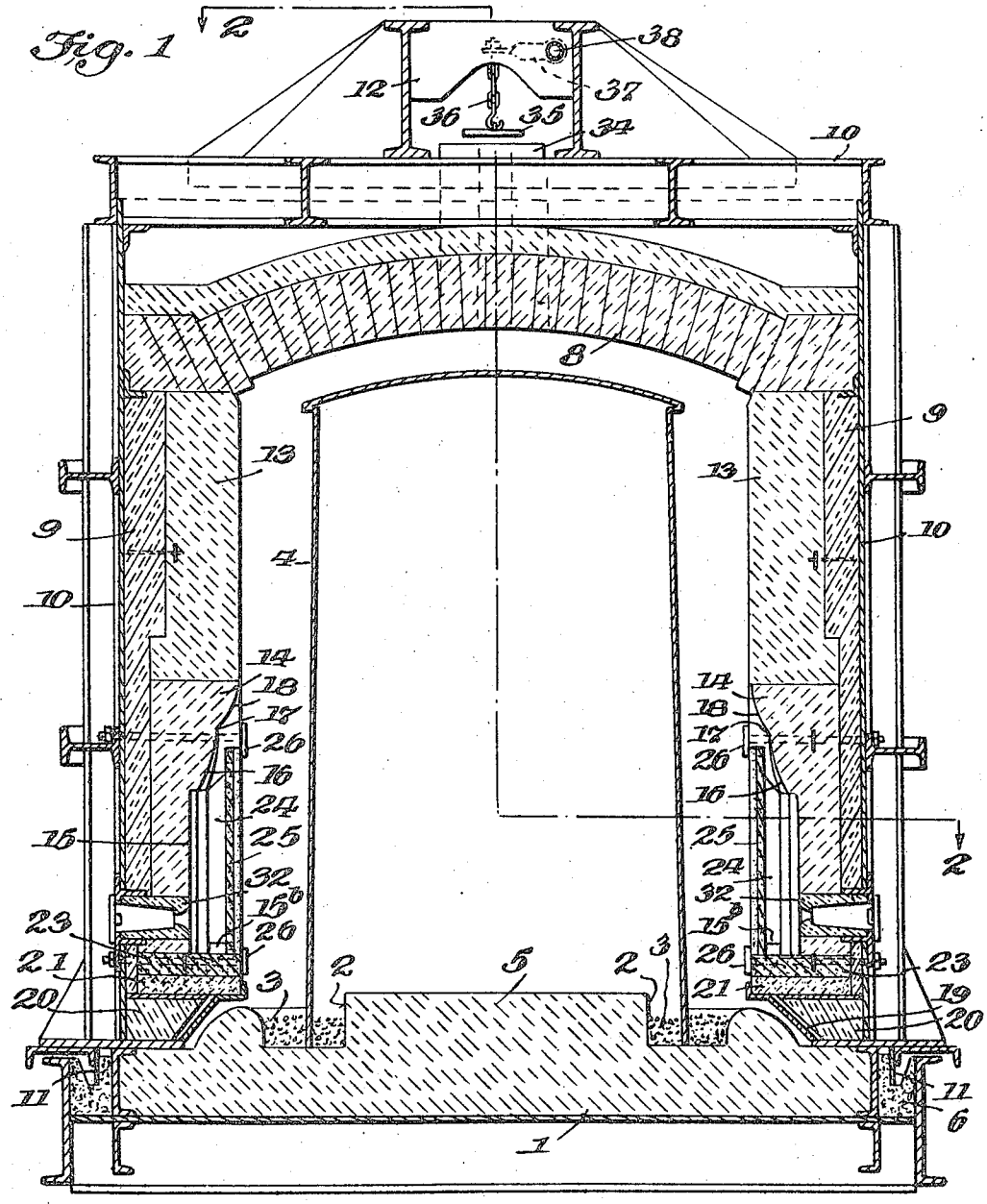
Feb. 17, 1948. L. E. SMITH 2,436,024

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Fig. 1



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Fig. 2.

