLASS FURNACE.

Application filed September 9, 1921. Serial No. 499,485.

To all whom it may concern:

Be it known that I, PHILLIP EBELING, a citizen of the United States of America, and resident of Bellaire, county of Belmont, and State of Ohio, have invented certain new and useful Improvements in Muffle Glass Furnaces, of which the following is a specification.

This invention relates broadly to annealing furnaces, and more specifically to an oven or lehr of muffle type designed primarily for annealing glassware, ceramic ware and the like.

The primary object of the invention is to provide a muffle oven or lehr having a muffle constructed of cast iron which shall possess various marked advantages over ordinary forms or types of lehrs embodying muffles constructed of tiles, blocks and like refractory materials.

A further object is to provide a cast-iron muffle which may be operated over long periods of time without warping or buckling of its parts and which effectually prevents leakage of harmful gases and fumes to the interior thereof.

With these and other important objects in view, which will hereinafter be pointed out, the invention resides in the features of construction, arrangement of parts and combinations of elements which will hereinafter be fully described, reference being had to the accompanying drawings, in which—

Figure 1 is a longitudinal section of a portion of a muffle lehr embodying my invention;

Figure 2 is an enlarged transverse section of the same;

Figure 3 is an enlarged detail perspective view of a cast-iron roof plate;

Figure 4 is a similar view of an upright wall plate;

Figure 5 is a similar view of a bottom plate; and—

Figure 6 is a similar view, still further enlarged, of a box-like support for the rollers upon which the ware-carrying pans travel.

Referring to said drawings, 1 indicates the bottom, 2 the side walls, and 3 the crown of the oven, the same being constructed of brick or other refractory material, as ordinarily. Extending longitudinally through the oven is a muffle composed of cast iron plates possessing a peculiar form whereby they are enabled to withstand the usual annealing temperatures over relatively long periods of time without undue deterioration and without warping. Said muffle is disposed within the oven with its bottom, side walls and roof spaced from the corresponding walls of the oven, so that heat generated within the oven by the burning gases in the combustion chamber 4 located beneath the crown 3 may more or less completely encircle said muffle for heating the latter.

The bottom of the muffle, which is formed of a plurality of connected cast-iron plates 5, is supported by a plurality of transverse walls 6 which are spaced relatively to provide one or more transversely extending flues 7, each communicating at its outer end with vertical flues 8 located adjacent to the side walls of the muffle and leading from the combustion chamber 4. A central longitudinal flue 9 in open communication with the inner ends of each of said flues 7 leads to a passage 10 having communication with a conduit 11 which leads to the stack (not shown).

The plates 5 composing the bottom of the muffle are of identical form and are arranged in pairs, each of which constitutes a unit. The number of these units may be varied to any extent desired or according to the length of muffle required by any lehr structure. Each of said plates, clearly illustrated in Fig. 5, is a one-piece casting and comprises a bottom panel 12 of rectangular form, lateral upright walls or flanges 13, an inner upright end flange 14, and a similar outer end wall or flange 15. The length of said plate is substantially one half of the width of the muffle, it being designed that two such plates shall be disposed in alined relation and have their inner end flanges closely secured together, as by means of bolts 16. Each of said plates has its outer end extended somewhat beyond the flange 15 to provide a seating ledge 17 for the lower end of one of the upright cast-iron plates 18 of which the side walls of the muffle is composed. The upright flanges 13 of laterally adjacent plates 5 are secured in closely abutting relation by means of bolts 19. Each of said plates 5 has oppositely disposed upward extensions or seats 20 formed on the flanges 13 thereof at suitable points, said seats being designed to receive thereon the opposite ends of box-like bearing members 21 on which are journaled the spindles

22 of rollers 23 designed to carry the traveling pans 24 upon which the ware to be annealed is transported through the muffle chamber. Each member 21 is designed to have two of said rollers 23 journaled thereon, and each has downwardly extending tongues 25 on its bottom adjacent to its opposite ends adapted for reception in guideways provided between vertical ribs 26 formed on the inner surfaces of said flanges 13 and said seats 20, whereby said member is retained in its seated position against chance displacement.

Each of the plates 18 of which the side walls of the muffle are composed has a length approximately equal to the height desired for the side walls and a width corresponding to that of the bottom plates 5. Each plate 18 comprises a rectangular panel 27 having lateral outwardly extending flanges 28, the flanges of adjacent plates being designed to occupy closely abutting relation and to be firmly secured together, as by means of bolts 29. The lower end of the panel 27 seats upon the ledge 17 of a bottom plate 5 behind, or inward of, a transverse upstanding lip 30 formed on said ledge. Said lip has a length substantially corresponding to the internal width of the plate 18 so that the outstanding flanges 28 of the latter abut the ends of said lip.

