Aug. 9, 1932. C. J. BROWN 1,870,551

APPARATUS FOR ANNEALING

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Fig. 1.

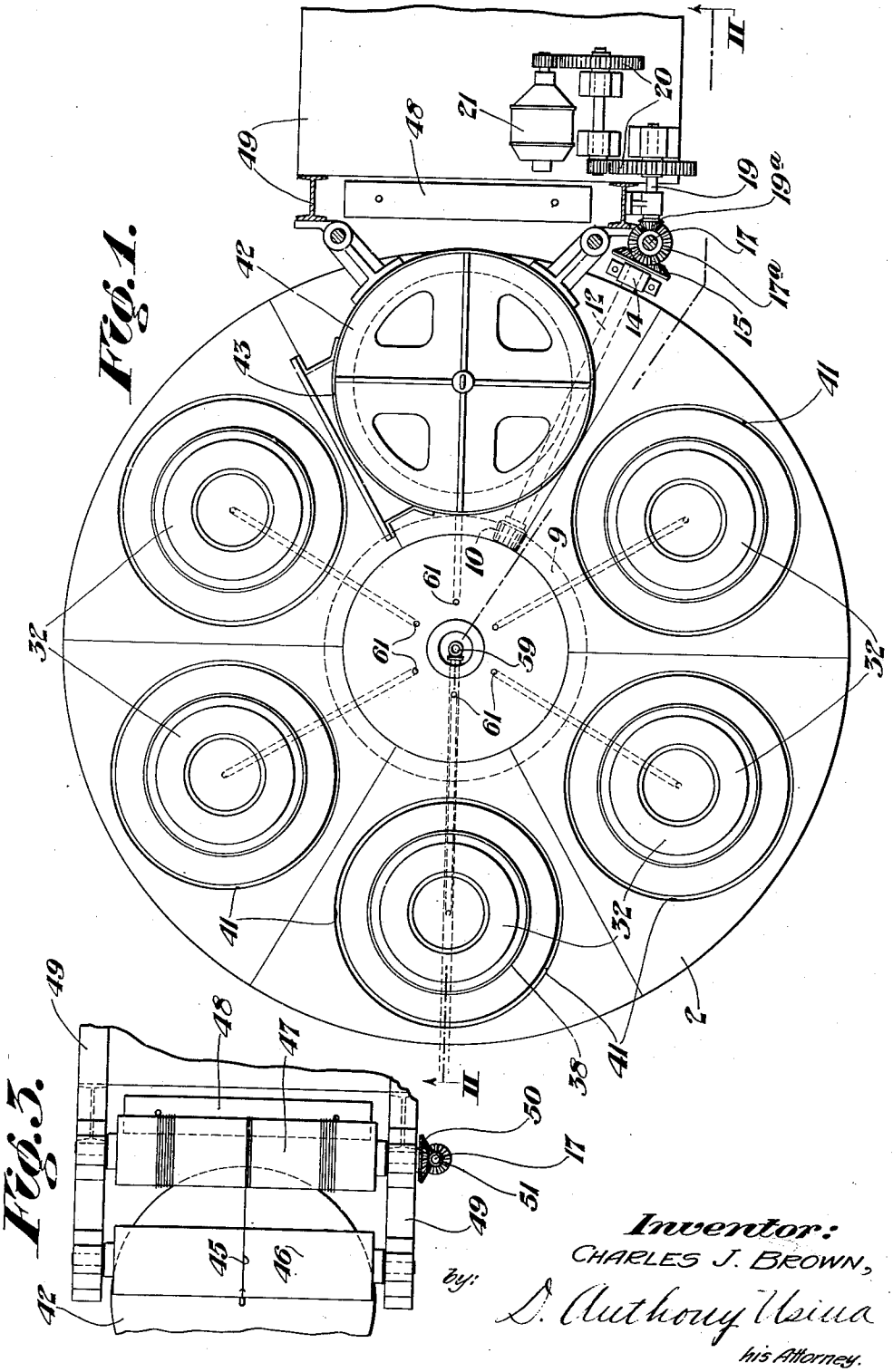


Fig. 3.

