Feb. 17, 1925. 1,526,583

H. C. BEASLEY

ANNEALING FURNACE

Filed May 13, 1920 4 Sheets-Sheet 1

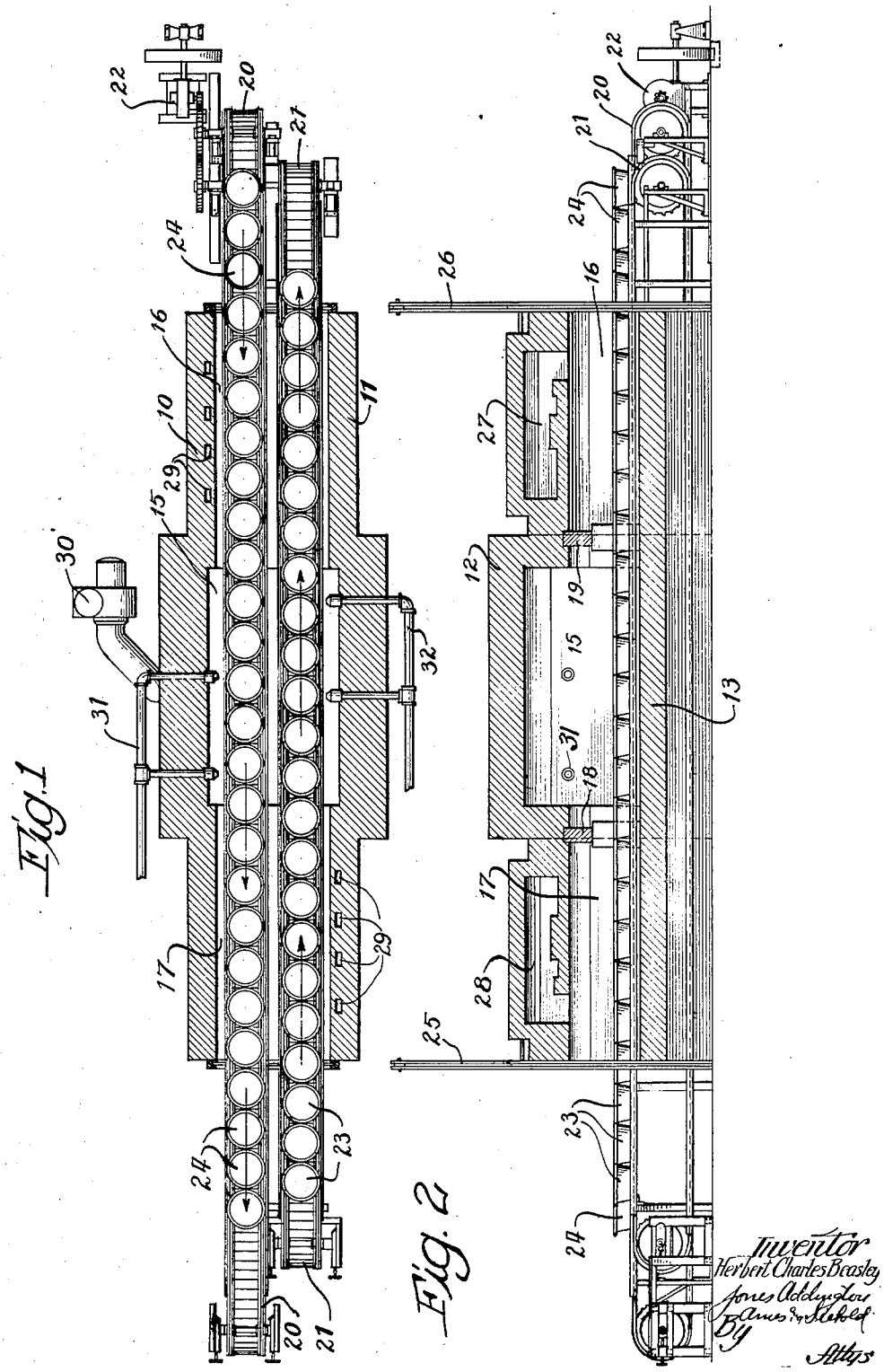


Fig. 1

Fig. 2

