Dec. 1, 1931. I. W. FRANK ET AL 1,834,304

HEATING FURNACE

Filed Dec. 31, 1927 5 Sheets-Sheet 1

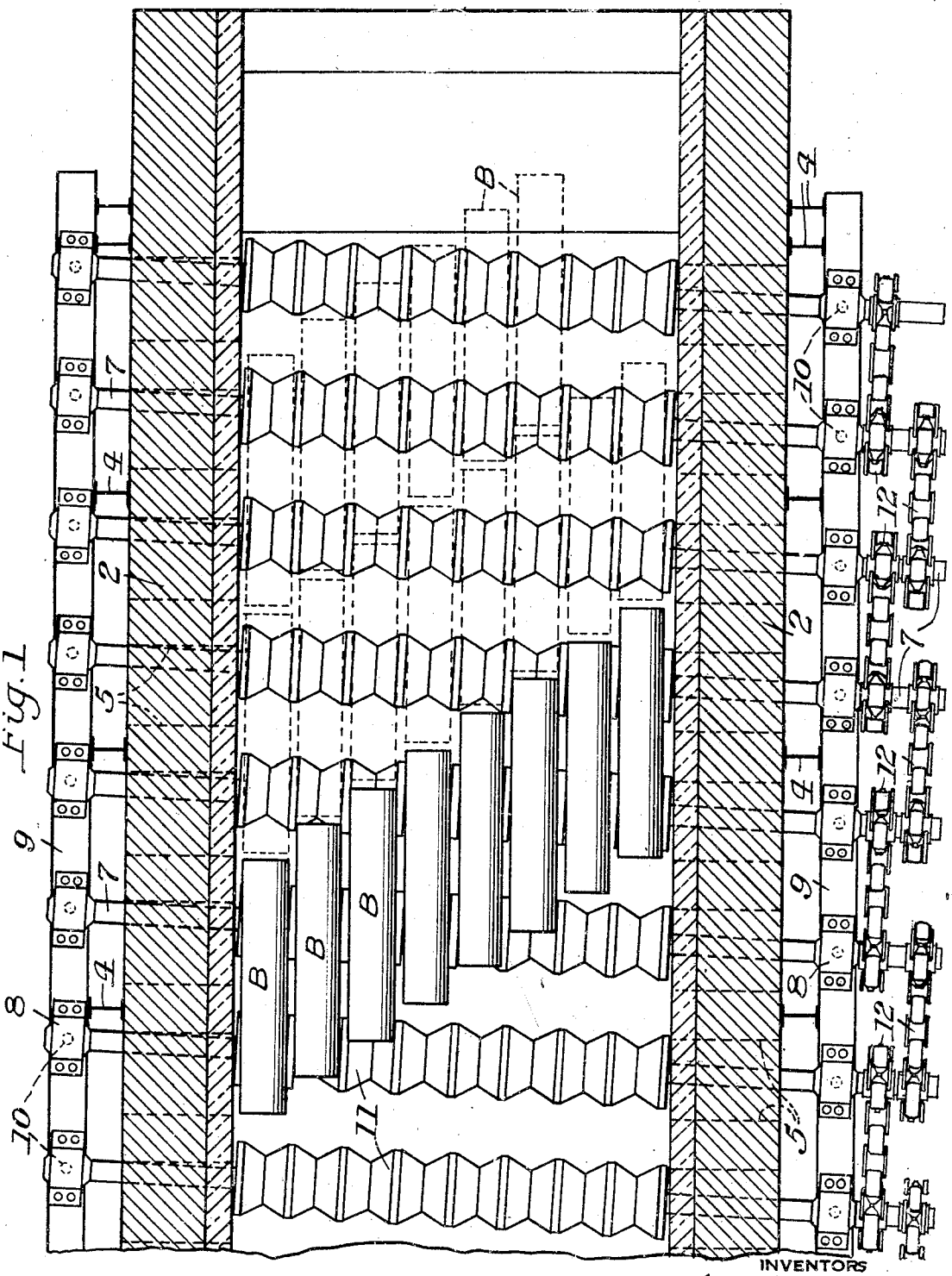


Fig. 1

INVENTORS

Isaac W. Frank,
Florence C. Bigelow Jr.,
Thomas J. Carroll,
By Byrnes, Kilburn & Darmelle,
Their Attys.