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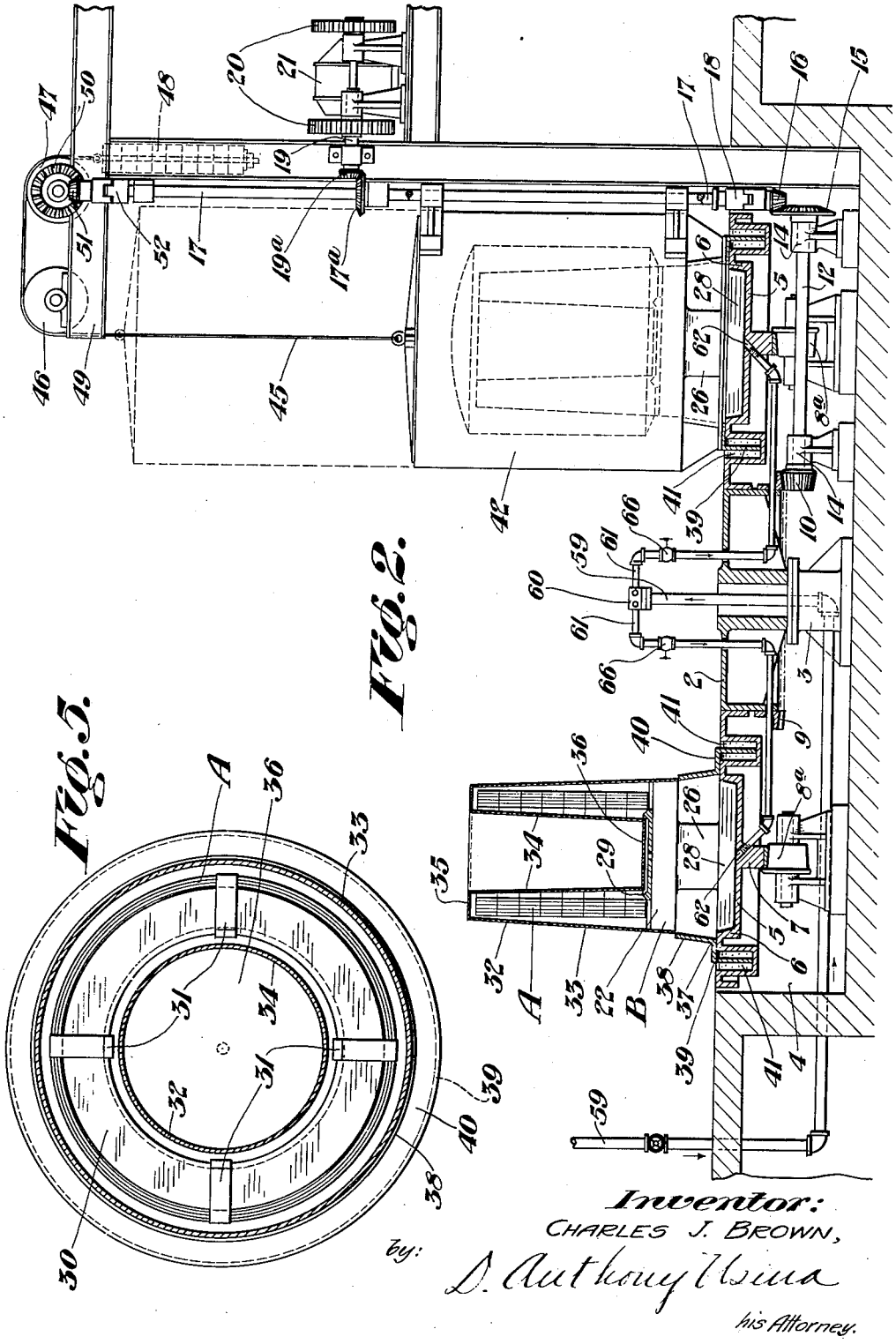


Fig. 2.

Fig. 3.

