Nov. 22, 1938. L. WILSON 2,137,868

APPARATUS FOR HEATING AND COOLING

Filed Nov. 25, 1936 2 Sheets-Sheet 1

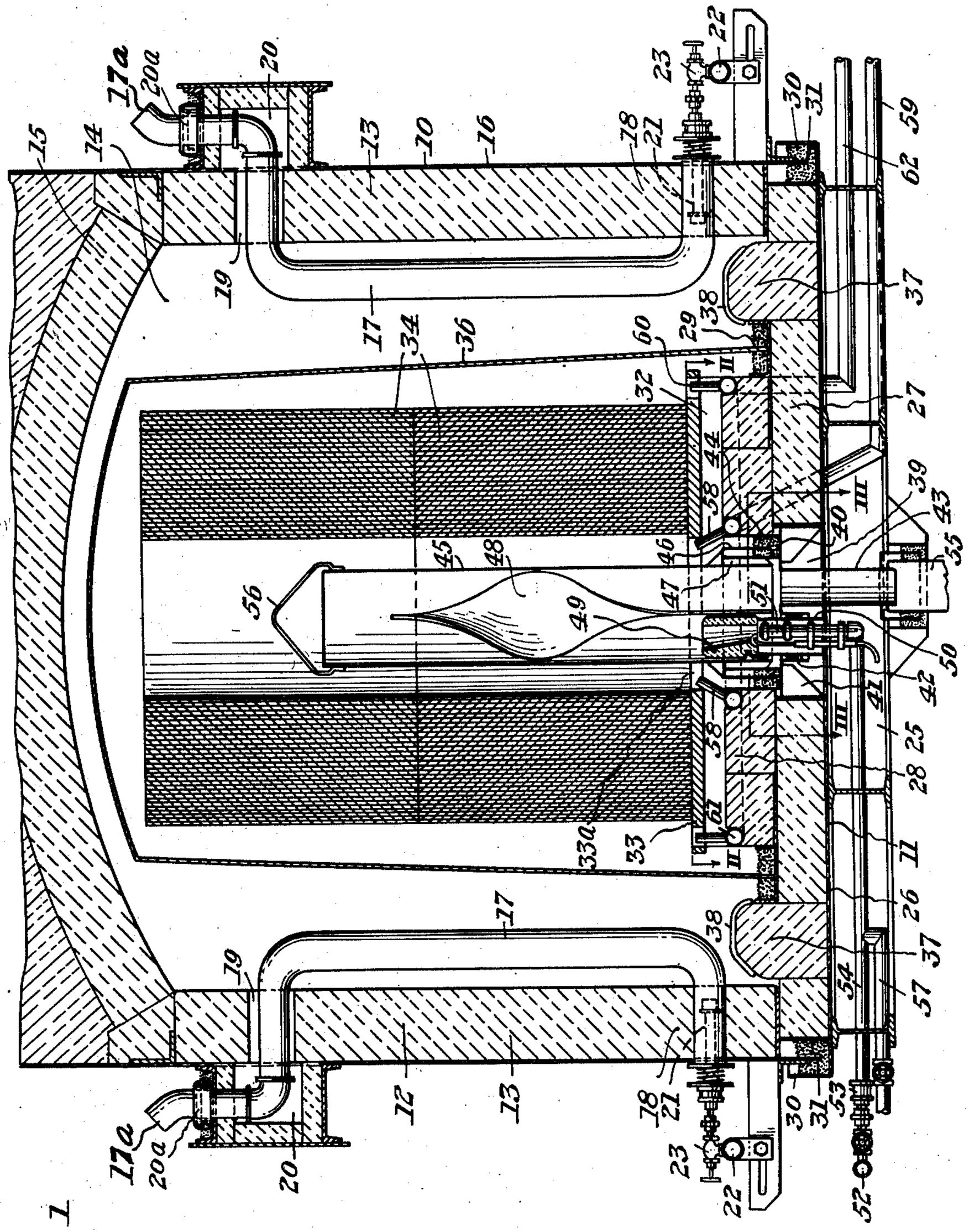



Fig. 1

INVENTOR
Lee Wilson

by his attorneys
Stebbins, Blenko & Parmelee

Nov. 22, 1938. L. WILSON 2,137,868

APPARATUS FOR HEATING AND COOLING

Filed Nov. 25, 1936 2 Sheets-Sheet 2

Fig. 3.