Dec. 1, 1931. I. W. FRANK ET AL 1,834,304

HEATING FURNACE

Filed Dec. 31, 1927 5 Sheets-Sheet 2

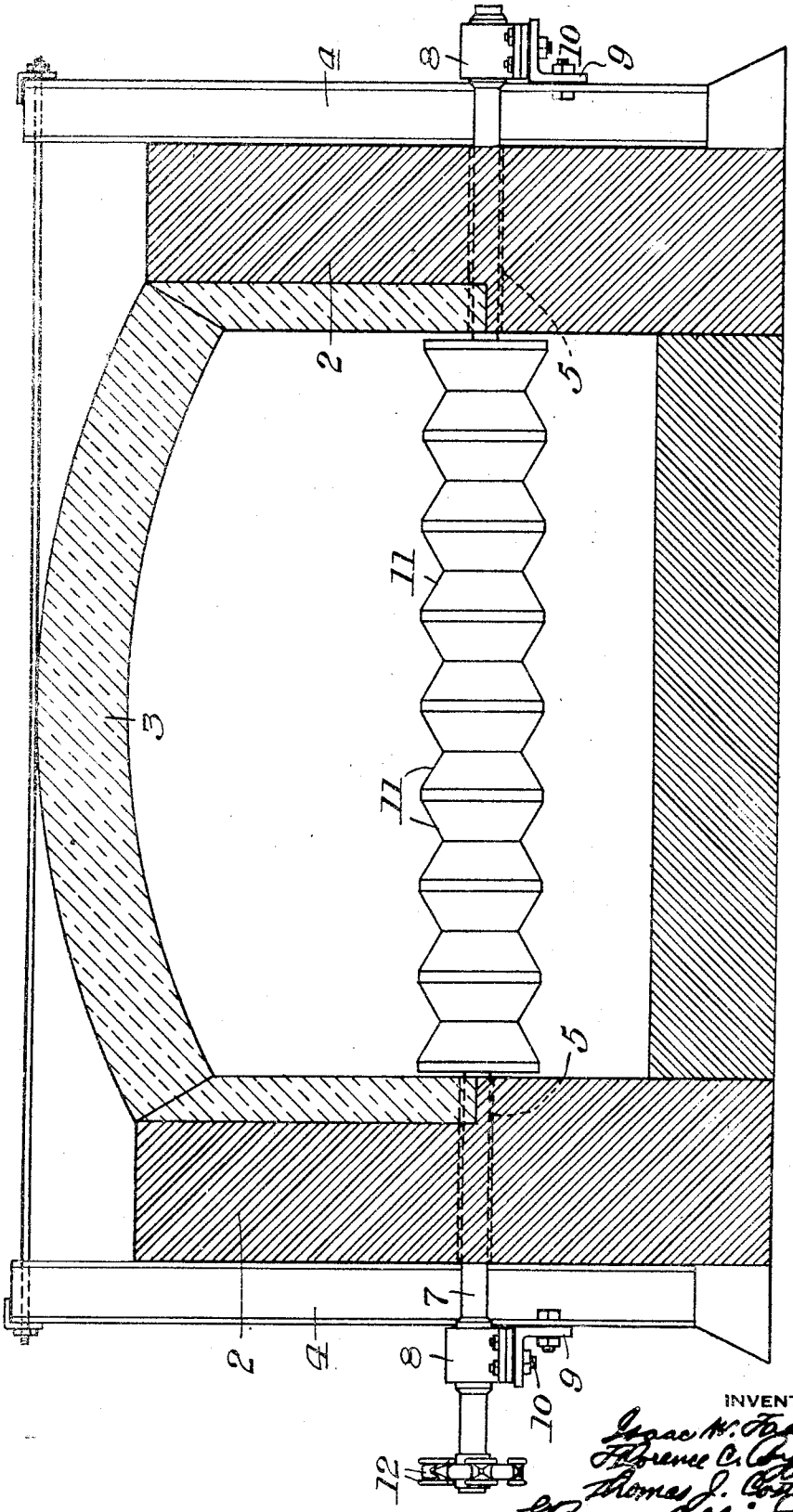


Fig. 2.

INVENTORS

Isaac W. Frank,
Florence C. Bryant Jr.,
Thomas J. Cottle,
By Burns, Robbins & Furniss
their Attys.