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ANNEALING FURNACE

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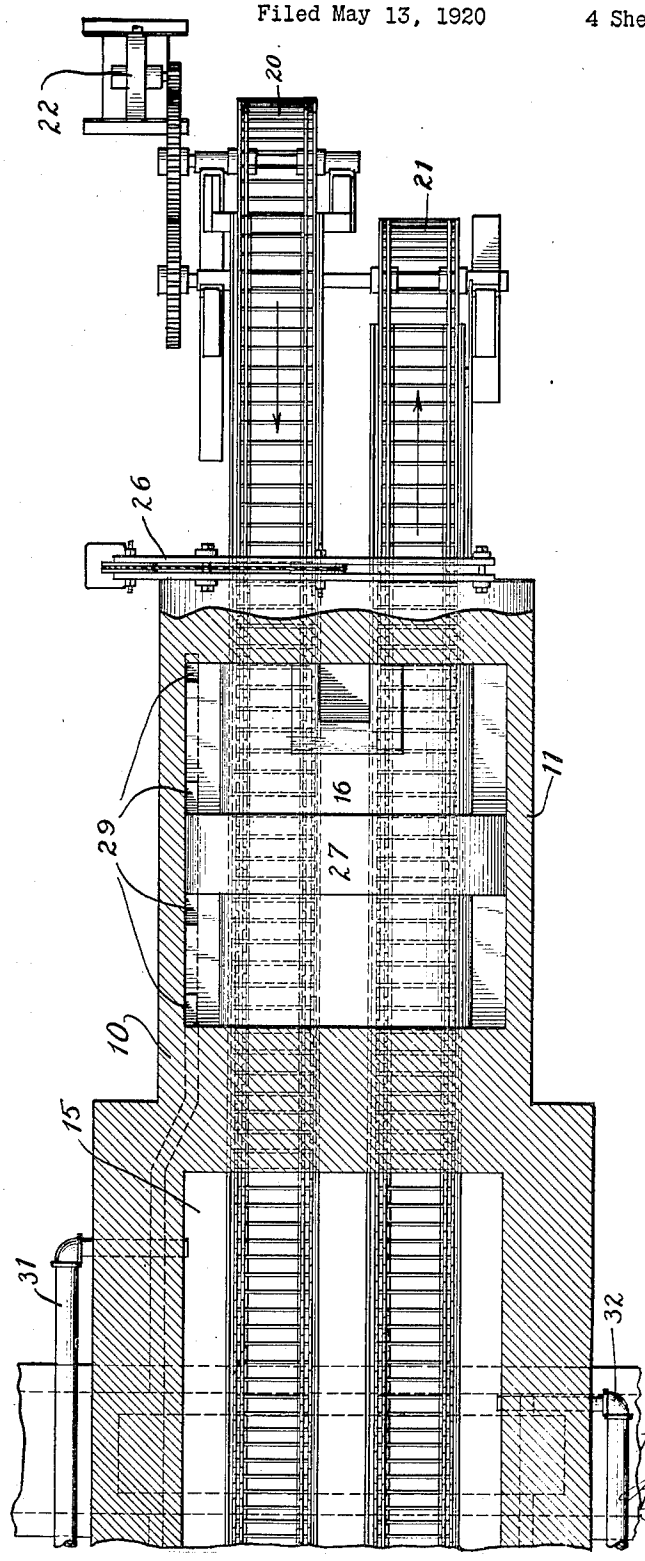