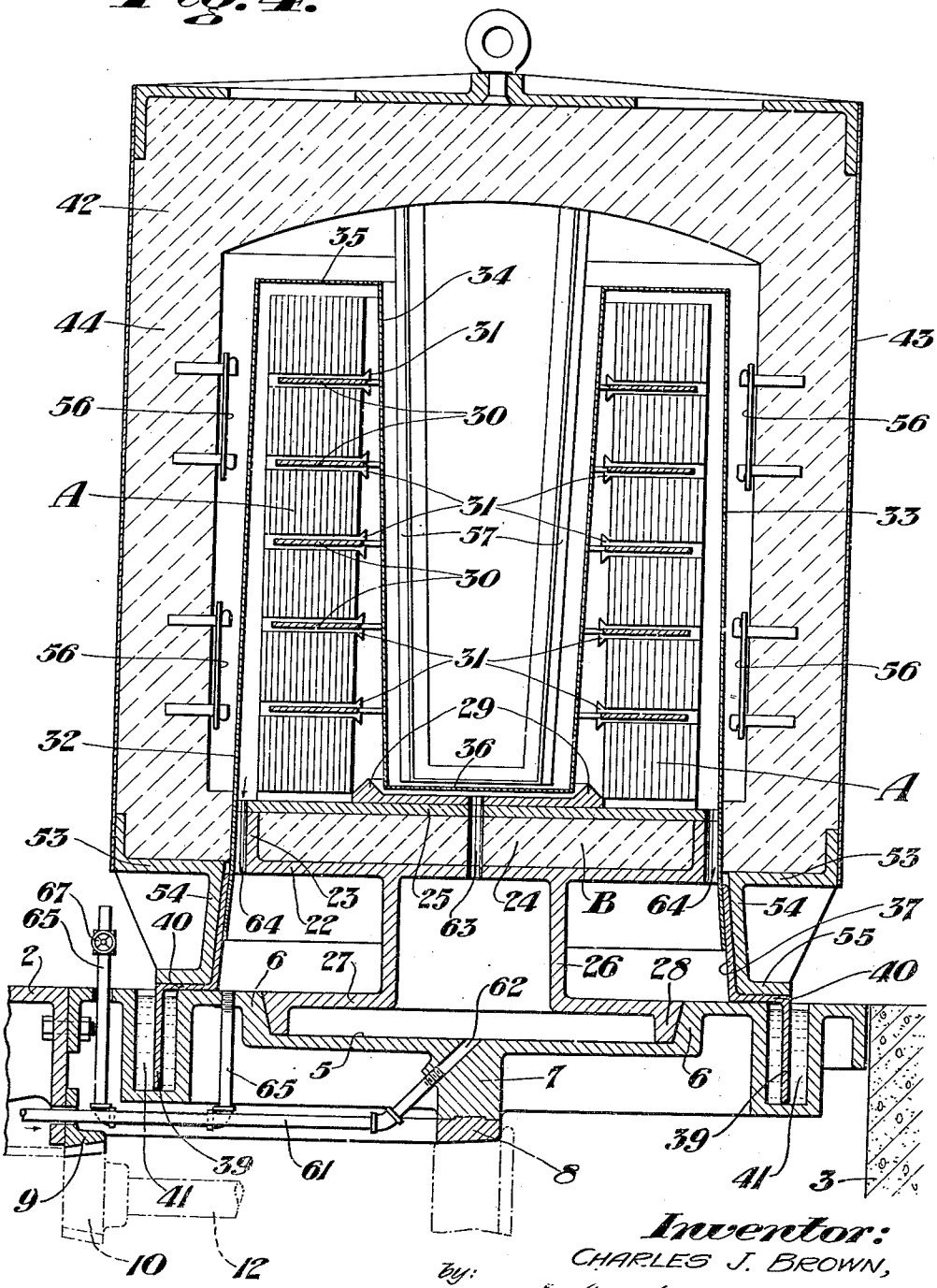
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APPARATUS FOR ANNEALING

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Fig. 4.