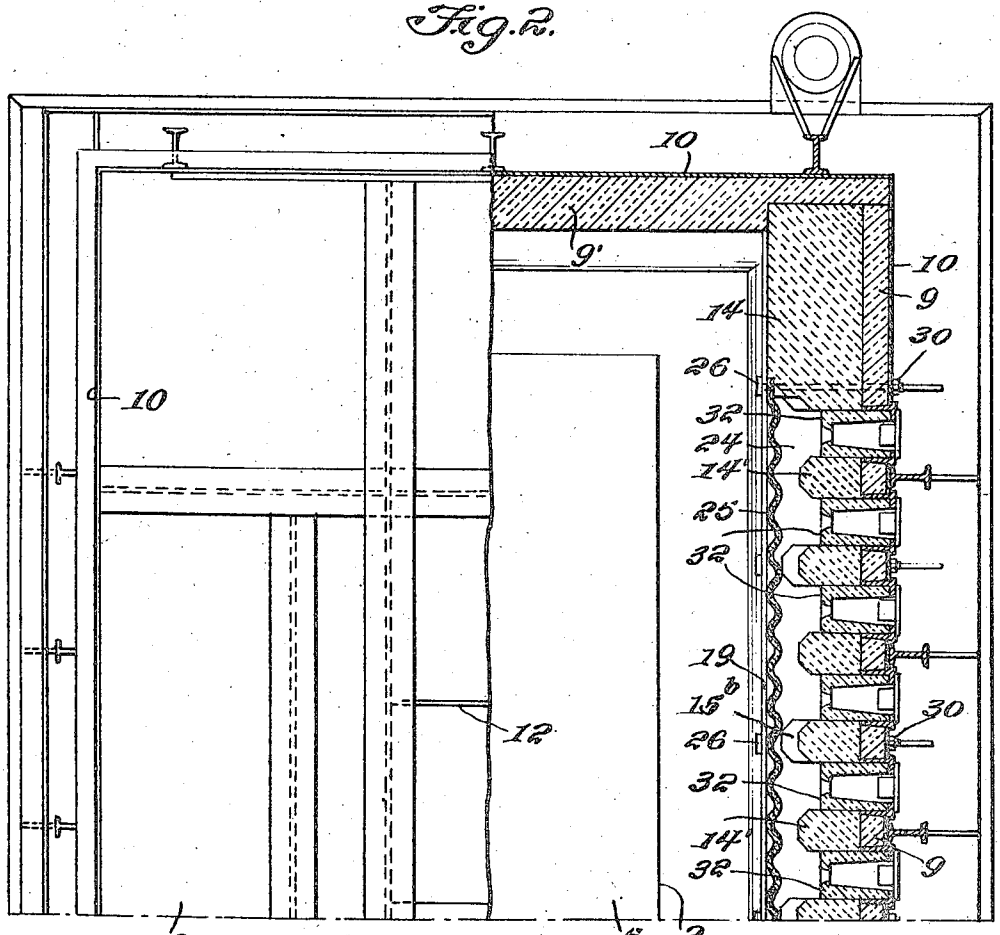
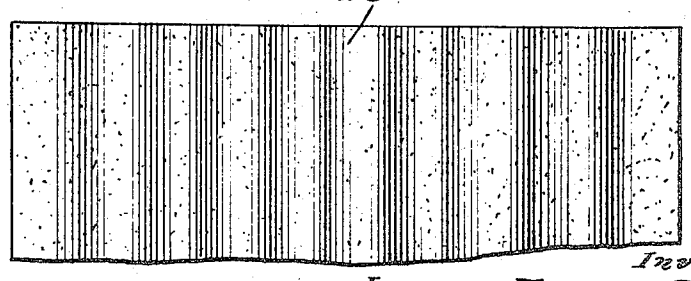


Fig. 6.



Fig. 7.