Fig 3

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ANNEALING FURNACE

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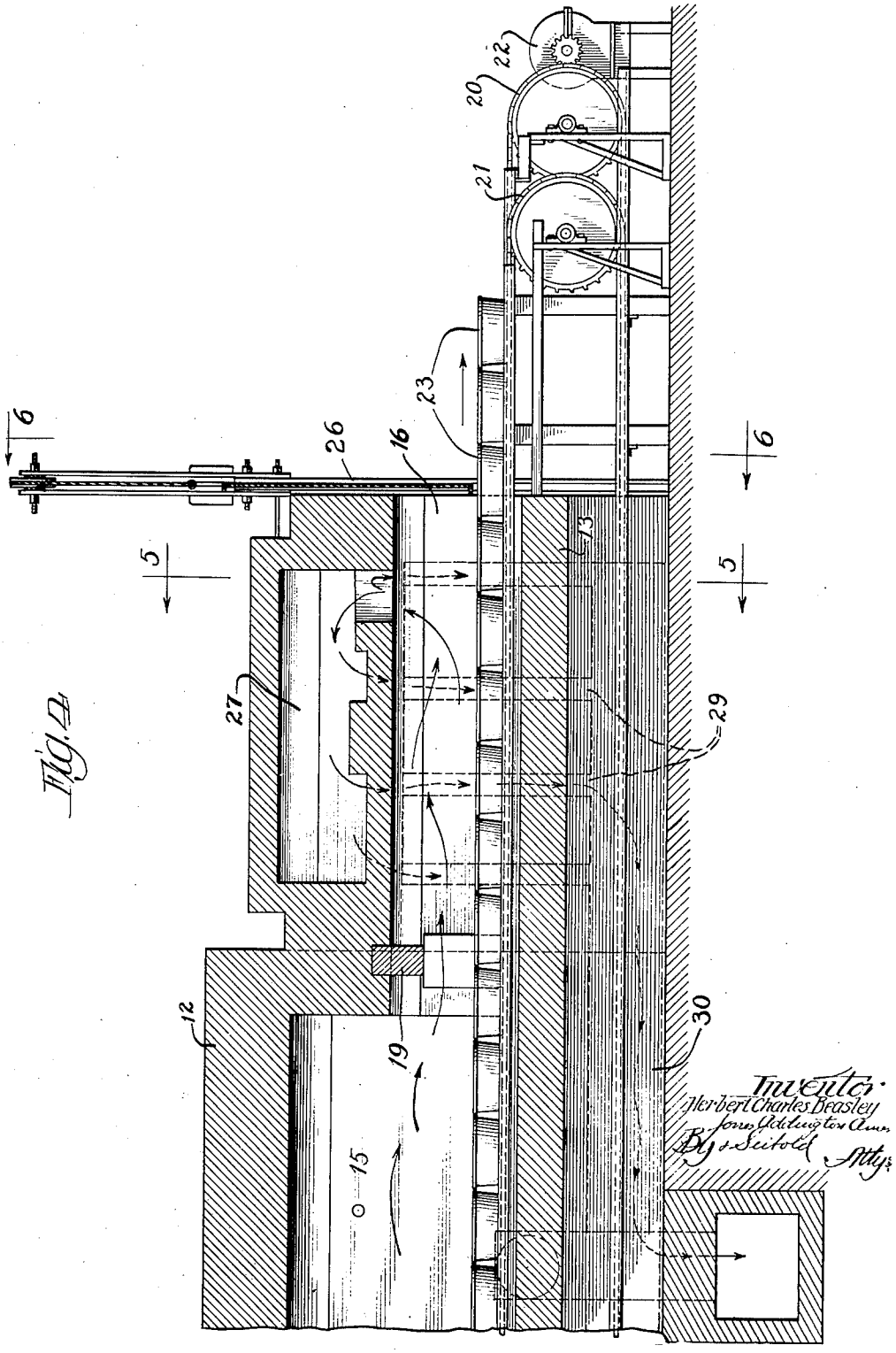


Fig. 4.