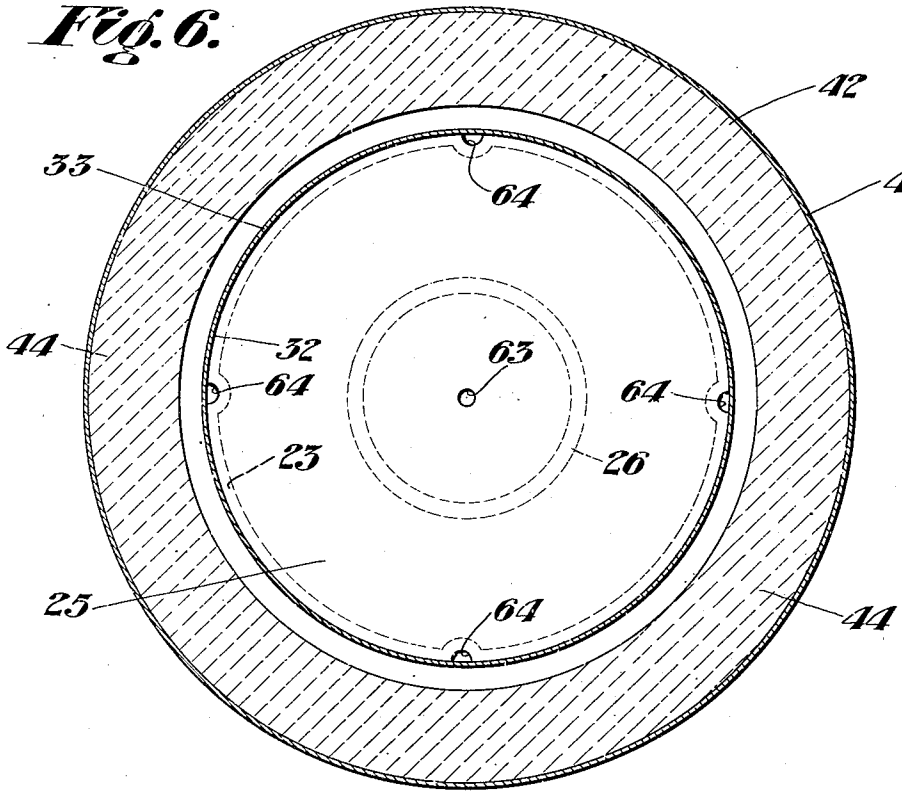
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APPARATUS FOR ANNEALING

Filed May 31, 1928 4 Sheets-Sheet 4

Fig. 6.



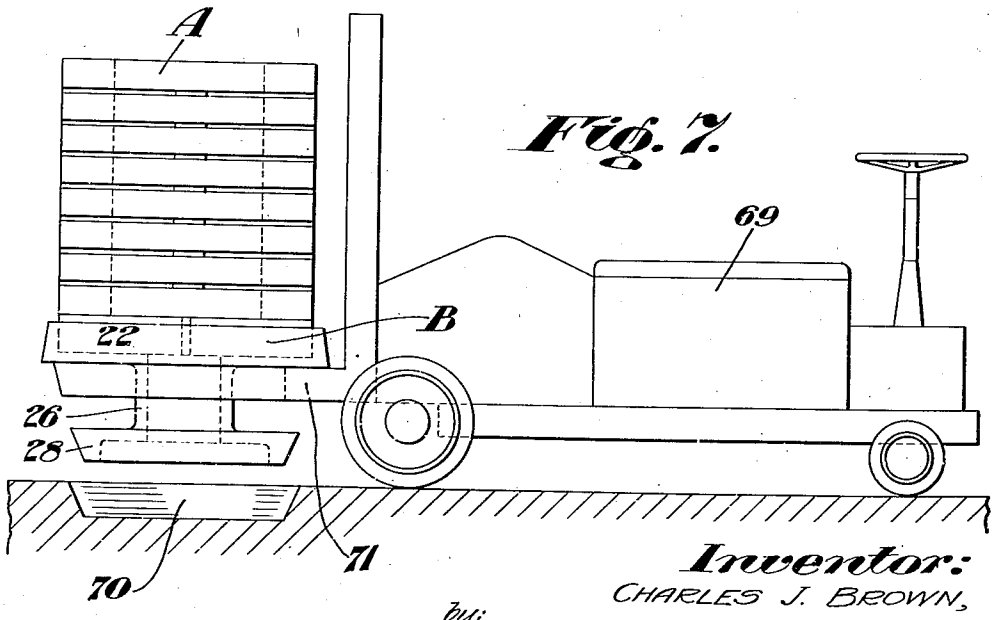


Fig. 7.