Dec. 1, 1931. I. W. FRANK ET AL 1,834,304

HEATING FURNACE

Filed Dec. 31, 1927 5 Sheets-Sheet 3

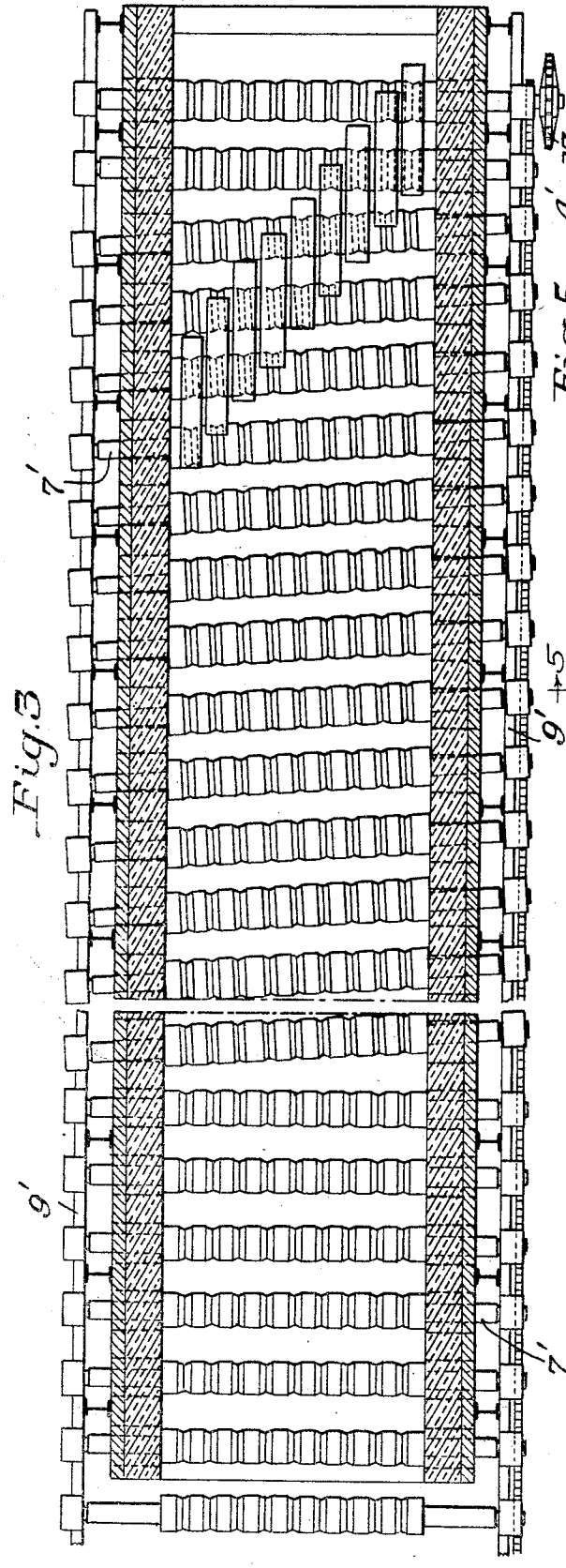


Fig. 3

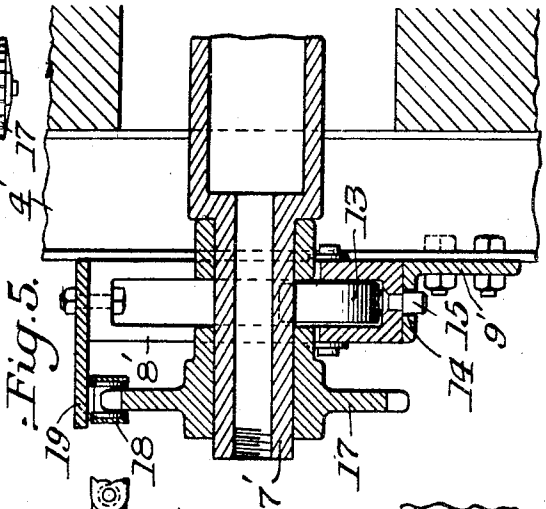


Fig. 5.

