Jan. 28, 1936. P. J. McINTYRE 2,028,941

BRIGHT ANNEALER

Filed March 6, 1931 4 Sheets-Sheet 1

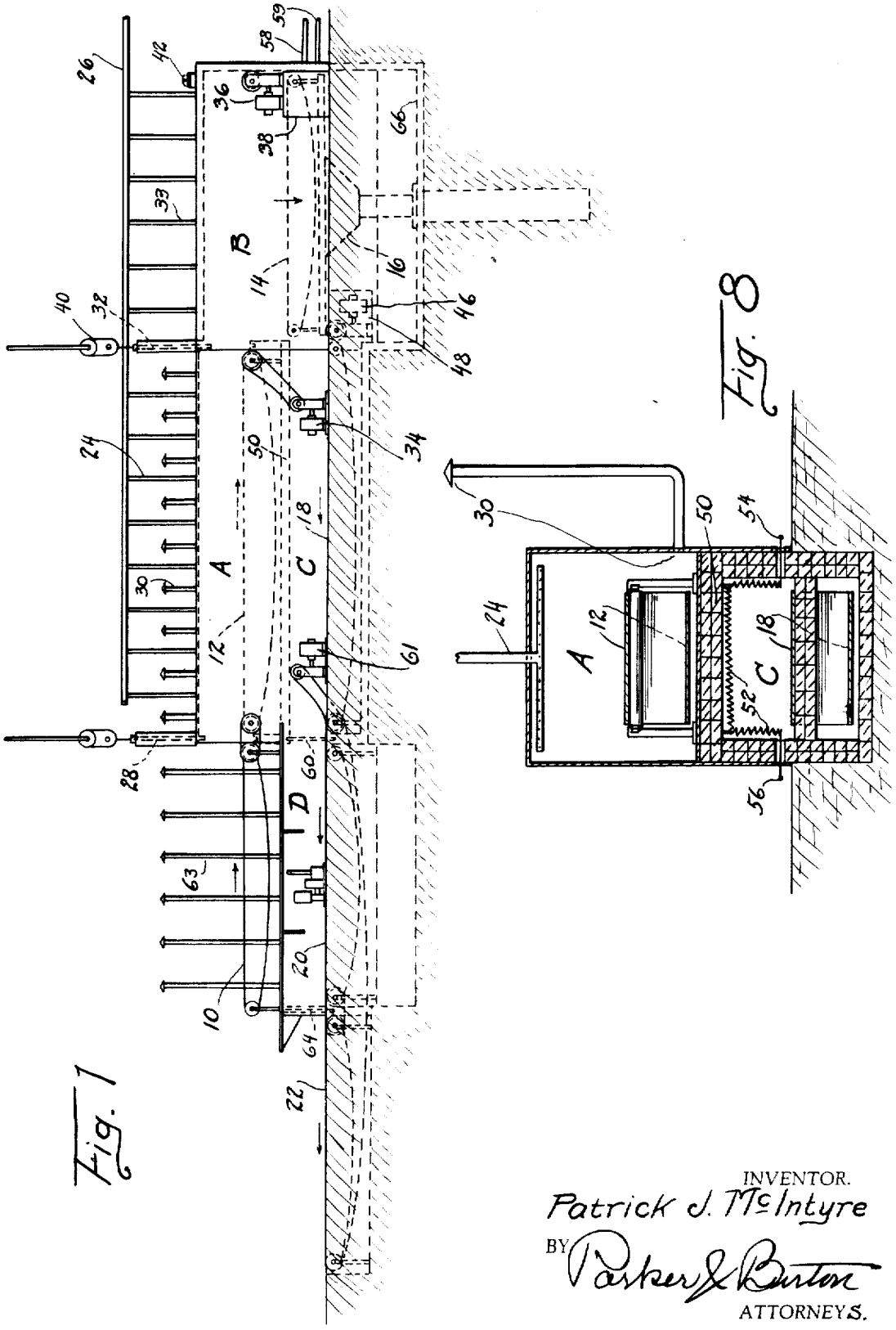