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UNITED STATES PATENT OFFICE

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APPARATUS FOR ANNEALING

Application filed May 31, 1928. Serial No. 281,804.

This invention relates to methods of and apparatus for annealing and, while not limited thereto, relates more particularly to methods of and apparatus for annealing coiled strip steel and the like, and has for its object the provision of a method and apparatus which will be more efficient in that it will eliminate the major portion of the handling steps necessary in the methods heretofore employed, and also will produce a higher grade of annealed product.

Another object is to provide a method and apparatus which will cause the products being annealed to be heated and annealed quicker than has been possible with the methods and apparatus heretofore employed.

Heretofore, the product to be annealed has generally been enclosed in annealing boxes weighing approximately 20,000 pounds and the load for such boxes generally was around 10,000 pounds of coiled product. The loaded boxes were then passed into a furnace heated by coal, gas or liquid fuel. The boxes being of twice the weight as the material to be annealed, took twice as long to heat as did the material to be annealed and this heat was lost as far as actual annealing was concerned.

After the product was annealed, the boxes were removed from the furnace and it was necessary to permit them to stand for from three to four days to allow the annealed material to cool.

The present method and apparatus entirely eliminates the heavy annealing boxes of the prior art, and provides for quick heating and cooling of the product.

In the drawings—

Figure 1 is a plan view of the annealing apparatus as a whole.

Figure 2 is a sectional elevation taken on the line II—II of Figure 1.

Figure 3 is a fragmentary plan view showing the elevating mechanism for the furnace cover.

Figure 4 is a vertical sectional view through a pile of coils mounted in position and covered for annealing.

Figure 5 is a sectional plan through a pile of coils covered on an annealing base prior to their being covered by the furnace cover.

Figure 6 is a sectional plan through the assembled base and covers in line with the top face of the base.

Figure 7 is a more or less diagrammatic elevation showing a loaded base being conveyed by a lifting truck.

Referring more particularly to the drawings, the numeral 2 designates the circular turntable base of the annealing apparatus journaled on a spindle 3 in a pit 4. The turntable base 2 is provided with six circular depressions or recesses 5, having inwardly inclined side walls 6 for a purpose to be described.

A rail-rib 7 is formed integral with the underside of the turntable base and extends under the recesses 5. A removable wear-face 8 is secured to the rib 7. A plurality of flanged supporting wheels 8^a are journaled in the pit 4 and engage the track-rib 7 to form a support for the turntable.

The turntable base 2 is adapted to be turned by power and is provided with a toothed rack 9 which is meshed with a pinion 10 on a shaft 12 journaled in bearings 14. The shaft 12 is provided with a bevel gear 15 which is meshed with a bevel pinion 16 journaled on a vertical drive-shaft 17 and adapted to have a drive connection with the shaft 17 through a clutch 18. The vertical shaft 17 is provided with a bevel gear 17^a intermediate its ends which is meshed with a bevel pinion 19^a on a shaft 19 which is connected through a series of reducing gearing 20 with a motor 21.

The coils of material A to be annealed are adapted to be supported on circular annealing bases B composed of a top 22 having an upstanding rim 23 and a filling of refractory heat insulating brick 24 and a cover-plate 25. A hollow or tubular stem 26 is formed integral with and depends downwardly from the top 22 and is provided with a base disk or flange 27 having a vertical rim flange 28 which is beveled so as to provide a snug sealing fit with the inclined walls 6 of the depressions or recesses 5 in which the bases B are adapted to be mounted.

The cover-plates 25 are provided with integral upstanding centering rings 29 having

a diameter substantially equal to the internal diameter of the coils of material to be annealed, so that the lowermost coil may be readily centered on the base when positioned thereon. The succeeding coils to make up an annealing charge are then piled one on top of the other, and preferably an alining and spacing-ring 30 is positioned between each of the succeeding coils. The rings 30 have spacing-lugs 31 around their inner circumference which serve to space the coils from each other and also guide or aline the coils, the space between the coils permitting the circulation of heated gases between the coils and thus facilitating the heating thereof.

