BEST AVAILABLE COPY

F. H. DANIELS.

METHOD OF SAVING HEAT.

APPLICATION FILED AUG. 20, 1910.

1,028,685.

Patented June 4, 1912.

4 SHEETS-SHEET 1.

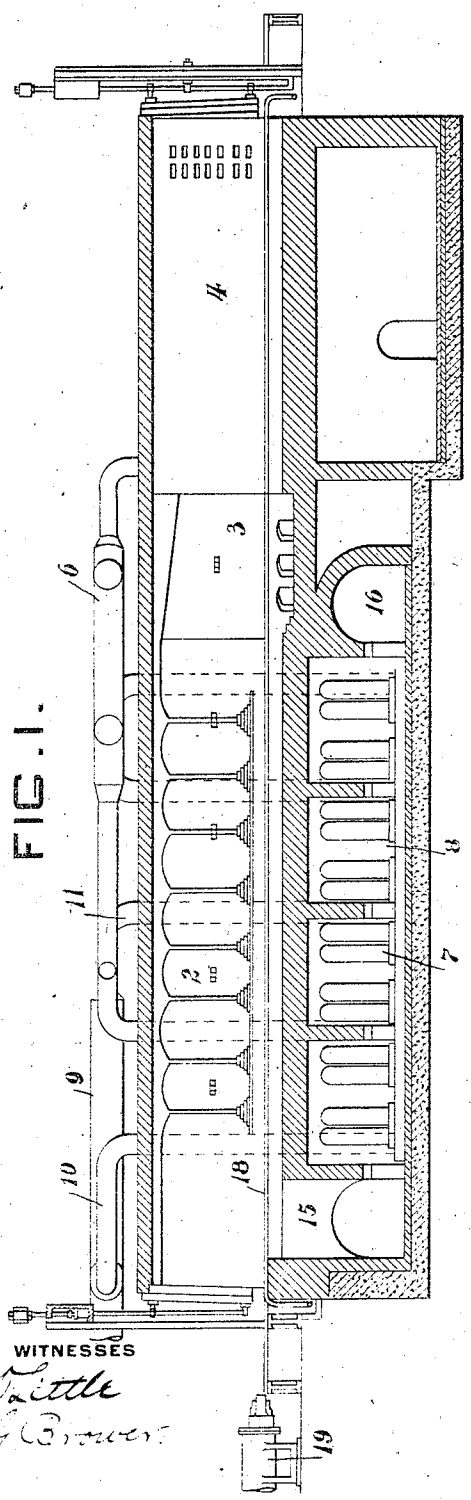


FIG. 1.

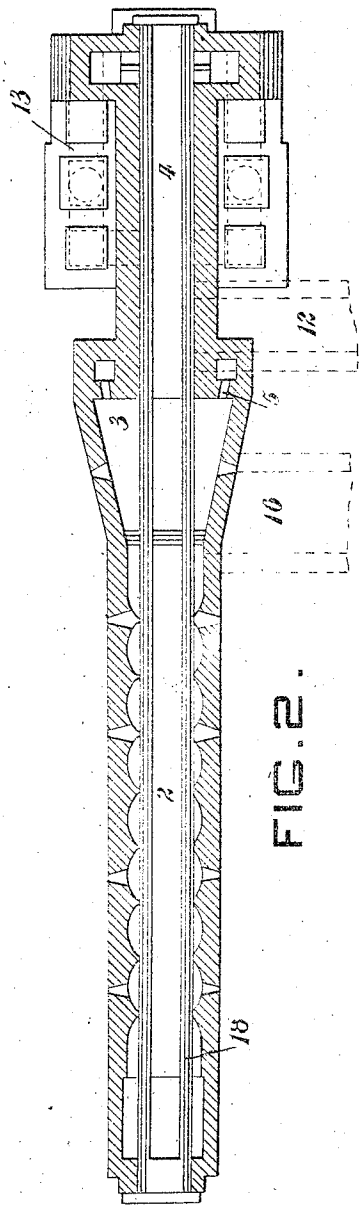


FIG. 2.