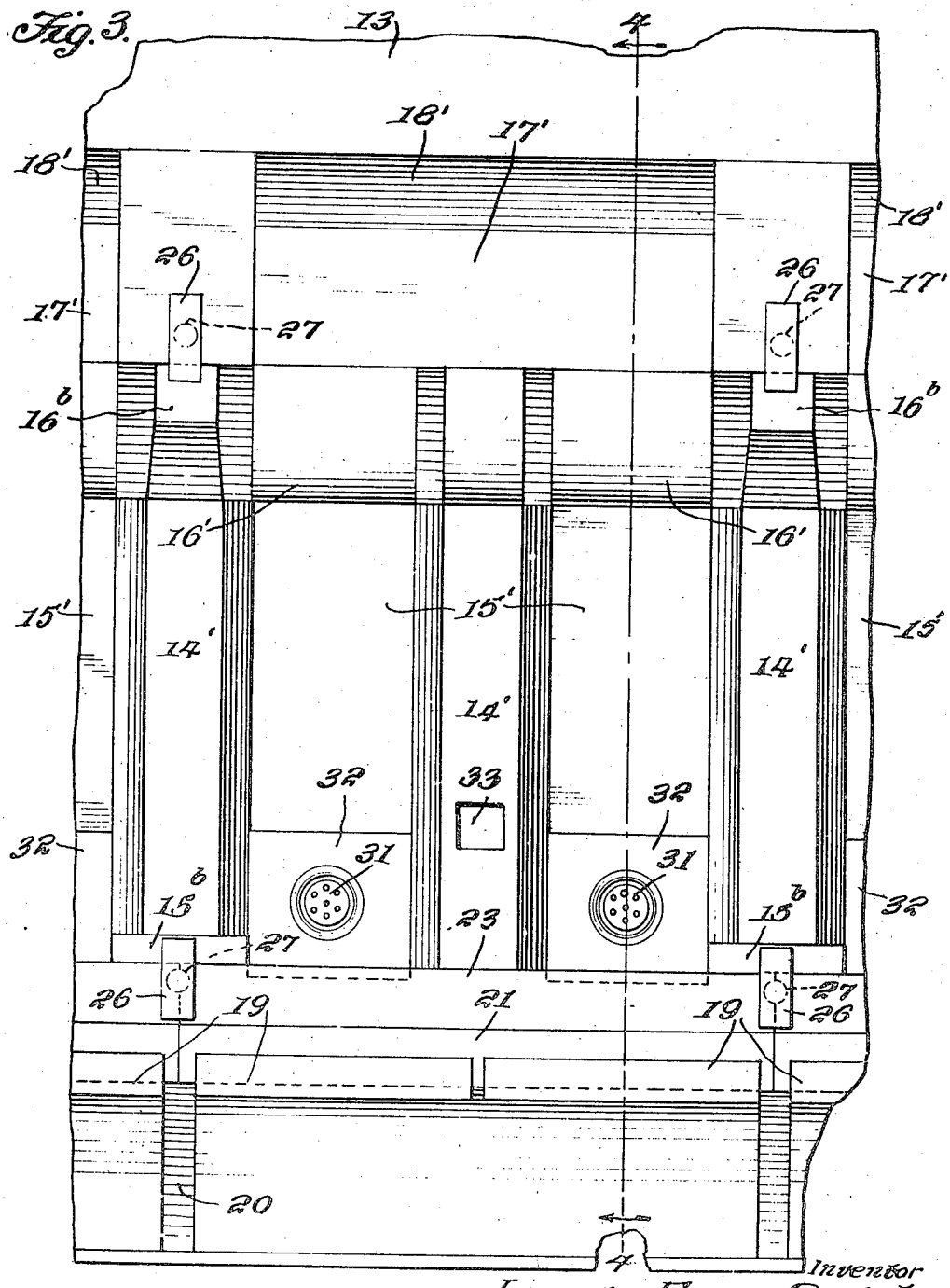
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Fig. 3.



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Fig. 4.