The charge of coils A, after they are positioned on the bases B, is adapted to be covered by a sheet-metal cover 32 composed of an outer cylinder 33 adapted to telescopically enclose the outer wall of the piled coils, and an inner cylinder 34 adapted to fit within the center of the pile of coils. The cylinders 33 and 34 are joined at their upper ends by a top plate 35 and the inner cylinder is closed at its lower end by a bottom wall 36. A sealing ring 37 is secured to the lower end of the outer cylinder 33 and comprises a downwardly and outwardly inclined flange 38 secured to the cylinder 33 and a vertical sealing flange 39 of a larger diameter than the flange 38 and connected thereto by a horizontal web 40. The vertical sealing flange 39 is adapted to project downwardly into a circular liquor filled sealing groove 41 which surrounds each of the recesses 5 so as to seal the covers 32 with the turntable base 2.

A single annealing or furnace-cover 42 is mounted for vertical movement above the turntable and comprises a cylindrical enclosing casing 43 of materially greater diameter than the cover 32 and having a heat insulating lining 44 of refractory brick. The cover 42 is suspended for vertical movement from one end of a cable 45 which is trained around drums 46 and 47, and has its other end connected to a counter-weight 48.

The drums 46 and 47 are journaled in suitable bearings on a supporting structure 49 and the drum 47 has its shaft extended and provided with a bevel gear 50 which is meshed with a bevel pinion 51 freely mounted on the upper end of the drive-shaft 17 and adapted to be connected thereto by a clutch 52.

The lower end of the furnace-cover 42 terminates in a relatively heavy metal rim-member 53 having an outwardly flaring web portion 54 adapted to snugly fit or seat on the flange 38 of the sealing ring 37 on the cover 32, and terminates at its lower end in a horizontal flange 55 adapted to rest upon the horizontal web 40 of the sealing ring 37.

The furnace-cover 42 is provided around its inner circumference with electrical heating elements 56 and is also provided with electrical heating elements 57 which depend from the top of the cover and are adapted to project down into the cylinder 34 of the cover 32.

A suitable gas supply pipe 59, for a non-oxidizing or neutral gas extends upwardly through the spindle 3 on which the turntable 2 is journaled and has a rotary connector 60 on its upper end. Branch gas supply pipes 61 lead from the connector 60 down through the turntable and are connected to inlet openings 62 communicating with each of the recesses 5 at a point within the area enclosed by the hollow stem of the annealing base. The annealing bases B each have an opening 63 in their tops communicating with the hollow stem portion thereof so that gas flowing through the branch pipes 61 will pass through the inlet openings 62, then through the hollow stems 26 of the annealing bases and openings 63 into the center of the pile of coils being annealed.

The edges of the annealing base tops or rims 23 are provided with a plurality of notches 64 which form outlet passages for vaporized oil or other foreign matter burned from the material being annealed and forced out by the gases from the pipes 61. The notches 64 communicate with the space between the tops 22 of the annealing bases B and the turntable, which spaces are vented by outlet pipes 65.

The pipes 61 and 65 are provided with valves 66 and 67, respectively, by which the circulation of gases within the covers 32 is controlled.

In Figure 7 I have shown a loaded annealing base B which has been lifted from the floor by a standard lifting platform truck 69 such as is in common use in and around mills and factories. The mill floor is provided with a recess or socket 70 adjacent the point at which the coils of material A are formed and the annealing bases B are adapted to be mounted and supported in the recesses while the coils A are piled thereon. After the annealing base is loaded, the lifting platform truck is moved into position so that its platform 71 will engage under the top 22 of the base and lift the base out of the recess 70. The truck 69 will then convey the loaded base to the turntable 2 and deposit the base in one of the recesses 5 of the table.

In carrying out the method of this invention by the use of the apparatus described above, the coils of material A, which may be strips of metal, wire, rods, or any coiled metal, are piled on one of the annealing bases B as the coils are formed and, if the spacing-rings 30 are to be used to space the coils apart, one of the spacing-rings is positioned on top of each bundle or coil. After the desired number of coils are piled on the base B, the loaded base will be lifted from the recess 70 by the lifting truck 69 and conveyed to

the annealing turntable base 2, where it will be deposited in one of the recesses 5.

