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W. J. HARRIS, JR.

METHOD OF AND APPARATUS FOR HEAT TREATMENT.

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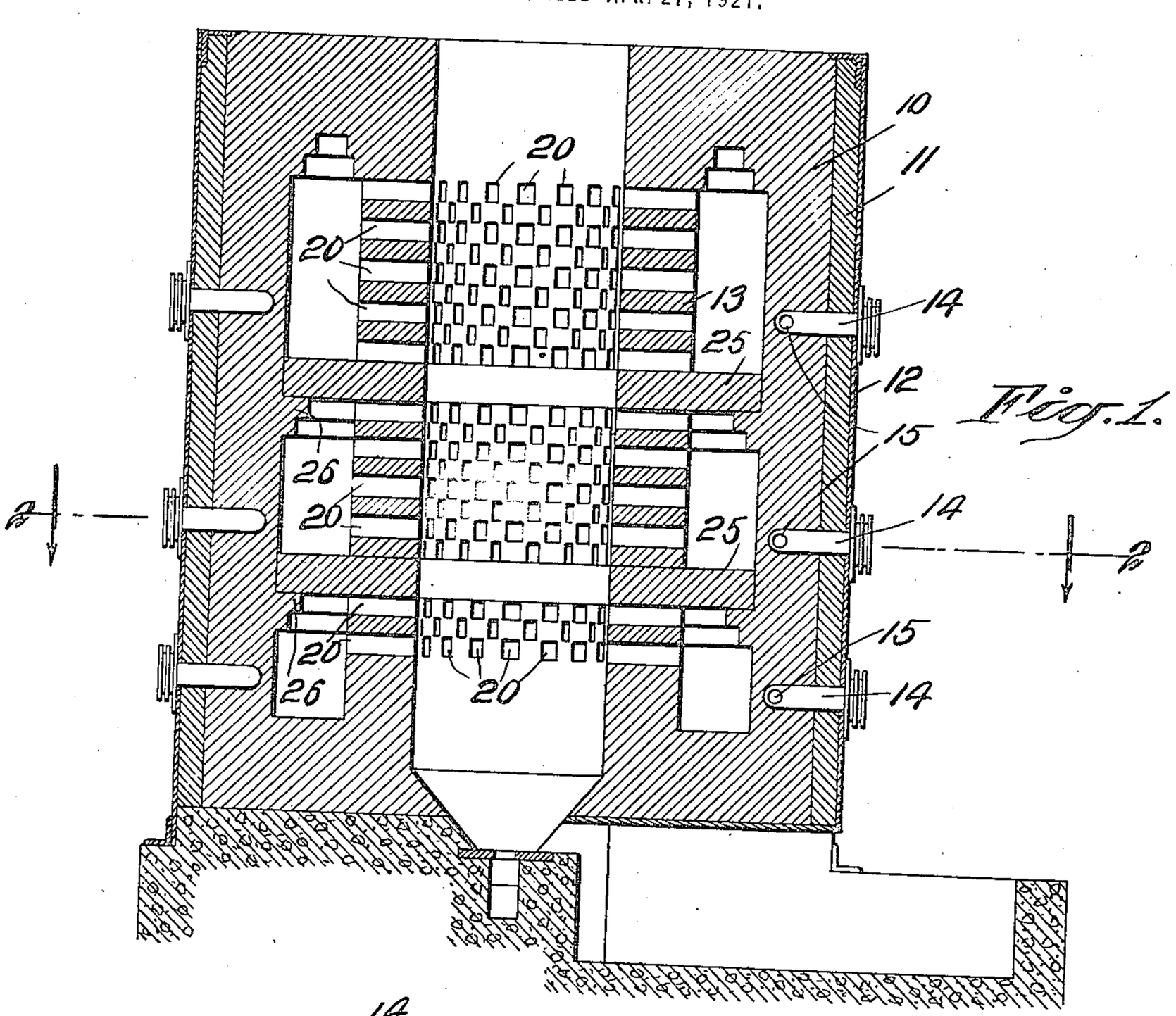

Fig. 1.