WITNESSES

C. P. Wattle

E. J. Brown

INVENTOR

F. H. Daniels

by Lothrop, Bell & Fuller

his Attorneys

F. H. DANIELS.

METHOD OF SAVING HEAT.

APPLICATION FILED AUG. 20, 1910.

1,028,685.

Patented June 4, 1912.

4 SHEETS-SHEET 2.

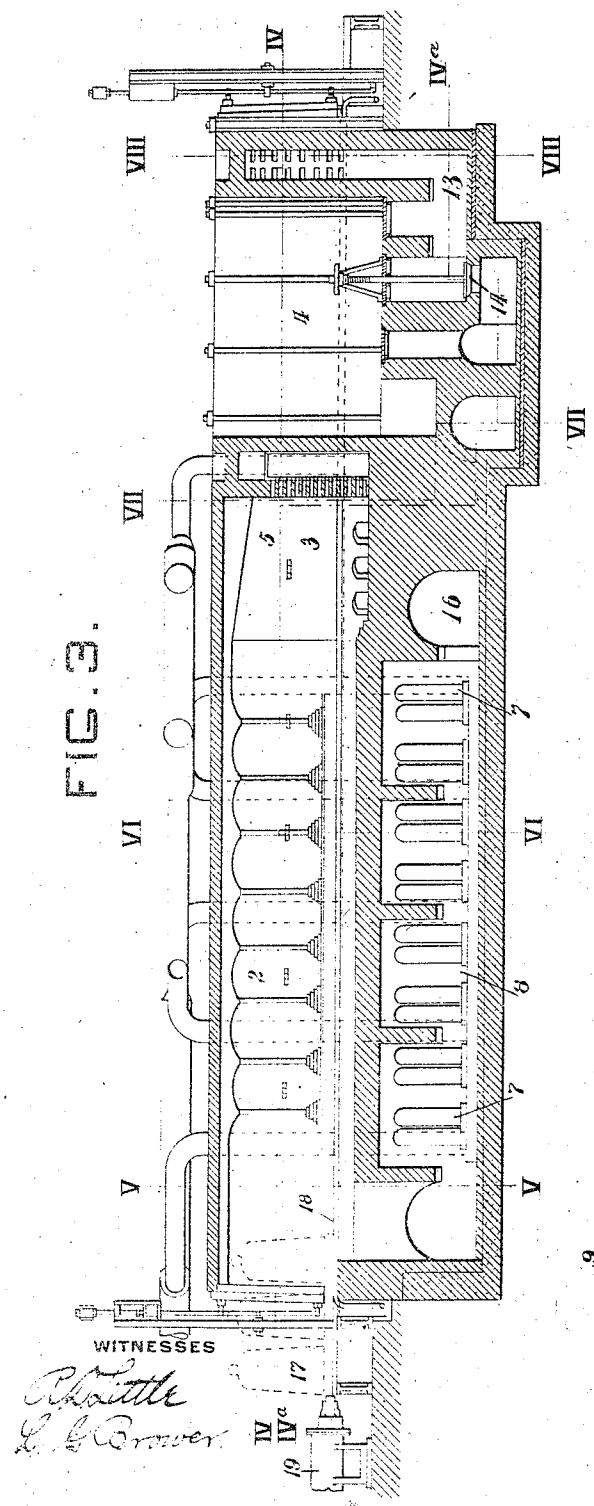


FIG. 3.