Fig. 1

Fig. 8

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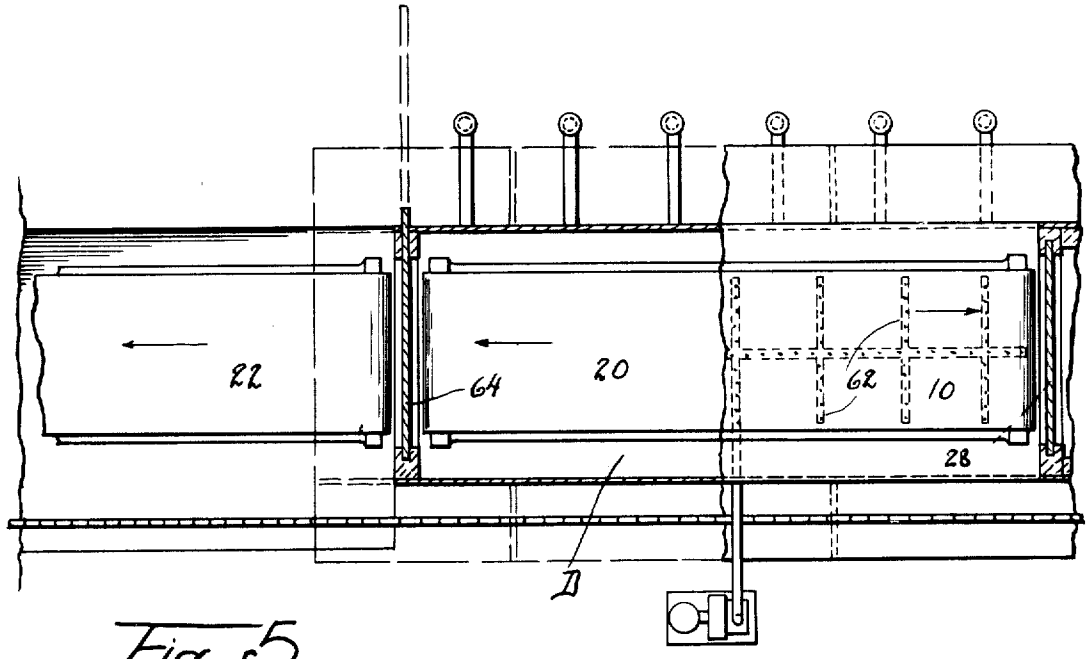