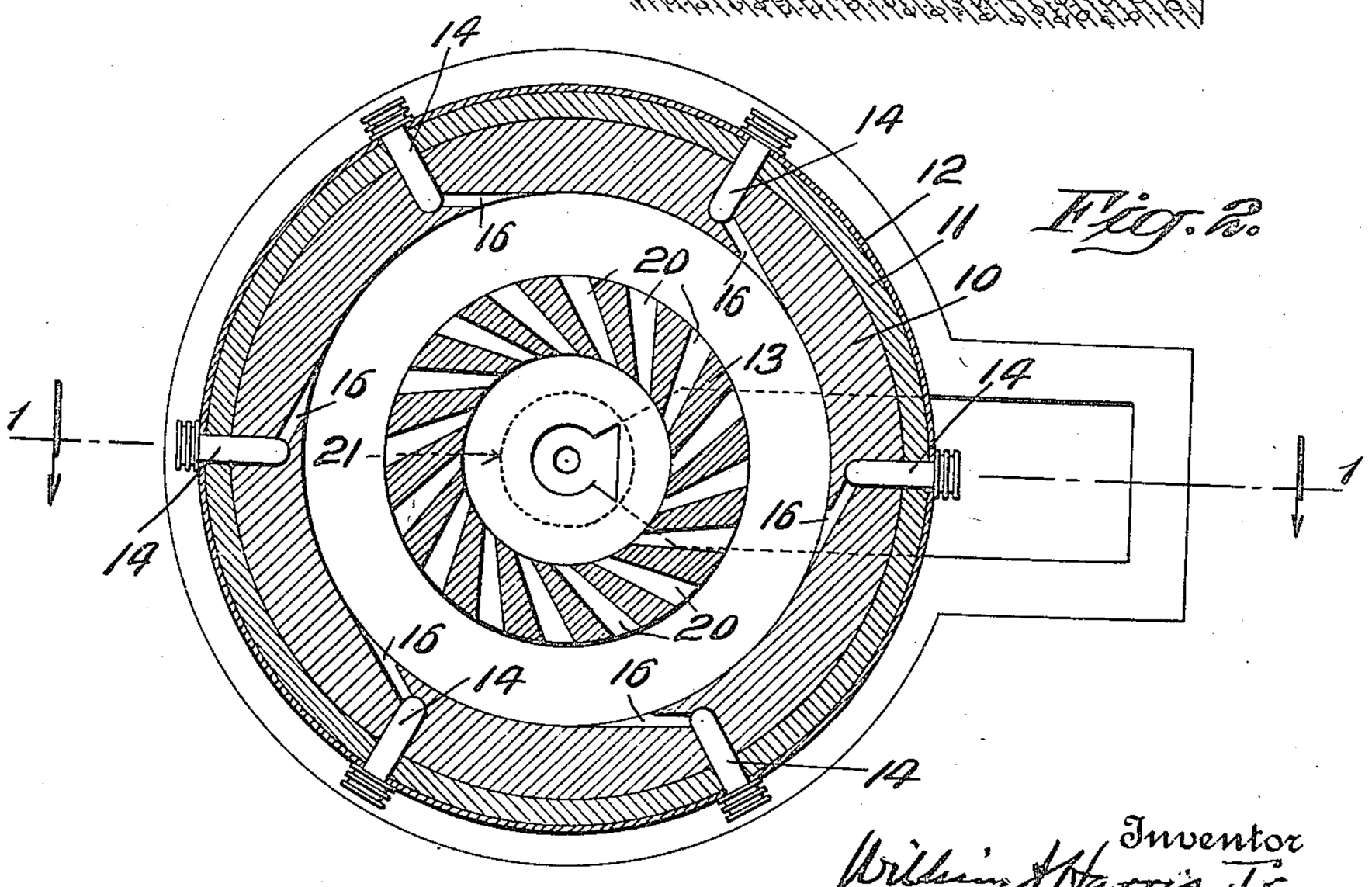

Fig. 2.

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UNITED STATES PATENT OFFICE.

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METHOD OF AND APPARATUS FOR HEAT TREATMENT.

Application filed April 27, 1921. Serial No. 464,872.

To all whom it may concern:

Be it known that I, WILLIAM J. HARRIS, Jr., a citizen of the United States, residing at New York city, in the county of New York and State of New York, have invented certain new and useful Improvements in Methods of and Apparatus for Heat Treatment, fully described and represented in the following specification and the accompanying drawing, forming a part of the same.