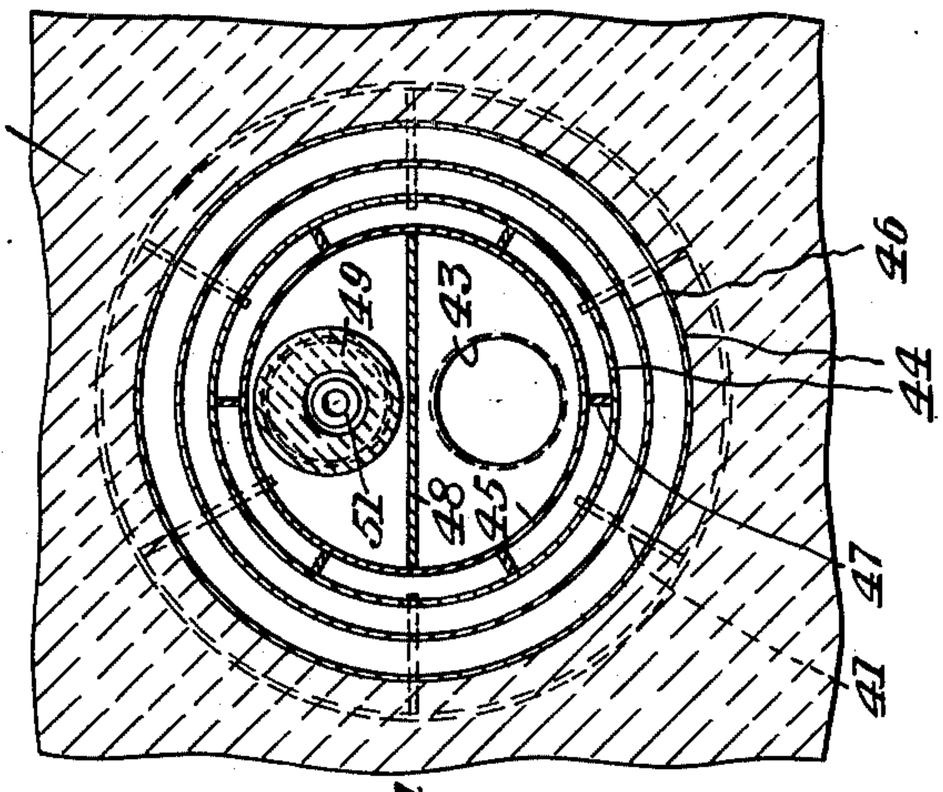
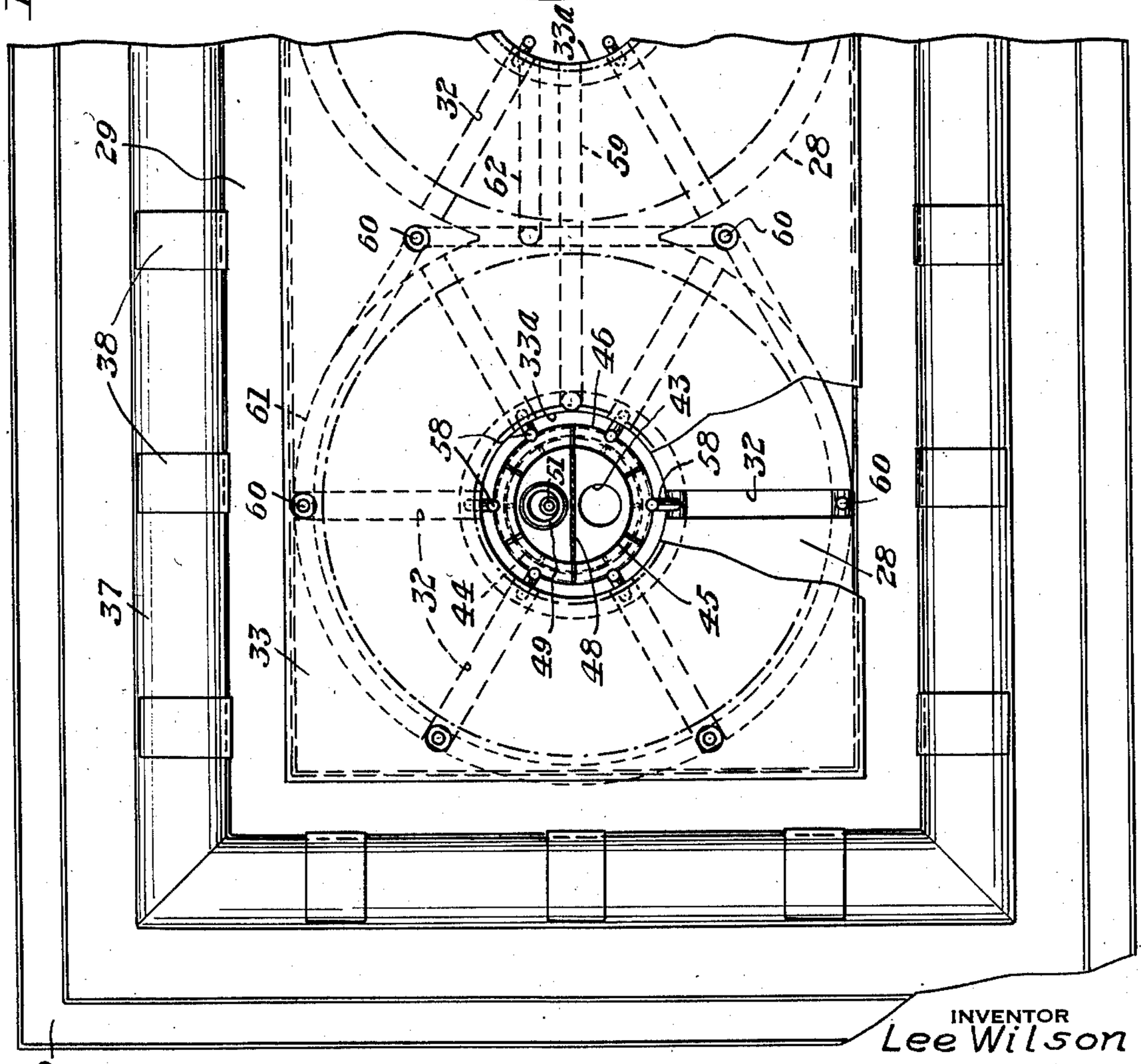