Fig. 5

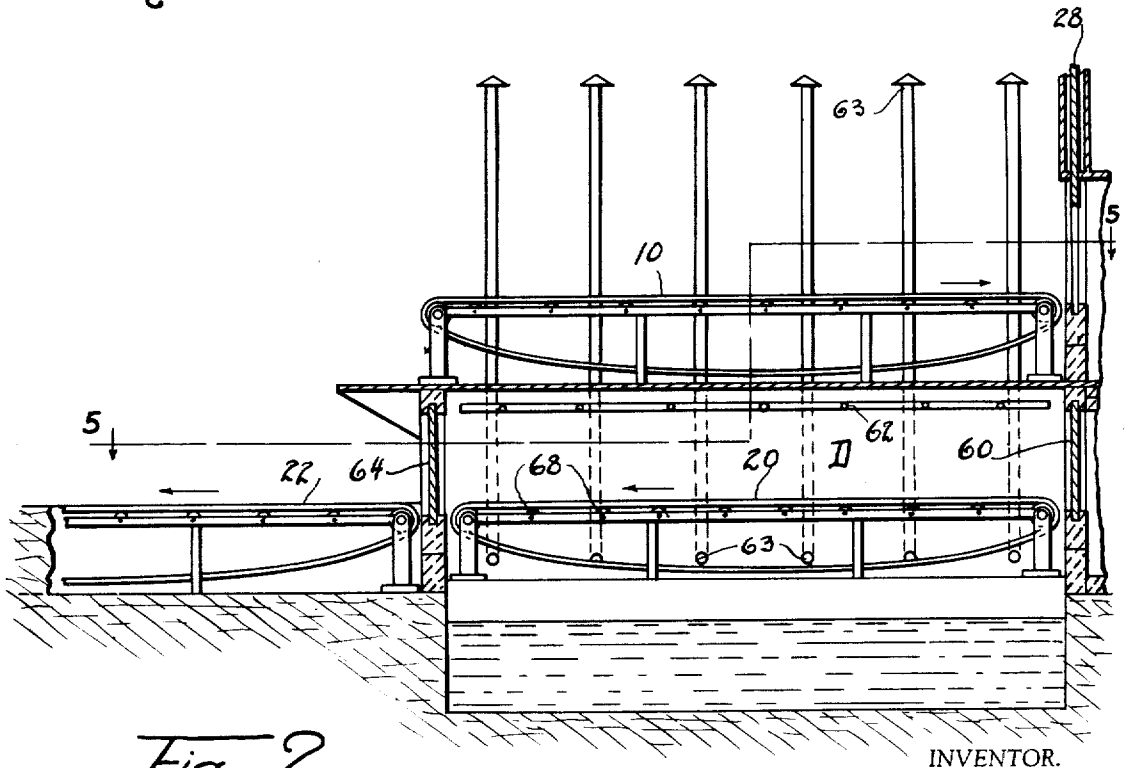


Fig. 2

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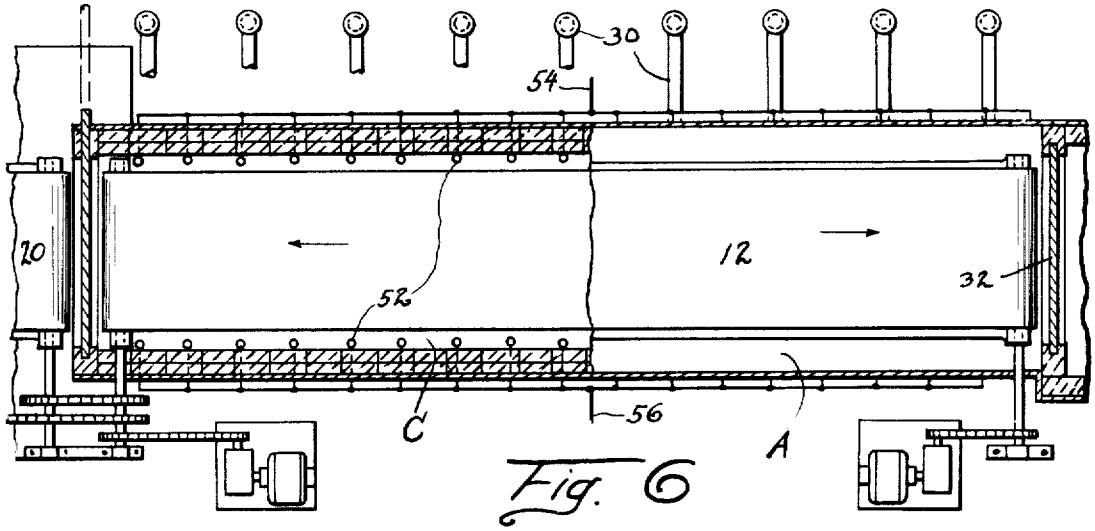


