No. 789,316. PATENTED MAY 9, 1905.

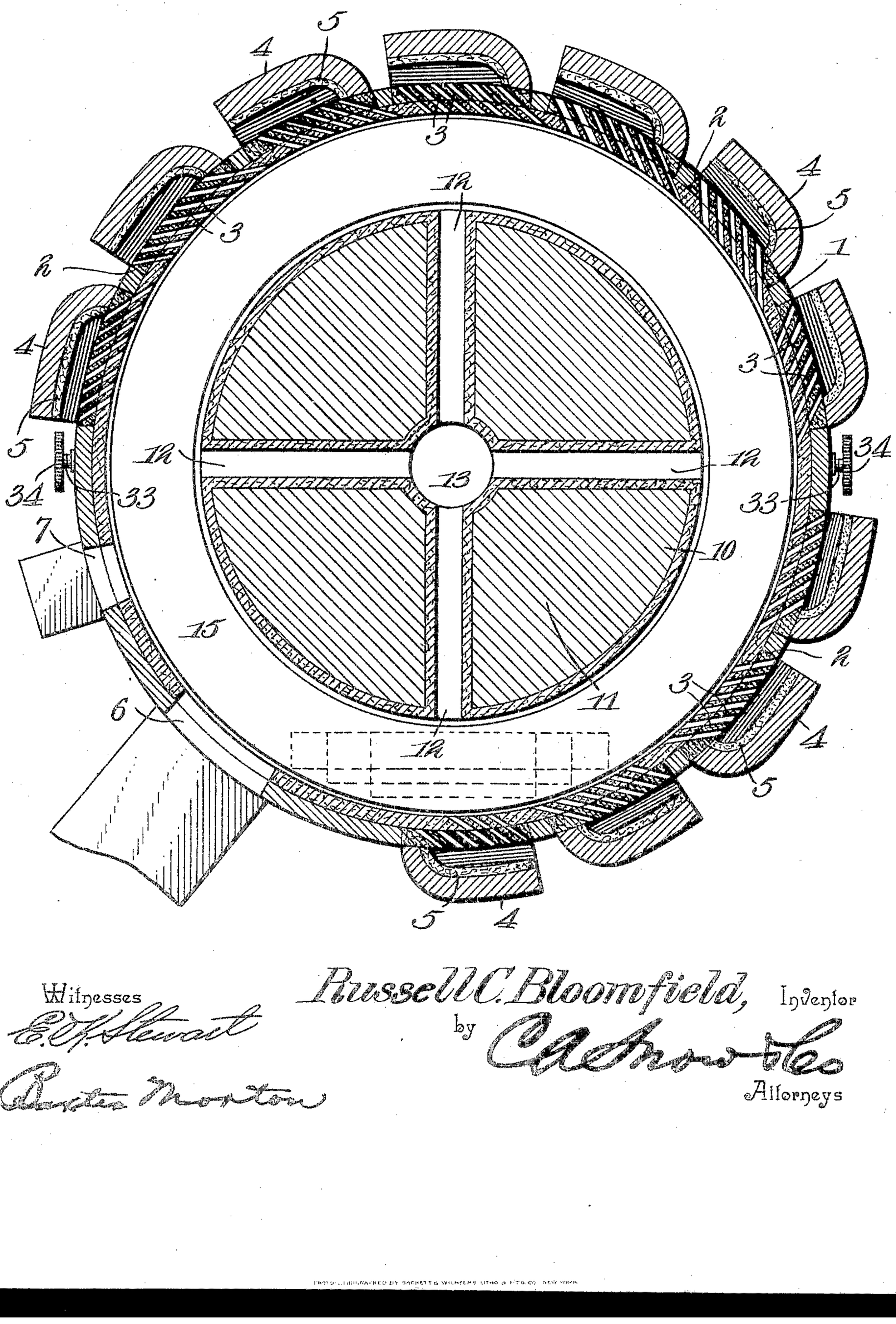
R. C. BLOOMFIELD.

FURNACE.

APPLICATION FILED MAY 16, 1904.