This invention relates to methods of and apparatus for heat treatment, and has for an object to secure uniform heating about the periphery of the article under treatment.

The invention comprises a method wherein the article to be heated is surrounded by a whirling body of hot gases. The whirling movement of the gases about the article serves to make the heating of the article uniform about the periphery of the article. The method may be carried out so as to heat the article uniformly throughout its length or to heat different zones of the article to different temperatures while securing a uniform temperature in each zone.

The apparatus by which the method is carried out comprises a furnace having a treating chamber in which the article is placed and provided with means for supplying hot gases to the treating chamber and causing a whirling motion of these gases in the treating chamber about the object.

While the invention may be carried out in various different types of furnaces and applied to treatment of various different articles, I have, for the sake of illustration, shown in the drawings a type of furnace which has heretofore been used in treatment of projectiles. In the drawings:

Fig. 1 is an elevation sectioned upon the line 1—1 of Fig. 2; and

Fig. 2 is a plan view sectioned upon the line 2—2 of Fig. 1.

The furnace illustrated in the drawings is cylindrical and its side wall 10 may be composed of firebrick covered by a layer of insulating material 11 and a metal shell 12. Within the chamber formed by the side wall 10 is an inner wall 13 which extends from the bottom to the top of the furnace and divides it into an outer annular chamber and an inner cylindrical chamber. Burners 14 are provided set in the outer wall to discharge into the annular chamber. Each of the burners 14 is provided with an outlet opening or nozzle 15 opening into a passage 16 which opens into the annular or combustion chamber in a direction substantially tangential to its outer wall. The arrangement of the nozzles 15 and passages 16 results in causing a whirling motion of the burning gases in the annular combustion chamber.

In shell treating furnaces heretofore constructed the nozzles and passages such as those described have been used, but in such furnaces used prior to my invention the passages in the inner wall through which hot gases are introduced from the combustion chamber into the treating chamber have been made radial so that the gases passing through these passages were projected directly against the surface of the projectile in the treating chamber, which resulted in heating the portions of the projectile surface directly opposite the openings in the inner wall to a higher temperature than the other parts of the projectile surface.

In accordance with the present invention, the inner wall 13 is so constructed that the passages 20 provided in it are substantially tangential to its inner surface so that the gases entering the treating chamber through them are directed not against the surface of the projectile (indicated by the dotted line 21 in Fig. 2), but tangentially into the annular space between the surface of the projectile and the inner surface of the wall 13. The passages 20 extend in the same general direction as the passages 16 so that the whirling motion in a clockwise direction, as viewed in Fig. 2, given to the burning gases in the annular chamber by the passages 16 tends to cause the gases to enter the outer ends of the passages 20. The hot gases thus pass through the passages 20 with great rapidity and pass around the annular space between the projectile 21 and the inner surface of the wall 13 in a clockwise direction so that the projectile is surrounded by a whirling mass of hot gases. This results in a uniform heating of the projectile all the way around its periphery.

In order more effectually to maintain a uniform heating throughout the length of the projectile when this is desired, and in order to obtain a different degree of heating in different zones along the length of the projectile, it is desirable to make the passages 20 perpendicular to the axis of the

treating chamber as illustrated so that the gases entering the treating chamber through the passages are caused to whirl about the annular space between the projectile 21 and the inner surface of the wall 13 in planes perpendicular to the axis of the treating chamber and consequently perpendicular to the axis of the projectile. It is also desirable to divide the annular chamber between the outer wall 10 and the inner wall 13 into a plurality of separate combustion chambers by means of horizontal walls or partitions 25. Such partitions have heretofore been used in projectile treating furnaces, but it has heretofore been customary to support the partitions by building their outer edges into the outer wall 10. This arrangement has been found disadvantageous as it has made it necessary to demolish more or less the outer wall 10 of the furnace in order to remove the partitions to change their position or to renew them or the inner wall 13.

In accordance with my invention, the outer diameter of the partitions 25 is slightly less than the inner diameter of the outer wall 10 and the partitions are supported upon annular inward projections or ledges 26. This arrangement makes it possible to remove the partitions 25 to renew the inner wall 13 without injuring the outer wall 10.