Fig. 6

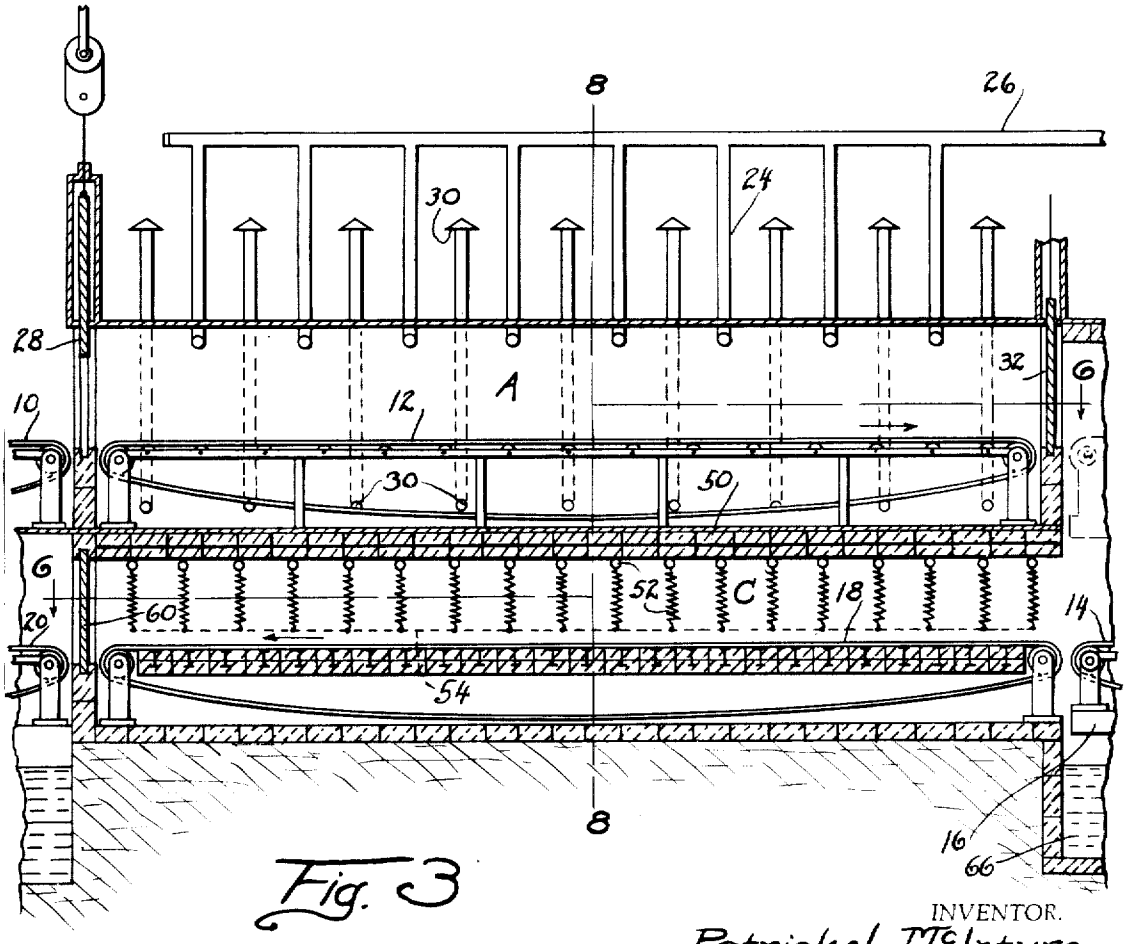


Fig. 3

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Fig. 7

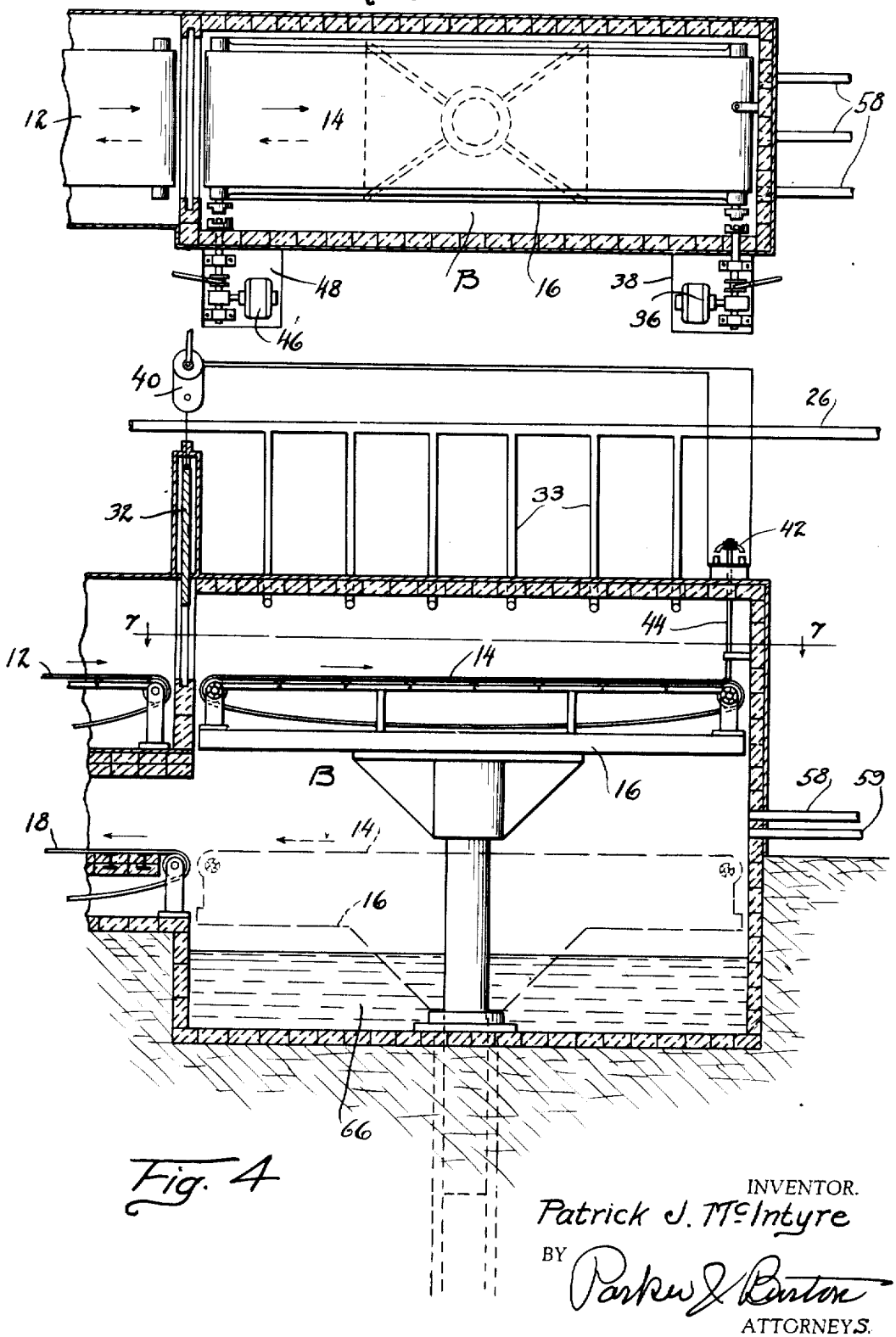


Fig. 4

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UNITED STATES PATENT OFFICE

2,028,941

BRIGHT ANNEALER

Patrick J. McIntyre, Detroit, Mich.

Application March 6, 1931, Serial No. 520,559

9 Claims. (Cl. 263—8)

My invention relates to annealing furnaces and has particular reference to an electric furnace adapted to anneal bright or burnished metal without oxidizing the same, thereby resulting in a surface which is unblemished and untarnished, retaining all of its original brilliancy and, perhaps, enhancing the same somewhat.

An object of my invention is to facilitate the above described annealing process by providing substantially automatically operable means for transferring the metal to be annealed throughout the various necessary stages of the heat treatment. In this way economy of labor and maximum output of the furnace at a minimum of expense is secured.

Still another object of my invention is to eliminate the possibility of blemishing or spotting the bright metal to be annealed by contact with either oxygen or water at any stage of the furnace operation. Hitherto it has been customary to provide water seals through which the metal was passed at the inlet to and the outlet from the furnace as a barrier to the ingress of oxygen into the furnace. Contact with oxygen during a heat treatment of the annealing process results in the oxidization of the surface of the metal and consequent tarnishing thereof. Where such water seals were used certain metal parts, such as tubes, picked up water which proved of itself to be an additional disadvantage. I propose to eliminate the necessity for such a water seal in carrying out my invention.

A further object of my invention is to facilitate the operation of the furnace by arranging the feed and discharge ends of the furnace at substantially the same end. This I propose to accomplish by arranging the various compartments of the furnace to form a U-shaped structure having adjacent ends, one serving as an inlet and the other as an outlet. This arrangement has the further advantage of necessitating less floor space in any plant.

Another object is to secure economy of operation, particularly as to the consumption of electricity, by utilizing superheated steam, superheated gas of non-oxidizing nature, or both, to assist the heating function of the electrical coils in the heat treatment chamber of the furnace.

Various other meritorious features of my invention will be apparent from the following description taken in conjunction with the drawings wherein:

Fig. 1 is a diagrammatic illustration of the furnace,

Fig. 2 is a section through the feed end of the furnace,

Fig. 3 is a section through the central portion of the structure which includes a conditioning chamber and a heat treatment chamber therebelow,

Fig. 4 is a section through the elevator chamber at the base of the U-shaped structure,

Fig. 5 is a section along 5—5 of Fig. 2.