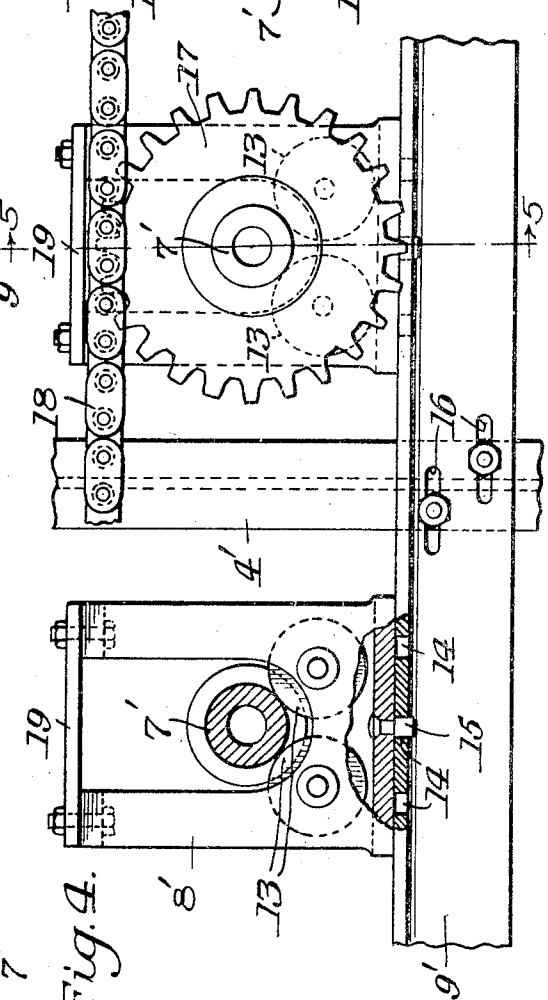


Fig. 4.

INVENTORS

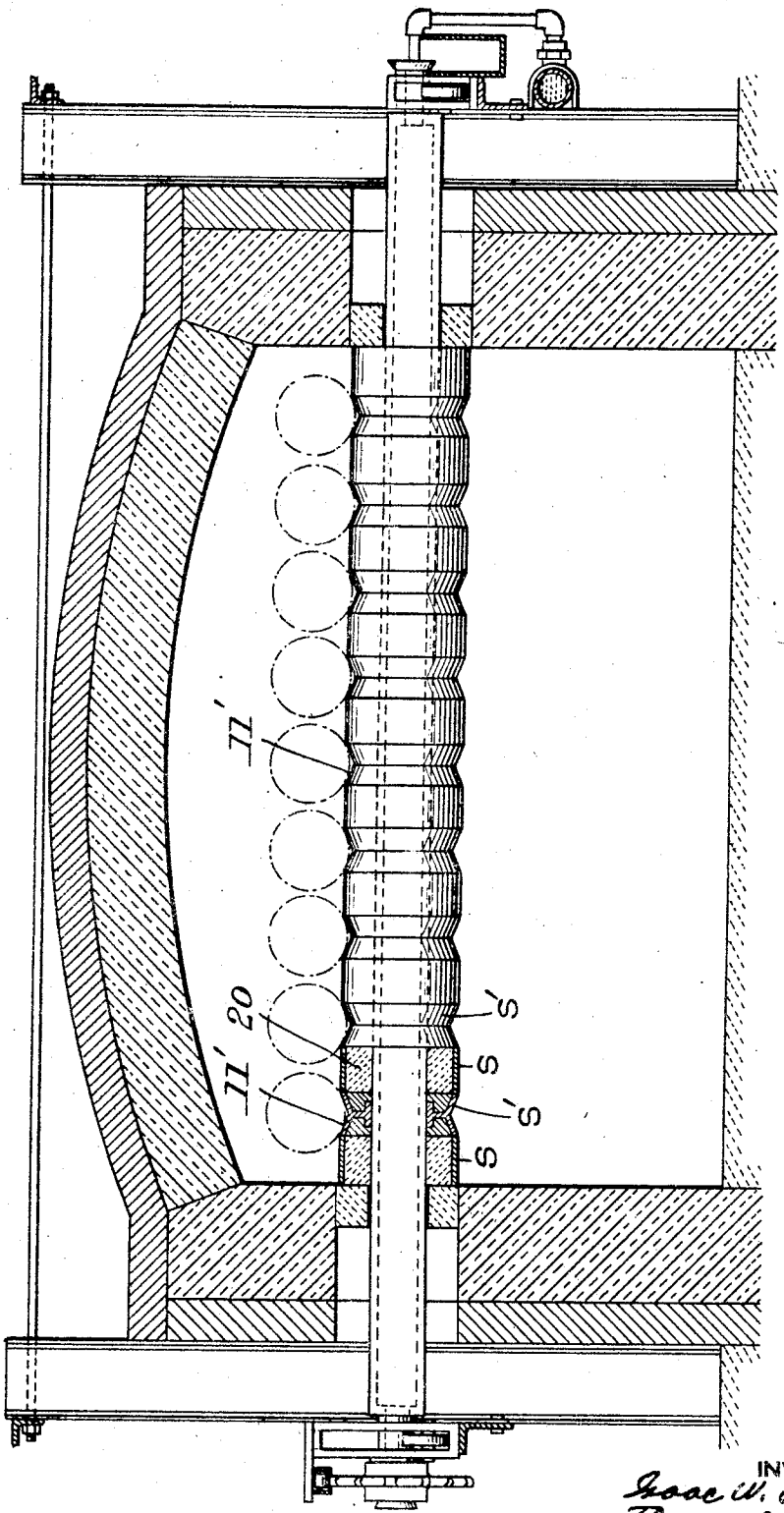
Isaac W. Frank,
Florence C. Bigelow,
Thomas J. Cotter,
By Burns, Lachmis & Reynolds
their attys.