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Feb. 17, 1925. 1,526,583

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ANNEALING FURNACE

Filed May 13, 1920 4 Sheets-Sheet 4

Fig. 6

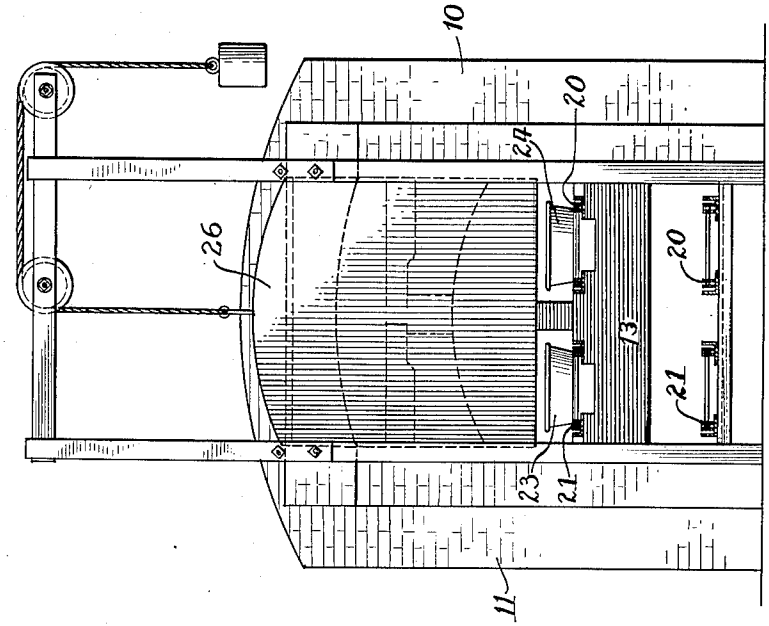
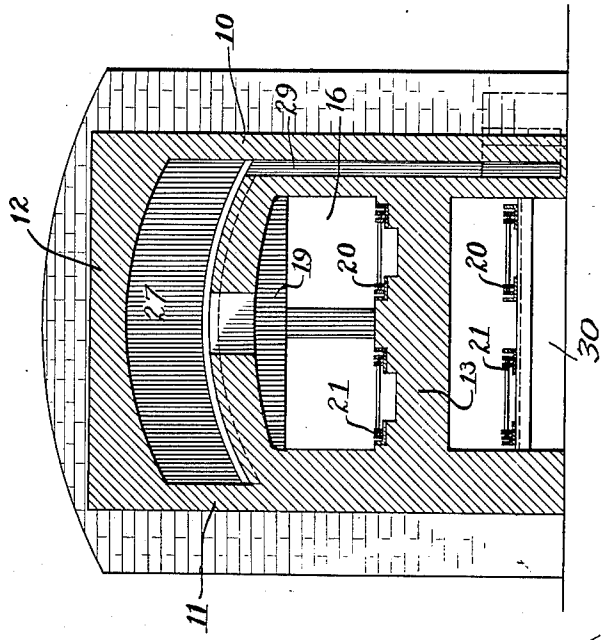


Fig. 5



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UNITED STATES PATENT OFFICE.

HERBERT CHARLES BEASLEY, OF CHICAGO, ILLINOIS, ASSIGNOR TO COONLEY MANUFACTURING COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

ANNEALING FURNACE.

Application filed May 13, 1920. Serial No. 380,959.

To all whom it may concern:

Be it known that I, HERBERT CHARLES BEASLEY, a citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented new and useful Improvements in Annealing Furnaces, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawing, forming a part of this specification.

My invention relates to annealing furnaces, and it has particular relation to furnaces of the character designated wherein the articles to be annealed are continuously supplied to said furnace and continuously withdrawn therefrom, pre-heating and cooling chambers being provided in connection with said furnace.

In connection with furnaces of the above type it is essential that the articles which have been annealed are cooled in such manner that scaling does not take place. So far as I am aware "open" annealing has not been practiced with great commercial success heretofore because of the production of scale which occurs when hot annealed articles are exposed to the atmosphere. In order to prevent such a scale it is the usual practice to pack the articles in such manner that they do not come in contact with the atmosphere. This method is obviously quite expensive and moreover takes considerable time.

One of the objects of my invention, therefore, is to provide a furnace wherein the annealed articles are cooled uniformly in a chamber filled with a reducing gas. By cooling the annealed articles in such a reducing chamber the tendency for them to scale is substantially eliminated.

Again, it is of great benefit for the articles which are to be annealed in a heating chamber to be pre-heated before entry into the latter, otherwise there is a great tendency for the articles to warp out of shape upon being subjected to the intense heat in the heating chamber. The use of a pre-heating chamber also eliminates the exposure of the workmen to excessively high temperatures and consequently promotes greater efficiency.

Another object of my invention, therefore, is to provide an annealing furnace in which the articles are continuously fed through a pre-heating chamber, a heating chamber, and a cooling chamber, the atmosphere in the latter chamber preferably being maintained reducing in character.

In connection with a furnace as just described, I also provide means whereby a great economy in the fuel supply can be effected by causing the articles emerging from the heating chamber to supply heat to the cool articles about to enter said chamber, and thus pre-heat them to a desirable degree.

In practicing my invention with respect to the latter advantage, I so arrange a pair of oppositely moving conveyors that the chambers which are associated with the heating chamber perform the incompatible functions of pre-heating and cooling.