Fig. 6 is a section along 6—6 of Fig. 3,

Fig. 7 is a section along 7—7 of Fig. 4, and

Fig. 8 is a section along 8—8 of Fig. 3.

The structure comprises what may be regarded as a generally U-shaped affair, broadly illustrated by Fig. 1, which includes a conditioning chamber A constituting one leg of the structure, an elevator chamber B wherein the metal being treated is transferred from one arm of the U-structure to another, constituting the base of the U, a heat treatment chamber C and a cooling chamber D, which latter two chambers constitute the second leg of the U-shaped assembly.

The operation and process will be clearly understood from Fig. 1. The metal to be annealed is placed in pans, not shown, upon the conveyor 10 and thereby transferred to a similar conveyor 12 which carries it through the conditioning chamber A. After the required treatment in conditioning chamber A the metal is transferred to a conveyor 14 upon a hydraulic elevator 16 in the elevator chamber B and lowered to a position from which it may be carried by conveyor 18 through the heat treatment chamber C. It will be noted from the drawings that the elevator chamber B is of a length which closely approximates that of the conditioning chamber A and the heat treatment chamber C. In this way elements of substantial length may be treated in the annealing furnace with a minimum of effort in contradistinction to the prevailing type of U-shaped furnace wherein the elevator chamber constituting the base thereof is of relatively small length in comparison with the legs of the U formed between other chambers. As illustrated in Fig. 1, the most convenient arrangement has been found to include chambers of substantially equal length in order that the annealing furnace may be continuously operated when metal forms of considerable length are being treated. It is then transferred to another conveyor 20 which carries it through the cooling chamber and conveyor 22 is adapted to receive the cooled metal and bring it out of the furnace for removal. Various operations are performed during its travel through the furnace, and various mechanisms are ar-

ranged to cooperate to insure exclusion of oxygen from within the furnace; all of which will be more clearly described hereinafter.

As hitherto stated, it is essential that the metal does not contact oxidizing agents of any kind during its passage through the furnace. For the purpose of eliminating the possibility of such contamination, I propose to utilize steam under pressure which may be injected into the conditioning chamber A through the branch steam lines **24** of the main steam conduit **26**. The door **28** in the entrance of the conditioning chamber A is lowered after the metal has been transferred to the chamber from conveyor **10**. The steam is preferably injected at the upper portion of the chamber and vents **30** are provided at spaced apart intervals along the length thereof. The openings arranged adjacent the bottom of the chamber permit the heavier air to be forced out of the chamber as the steam pervades the chamber. By thus getting rid of the oxygen laden air, the heated metal can continue its passage through the furnace without the danger of the metal oxidizing.

During this operation the door **32** between the conditioning chamber A and the elevator chamber B has been closed. After all the oxygen has been driven out of chamber A, which operation will vary in the length of time consumed according to circumstances, the door **32** is opened and the conveyor **12** actuated by any desired means, as by the motor **34**, transfers the metal from the conditioning chamber onto the conveyor **14** in the elevator chamber B. It will be noted that the conveyor **10** is driven from the same power source as is conveyor **12** and that a fresh batch of metal is brought into the conditioning chamber A as the first batch is transferred to the elevator chamber B.

The conveyor **14**, when performing this operation is positioned as illustrated in Fig. 4, is driven by a motor and clutch arrangement **36** (see Fig. 1) which is supported upon the platform **38**. This driving motor is adapted to be clutched and de-clutched manually, as clearly illustrated in Fig. 7. When the metal emerging from conditioning chamber A has been completely transferred to conveyor **14**, the elevator **16** is lowered to the position indicated in dotted lines in Fig. 4. This operation functions to automatically close the door **32** by means of an electric hoist **40**, the circuit through which is controlled by the closing of a switch **42** which is adapted to drop to closing position when the conveyor **14** is lowered to remove the support for depending arm **44**. This structure is clearly illustrated in Fig. 4, and simply constitutes any one of a number of possible arrangements for simultaneously closing the door **32** automatically on lowering the elevator **16**.

A second driving motor and clutch assembly **46** is supported upon platform **48** located at the base of the pit of the elevator chamber. This power mechanism may be clutched and de-clutched manually and is adapted to start the conveyor **14** of elevator **16** for the purpose of transferring metal from the said elevator conveyor **14** to the heat treatment chamber conveyor **18**.