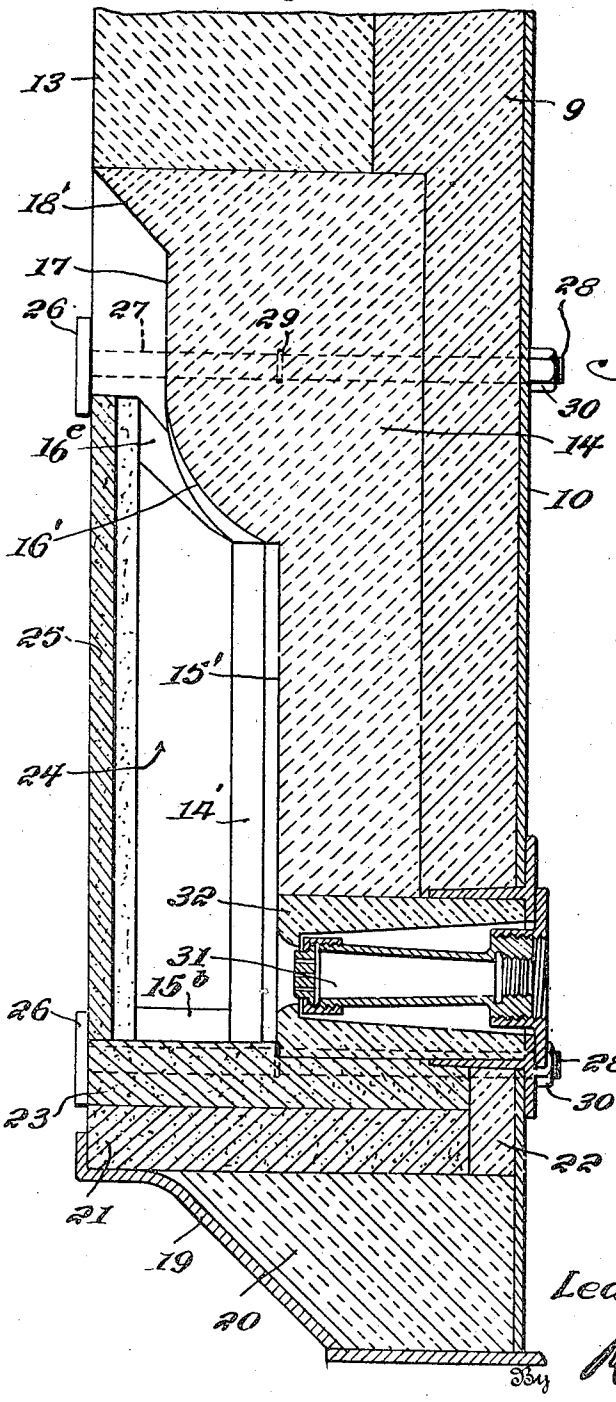
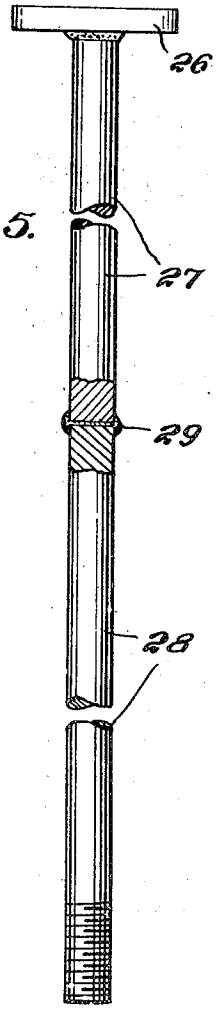


Fig. 5.



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Fig. 8

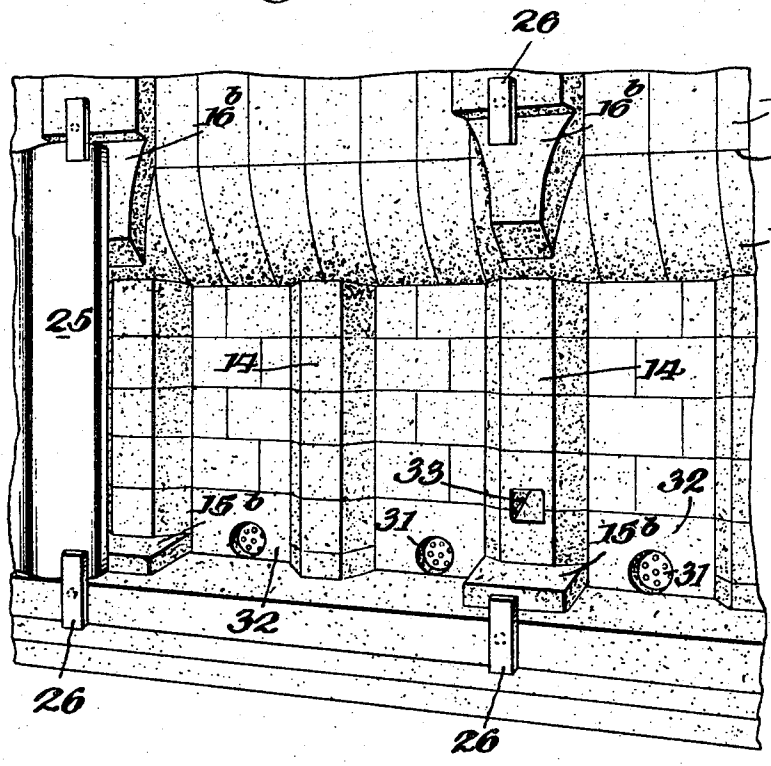
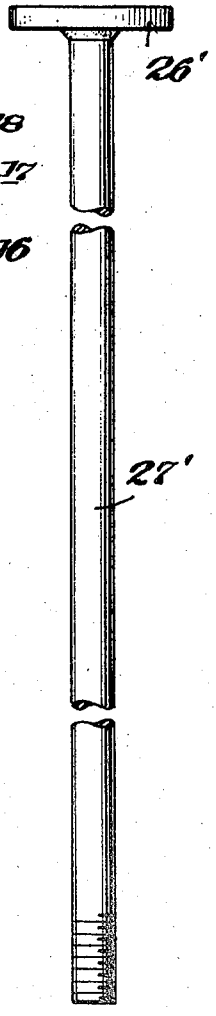