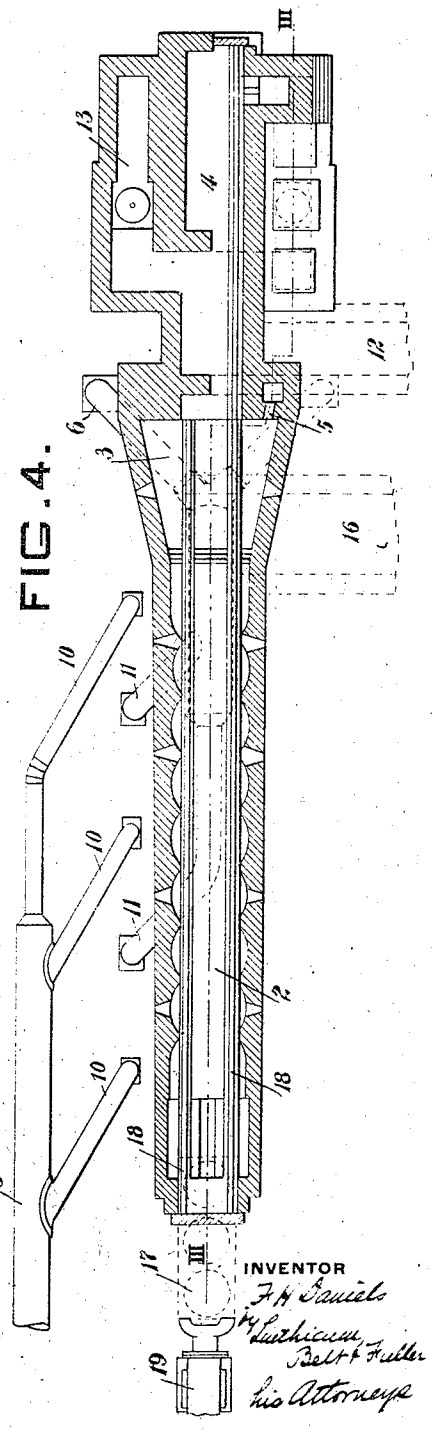


FIG. 4.

WITNESSES

R. Whittle

L. G. Brower

INVENTOR

F. H. Daniels

By Lothrop, Bell & Fuller

His Attorneys

F. H. DANIELS.

METHOD OF SAVING HEAT.

APPLICATION FILED AUG. 20, 1910.

1,028,685.

Patented June 4, 1912.

4 SHEETS—SHEET 3.

FIG. 5.

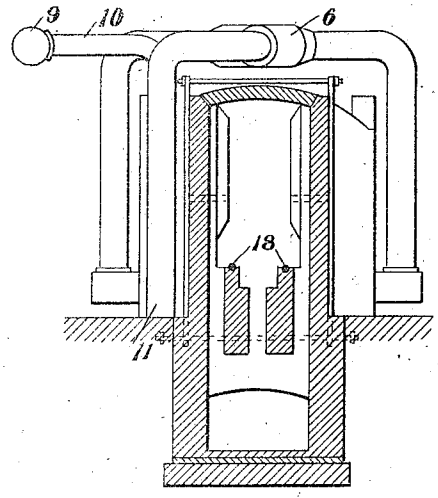


FIG. 6.

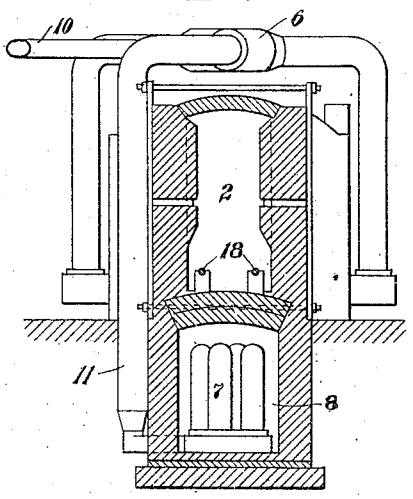


FIG. 7.