2 SHEETS—SHEET 1.

Fig. 1.



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2 SHEETS—SHEET 2.

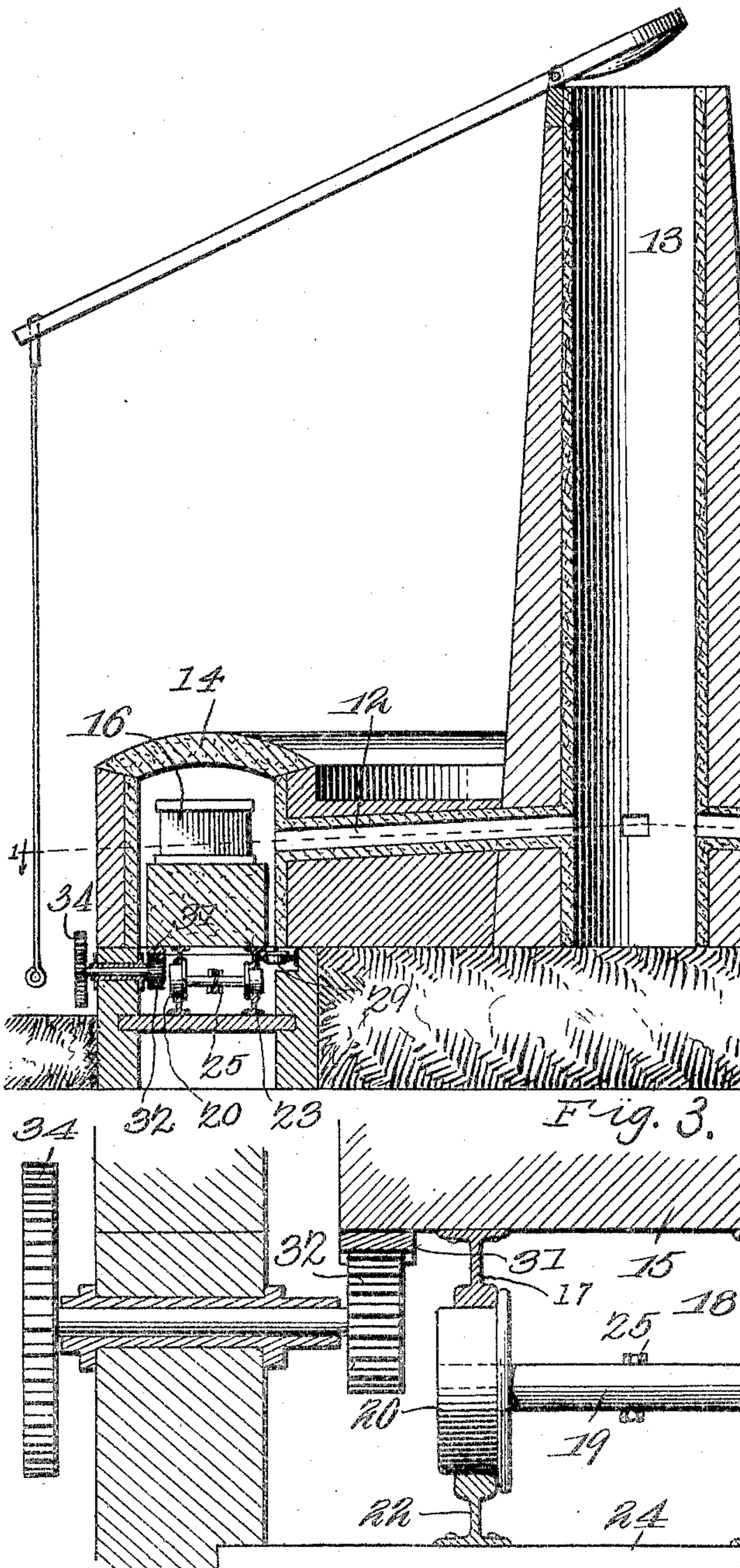

Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE.

RUSSELL C. BLOOMFIELD, OF ROCKFORD, ILLINOIS.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 789,316, dated May 9, 1905.