Fig. 2.




INVENTOR
Lee Wilson
by his attorneys
Stebbins, Blenko & Parmelee

Patented Nov. 22, 1938 2,137,868

# UNITED STATES PATENT OFFICE

2,137,868

## APPARATUS FOR HEATING AND COOLING

Lee Wilson, Cleveland, Ohio

Application November 25, 1936, Serial No. 112,737

6 Claims. (Cl. 266—5)

This invention relates to an apparatus for heating and cooling and particularly to the heating and cooling of large masses of metal as is necessary, for example, in the annealing of sheet steel, and the invention will be described with particular reference to this application, although it is not limited thereto.

It has been proposed heretofore to anneal coils of strip by stacking them on their sides and radiating heat to the interior and exterior of the coils from appropriately disposed heat-exchange tubes having hot combustion gases circulating therethrough. This required an annealing furnace of special design which was not adapted to serve any other purpose. The annealing of sheets in stacks, for example, required a different type of furnace. The methods and apparatus used heretofore for annealing coils, furthermore, did not produce uniform temperature conditions in all portions of the charge of material being annealed, and this resulted in objectionable variations in the qualities of the annealed product.

I have invented a novel apparatus which is particularly adapted to the annealing of strip in coils, but overcomes the aforementioned objections, providing for the treatment of sheets as well as coils, and for the attainment of highly uniform temperature conditions throughout the metallic mass. In accordance with my invention, I provide a charge-supporting base and a cover-type furnace adapted to be disposed thereon to enclose the charge during heating. The cover is provided with radiator tubes spaced along the side walls thereof in the known manner. I also provide the base with a removable radiator tube having means associated therewith for supplying hot combustion gases thereto. A helical baffle in the tube causes the gases to sweep around the tube, in addition to passing back and forth therealong. I also contemplate the introduction of gas under pressure through expanding nozzles, whereby to cool the charge after it has been heated to the proper annealing temperature. The cooling gas, after expansion, may be cooled as in the usual refrigerating system before further circulation over the heated mass.