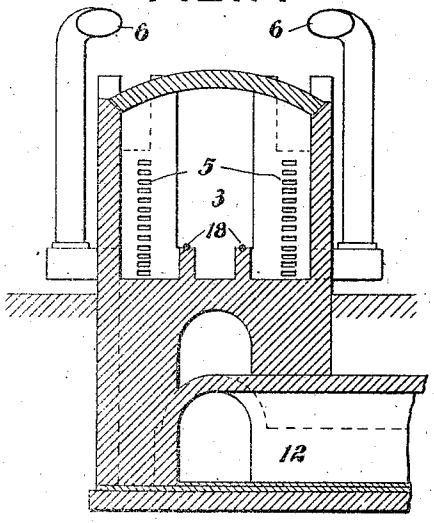
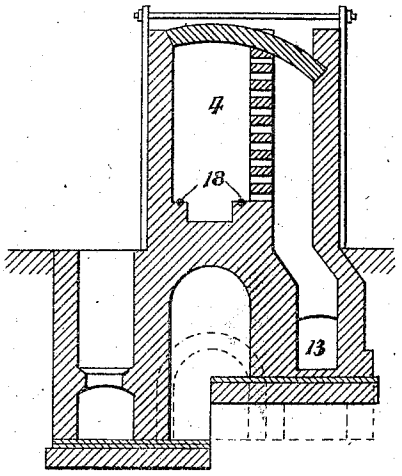


FIG. 8.



WITNESSES

R. D. Little

L. G. Brower.

INVENTOR

F. H. Daniels

by Linthicum, Belt & Fuller

his Attorneys

F. H. DANIELS.

METHOD OF SAVING HEAT.

APPLICATION FILED AUG. 20, 1910.

1,028,685.

Patented June 4, 1912.

4 SHEETS—SHEET 4.

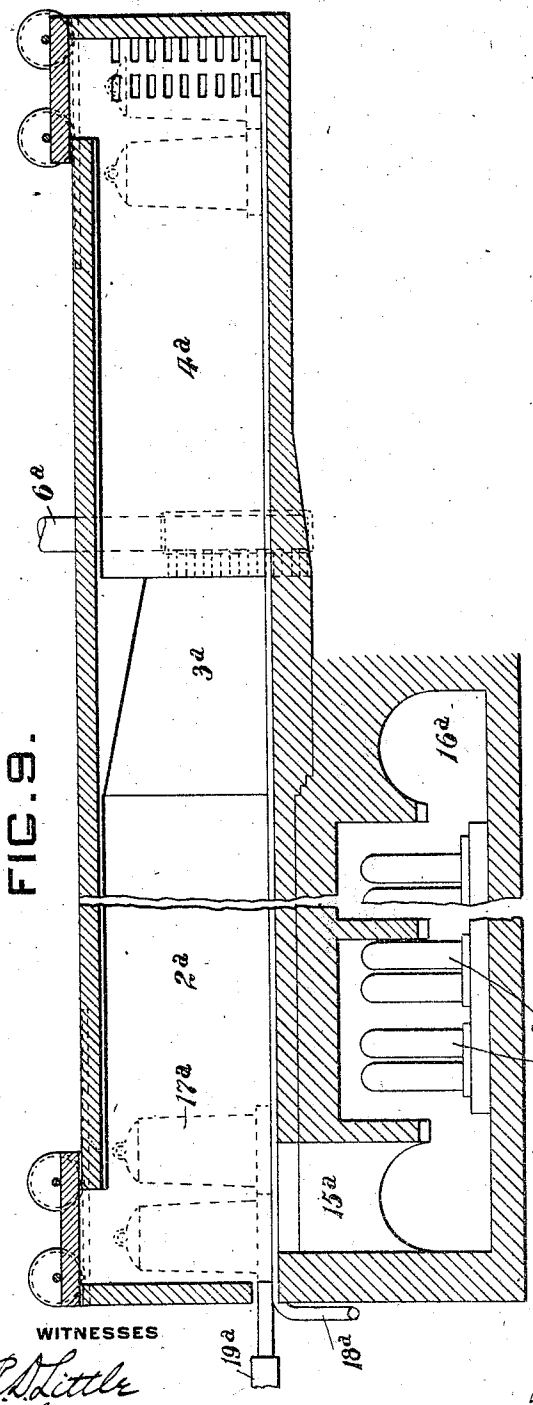


FIG. 9.