Application filed May 16, 1904. Serial No. 208,249.

To all whom it may concern:

Be it known that I, RUSSELL C. BLOOMFIELD, a citizen of the United States, residing at Rockford, in the county of Winnebago and State of Illinois, have invented a new and useful Furnace, of which the following is a specification.

This invention relates to furnaces, and more particularly to furnaces of the type employed in carbonizing and decarbonizing iron and steel.

The invention has for its principal object the provision of a furnace of the type specified in which the maximum heating effect may be obtained from the fuel used, uniformity be secured in the distribution of the heat, and a general improvement produced in the character of the results of the operation of the furnace.

As is well known, the carbonizing and decarbonizing of iron and steel is usually effected by placing the metal to be treated in a box of suitable size together with a compound of suitable character to effect carbonization or decarbonization, then subjecting the box so filled to the action of heat in a furnace for a sufficient length of time to bring about the desired chemical action. The boxes employed in this process vary in length according to the length of the pieces of metal to be treated, and in some instances it is necessary to employ boxes of ten feet or more in length. The furnaces ordinarily employed in carrying out the process outlined are circular in form, with the grates arranged at one side thereof and a chimney or smoke-stack at the opposite side, the hearth or floor of the furnace being rotatably supported and provided with means for imparting rotation thereto in order to bring each box successively into the portion of the furnace in which the maximum heat is produced. By means of a furnace of this character it is possible to produce tolerably satisfactory results in carbonizing or decarbonizing iron and steel; but the fuel employed is not economically used, and the furnaces and boxes are subjected to unnecessarily high temperatures, with deleterious results to both.

In the invention forming the subject of the present application the design of the furnace has been changed in a radical manner to effect the uniform distribution of heat within the flame-chamber of the furnace in order that the boxes may not be subjected at any step of the process to extremely high temperatures and in order to avoid the injurious effects upon the furnace of extreme heat in one part with less heat in another. The furnace has also been designed with a view to the elimination of unnecessary space in the flame-chamber and the consequent waste of heat.

In describing the invention reference will be had to the accompanying drawings, in which I have illustrated a preferred form of embodiment of the invention, it being understood that changes in the details of construction may be resorted to without departing from the spirit of the invention as defined in the appended claims or sacrificing any of the advantages thereof.

In the drawings, Figure 1 is a view in horizontal section, taken on the line 1 1, Fig. 2, and looking in the direction of the arrow thereon. Fig. 2 is a vertical diametral section through the furnace. Fig. 3 is a detail view showing the mechanism by which the movement of the traveling hearth is produced and the mechanism by which the hearth is guided in its movements.

Referring to the drawings, in which corresponding parts are designated by similar characters of reference, 1 designates the outer wall of the furnace, which is constructed of brick, the inner face thereof being covered with fire-brick, as shown. The wall 1 forms the circumference of a circle of suitable diameter, the size which is most generally used being thirty feet in diameter, inside measurement. At intervals throughout the greater portion of its extent the wall 1 is provided with rectangular openings 2, having plates or slabs 3 of fire-brick disposed therein at oblique angles to the outer surface of the wall. Just external to each of the openings 2 is arranged a fire-box 4, provided with a grate 5, extending longitudinally of the fire-box and in contact with the outer surface of the furnace-wall, as best seen in Fig. 1. The fire-boxes and grates illustrated are of suitable proportions for the use of oil as a fuel; but if it is

preferred to use coal or other fuel instead of oil the proportions of the fire-boxes and grates should be altered to some extent. In the portion of the wall unprovided with openings 2 there are arranged two doors 6 and 7, respectively. The larger door 6 is provided for the introduction of the boxes into the furnace, and the smaller door 7 is provided to facilitate the adjustment of the boxes upon the hearth.

Concentric with the outer wall 1 of the furnace is an inner wall 10, which is also faced with fire-brick, as shown, and which surrounds a central body 11 of ordinary brick, through which extend radially-arranged flues 12, converging to a smoke-stack 13 at the center of the furnace, which is provided at the top with a pivoted damper of ordinary form. The annular space between the outer and inner furnace-walls constitutes the flame-chamber, and this is covered with an arched roof of fire-brick 14.