In attaining the above objects I provide a furnace wherein a heating chamber has associated therewith, and positioned at opposite ends thereof, combined pre-heating and cooling chambers, the combination pre-heating and cooling chambers as well as the centralized heating chamber, have chain conveyors extending therethrough which move in opposite directions.

The purpose of these conveyors is to introduce the metal which is to be annealed from either side of the furnace as well as to withdraw from either side of the furnace the articles which have been annealed. By moving the conveyors, as above described, that is in opposite directions to each other, the cool unannealed articles are introduced into the furnace from either end and at the same time the hot annealed articles are withdrawn from the furnace at either end. By this arrangement the cold articles serve to cool the hot articles and vice versa whereby the chambers on either side of the centralized chambers serve as both pre-heating and cooling chambers inasmuch as the cold articles are pre-heated by derivation of heat from the hot articles, whereas the latter are cooled by the proximity thereto of the cold articles.

With this construction it is possible to very materially reduce the length of the pre-heating and cooling chambers as well as to economically maintain a reducing atmosphere in the chambers, whereby the scaling of the articles which have been annealed is prevented.

I regard this latter advantage as of great

importance. So far as I am aware "open" annealing, that is annealing without packing the articles, has not heretofore been accomplished without excessive scaling of said articles. In the furnaces of the prior art wherein it is desired to anneal articles without scaling, the laborious method of packing the articles is usually employed. After such articles have been annealed they are set aside for a long period to cool or until the temperature thereof falls to such a point that scaling does not result when the articles are exposed to the atmosphere wherein there is an excess of oxygen. Obviously when the articles are packed in receptacles in this manner it takes an abnormal length of time for them to cool so that they may be removed from the packing.

I find that the provision of a furnace wherein the auxiliary chamber situated at either end of the centralized heating chamber perform a combined pre-heating and cooling function, renders the maintenance of a reducing atmosphere in said furnace quite economical. Moreover this particular feature of my invention, that is the double character of the auxiliary chambers, results in a pronounced decrease in the quantity of fuel used, inasmuch as the heat given off by the articles while cooling is utilized to a large extent in the initial heating of the articles about to be annealed.

For a better understanding of my invention reference may be had to the accompanying drawing, in which:

Fig. 1 is a plan sectional view of a furnace embodying my invention;

Fig. 2 is an elevational sectional view of the furnace shown in Fig. 1;

Fig. 3 is an enlarged plan sectional view of one end of my furnace;

Fig. 4 is an elevational sectional view of Fig. 3;

Fig. 5 is an elevational sectional view taken on the line 5—5 of Fig. 4; and

Fig. 6 is an elevational sectional view taken on the line 6—6 of Fig. 4.

The annealing furnace comprises side wall portions 10 and 11 and a roof portion 12. A platform 13 extends the length of the furnace and serves to divide the latter into an upper and lower portion.

The upper portion of said furnace comprises a centralized heating chamber 15 and associated auxiliary chambers 16 and 17, the latter being separated from the centralized chamber only by transversely extending members 18 and 19, which serve to support the roof portion 12 near the central part thereof.

Chain conveyors 20 and 21 extend through all of the chambers of the furnace and are provided with driving means 22 whereby they may be moved in opposite directions, as indicated by the arrows thereupon. These conveyors are adapted to receive articles 23 and 24 and to pass the same progressively through the furnace chambers from one end of said furnace to the other. Doors 25 and 26 are positioned at the ends of the furnace and may be raised and lowered to provide access to the interior of the latter.

The waste gases from the auxiliary chambers 16 and 17 are led by suitable baffle means into hoods 27 and 28, overlying the chambers 16 and 17, respectively. They are then led downwardly through vertical flues 29 into a longitudinally extending flue 30 whence they escape. The downwardly extending flues 29 are situated in but one wall of each of the auxiliary chambers 16 and 17 the flues being located in the wall adjacent the incoming of cold articles. The flues 29 are connected with a draft flue at the bottom of the chambers and this flue is connected to an exhaust chamber which is fitted with an exhaust fan 30'. It will be observed that the conveyor 20 moves in such a direction that the articles to be annealed will enter the chamber 16 from the end of the furnace shown in Fig. 3 and will, therefore, be in proximity to the side wall of the chamber 16 in which the downwardly extending flues 29 are positioned. It will be understood that at the other end of the furnace the cold unannealed articles enter the furnace on the conveyor 21 and that in the chamber 17 the flues 29 which extend downwardly from the overlying hood 28 are positioned in the wall which is adjacent the conveyor 21 as shown in Fig. 1.