After the loaded base is deposited in the recess 5, the sealing cover 32 will be lowered over the loaded base with the flange 39 of its sealing ring 37 lowered into the liquor filled sealing groove 41, thus forming a sealed enclosure for the loaded base. After the cover 32 is in position, the turntable base 2 will be rotated to move the covered charge into the annealing position, that is, into line with the furnace-cover 42. The furnace-cover 42 will then be lowered over the covered charge with its rim 53 engaged on and forming a sealing fit with the flange 38 of the ring 37 of the sealing cover 32. As the furnace-cover 42 is lowered into operative position, the heating elements 57 will enter the inner cylinder of the cover 32 and the heating elements 56 will be positioned around the outer cylinder 33 of the cover 32.

The heating elements will then be energized to heat the material to be annealed, and the gas valve 66, in the gas supply branch pipe 61 leading to the recess 5 in which the loaded base is mounted, will be opened as will also the valve 69 in the vent pipe 65 leading from the space below the top of the loaded base, so as to cause a circulation of the non-oxidizing or neutral gas around the coils being annealed. After the coils A being annealed are heated sufficiently so as to burn off any oil or other foreign matter, and the smoke and other products of combustion have been forced out of the sealing cover by the circulation of gas therethrough, the valve 69 will be closed and the gas from the branch pipe 61 will be permitted to build up pressure within the cover 32 and around the material being annealed.

After the material has been raised to an annealing temperature, which experience has shown to take about six hours, the circuit to the heating elements 56 and 57 will be broken and the furnace-cover 42 elevated above the cover 32.

Prior to the time when the material within the furnace-cover is heated to an annealing temperature, a second loaded base B will be positioned in the recess 5 next to the left of the recess under the furnace-cover. This second loaded base will have a sealing cover 32 positioned thereover in readiness to be moved under the furnace-cover 42.

After the furnace-cover 42 is elevated, the turntable 2 will be rotated sufficiently to move the hot loaded base from under the furnace-cover, and to move the second loaded base thereunder. The furnace-cover will then be lowered over the cold loaded base and the heating elements energized to heat the material on this base. The gas will be caused to first circulate through the cover 32 over this second base and then build up pressure therein, as described for the first annealing operation, and the gas will be maintained under pressure within the cover 32 over the first loaded base while it is continuing.

The above operations will be repeated until all of the recesses 5 have loaded bases thereon and the first heated base has made the complete circle and has returned to the station next to the left of the base being heated, at which time it has become sufficiently cool to permit it to be removed and the material exposed to the atmosphere and further worked if desired. The gas will then be shut off from under the cover over this first base by closing the valve 66 in the branch supply pipe 61 leading to this base, and the cover 32 will be removed. The base is then removed from the recess 5 in the turntable 2 and another cold loaded base positioned therein.

After the material has thus meen annealed and cooled, the bundles or coils may be readily removed from the base B by mechanical handling apparatus.

By the use of the apparatus and method above described, experience has shown that the time consumed in the annealing and cooling operation is shortened from approximately 78 hours to a little less than 24 hours and the manual labor is reduced to a minimum. Also, materially less energy or heat is consumed since the heavy annealing boxes of the prior art are eliminated and, under the old methods, these boxes had to be heated before the material within the boxes became heated. Furthermore, by providing the novel step of circulating neutral gases around the articles or material being heated while the oil, grease and other foreign matter are being burned therefrom or vaporized, serves to remove the vapors or products of combustion and results in a better finished product. Also, by continuing the gas pressure within the sealed cover while the product is cooling, atmospheric air is prevented from entering and oxidizing the annealed material.

While I have illustrated and described one specific form of apparatus for carrying out my novel method and also a certain sequence of steps in the method of my invention, it will be understood that I do not wish to be limited thereto, since various modifications and changes will readily suggest themselves to those skilled in the art, and many of such modifications and changes may be made without departing from the scope of my invention as defined in the appended claims.