Steam may be injected into chamber B through branch conduits **33** which are supplied by the main line **26**. The elevator chamber B and the heat treatment chamber C are both lined with fire brick, as clearly indicated in Figs. 4 and 8, there being a fire brick shelf **50** extending along the length of the heat treatment chamber to form a cooling compartment for the conveyor **18** during a portion of its travel. Resistance coils **52** are supported around the top and side walls of chamber C along its length, the current being provided by means of leads **54** and **56** which are brought in from the exterior of the furnace.

The amount of electricity utilized to bring the metal up to the high temperature essential to proper annealing is ordinarily great and for the purpose of reducing the kilowatt hour consumption of electricity during this heat treatment I propose to inject into the chamber C superheated steam along with non-oxidizing gas. This not only reduces the amount of electricity consumed during the heat treatment but, by virtue of the pressure created by the two non-oxidizing gaseous agents, any possibility of air entering the chamber during the heat treatment of the metal is eliminated. The superheated steam and gas are admitted through the conduits **58** and **59**, respectively, which may be located as indicated in Figs. 4 and 7 to direct the mixture through the elevator chamber into the heat treatment chamber. It will be noted that the elevator chamber constitutes a portion of the heat treatment chamber inasmuch as there is no positive barrier or door between the two.

The metal having been held at the proper temperature for a proper period of time the door **60** is opened and the metal transferred to conveyor **20** in the cooling chamber D. The pressure maintained in the heat chamber C by virtue of the gas and steam will prevent the inrush of any air which may happen to be in the cooling chamber D to the heat chamber C. Door **60** is then closed and the heat treatment chamber C is ready to receive another load from the elevator conveyor **14**. It is to be noted that conveyors **18**, **20**, and **22** may be driven simultaneously by a single power source **61**.

Cooling chamber D is provided with conduits **62** through which steam and hot water may be forced into the chamber for the purpose of cooling the annealed metal to a temperature at which contact with the oxygen and the air upon discharge thereof through the door **64** will not cause oxidation and consequent tarnishment of the metal surface. Air vents **63** are likewise provided for chamber D. The completely annealed metal is transferred from conveyor **20** to the unloading conveyor **22** and the discharge door **64** then closed to permit cooling of a fresh batch which will be transferred from the heat treatment chamber C.

While I have not illustrated the various detailed constructions utilized in my furnace assembly, such illustration being unessential to a proper showing of the operations and the broad structure involved in the invention it may be necessary to provide some means for cooling the elevator structure and I have illustrated a water sump **66** for this purpose. It will be apparent that the metal at no time contacts the water and as a consequence there is no possibility of its being injuriously affected thereby.

The bearings for the various conveyors and particularly those most closely associated with the heat treatment chamber where the temperature is very high, may be provided with adequate cooling means. I contemplate water cooled bearings and the possibility of utilizing hollow tube rollers through which water as a cooling medium may be forced for the purpose of supporting the various conveyors. Such water cooled rollers are indicated by the numeral **68** in Fig. 2 and may be utilized wherever desired.

The chamber A with the upper portion of B constitutes what might be termed one leg of the U and the lower portion of B with C and D constitutes the other leg of the U. The base of the U is constituted by the chamber B itself. The maintenance of pressure constantly in B will tend to prevent when any door is opened, the entrance of air toward the base of the U and also creates a pressure away from the base of the U toward the extremities of the legs.

Having described an illustrative form of my invention various modified structures will be at once apparent to those skilled in the art and therefore I do not wish to limit myself except within the scope of the appended claims.

What I claim:

1. An annealing furnace comprising a generally U-shaped structure divided into a plurality of compartments of substantially equal length, the base of the U forming a compartment of a length substantially equal to the length of the next adjacent compartment in each leg of the U, a fluid tight closure member located at the juncture of one leg with the base, and means in alinement with the other leg extending within the base for injecting therein a plurality of gaseous mixtures.

2. An annealing furnace comprising a generally U-shaped structure divided into a plurality of compartments of substantially equal length, the base of said structure forming a compartment of a length substantially equal to the length of the next adjacent compartment in each leg of the U, a fluid tight closure member located at the juncture of one leg with the base, and means in alinement with the other leg extending within the base for injecting therein a plurality of gaseous mixtures, an elevator operable within said base to transfer material from one leg to the other, and automatic means cooperable with said elevator for closing said closure upon movement of said elevator in one direction.