Pipe lines 31 and 32 furnish fuel to the centralized chamber wherein an intense heat is maintained.

It will be understood that the lengths of the auxiliary chambers are adjusted in accordance with the degree of cooling and preheating which it is desired to obtain therein, and moreover that the pre-heating, annealing, and cooling functions may be governed by the length of the furnace as a whole as well as by the speed at which the conveyors move the articles therethrough.

Having described one embodiment of my invention, the operation thereof is as follows:

For purposes of illustration that end of the furnace which is shown in detail in Figures 3 and 4 will be considered. The cold unannealed articles 24 are positioned on the conveyor 20 and are thereby introduced into the chamber 16. The oppositely moving conveyor 21 carries hot annealed articles from the centralized chamber 15 into the chamber 16 and into proximity with the cold articles 24, the cold articles are thereby pre-heated and by so absorbing the heat tend to cool the articles which have just emerged from the heating chamber. The gases in said chamber as well as those from the heating

chamber are led upwardly into the hood 27 and thence downwardly through the flues 29.

As before pointed out, the latter flues are positioned in the wall adjacent the conveyor bearing the cold, entering articles. In this manner the heat in the vicinity of the cold articles is intensified.

The articles upon the conveyor 20 are next introduced into the heating chamber 15 where they are subjected to an intense heat, after which they emerge into the auxiliary chamber 17 where they serve to heat the articles being introduced thereinto on the conveyor 21. As before pointed out, the heat in the chamber 17 is intensified on the side adjacent the conveyor 21 by the positioning of the downwardly extending flues 29 in the wall at this side.

It will be understood that the atmosphere in all of the chambers and especially in the auxiliary chambers wherein the annealed articles are cooled, is maintained reducing in character, whereby the scaling which has heretofore been present with "open" annealing, is eliminated.

To those skilled in the art it will be apparent from the above description, that a furnace constructed in accordance with my invention consumes a minimum amount of fuel because of the manner in which the heated annealed articles are utilized to cool the unannealed articles and vice versa. Moreover, I am enabled to secure a very desirable uniformity of product because of the manner in which the articles are continuously and progressively passed through the pre-heating, heating and cooling chambers.

While I have described but one embodiment of my invention, it is apparent that many modifications therein may occur to those skilled in the art, and I desire, therefore, that it be limited only by the showing of the prior art or by the scope of the appended claims.

What I claim as new and desire to secure by Letters Patent of the U. S. is:

1. The method of annealing articles which comprises utilizing the heat stored in annealed articles to heat articles to be annealed while said articles are in an oxidation-preventing atmosphere.

2. The method of annealing articles which comprises utilizing the heat given off by annealed articles during cooling to preheat articles to be annealed while said articles are in an oxidation-preventing atmosphere.

3. The method of annealing articles which comprises cooling annealed articles in a reducing atmosphere and utilizing the heat given off thereby to heat articles to be annealed.

4. The method of pre-heating and cooling articles in an annealing furnace which comprises passing hot annealed articles and cold unannealed articles through an oxidation-preventing atmosphere in proximity to each other.

5. The method of pre-heating and cooling articles in an annealing furnace which comprises moving hot annealed articles and cold unannealed articles relatively to each other and in proximity to each other therein through an oxidation-preventing atmosphere.

6. The method of pre-heating and cooling articles in an annealing furnace which consists in causing the annealed articles leaving an annealing chamber to pass the articles about to enter said chamber to be annealed while both of said articles are in an oxidation-preventing atmosphere.

7. In an annealing furnace, means for causing cold unannealed articles to absorb heat from hot annealed articles while in an oxidation-preventing atmosphere.

8. In an annealing furnace, a chamber containing an oxidation-preventing atmosphere, and means for causing both hot and cold articles to pass therethrough.

9. In an annealing furnace, a chamber containing an oxidation-preventing atmosphere, and means for causing hot and cold articles to pass each other therein.