Dec. 1, 1931. I. W. FRANK ET AL 1,834,304

HEATING FURNACE

Filed Dec. 31, 1927 5 Sheets-Sheet 4

Fig. 6.



INVENTORS

Isaac W. Frank,
Florence C. Eggert, Jr.,
Thomas L. Costello,
By Byerly, Watkins & Byerly
Their Attys

Dec. 1, 1931. I. W. FRANK ET AL 1,834,304

HEATING FURNACE

Filed Dec. 31, 1927 5 Sheets-Sheet 5

Fig. 7.

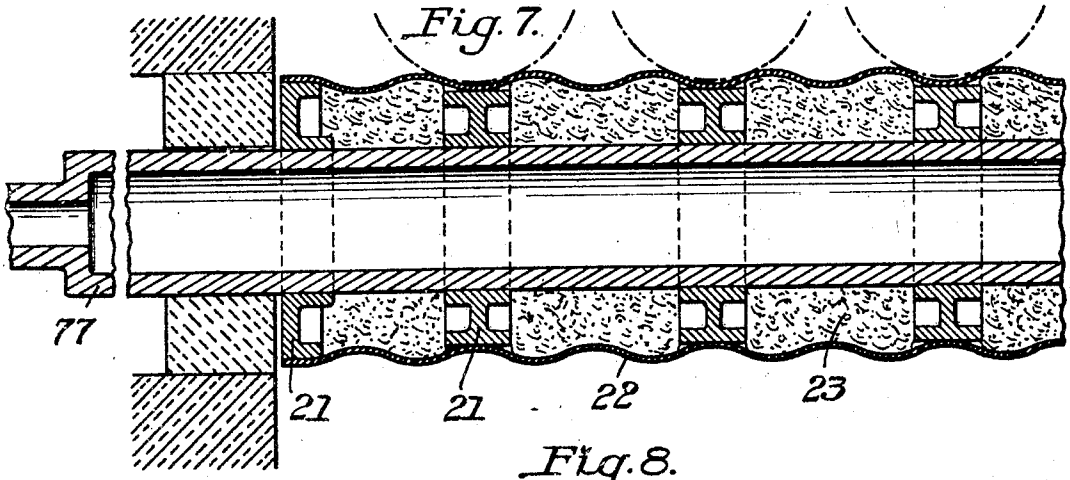


Fig. 8.