Fig. 9



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Fig. 10

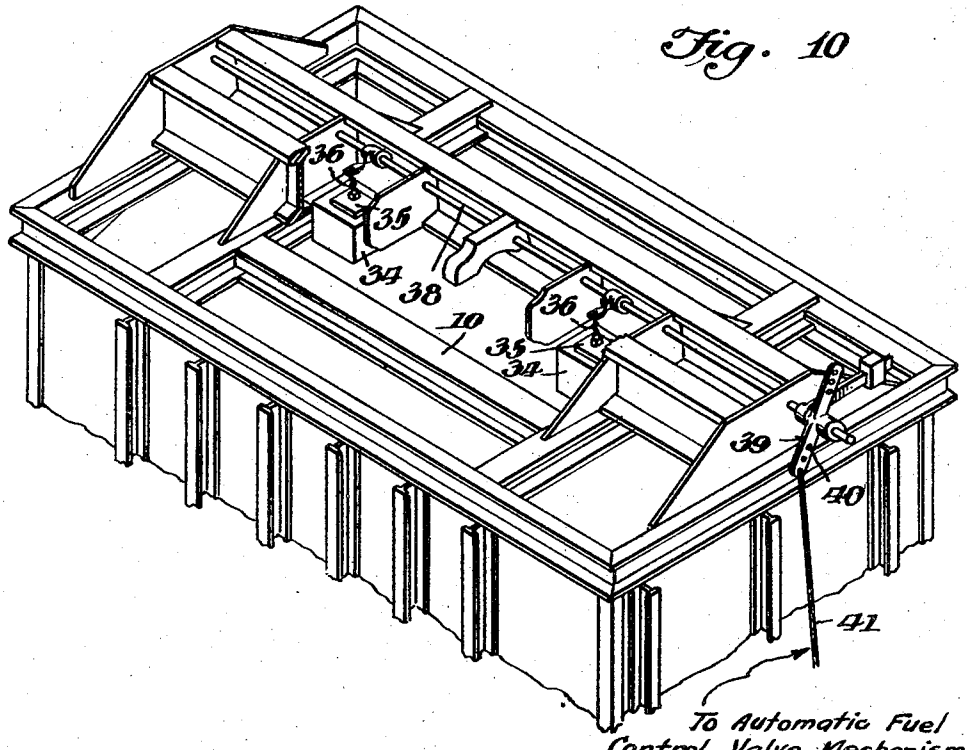
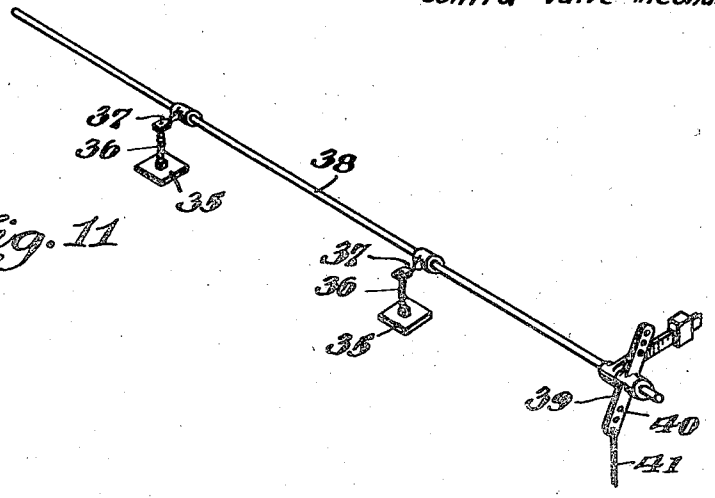


Fig. 11



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2,436,024

UNITED STATES PATENT OFFICE

2,436,024

ANNEALING FURNACE

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Application January 20, 1942, Serial No. 427,505

5 Claims. (Cl. 263—43)

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This invention relates to annealing furnaces, particularly for annealing sheets, although capable of use for annealing other material, for example, wire, and hence not so limited.