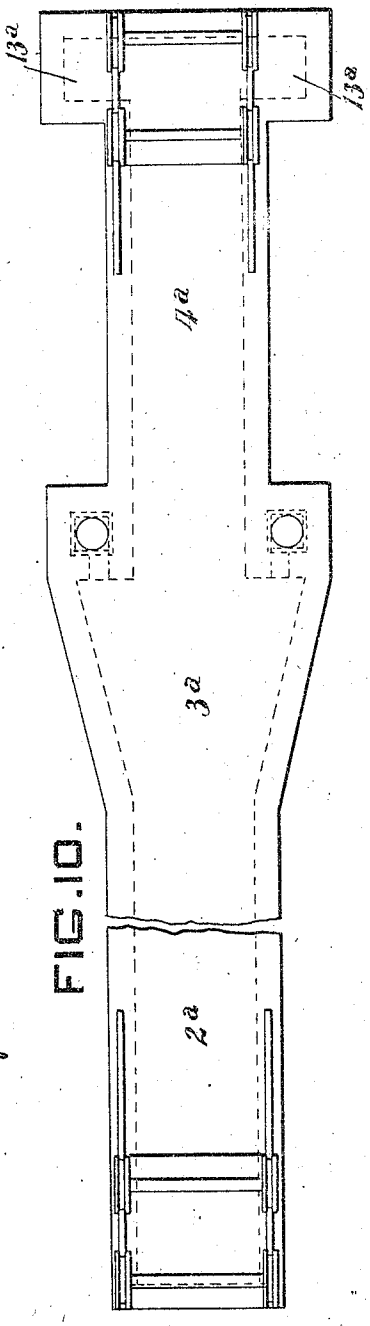


FIG. 10.

WITNESSES

R. D. Little

L. G. Brower.

INVENTOR

F. H. Daniels

by Lothrop Bell & Fuller

his Attorneys

UNITED STATES PATENT OFFICE.

FRED H. DANIELS, OF WORCESTER, MASSACHUSETTS, ASSIGNOR TO THE AMERICAN STEEL AND WIRE COMPANY OF NEW JERSEY, OF HOBOKEN, NEW JERSEY, A CORPORATION OF NEW JERSEY.

METHOD OF SAVING HEAT.

1,028,685. Specification of Letters Patent. Patented June 4, 1912.

Original application filed January 25, 1910, Serial No. 540,061. Divided and this application filed August 20, 1910. Serial No. 578,113.

To all whom it may concern:

Be it known that I, FRED H. DANIELS, of Worcester, in the county of Worcester and State of Massachusetts, have invented a new and useful Method of Saving Heat, of which the following is a full, clear, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to the annealing of various material in pots, and more particularly relates to annealing rods or wire in such annealing pots, and the object of the invention is to provide a novel method of saving heat in annealing such materials, the apparatus preferably employed being that shown in the drawings which illustrate the construction covered by my copending application Serial No. 540,061, filed January 25, 1910, for apparatus for annealing, of which this application is a division.

Heretofore in annealing in pot annealing furnaces, the materials being annealed remain in the furnace only for a sufficient length of time to be heated, the pots containing the hot materials being removed while in a heated condition from the furnace and afterward allowed to cool, or the pot with its contents allowed to remain in the furnace until the furnace pot and contents had become cool.