As will be seen in Fig. 2, the flues 12 have their outer ends substantially on a level with the lower portions of the openings 2 in the outer furnace-wall, and their inner ends are at a slightly higher level, thus giving a slight upward slope toward the smoke-stack. The arrangement of the outer ends of the flues 12 at the level of the lower portions of the openings 2 is designed to obtain the maximum effect of the flame which enters the furnace through the passages between the slabs 3 of fire-brick. The hearth, which consists of a mass of fire-brick 15, has its upper surface just below the outer ends of the flues 12, so that each box, as shown at 16, may lie directly between the openings 2 in the outer wall and the flues 12 in the inner wall of the furnace. As best seen in Fig. 2, the height of the flame-chamber of the furnace is comparatively small, and the flame entering the furnace from the fire-box around the outer wall must necessarily strike against the box mounted on the hearth and also be deflected down upon the box from the arched roof over the flame-chamber.

The hearth 15 is of course arranged for movement in the furnace in order to bring each portion of the hearth adjacent to the larger door of the furnace and also to permit the boxes on the hearth to be moved steadily through the flame-chamber of the furnace during the process of heating, as it is practically impossible to obtain even in a furnace of the improved type absolutely uniform distribution of heat within the flame-chamber. The preferred form of mechanism provided for imparting movement to the hearth and guiding it in such movement is illustrated in Fig. 3. Upon reference to that figure it will be seen that the hearth 15 is provided on its lower surface with T-rails 17 and 18, arranged near the outer and inner margins of the hearth, respectively, the rails 18 being of greater height than the rails 17 for reasons which will presently appear. The rails 17 and 18 rest upon trucks consisting of an axle 19 and wheels 20 and 21, provided with flanges, as usual, and rigidly attached to the axle 19 at the outer and inner ends thereof, respectively. The wheel 21 of each truck is smaller than the wheel 20 to correspond to the difference in height of the rails 17 and 18 and to a similar difference in height between rails 22 and 23, upon which the trucks are supported. The heights of the rails 17 and 18 and rails 22 and 23 are similarly related to the diameters of the wheels disposed between them, and the diameters of the wheels 20 and 21 are directly proportional to their distances from the center of the furnace. This relation in the size of the wheels and the heights of the rails is of course adopted in order to insure the proper position of the trucks at all times and to prevent excessive friction in the operation of the hearth. The rails 22 and 23 are supported upon radially-arranged iron ties 24, supported some distance above the ground in order to provide a pit for the reception of trash of any character which may be introduced into the furnace. The proportions of the rails and wheels as described above are of suitable character to keep the trucks in substantially radial position at all times; but to prevent any slight inaccuracy in proportions from resulting in an ultimate derangement of the trucks I provide chains 25 to connect the trucks and keep them at uniform distances apart.

In order to keep the inner margin of the hearth suitably spaced from the inner wall of the furnace and to prevent wear upon the flanges of the wheels 20 and 21, I provide positively-operating spacing devices, consisting, preferably, of a horizontally-disposed rail 26, rigidly attached to the web of the rail 18, an oppositely-arranged rail 27, mounted in a channel 28 in the inner furnace-wall, and a plurality of horizontally-arranged flanged rollers 29, which travel between the rails 26 and 27, as shown in Fig. 3. The flanges upon the rollers 29 rest upon the upper surfaces of the rails 26 and 27, and so prevent the displacement of the rollers from their position between the rails. To prevent unequal distribution of the rollers by reason of any slight differences in their diameters, a chain 30 is used to connect the rollers to hold them at uniform distances apart.

The mechanism for imparting movement to the hearth consists, preferably, of a rack 31, rigidly attached to the under surface of the hearth, external to the rail 17, and pinions 32, mounted upon shafts 33, journaled in the outer furnace-wall at dimetrically opposite points and driven by any suitable devices. In the form of the invention illustrated each of the shafts 33 is provided upon its outer end with a sprocket-wheel 34, of suitable diameter, to

which power is applied by means of chains 35, running over the sprocket-wheels and connecting the sprocket-wheels with a motor. (Not shown.)