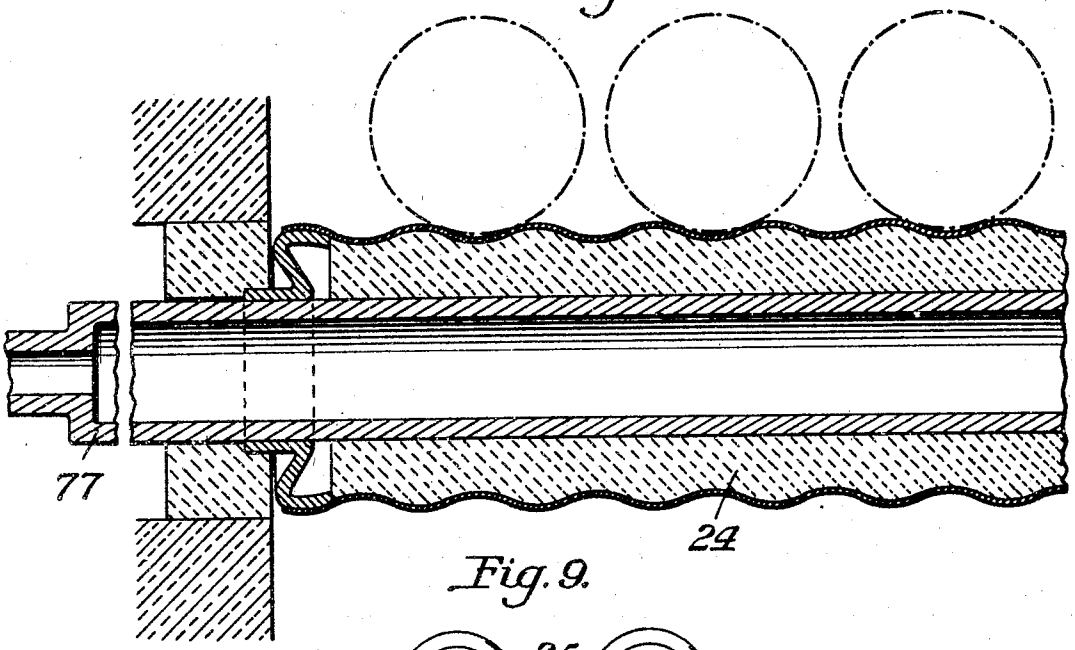
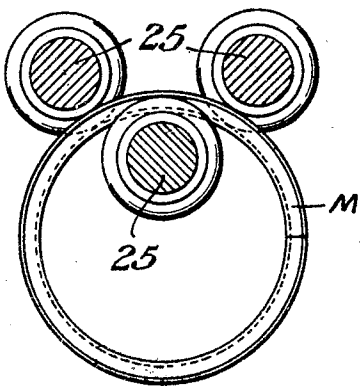


Fig. 9.



INVENTORS

Isaac W. Frank,
Florence C. Bigsby Jr.,
Thomas J. Costello,
By Lyon, Lyon & Parmelee,
Their Attys.

Patented Dec. 1, 1931 1,834,304

UNITED STATES PATENT OFFICE

ISAAC W. FRANK, OF PITTSBURGH, AND FLORENCE C. BIGGERT, JR., OF CRAFTON, PENNSYLVANIA, AND THOMAS J. COSTELLO, OF WARREN, OHIO, ASSIGNORS TO UNITED ENGINEERING & FOUNDRY COMPANY, OF PITTSBURGH, PENNSYLVANIA, A CORPORATION OF PENNSYLVANIA

HEATING FURNACE

Application filed December 31, 1927. Serial No. 243,844.

The present invention relates broadly to the art of heating or heat treating furnaces, and more particularly to an improved furnace structure and method of operating the same whereby the material being heated is caused to travel in such manner that more uniform heating thereof is obtained.

In the accompanying drawings there are shown for purposes of illustration only, certain preferred embodiments of our invention, it being understood that the drawings do not define the limits of our invention as changes in the construction and operation of the furnaces may be made without departing either from the spirit of our invention or the scope of our broader claims.

In the drawings,

Fig. 1 is a partial horizontal sectional view through one form of the furnace constructed in accordance with the present invention.

Fig. 2 is a vertical transverse sectional view, on an enlarged scale, through the furnace Fig. 1.

Fig. 3 is a view similar to Fig. 1 illustrating a slightly modified embodiment of the invention.

Fig. 4 is a detailed view, on an enlarged scale and partly broken away, illustrating a portion of the driving and supporting structure for the conveying members.

Fig. 5 is a vertical sectional view along the line 5—5 of Fig. 4.

Fig. 6 is a vertical transverse sectional view through the furnace of Fig. 3, a portion of one of the supporting and conveying members being shown in section.

Fig. 7 is a detail sectional view, on an enlarged scale, through a slightly modified form of conveying member.

Fig. 8 is a view similar to Fig. 7 illustrating still another embodiment of the invention, and

Fig. 9 is a diagrammatic view illustrating one manner of forming a conveying member.

In the art of heating material, such for example as billets, it is desirable to effect as uniform a heating as possible. In accordance with the present invention this is accomplished by effecting a rotational movement of the billets about their own axes simultaneously with their longitudinal travel through the heating zone. By means of such a travel of the billets, the different portions thereof are subjected to substantially the same heating conditions and the desired results are obtained.