In carrying out my improved method, the annealing pots which contain the materials to be annealed, are introduced in the heating chamber of the furnace, and are caused to gradually move through the furnace, passing successively through the heating chamber into the combustion chamber into and through the gas heating chamber also forming part of my improved apparatus. In this way the pots and their contents are heated during their passage through the heating and combustion chambers, become cooled gradually while passing through the gas heating chamber, and at the same time the incoming, unburned gases become highly heated by contact with the heated pots in the gas heating chamber, and, when entering the combustion chamber, are in a proper condition for mixing with the air therein, in order to promote combustion and burn, the chamber of the furnace while passing therethrough.

Referring to the drawings, Figure 1 is a longitudinal sectional elevation showing in vertical section the heating chambers of a furnace adapted for use in carrying out my improved method. Fig. 2 is a sectional plan showing the heating chambers of the furnace in horizontal section. Fig. 3 is a longitudinal sectional elevation on the line III—III of Fig. 4, showing an annealing furnace constructed and arranged in accordance with my invention. Fig. 4 is a sectional plan, the bottom half of the section being taken on the line IV—IV of Fig. 3, the top half of the section being taken on the line IV^a. Fig. 5 is a sectional end elevation of the apparatus on the line V—V of Fig. 3. Fig. 6 is a similar sectional end elevation through the heating chamber of the furnace, on the line VI—VI of Fig. 3. Fig. 7 is a sectional end elevation through the combustion chamber of the annealing furnace, on the irregular line VII—VII of Fig. 3. Fig. 8 is a sectional end elevation showing the gas inlet opening leading from the gas flues into the pot cooling chamber of the annealing furnace, this section being taken on the line VIII—VIII of Fig. 3. Fig. 9 is a longitudinal sectional elevation showing a modified form of furnace and Fig. 10 is a plan view of the same.

In the drawings, referring to Figs. 1 to 8, 2 represents the pot heating compartment or chamber of my improved furnace and 3 is the combustion chamber, which is located intermediate of the heating chamber 2 and a gas heating chamber 4. The combustion chamber 3 is supplied with air through ports 5 located in the end wall of the combustion chamber, as is clearly shown in Figs. 1, 2 and 5. Air is supplied to the ports 5 through flues or pipes 6 which are connected to the outlets on the heaters 7 mounted in the air heating chamber 8, which is located below the heating chamber 2 of the furnace.

The air is supplied by means of a suitable blower, through the air pipe 9 and branch pipes 10 to the inlet side of the heaters 7 in the air heating chamber 8, the air passing

vertical legs 11 of the pipe 6, which is shown by dotted lines in Fig. 2.

Gas is supplied to the gas heating chamber 4 through the gas flue 12 and the branch flues 13, the supply of gas being controlled by means of the mushroom valves 14, or in any other desired manner, and the products of combustion are caused to travel through and pass from the heating chamber 2, downwardly through the connecting flue 15 into the air heating chamber 8 where the heat of these outgoing burned gases is utilized to heat the air passing through the heaters and then passing outwardly through the stack flue 16 to the furnace stack.

The annealing pots 17, after being filled with the material to be annealed are placed in front of the inlet opening in the end of the heating chamber 2, these pots resting upon water cooled skid pipes 18 which extend lengthwise through the heating chamber 2, combustion chamber 3 and gas heating chamber 4 of the furnace.

As shown in Fig. 1, a pusher 19 is employed to cause the pots to pass gradually through the furnace by a step by step movement. As the pot is introduced into the heating chamber 2, one is moved out from the door or opening in the opposite end of the furnace in the gas heating chamber 4.