The operation of the furnace will be readily understood from an inspection of the drawings in the light of the foregoing description. The boxes containing the metal to be carbonized or decarbonized are introduced through the larger door of the furnace, the hearth being advanced a sufficient distance after the introduction of each box to permit the insertion of the next, and the boxes are adjusted in position after insertion by implements introduced through the door provided for that purpose. The boxes having been properly disposed upon the hearth of the furnace, the fires in the fire-boxes impart heat to the boxes as the hearth is caused to travel slowly around in the annular flame-chamber. The direct action of the flames upon the boxes is mitigated by the obliquely-disposed deflector-plates 3 of fire-brick arranged in the openings 2 in the outer furnace-wall. These obliquely-disposed plates cause the flames to enter the flame-chamber at oblique angles to the periphery thereof, and so set up currents following the curve of the flame-chamber instead of going directly across it and into the flues leading to the smoke-stack. This effect of the deflector-plates is advantageous in diminishing the effect of the flame upon the outer sides of the boxes, which are most directly exposed thereto, and in also effecting a more uniform distribution of the heat through the flame-chamber, so that in the event of the heat from certain of the fire-boxes being greater than that from others the temperature in the flame-chamber will be in a measure equalized by means of the currents following the curve thereof. The close proximity of the arched roof of the flame-chamber to the tops of the boxes insures the contact of the flames with the tops of the boxes, and the disposition of the ends of the flues 12 just above the upper surface of the traveling hearth necessitates the downward passage of the flames along the inner wall of the flame-chamber before they enter the flues and pass to the smoke-stack. The slight upward inclination of the flues 12 is effective in preventing any back draft from the smoke-stack and insuring the establishment of sufficient draft in all parts of the furnace.

From the foregoing explanation of the operation of the furnace it will be clearly evident that the waste of heat inevitable in a furnace having a circular flame-chamber is almost entirely obviated by the provision of an annular flame-chamber in lieu thereof and at the same time the possibility of producing a tolerably uniform temperature within the flame-chamber results. The provision of a central smoke-stack with flues converging thereto from all parts of the furnace renders possible the provision of fire-boxes around the greater portion of the circumference of the furnace, and so permits the introduction of heat at a large number of points.

The products of the improved type of furnace above described are characterized by greater uniformity than those of furnaces of the ordinary type, as would naturally be supposed, and the boxes employed to hold the metal plates or bars to be carbonized last a much greater length of time in the improved furnace, because they are not subjected at any time to excessive temperatures, and the scaling of the outer surface on account of the excessive heat is greatly lessened.

Having thus described the invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A furnace of the character specified having an annular flame-chamber, a central smoke-stack, a plurality of flues connecting said chamber and stack, a plurality of grates external to said flame-chamber but communicating therewith, and a plurality of deflector-plates disposed between each of said fire-boxes and said flame-chamber to deflect the flames entering into said chamber.

2. A furnace of the character specified having an annular flame-chamber, a central smoke-stack and a plurality of flues connecting said chamber and stack, a plurality of fire-boxes external to the furnace-wall, but communicating with the flame-chamber, and a plurality of deflector-plates arranged in said wall between said flame-chamber and the fire-boxes to deflect the flames entering said flame-chamber.

3. A furnace of circular contour having an annular flame-chamber therein, and a plurality of fire-boxes external to the furnace-wall, said furnace-wall having a plurality of slots extending obliquely through the wall adjacent to each fire-box.

4. A furnace of the character specified having an annular flame-chamber, an annular hearth disposed in said flame-chamber, supporting-rails beneath said hearth, trucks provided on said supporting-rails and having wheels whose diameters are proportional to their distances from the center of the furnace, and rails attached to the under surface of said hearth and resting on said trucks.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

RUSSELL C. BLOOMFIELD.

Witnesses:
GEO. W. LAIDLEY,
JOHN GRIFFITHS.