It is also desirable, in accordance with the present invention, to obtain a travel of the billets in such manner that a successive discharge of the billets is effected. By such an operation, billets may be delivered as desired, and substantially the same length of time of heating for each of the billets is insured.

The word "billets" is herein used in its generic sense, as a word of definition, and not as a word of limitation, it being inclusive of a variety of shapes and sizes of material, as will be readily understood by those skilled in the art.

In accordance with the embodiment of Figures 1 and 2 of the invention, there may be provided a furnace of any usual construction, having side walls 2, carrying a roof 3, and provided with supporting buckstays 4 tied together in any usual manner. The side walls of the furnace are formed with openings 5 through which extend shafts 7, mounted in bearings 8. These bearings may conveniently be carried by angle bars 9, extending longitudinally of the furnace on opposite sides thereof, and secured in any desired manner to the buckstays.

Each of the bearings 8 preferably has a pivotal mounting 10 by which it is secured to its cooperating angle bar whereby the shafts 7 may be adjusted angularly with respect to the stays 4 to provide any desired inclination thereof as indicated, for example, in Fig. 1. In accordance with this embodiment of the invention, the angular adjustment may be obtained by effecting longitudinal movement of one of the angle bars in one direction or the other, as may be desired, and then bolting it in its adjusted position to the buckstays.

The shafts are indicated as provided with enlarged central portions shaped in such manner as to form a series of guide grooves 11 for the billets B. The guide grooves of the successive conveying members define

lines of travel for the billets as is apparent from Fig. 1, the guide groove of any individual conveying member, however, extending at an angle to the actual line of travel, as will be readily apparent. The shafts of the conveying members may be interconnected in any desired manner as, by sprockets and sprocket chains 12, whereby all of the conveying members may be caused to travel in unison.

In the actual use of the furnace, with the conveying members rotating, the billets are successively placed in position in the adjacent guide grooves with adjacent billets offset in the direction of travel as clearly shown in Fig. 1. By thus placing the billets, the rotation of the rolls causes a successive delivery of the billets, the billet first in the furnace being the first delivered, whereby the same time of heating for successive billets will be insured.

Due to the inclination of the supporting members relative to the line of travel of the billets, the billets are caused to rotate on their own longitudinal axes simultaneously with their travel through the furnace, the rate of rotation being determined by the angularity of the guide grooves 11, which in turn is variable in the manner set forth. By reason of this construction, therefore, the material to be heated may be simultaneously conveyed endwise through the furnace and caused to continuously rotate about its own axis so that different portions are successively subjected to the same temperature conditions.

In Figures 3 to 6, both inclusive, we have shown a slightly modified embodiment of the invention, in which the shafts 7′ are of hollow construction to facilitate the passage of a cooling medium therethrough. The bearings 8′ are likewise of modified construction embodying open top bearings of the well known grind stone type, including anti-friction rolls 13. One of the angle bars 9′ is formed with a plurality of sets of openings 14, one set for each of the bearings, and each set preferably including 3 or more openings. Each of the bearings 8′ may be formed with a pin 15, adapted to extend into any one of the openings. When positioned in the center opening of each set, the rolls will extend in a direction substantially normal to the longitudinal axis of the furnace as indicated by a few of the left hand rolls and the two extreme right hand rolls of Fig. 3. When the pin 15 of one of the bearings is moved into one of the side openings, the rolls will assume an angular relation to the furnace, as indicated by the central group of rolls of Fig. 3. By varying the number of openings 14, any desired angularity may be obtained. At the same time, the position of all of the rolls may be adjusted simultaneously by lengthwise movement of one of the angle bars 9′, such movement being permitted by reason of the slots 16 formed therein as shown in Fig. 4.

For driving the shafts 7′, each shaft may have secured thereto a sprocket 17, all of which are adapted to cooperate with a sprocket chain 18, the chain being held in driving engagement with each of the sprockets by a backing up and guide plate 19 secured to the bearings.

The conveying members of this form of the invention may be of composite construction comprising sections S alternating with sections S′. The sections S may be of substantially cylindrical contour, while the sections S′ may be shaped to provide guide grooves 11′ of the general nature heretofore referred to. The sections S may have a filling 20, of any desired nature but preferably such that the transmission of heat to the hollow shafts is prevented or minimized. The sectional construction permits rapid fabrication of the rolls and enables rolls of different lengths, and rolls having guide grooves spaced different distances to be easily produced.