3. An annealing furnace comprising a generally U-shaped structure, the arms of the U being arranged to provide a plurality of chambers, a lift arranged in the base of the U for transferring material from one arm to another, an endless conveyor extending across the upper surface of said lift and constituting a supporting surface for said material, and an independently operable conveyor actuating means positioned at each effective lift level.

4. An annealing furnace comprising a generally U-shaped structure, the arms of the U being arranged to provide a plurality of chambers, endless conveyors positioned within each arm and extending therealong, a lift arranged in the base of the U for transferring material from one arm to another, the said lift including an endless conveyor material supporting surface adapted to receive material from the conveyors extending along the arms of said U, independently operable conveyor actuating means positioned at each effective lift level, and manually operable means associated with each conveyor actuating means for controlling the same.

5. A heat treatment furnace for treating metal objects comprising, in combination, an enclosed rectangular structure divided into an upper and lower level and provided with connecting heat treating and conditioning chambers on each of the levels, said enclosed structure provided at one end with an opening into each of said levels, the other end of said structure being closed to the entrance of air, a conveyor system in said structure adapted to convey metal objects along one level from its opening at one end of the structure to the closed end of the structure and along the other level from the closed end of the structure to its opening at the other end thereof, a vertical transfer chamber at the closed end of the structure having an elevator therein, a reversible conveyor on said elevator adapted to cooperate with the oppositely traveling conveyor on the two levels for shifting metal objects to and from the elevator, means for introducing non-oxidizable gas into said transfer chamber so as to cause the pressure of this gas to build up to such an extent at the closed end of the structure as to continually flow through the chambers of both levels in the direction of the openings at the other end of the structure thereby preventing the seepage of air into the furnace from the opened end of the structure.

6. A heat treatment furnace for treating metal objects comprising, in combination, an enclosed U-shaped structure, conveyor mechanisms for conveying metal objects along one leg of the U to the base thereof and back along the other leg thereof, said structure provided with electrical heating means for raising the temperature of the metal objects transmitted therethrough, and means for introducing non-oxidizable gas under high temperature into the base of said U-shaped structure so as to assist the electrical means in heating the metal objects and to create a relatively high pressure of this gas at the base of the structure in order that it may expand away therefrom along the legs of the U thereby tending to prevent the seepage of air through the ends of the legs of the U-shaped structure.

7. A heat treatment furnace for treating metal objects comprising a generally U-shaped structure, the arms of the U provided with endless conveyors for advancing material along one arm toward the base of the U and returning the material along the other arm, a transfer platform arranged in the base of the U for transferring material from one arm to the other, a fluid tight closure member located at the juncture of one arm with the base of the U, and automatic means cooperable with said platform for closing said closure upon movement of the platform in one direction.

8. A heat treatment furnace for treating metal objects comprising a generally U-shaped structure closed at the base of the U but adapted to be opened to atmosphere at the extremities of the arms of the U to receive and discharge material, a conveyor system for advancing the material along one arm to the base of the U and return the same along the other arm to the latter's extremity, a transfer platform in the base of the U for transferring material from the conveyor system in one arm to that in the other arm, and means for introducing non-oxidizing gas under pressure into the base of the U to create a pressure away from the base of the U toward the extremities of the arms whereby the seepage of atmosphere through the extremities of the arms toward the base is prevented.

9. A heat treatment furnace for treating metal objects comprising a generally U-shaped structure closed at the base of the U but adapted to be opened to atmosphere at the extremities of the arms of the U to receive and discharge material, the arms of the U divided into a plurality of heat treatment chambers in each of which is a material supporting conveying mechanism forming a part of a conveyor system adapted to ad-

vance material along one arm toward the base of the U and return the same along the other arm to the extremity of the latter, closure members adapted to separate several of said heat treatment chambers from one another, a transfer chamber in the base of the U provided with means for transferring the material from one arm to the other, and means for introducing non-oxidizing gas under pressure into the base of the U to create a pressure of such gas away from the base toward the extremities of the arms to counteract the leakage of atmosphere toward the base when any of said closure members are opened.

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