This invention also relates to a detail of the construction of the furnace cover, specifically to the provision of means for sealing the upper ends of the tubes to the furnace wall.

A further and more complete understanding of the invention may be had by consideration of the following detailed description, which is to be read in connection with the accompanying drawings illustrating a preferred embodiment of the apparatus of my invention. In the drawings,

Fig. 1 is a sectional view taken transversely through a furnace in accordance with the invention;

Fig. 2 is a view largely in plan showing the base with the cover removed, parts being shown in section along the line II—II of Fig. 1; and

Fig. 3 is an enlarged sectional view along the line III—III of Fig. 1.

A furnace embodying the invention includes a cover 10 and a base 11. The cover 10 comprises an open-bottomed, refractory-lined housing 12 removably disposed on the base and having side walls 13, end walls 14, and a roof 15 assembled within a structural frame (not shown) and metallic sheathing 16.

Radiator tubes 17 are mounted on the side walls of the furnace, the lower ends thereof being embedded in the refractory lining indicated at 18. The upper ends of the tubes extend through openings 19 in the side walls into refractory-lined channels 20, and thence upwardly therethrough. The channels 20 are closed at their ends. Seals 20*a* are provided for the ends of the tubes 17*a* projecting upwardly through the top wall of the channels 20. These seals are in the nature of skirts depending from the upper ends of the tubes and extending into sealing material such as sand carried on top of the channels 20. Burners 21 are mounted in lower ends of the tubes 17 and are supplied with fuel from a header 22 under the control of individual valves 23. The tubes 17 are heated to radiant temperature by the hot combustion gases delivered thereto by the burners 21.

The base 11 comprises a structural frame 25 having a bottom plate 26 disposed thereon. A refractory hearth 27 built up on the bottom plate 26 includes charge-supporting piers 28. An inner sealing channel 29 extends around the piers 28. An outer sealing channel 30 extends along the edges of the base and is adapted to cooperate with a flange 31 depending from the cover 10. The piers 28 have radial passages 32 formed therein, and are provided with a plate 33 on which a charge may be disposed, e. g., coils 34 stacked end on end. A protective cover 36 is disposed over the coils 34 with its lower edge resting in the channel 29. A refractory curb 37 extends around the base between the channels 29 and 30, and has bumper blocks 38 disposed thereon.

Openings 39 are formed in the base substantially centrally of the piers 28. Each opening 39 is closed by a plate 40 which rests on radial brackets 41 extending inwardly from the edge of

the opening. The plate 40 has tubes 42 and 43 extending downwardly therefrom. An annular sealing channel 44 is carried on the plate 40. An internal radiator tube 45, having its upper end closed, rests on the inner wall of the channel 44, and has a depending flange 46 extending thereinto. The tube 45 extends upwardly through a central opening 33a in the plate 33. Radial centering fins 47 are disposed about the periphery of the tube 45 adjacent its bottom. The tube 45 is provided with an internal helical baffle 48.

A burner block 49 extends into the lower end of the tube 45 at one side of the baffle 48, being supported on a sleeve 50 extending through the tube 42, the space between the tube and the sleeve being closed by an annular gasket. A burner 51 extends through the sleeve 50 and is supplied with fuel from a supply pipe 52 and air induced at an inspirator 53, through a pipe 54.

It will be apparent from the foregoing description that the apparatus described is effective to radiate heat through the protective cover 36 to the outside of the coils 34 from the radiator tubes 17 and to the interior of the coils from the tube 45. The hot combustion gases delivered to the latter by the burner 51 flow upwardly therethrough and sweep helically therearound, because of the shape of the baffle 48, and thence downwardly of the radiator tube and into the tube 43 which serves as an exhaust, discharging into a duct or offtake 55. A cup or channel seal 43a closes the joint between the tube 43 and the duct. Because of the helical or swirling motion imparted to the gases traversing the tube 45, the latter is heated to uniform temperature at all points therearound and, since the gases travel first in one direction through the tube and then in the other direction, there is ample opportunity for the transfer of the maximum amount of heat from the gases to the tube.

Since the tube 45 and the baffle 48 therein are removably supported on the base, they may be easily lifted therefrom, a bail 56 being provided for this purpose, to facilitate the stacking of coils on the piers and their removal therefrom. This eliminates the necessity for accurately centering the coils when lowering them onto the piers.