It will be understood by those skilled in the art that the furnace described may be provided with any suitable means for supporting a projectile in the center of the treating chamber, a tank at the bottom of the treating chamber for the emersion of the lower portion of the projectile in certain kinds of treatment, and with such other auxiliary devices as have customarily been used in connection with projectile treating furnaces of the same general character, or with other suitable auxiliary devices. It will be understood also that the furnace described, for practicing my method and embodying the apparatus features of my invention, may be used for various different kinds of heat treatment, including such as require a uniform heating of the entire projectile, such as require a differential heating of different zones of the projectile, and such as require the immersion of part of the projectile in a cooling liquid.

It should be understod also that the invention is by no means limited to the particular type of furnace described nor to treatment of projectiles.

What is claimed is:

1. The method of heating different zones of an article under heat treatment to different temperatures while securing a uniform heating around the periphery of each zone of the article, which comprises surrounding the article with a body of gases, causing said body of gases to whirl about the article in planes perpendicular to the axis of the article, and maintaining the gases whirling about one zone of the article at a temperature different from the gases whirling about another zone of the article.

2. The method of heat treatment, comprising placing the article to be treated in a cylindrical treating chamber, introducing hot gases into the annular space between the surface of the article and the wall of the treating chamber in a direction substantially tangential to the surface of the article and perpendicular to the axis of the article so that they whirl about the article in planes perpendicular to its axis without direct impingement upon its surface, and maintaining the gases whirling about one zone of the surface of the article at a temperature different from those whirling about another zone of this surface.

3. In a heat treating furnace, an outer cylindrical wall, an inner cylindrical wall dividing the space within the outer wall into an annular combustion chamber and a cylindrical treating chamber, and means for causing combustion in said combustion chamber and for causing a whirling of the burning gases in said combustion chamber, said inner wall being provided with passages adapted to direct the whirling gases from the combustion chamber into the heating chamber and cause them to continue their whirling motion in the treating chamber.

4. In a heat treating furnace, an outer cylindrical wall, a concentric inner wall dividing the space within the outer wall into an annular chamber and a cylindrical treating chamber, partitions dividing said annular chamber into a plurality of combustion chambers, and means for providing a whirling mass of burning gases in each combustion chamber, said inner wall being provided with passages arranged to direct the whirling gases from each combustion chamber into the treating chamber and to cause them to whirl about the treating chamber in planes perpendicular to its axis.

5. In a heat treating furnace, an outer cylindrical wall provided with an internal annular projection, an inner wall within said outer wall, and an annular partition of less diameter than the inside diameter of said outer wall and having its outer portion resting upon said projection and having its inner portion extending into said inner wall.

6. In a heat treating furnace, an outer wall and an inner wall, forming an inner treating chamber and a combustion chamber surrounding the treating chamber, burners directed into the combustion chamber through the outer wall, the inner wall being provided with a plurality of passages extending substantially parallel to its inner surface.

7. In a heat treating surface, an outer cy-

lindrical wall and an inner cylindrical wall, forming a cylindrical treating chamber and an annular combustion chamber surrounding said treating chamber, burners directed into the combustion chamber through the outer wall, the inner wall being provided with a plurality of passages extending substantially tangential to its inner surface and adapted to admit hot gases from the combustion chamber to the treating chamber and to cause a whirling of said gases in the treating chamber.

8. In a heat treating furnace, an outer cylindrical wall and an inner cylindrical wall, forming a cylindrical treating chamber and an annular combustion chamber surrounding the treating chamber, burner passages in said outer wall entering said combustion chamber and directed tangentially so as to cause a whirling of the burning gases in the combustion chamber, the inner wall being provided with a plurality of tangential passages extending in substantially the same direction as said burner passages.

9. In a heat treating furnace, an inner cylindrical wall enclosing a treating chamber and provided with a plurality of tangential passages, the combined cross-sectional area of said passages approximating one-half of the area of the wall.

In testimony whereof I have hereunto set my hand in the presence of two subscribing witnesses.

WILLIAM J. HARRIS, JR.

Witnesses:
EUGENE E. BASQUIN,
W. M. HEPBURN.