Supported by the side walls of the muffle is the roof, preferably of ridge-roof, or gable-roof, form, which is composed of cast-iron plates 31 arranged in pairs with their inner ends meeting midway between said side walls. Each of said plates comprises a rectangular panel 32 having downwardly extending lateral flanges 33, an inner end flange 34 and an outer end flange 35. The plates composing each pair have their inner end flanges 34 disposed in closely abutting relation and rigidly attached together, as by bolts 36, while adjacent longitudinally alined plates have their lateral flanges 33 abutting and secured together by bolts 37. Each plate 31 has an integral extension or projection 38 provided on its outer end terminated by a vertically depending or downturned lip 39 which is designed to interlock with the upper end of the panel 27 of a wall plate 18. Said lip 39 has a width corresponding to that of the plate 31 of which it forms a part, and, consequently, to provide for the reception or accommodation thereof the upper ends of the flanges 28 of the plates 18 are terminated short of the panel 27, as shown. Said lip 39 and the end flange 35 are spaced relatively to provide therebetween a channel 40 in which the upper edge of the engaged wall plate 18 is more or less snugly received, as shown in Fig. 2.

Each of the roof plates 31 has it upper face more or less deeply furrowed or corrugated transversely whereby is formed transverse ribs 32^a, and the under surface of the panel 32 of said plate is similarly furrowed or corrugated longitudinally to form longitudinal ribs 32^b. The roof composed of said plates has its outer, or top, surface coated to a suitable depth with a protective covering 41 of a refractory cementitious material designed not only to shield the cast-metal plates from contact with the flame and the gases in the combustion chamber, which would have a deteriorating effect upon the metal, but also to seal the joints between said plates against the passage of gases and fumes which would otherwise leak through said joints into the muffle chamber. The ribs 32^a not only serve to strengthen or reinforce the plates against tendency to warp or buckle under the influence of the heat, but also to allow the coating 41 to obtain a firmer hold upon the plates; and the ribs 32^b extending in a direction transverse to that of the ribs 32^a not only serve to additionally reinforce said plates, but also to provide increased surface for the radiation of heat into the muffle chamber and for insuring a more or less even distribution of such heat throughout said chamber.

The inner surfaces of the upright wall plates 18 are also longitudinally corrugated, providing ribs 18^b which serve the same purposes as the ribs 32^b of the roofing plates. The outer surfaces of said plates 18 are transversely grooved to provide teeth-like ribs 18^a which preferably have horizontal upper surfaces, as shown in Fig. 2, whereon support is had for a protective coating 42 similar to and having the same purpose as the aforesaid coating 41.

The bottom plates 5 are similarly provided on opposite sides with ribs 5^a and 5^b, but the application of a protective coating to the outer faces of said plates may be dispensed with, as the temperature to which said plates are subjected by the passage of products of combustion through the bottom flues 7 and 9 is materially lower than that to which the roof plates and wall plates are subjected, due to the earlier absorption of heat from said products.

The lateral flanges 28 of the wall plates 27 are protected against heat and flame, due to the fact that they are embedded in the upright walls or webs 43 of refractory bricks or blocks which separate the vertical wall flues 8.

It will be manifest that, due to the fact that the roof plates and bottom plates of the muffle structure are interlocked with the wall plates, practically no relative movement is permitted in a direction transverse with respect to said structure, and that, consequently, expansion and contraction of said plates in said direction can not result in the production of cracks or crevices

through which fumes might obtain access to the muffle chamber.

The opposite ends of the combustion chamber are closed by arches 44 of refractory blocks or tile which closely overlie angle-bars 45 bolted to and supported by the opposite end plates 31 of the roof of the muffle. Said bars are free to move with respect to said arches so that expansion and contraction of the roof in a lengthwise direction may occur without subjecting the joints of the roof to strains which might be productive of cracks or crevices.

The joints between the outer end flanges 35 of the roof plates 31 and the side walls 18 are closed by a filling 46 of a suitable cement or similar material, said filling closing the spaces between the ribs 18^b of said wall plates; and a filling 47 of sand or other suitable material is likewise provided between the lower ends of said side-wall plates and the outer end flanges 15 of the bottom plates 5.

What is claimed is—

1. A muffle furnace comprising outer furnace walls and a crown, and a muffle extending longitudinally through said furnace and spaced from the latter to provide a combustion chamber and muffle encircling flues leading from said chamber, said muffle consisting of a bottom, side walls and a roof, each composed of a plurality of rigidly connected cast-metal plates, and a refractory coating carried exteriorly by the plates of said side walls and said roof.

2. A muffle furnace comprising outer furnace walls and a crown, and a muffle extending longitudinally through said furnace and spaced from the latter to provide a combustion chamber and muffle encircling flues leading from said chamber, said muffle consisting of a bottom, side walls and a roof, each composed of a plurality of rigidly connected cast-metal plates, the wall plates being carried upon the outer ends of the bottom plates, and the outer ends of the roof plates being seated upon and interlocked with the upper ends of said wall plates, and a refractory coating carried exteriorly by the plates of the side walls and the roof.