The invention more especially pertains to that type of annealing furnace wherein after the sheets or charge of other materials are piled on the hearth, an inner cover formed of good heat conducting metal is placed over the sheets to enclose same, following which the outer cover, or the furnace proper is placed over the inner cover, with both covers supported on the base or bottom of the furnace, and sealed from the ingress or infiltration of air by sand, oil, or equivalent, the covers being spaced to provide a heating and combustion chamber in such space.

Following the application of heat, for sufficient a period of time to anneal the charge, the outer cover is removed and replaced with relation to another inner cover which latter encloses a second charge piled on a second base, after which the heat is similarly applied to the inner cover of the second charge, while the first charge, from which the outer cover has first been removed, is permitted to cool out of contact with air, and during which the first-named inner cover, remains in place to protect the first charge from contact with air until completion of the cooling cycle.

The primary object of the invention is to provide improved means for applying heat to the combustion zone between the inner and outer covers.

A further object of the invention is to provide an annealing furnace of the type set forth, which increases the rapidity of heating of the inner cover, and which also applies the heat in a uniform manner so as to effect uniform heating of the batch or charge of material.

A further object of the invention is to provide means for applying heat to the inner cover by maintaining a zone of firing with the flame enveloping and literally hugging the inside wall of the outer cover.

Still further the invention aims to provide heating means for the inner cover which intercepts the flame and thereby not only directs or deflects same so as to cause the flame to follow a path close to the inside wall of the outer impinging cover, but also does not subject the inner cover to the direct action of the flame.

A further object of the invention is to provide heating means which embodies a corrugated or undulating baffle, tile, that is interposed between the heating chamber proper and inner cover, and

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acts to direct or deflect and spread the flame against the inside wall of the outer cover, and also provides an increase of heat by radiation.

The invention further resides in means for holding the corrugated baffle plate or tile in position and to provide means on the inside wall of the outer cover, which cooperates with the baffle plate or tile to form a heat passage that deflects the heat so as to cause the flame to always maintain a position close to the inside wall of the cover.

The invention still further aims to control the heat supplied to the inner cover by providing a damper mechanism which is responsive to the gas supply.

The invention has still other and further objectives which will be later set forth and of themselves manifested in the course of the following description.

In the drawings:

Fig. 1 is a vertical sectional view taken transversely through the central portion of a furnace constructed in accordance with the present invention;

Fig. 2 is a section on line 2—2 of Fig. 1, the inner cover being removed;

Fig. 3 is an enlarged fragmentary elevation of the inner face of a modified form of side wall of the outer cover, the corrugated refractory plate or tile being omitted;

Fig. 4 is a fragmentary vertical section of Fig. 3;

Fig. 5 is an elevation partly broken away, and partly in section, of one of the bolts or fasteners employed to secure the refractory tile in position;

Fig. 6 is a top plan view of the corrugated or undulating refractory baffle plates, showing the mode of connecting the sections;

Fig. 7 is a front elevation of Fig. 6, partly broken away, of one of the baffle sections;

Fig. 8 is a fragmentary perspective view of the inner face of the side wall of the outer cover;

Fig. 9 is a view similar to Fig. 5 of a modified form of bolt or fastener;

Fig. 10 is a fragmentary view of the top of the outer cover; and

Fig. 11 is a fragmentary perspective view of the damper control.

In proceeding in accordance with the present invention and referring more particularly to Fig. 1, 1 designates the hearth of the furnace which is formed of refractory material and is provided with a trough 2, which surrounds and receives any suitable air sealing material such as sand as indicated at 3.

An inner cover 4 has its lower edge received in the trough and seats upon the bottom wall 5 thereof so as to be supported thereby. The shape of the inner cover 4, of course conforms to that of the furnace, and while the furnace is herein shown as of a rectangular type it will be apparent that same is equally applicable to other forms.

Therefore dependent upon the shape of the inner cover 4, the trough 2 is shaped to correspond thereto so as to receive the entire bottom portion of the inner cover and thereby seal same against the ingress or infiltration of air. The batch or stack of sheets or other charge of material is initially placed upon the sand filled portion 5 of the hearth, following which the inner cover 4 is applied in the position shown in Fig. 1.