In Fig. 7 there is illustrated still another embodiment of the invention in which the conveying members may comprise hollow shafts 77 carrying heads 21 on which is supported a covering 22 herein illustrated as comprising a sheet of corrugated metal. The distance between the heads 21 is such as to cooperate with alternate corrugations, the distance between the corrugations being such that alternate corrugations provide guide grooves in which the billets may travel. The main body of the roll intermediate the heads may be filled with a suitable relatively poor heat conducting material 23.

In Fig. 8 there is illustrated an embodiment of the invention generally similar to that of Fig. 7 with the exception that the heads 21 are omitted and the filling 24 is of such nature as to give sufficient rigidity as to prevent deformation of the rolls.

In Fig. 9 there is illustrated diagrammatically an arrangement of rolls 25 adapted to take a sheet of corrugated material M and bend it into circular form for use as a roll cover, as will be clearly understood by those skilled in the art.

A furnace constructed in accordance with our invention provides all of the desired features of furnaces now in use with respect to the actual conveyance of material therethrough, and the supporting of the material during its travel, with the additional advantages of producing rotation of the material about its own longitudinal axis to effect more uniform heating thereof. The rate of rotation and the direction of rotation may be varied at will by changing the amount of, direction or inclination of the guide grooves of the individual rolls relative to the actual line of travel established by all of the rolls.

The feature of individual adjustment of the rolls is likewise of advantage in that it enables certain of the rolls to be angularly adjusted to effect rotation of the material during the travel the one portion of the furnace while other rolls may be maintained at substantially right angles to the direction of the travel of the material to merely advance the same. Thus the rolls adjacent the entering and discharging ends of the furnace may be maintained in normal positions with the intermediate rolls inclined, whereby during the charging and discharging the billets are merely caused to travel in a straight line, thereby facilitating placing of the billets in position and removal of the same from the furnace.

A further advantage of our invention arises from the placing of successive billets in offset relation whereby successive discharge of the billets in the order in which they were charged into the furnace is obtained.

Our invention is susceptible of embodiment in a furnace of a wide variety of shapes, sizes and constructions, it being principally characterized by conveying members extending at, or adapted to be placed at, an angle to the line of travel of the material, or having such constructional characteristics that longitudinal travel of the material is accompanied by such a movement thereof as to insure more nearly uniform heating.

We claim:—

1. In an elongated horizontal furnace, a plurality of supporting rolls having circumferential grooves adapted to receive elongated articles to be conveyed, means for adjusting the angular relation of said rolls to the longitudinal axis of the furnace, and means for simultaneously driving said rolls in any of their angularly adjusted positions.

2. In an elongated horizontal furnace, a plurality of supporting rolls having circumferential configurations adapted to receive articles to be conveyed through the furnace, said rolls being disposed at substantially right angles to the longitudinal axis of the furnace, and supporting means for the rolls having provision for separately adjusting the angular disposition of the separate rolls relative to the axis of the furnace.

3. In an elongated horizontal furnace, a plurality of supporting rolls having circumferential configurations adapted to receive articles to be conveyed through the furnace, said rolls being disposed at substantially right angles to the longitudinal axis of the furnace, and supporting means for the rolls having provision for separately adjusting the angular disposition of the separate rolls relative to the axis of the furnace, and for adjusting the angular positions of all of the rolls.

4. A furnace comprising a plurality of material supporting rolls, pin positioning means associated with at least certain of the respective rolls, supporting means for the rolls, and slot means associated with the supporting means and cooperating with the pin positioning means to adjustably support said rolls.

5. A furnace comprising a plurality of material supporting rolls, and means selectively operable for adjusting the angularity of certain of said rolls and for simultaneously adjusting the angularity of a predetermined group of said rolls.

6. An elongated horizontal continuous heating furnace, provided with a plurality of article-supporting rolls having a plurality of aligned circumferential grooves adapted to receive cylindrical articles and to convey them into, through and out of the furnace, a plurality of the rolls at each end of the furnace being disposed at right angles to its longitudinal axis to charge said articles into and discharge them from the furnace without rotating them on their axes, the intermediate rolls being disposed at an angle to said axis to rotate said articles on their axes, and means for simultaneously driving all of said rolls.

In testimony whereof we have hereunto set our hands.

ISAAC W. FRANK.
FLORENCE C. BIGGERT, JR.
THOMAS J. COSTELLO.