In the operation of the annealing furnace by my improved method, the annealing pots 17 are successively placed in position in front of the pusher 19 by means of a traveling crane or other suitable pot handling device and the piston of the pusher 19 is caused to actuate so as to move the annealing pots 17 resting on the skid pipes 18 into the furnace. After the furnace becomes filled with the annealing pots, when a pot is introduced, one is caused to issue from the opposite end of the furnace. The furnace is of considerable length, and, while the pots are passing through the heating chamber 2 of this furnace, they and their contents become highly heated by contacting with the burned gases passing through the chamber 2 from the combustion chamber 3. The pots are passed through the combustion chamber 3 from the heating chamber 2, and are then caused to slowly move through the gas heating chamber 4. In this chamber 4 the cold, or relatively cold, gases entering through the gas ports are brought into contact with the outer surfaces of the highly heated pots and cause these pots and their contents to gradually become cooled in a non-oxidizing atmosphere during their passage through the gas heating chamber 4. The gases, by coming in contact with the surfaces of the heated pots, become highly heated and, on entering the combustion chamber 3, from the chamber 4, are there mixed with the air passing from the air ports 5 and are burned, the resulting products of combustion passing forwardly into the pot heating chamber 2, where they contact with and heat the pots and materials in the pots while in this chamber, then passing into the air heating chamber 8 where they are brought into contact with the air heaters 7 and heat the air during its passage through the air heaters 7 in the chamber 8, the air becoming heated before issuing finally from the ports 5 in the combustion chamber 3.

In the modification shown in Figs. 9 and 10, the arrangement of the pot heating chamber, combustion chamber and gas heating chamber is the same as in the preceding figures, like parts being marked with like numbers with the letter "a" applied thereto, and the pots, instead of being moved into and out of the furnace through doors located in its end walls, are placed in and are taken from the furnace through suitable openings in the ends of the roof of the furnace. These openings are normally closed by means of a cover mounted on wheels so as to be horizontally movable upon the track wheels, as is shown in the drawings. After the pots have been introduced through the openings in the roof of the furnace shown in Figs. 9 and 10, the operation is the same as in the preceding figures until they have reached the opposite end of the furnace, when they are removed through the opening in the roof at the cooling chamber end of the furnace.

The advantage of my improved method will be apparent to those skilled in the art. Instead of heating the annealing pots and their contents and then removing the pots from the furnace while in a highly heated condition, and afterward allowing the pots to cool by contact with the atmosphere while without the furnace, the pots are gradually cooled by contact with the unburned gases passing to the combustion chamber of the furnace and these gases, forming a non-oxidizing atmosphere, prevent oxidization of the pots and very materially increase their life. The gases, by contacting with the highly heated pots during their passage through the gas heating chamber, become highly heated and when leaving the cooling chamber are in the best possible condition for mixing with the air in the combustion chamber of the furnace, in this way avoiding the necessity for gas regenerators and utilizing the heat from the heated pots to raise the temperature of the gases and at the same time gradually cool the pots and their contents.

Modifications in the construction and arrangement of the apparatus used in carrying out my improved method may be made without departing from my invention. The air burned in the furnace may be heated partly, prior to its entrance into the gas heating chamber. The means

employed for moving the pots through the furnace may be varied and other changes may be made without departing from my invention.

I claim:—

1. In the art of annealing, the method of saving heat consisting in passing annealing pots and their contents through a furnace and bringing the annealing pots into contact therein with the burning gases to heat the pots and then with the unburned gases to thereby heat the unburned gases.

2. In the art of annealing, the method of saving heat consisting in passing annealing pots and their contents through a furnace and therein heating the pots by contact with the burned and burning gases and heating the unburned gases by contact with the heated pots, passing the burned gases from the heating chamber through an air heating chamber and heating by radiation air supplied thereto, then mixing and burning the mixed heated air and heated unburned gases within the combustion chamber of the furnace.

3. In the art of annealing the method of saving heat consisting in passing the articles to be annealed through a heating furnace, heating the articles by the burned and burning gases and then heating the unburned gases by radiation from the heated articles and thereby effecting an interchange of heat between the annealed articles and their retainers with the unburned gases and thereby reducing the temperature of the annealed articles and raising that of the unburned gases.

In testimony whereof, I have hereunto set my hand.

FRED H. DANIELS.

Witnesses:
GEO. SIEURIN,
G. D. BOYD.