The superstructure of the furnace, which will be referred to as the furnace proper, is removable from the base structure, which latter includes the hearth, and has a supplemental trough 6 provided below, and in surrounding relation to the trough 2, to likewise receive a sealing material. The furnace proper has an arched top 8, ends 9' and sides 9 formed of tile or refractory material, and held in place by a suitable metal casing indicated generally at 10. The bottom of the casing has a depending web 11 secured thereto, which is received within the trough 6 so as to form an air seal, as in the instance of the seal of the trough 2.

Any suitable crane or grapple engaging member 12, is connected to the top of the furnace proper, which constitutes the outer cover, so that the latter may be removed and replaced upon a second base corresponding in structure to that just described, to heat a second batch or charge of material while the first batch or charge of material is cooling with the inner cover enveloping same to thereby prevent the ingress of air to the batch, as shown in Fig. 1.

In the instance of a furnace of rectangular form such as herein illustrated the two opposite sides only are equipped with burners or heat generators which extend substantially throughout the length thereof. The sides 9 have their inner walls formed or faced with either refractory and/or refractory insulation material in brick or tile monolithic construction, and similar lower tiles 14, which conjointly form the inner faces of the side walls of the outer cover.

The tiles 14 are formed with substantially vertical lower faces 15; outwardly curved or bulged intermediate portions 16, which merge at 17 into outwardly bulged upper portions 18, so that the heat from the burners will be directed inwardly of the tiles by the bulged portions 16 and 18.

Vertically disposed spaced pilasters 14' are formed on the sides 9, and have beveled sides which deflect and spread the heat and increase radiation. The pilasters are located on opposite sides of the burners, and serve to provide a series of vertical alleys for the heat, and to also support or reinforce the walls.

The bottoms of the walls of the furnace proper are chambered as indicated at 19, to receive insulation 20, upon which latter slabs 21 and 23 formed of insulating material, are disposed, the latter forming the bottom or floor of the heat supplying chamber 24. The outer edges of the slabs abut a refractory tile 22.

The inner faces of the tiles 14, form the outer walls of the heat supplying passages, or chambers 24, while vertically disposed baffles or plates 25, are provided to form the inner walls of such passages or chambers, and are corrugated or of undulating formation, so as to provide an increased heat radiating area which confronts the inner cover 4.

For the purpose of securing the baffles in position, bolts having rectangular heads 26, as shown in Fig. 5 are employed, the latter being composed of inner sections 27, and outer sections 28, the sections being preferably welded in end to end relation as indicated at 29. Since the sections 27 are disposed in a zone subjected to intense heat, same are made of a suitable heat resisting alloy, while the sections 28 which are not subjected to as intense a degree of heat, may be formed of mild steel.

As depicted in Fig. 6, the baffles are formed in sections and have their adjacent sides overlapped and held seated against the abutments 16b, and also against 15b, by the heads 26 of the bolts, which hold the sections securely in position in their overlapped relation.

Fig. 9 illustrates a modified form of bolt 27' which is formed throughout of heat resisting alloy and has a rectangular head 26' similar to the head 26 of the form of the bolt depicted in Fig. 5.

In Figs. 3 and 4, a modified form of side walls is disclosed, and wherein the bulge of the portions 16' is more pronounced and extend outwardly from the vertical faces 15' to a greater degree, than in Fig. 1. Further there are straight portions 17' which extend upwardly from the portions 16' and which terminate in straight inclined upper portions 18', which deflect the heat inwardly. Otherwise the structure is similar to that depicted in Fig. 1.

The burners, generally indicated at 31, are of any suitable type and are disposed within housings 32 formed of refractory material. A lighting hole 33 for the burners is provided, as depicted in Figs. 3 and 8. A series of lower abutments or projections 15b, are formed on the tiles 14, and also upper abutments or projections 16b, to engage the upper and lower sides respectively of the baffles, the abutments 15b and 16b, forming seats against which the outer faces of the baffles engage, and are held seated by the heads of the bolts 26 or 26' which extend through the tiles 14, and securely engage the inner faces of the baffles, upon tightening of the nuts 30 of the bolts.