3. A muffle furnace comprising outer furnace walls and a crown, and a muffle extending longitudinally through said furnace and spaced from the latter to provide a combustion chamber and muffle encircling flues leading from said chamber, said muffle consisting of a bottom, side walls and a roof, each composed of a plurality of rigidly connected cast-metal plates, the roof plates and the bottom plates being interlocked with the upper and lower ends of the wall plates, respectively, and a refractory coating carried exteriorly by the plates of the side walls and the roof.

4. A muffle furnace comprising outer furnace walls and a crown, and a muffle extending longitudinally through said furnace and spaced from the latter to provide a combustion chamber and muffle encircling flues leading from said chamber, said muffle consisting of a bottom, side walls and a roof, each composed of a plurality of rigidly connected cast-metal plates, the wall plates being carried upon the outer ends of the bottom plates, and the outer ends of the roof plates being seated upon the upper ends of said wall plates, said muffle plates having the faces thereof ribbed, and a refractory coating carried exteriorly by the plates of the side walls and the roof.

5. A muffle furnace comprising outer furnace walls and a crown, and a muffle extending longitudinally through said furnace and spaced from the latter to provide a combustion chamber and muffle encircling flues leading from said chamber, said muffle consisting of a bottom, side walls and a roof, each composed of a plurality of rigidly connected cast-metal plates, the wall plates being carried upon the outer ends of the bottom plates, and the outer ends of the roof plates being seated upon the upper ends of said wall plates, each of said plates having its opposite faces of ribbed form, the ribs of one face being transverse to those of the opposite face.

6. A muffle furnace comprising outer furnace walls and a crown, and a muffle extending longitudinally through said furnace and spaced from the latter to provide a combustion chamber and muffle encircling flues leading from said chamber, said muffle consisting of a bottom, side walls and a roof, each composed of a plurality of rigidly connected cast-metal plates, the wall plates being carried upon the outer ends of the bottom plates, and the outer ends of the roof plates being seated upon the upper ends of said wall plates, said wall plates and said roof plates having their outer faces ribbed transversely, and a refractory coating carried by said ribbed faces.

7. A muffle furnace comprising outer furnace walls and a crown, and a muffle extending longitudinally through said furnace and spaced from the latter to provide a combustion chamber and muffle encircling flues leading from said chamber, said muffle consisting of a bottom, side walls and a roof, each composed of a plurality of flanged cast-metal plates having their flanges disposed in abutting relation and connected by bolts directed therethrough, the roof plates and the bottom plates being interengaged with opposite ends of said wall plates to allow free expansion and contraction of each without strain, and a refractory coating carried exteriorly by the plates of the side walls and the roof.

8. A muffle comprising a bottom, side

walls and a roof, each composed of a plurality of similar cast-iron plates, the plates of the bottom and roof being disposed in transversely alined pairs with their inner ends rigidly attached, each pair constituting a unit, and adjacent units being rigidly attached, said wall plates being loosely embraced at their upper and lower ends, respectively, by said roof plates and said bottom plates, and a refractory coating carried exteriorly by the plates of the side walls and the roof.

9. A muffle having a bottom, side walls and a roof, each composed of a plurality of connected cast-iron plates, said side walls being connected at opposite ends with the bottom and with the roof, and a refractory protective coating carried by said side walls and said roof.

10. A muffle having a bottom, side walls and a roof, each composed of a plurality of connected cast-iron plates, said side walls being connected with the bottom and with the roof to permit free expansion and contraction of each without strain, and a refractory protective coating carried by said side walls and said roof, the plates of said side walls and said roof being provided with means for retaining said coating in place.

11. A muffle having a bottom, side walls and a roof, each composed of a plurality of connected cast-iron plates, said side walls being connected with the bottom and with the roof to permit free expansion and contraction of each without strain, and a refractory protective coating carried by said side walls and said roof, the plates of said side walls and said roof being provided with transverse ribs on their external faces.

12. A muffle having a bottom, side walls and a roof, each composed of a plurality of connected cast-iron plates, said side walls being connected with the bottom and with the roof to permit free expansion and contraction of each without strain, and a refractory protective coating carried by said side walls and said roof, the plates of said side walls and said roof being provided with transverse ribs on their external faces and with longitudinal ribs on their internal faces.

13. A muffle having a bottom, side walls and a roof, each composed of a plurality of connected cast-iron plates, each of said plates having its opposite faces ribbed, the ribs of one face being transverse to those of the opposite face.

14. A muffle having a bottom, side walls and a roof, each composed of a plurality of connected cast-iron plates, each of said plates comprising a rectangular panel having lateral right-angle flanges, said panel having one face thereof ribbed longitudinally and the opposite face ribbed transversely.

15. A muffle having a bottom, side walls and a roof, each composed of a plurality of connected cast-iron plates, each of said plates comprising a rectangular panel having lateral right-angle flanges, said panel having one face thereof ribbed longitudinally and the opposite face ribbed transversely, the bottom plates having seats formed thereon, bearing members mounted on said seats, and pan-carrying rollers journaled on said members.

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

PHILLIP EBELING.

Witnesses:

A. T. MUHLEMAN,

DAVID WALKER