I claim—

1. Apparatus for annealing coiled metal products comprising, in combination, a base for supporting the coiled products, means for centering said coils on said base, a ring-like cover adapted to enclosed said coiled products, said cover comprising an inner cylinder closed at its lower end and adapted to extend within the center of the coiled products, an outer cylinder adapted to ex-

tend downwardly around said coiled products and engage said base, and a top wall extending between said cylinders and enclosing the top of the coiled products, and a bell-like furnace-cover mounted for vertical movement and adapted to enclose said covered coiled products.

2. In an apparatus for annealing coiled metal products, a turntable base, a plurality of circular recesses in said base, annealing bases removably mounted in said recesses for supporting the coiled products, a liquor filled sealing groove surrounding each of said recesses, covers adapted to enclose the coiled products on said annealing bases, said covers comprising an inner cylinder closed at its lower end and adapted to extend within the center of the coiled products, an outer cylinder adapted to extend downwardly around said coiled products and into the liquor in said sealing groove, and a top wall extending between the upper ends of said cylinders and enclosing the top of the coiled products, means for supplying neutral gas to the interior of said covers to surround said coiled products, and a bell-like furnace-cover mounted for vertical movement above said turntable base and adapted to be lowered over successive ones of said annealing bases having said coiled products thereon.

3. In an apparatus for annealing coiled metal products, a turntable base, a plurality of circular recesses in said base, annealing bases removably mounted in said recesses for supporting the coiled products, a liquid filled sealing groove surrounding each of said recesses, covers adapted to enclose the coiled products on said annealing bases, said covers comprising an inner cylinder closed at its lower end and adapted to extend within the center of the coiled products, an outer cylinder adapted to extend downwardly around said coiled products and into the liquor in said sealing groove, and a top wall extending between the upper ends of said cylinders and enclosing the top of the coiled products, means for supplying neutral gas to the interior of said covers to surround said coiled products, a bell-like furnace-cover mounted for vertical movement above said turntable base and adapted to be lowered over successive ones of said annealing bases having said coiled products thereon, and said furnace-cover being provided with one series of heating elements around its internal periphery and a second series of heating elements depending from its top and adapted to enter the inner cylinder of said cover over the coiled products.

4. In an apparatus for annealing coiled metal products, a turntable base, a plurality of circular recesses in said base, annealing bases removably mounted in said recesses for supporting the coiled products, a liquor filled sealing groove surrounding each of said recesses, covers adapted to enclose the coiled products on said annealing bases, said covers comprising an inner cylinder closed at its lower end and adapted to extend within the center of the coiled products, an outer cylinder adapted to extend downwardly around said coiled products and into the liquor in said sealing groove, and a top wall extending between the upper ends of said cylinders and enclosing the top of the coiled products, means for supplying neutral gas to the interior of said covers to surround said coiled products, means for permitting an outflow of the gases from said covers, and means for controlling said flow so as to permit the stopping of said flow when desired.

5. In an apparatus for annealing metal products, a base, a liquor sealing groove in said base, a cover member adapted to enclose the products, a sealing rim secured to the lower end of said cover and adapted to extend into the liquor in said groove, a horizontal flange formed intermediate the edges of said rim, and a bell-like furnace-cover adapted to be mounted over said product enclosing cover and supported on said flange.

6. In an annealing furnace, the combination with a furnace casing, of a heating element suspended therefrom centrally axially thereof, a gas-tight hood of annular shape substantially filling the space between said heating element and the wall of said casing, means within said hood for supporting a charge to be heated, means for maintaining an atmosphere of a desired chemical characteristic within said hood and for causing a circulation thereof about the charge, and an air seal for said hood, said furnace casing cooperating with the air seal to maintain it air-tight.

7. In an annealing furnace, a removable furnace bell, an electrical heating element depending centrally axially therefrom, means for supporting material to be heated around said element and independently of said bell, a gas-tight hood of annular shape disposed between said material and heating element and substantially enclosing said material and supporting means, and an air seal for said annular hood, said furnace bell resting on said air seal.

In testimony whereof, I have hereunto set my hand.

CHARLES J. BROWN.