The top 8, of the outer cover and the top of the metal casing is, as shown in Figs. 1 and 10, formed with a series of flues 34, which are controlled by dampers 35 that are connected to chains 36. The chains are suspended from arms 37 that are rigidly connected to a shaft 38, suitably journaled on the top of the metal casing 10.

An arm 39 is rigidly connected centrally of its ends to an end of the shaft 38, and has a series of perforations for selective connection to the upper end of a rod 41, which latter is actuated by an automatic control valve mechanism, not shown. This mechanism is responsive to the amount of gas supplied to the burners. Thus, if the gas supply is high, the dampers are fully opened, and if the supply is low the dampers are partially closed. Consequently the opening and closing of the dampers is proportional to the amount of gas supplied to the burners.

The disclosure of the invention is that preferred, but it is to be expressly understood that the same is susceptible to all changes, modifications and the like as fall within its scope and spirit, announced by the following claims.

What is claimed is:

1. In an annealing furnace of the type having a charge-receiving hearth, a removable inner cover for the charge, and a removable outer cover spaced from the inner cover to form a heating and combustion chamber therewith; a series of burners carried by the outer cover, and extending at right angles to the side wall of the latter, a lining for the outer cover forming one wall of a heat conducting passage for the gases and having a substantially straight portion disposed above the burners and further having an inwardly bulged portion and an upper portion extending vertically upward from said inwardly bulged portion, a bottom for the passage located beneath the burners, and a vertically disposed corrugated baffle forming the other wall of the passage disposed between the burners and the inner cover and spaced from each thereof, and having its upper end spaced below the upper inclined portion of the first-named wall of the passage.

2. In an annealing furnace, a series of burners, a body having means forming one wall of a heat supplying passage and having a substantially straight portion disposed above the burners and further having an inwardly bulged portion and an upper portion inclined inwardly and upwardly from the bulged portion, a bottom for the passage located beneath the burners, and a vertically disposed corrugated baffle forming the other wall of the passage and having its upper end spaced below the upper inclined portion of the first named wall of the passage.

3. In an annealing furnace, a base for supporting a charge to be heat treated, a cover having an open bottom mounted on said base and having side and end walls and a top provided with an outlet, the side walls of the cover having a plurality of spaced inwardly facing recesses therein adjacent the lower edges thereof, a baffle carried by the cover in spaced relation to the rear walls defining said recesses and having its upper edge terminating spaced from the upper walls defining said recesses so as to provide a heat conducting passage therebetween, and a plurality of spaced burners, one each in each of said recesses, projecting through the side walls of the cover adjacent the lower end of the baffle and at right angles to the latter for directing a flame thereagainst, whereby heat from the burners will flow upwardly through the heat conducting passage between the upper edge of the baffle and the upper wall of the recess and then upwardly along the face of the side wall of the cover above the recesses and toward and through the outlet in the top of the cover.

4. In an annealing furnace, a base for supporting a charge to be heat treated, a cover having a top wall, side walls, end walls and an open bottom mounted on said base, said top wall having a damper controlled outlet therethrough, the side walls of the cover each having an inwardly facing recess formed therein adjacent its lower edge, a burner in each of said recesses, and a vertically extending baffle disposed in each of said recesses in spaced relation to the wall defining the back of the recess and having its upper edge terminating spaced from the wall defining the top of the recess so as to provide a heat conducting passage therebetween, said baffles each having their outer side faces in vertical alinement with the inner side face of the side wall above the adjacent recess, whereby the heat from said burners is directed against the inner faces of the baffles and then upwardly through the heat conducting passage between the upper edge of the baffle and the top wall of the recess along the face of the side wall of the cover above the recesses and toward and through said outlet.

5. In an annealing furnace, a base for supporting a charge to be heat treated, a cover mounted on said base having a top wall, side walls, end walls, and an open bottom, said top wall having a damper controlled outlet therethrough, said cover having at least one of its side walls provided with an inwardly facing recess adjacent its lower edge, a baffle carried by the side wall in spaced relation to the wall defining the back of the recess and having its upper edge terminating spaced from the wall defining the upper end of the recess so as to provide a passage for the flow of hot gases therebetween, said baffle having its inner side face alined with the inner side face of the side wall of the cover above the recess, and a burner in said recess for directing hot gases against the outer side face of the baffle so as to be deflected upwardly thereby and through the passage defined between the upper edge of the baffle and the upper end of the recess and then upwardly along the inner side face of the side wall of the cover toward and through the damper controlled outlet in said top wall.

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