10. In an annealing furnace, a chamber containing an oxidation-preventing atmosphere, and means for causing hot and cold articles to continuously pass each other therein.

11. In an annealing furnace, a chamber containing an oxidation-preventing atmosphere, and means comprising oppositely moving article conveyors for causing hot and cold articles to continuously pass each other therein.

12. In an annealing furnace, an annealing chamber, cooling chambers containing an oxidation-preventing atmosphere at the ends thereof, and means for causing, in each of said cooling chambers, the hot articles leaving said annealing chamber to pass in proximity to the cold articles about to enter said annealing chamber.

13. In an annealing furnace, an annealing chamber, cooling chambers containing an oxidation-preventing atmosphere at the ends thereof, and means for causing, in each of said cooling chambers, the hot articles leaving said annealing chamber to pass in proximity to the cold articles about to enter said annealing chamber, the passage of said hot articles being so controlled that they are retained in said cooling chambers until they are below the scaling temperature.

14. In an annealing furnace, an annealing chamber, cooling chambers containing an oxidation-preventing atmosphere at the ends thereof, and conveyor means extending through all of said chambers whereby the

hot articles leaving said annealing chamber pass in proximity to the cold articles about to enter said annealing chamber while in said oxidation-preventing atmosphere.

15. In an annealing furnace, an annealing chamber, cooling chambers containing an oxidation-preventing atmosphere at the ends thereof, conveyor means extending through all of said chambers, and means for causing said conveyors to move in opposite directions through said furnace, whereby the hot articles leaving said annealing chamber pass in proximity to the cold articles about to enter said annealing chamber while in said oxidation-preventing atmosphere.

16. In an annealing furnace, an annealing chamber, auxiliary chambers containing an oxidation-preventing atmosphere associated therewith, and means for so supplying unannealed articles to said annealing chamber through said auxiliary chambers that the latter function as both pre-heating and cooling chambers.

17. In an annealing furnace, an annealing chamber, auxiliary chambers associated therewith, means for so supplying unannealed articles to said annealing chamber through said auxiliary chambers that the latter function as both pre-heating and cooling chambers, and means for intensifying the effect of hot waste gases in the vicinity of the cold articles passing through said auxiliary chambers.

18. In an annealing furnace, an annealing chamber, auxiliary chambers associated therewith, and a plurality of conveyor means for passing articles through said chambers whereby said articles are successively pre-heated, annealed, and cooled, and means whereby the articles on one conveyor are pre-heated at the same point the articles on the other conveyor are cooled, said pre-heating being the collective result of the heat absorbed from the cooling articles as well as the intensification of the waste gas heat in the neighborhood of the articles to be annealed.

19. In an annealing furnace, an annealing chamber, combined cooling and pre-heating chambers at the ends thereof, oppositely moving article conveyors extending through said chambers whereby cold articles on one conveyor pass hot articles on another conveyor in said cooling and pre-heating chambers, and means for intensifying the heat at the cold article conveyor side in said cooling and pre-heating chambers.

20. In an annealing furnace, an annealing chamber, combined cooling and pre-heating chambers at the ends thereof, oppositely moving article conveyors extending through said chambers whereby cold articles on one conveyor pass hot articles on another conveyor in said cooling and pre-heating chambers, gas chambers associated with said pre-heating chambers, and flues extending therefrom along the cold article conveyor side of said pre-heating chambers whereby a higher temperature exists on that side of said chambers.

21. In an annealing furnace, an annealing chamber, combined cooling and pre-heating chambers at the ends thereof, oppositely moving article conveyors extending through said chambers whereby cold articles on one conveyor pass hot articles on another conveyor in said cooling and pre-heating chambers, and means for returning the gases from said cooling and pre-heating chambers into proximity with cold article conveyor sides thereof.

22. In an annealing furnace, a heating chamber, and combined cooling and pre-heating chambers on either side thereof, means for introducing unannealed articles from either side of said furnace and for withdrawing annealed articles from either side thereof through said cooling and pre-heating chambers, and means for maintaining a reducing atmosphere in said cooling and pre-heating chambers.

In witness whereof, I have hereunto subscribed my name.

HERBERT CHARLES BEASLEY.