After heating the charge to the desired temperature, and removal of the cover 10, it may be desired to cool the charge at a more rapid rate than that at which cooling by natural radiation only proceeds. For this purpose, an air-supply pipe 57 intersects the pipe 54 whereby cooling air may be blown through the radiator tube 45 after the burner 51 has been extinguished. To supplement the cooling effect of this air blast, I provide expansion jets 58 extending upwardly into the opening 33a from an annular header extending around the opening 39. I supply expansible cooling fluid under pressure to the jets 58 through a pipe 59. The expansion of the gas as it emerges from the jets 58 further cools the charge. The cooling gas passes upwardly through the coils and thence downwardly of the exterior thereof to exhaust intakes 60 extending upwardly through holes in the plate 33 from a header 61. The passages 32 in the piers 28 provide for circulation of the cooling gas under the charge so that all portions thereof are cooled to substantially the same extent.

If it should be desired to employ the apparatus shown in Fig. 1 for the annealing of sheets in stacks, it is only necessary to remove the radiator tubes 45 and the plates 33. I have shown the plate 33 as being of substantially rectangular outline and resting on the two piers 28. This permits sheets to be stacked thereon for annealing after removal of the radiator tube 45. If desired, however, rectangular plate 33 may be replaced by two circular plates, one for each pier, when annealing coils and by a single rectangular plate without openings, for the annealing of sheets. In the latter event, the jets 58 and intakes 60 should also be removed when it is desired to anneal sheets, in order to avoid interference with the supporting plate therefor.

It will be apparent from the foregoing description that the invention provides a method and apparatus for heating and cooling which are particularly adapted to the annealing of sheet metal in the form of coils. The apparatus may also be used for annealing sheets. The invention thus has a wider range of utility than apparatus previously known, adapted specifically for either sheets or coils only. The invention has further advantages over the apparatus previously known in that the internal coil-heating element is removably mounted on the base, instead of being carried on the cover. Damage to the internal radiator is thus avoided, and the placing of the charge and lowering of the heating cover thereover are considerably accelerated. The invention also makes it possible to heat the charge uniformly throughout, thereby insuring a product without objectionable variations in characteristics.

Although I have illustrated and described but one preferred form of the invention, it will be recognized that changes in the apparatus and procedure described may be made within the scope of the appended claims.

I claim:

1. A furnace comprising a base or hearth, side walls and a roof, a plurality of heat exchange tubes mounted on said walls and extending outwardly thereof, and a sealing channel extending along said walls, said tubes extending upwardly through said channel after emerging from said walls.

2. A furnace as defined by claim 1, characterized by a refractory lined passage extending along said walls below said channel enclosing the portions of said tubes between the outer surface of the walls and the lower surface of said channel.

3. Annealing apparatus comprising a refractory base adapted to support an annular mass of metal to be annealed, a refractory lined cover removably positioned on the base and cooperating therewith to enclose the metal, an opening in said base, a heat-exchange tube removably disposed in said opening and extending upwardly from said base to penetrate said mass and heat it interiorly, fin guides for centering said tube in said opening, means in said base for delivering hot gases to said tube, and heat-exchange tubes mounted within said cover for heating the exterior of said mass.

4. A furnace including a charge-supporting base and a cover therefor, said base having an opening therein, an annular channel positioned in said opening, and a tubular radiator extending upwardly from the opening and having an annular sealing flange engaging the inner wall of said channel for removably supporting radiator thereon.

5. In a furnace, a base and a cover cooperating therewith, an opening in said base, an annular plate seated in said opening coaxially therewith, a tubular radiator removably carried on and extending upwardly from said plate, a burner extending upwardly through one side of said plate

and discharging into said radiator, an exhaust duct below said base, and a tube depending from the other side of said plate communicating with said duct.

6. In a furnace, a base and a cover cooperating therewith, an opening in said base, a diaphragm extending across said opening, a burner extending through said diaphragm on one side thereof and an exhaust tube depending therefrom on the other side thereof, and a tubular radiator having a central baffle, said radiator being removably supported on said diaphragm, the interior of the radiator on one side of the baffle being open to said burner, the interior of the radiator on the other side of the baffle communicating with said tube.

LEE WILSON.