No. 708,783. Patented Sept. 9, 1902.

E. H. SCHWARTZ.

METHOD OF MELTING AND TREATING METALS.

(Application filed June 13, 1901.)

(No Model.)

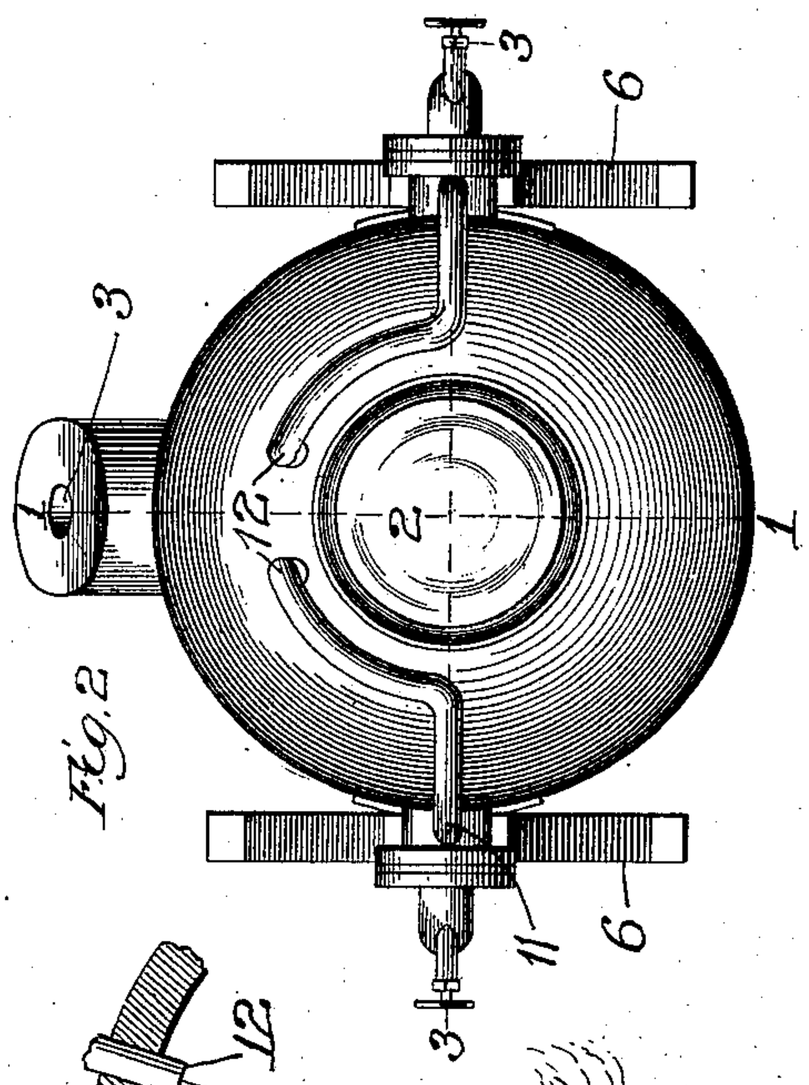

Fig. 2

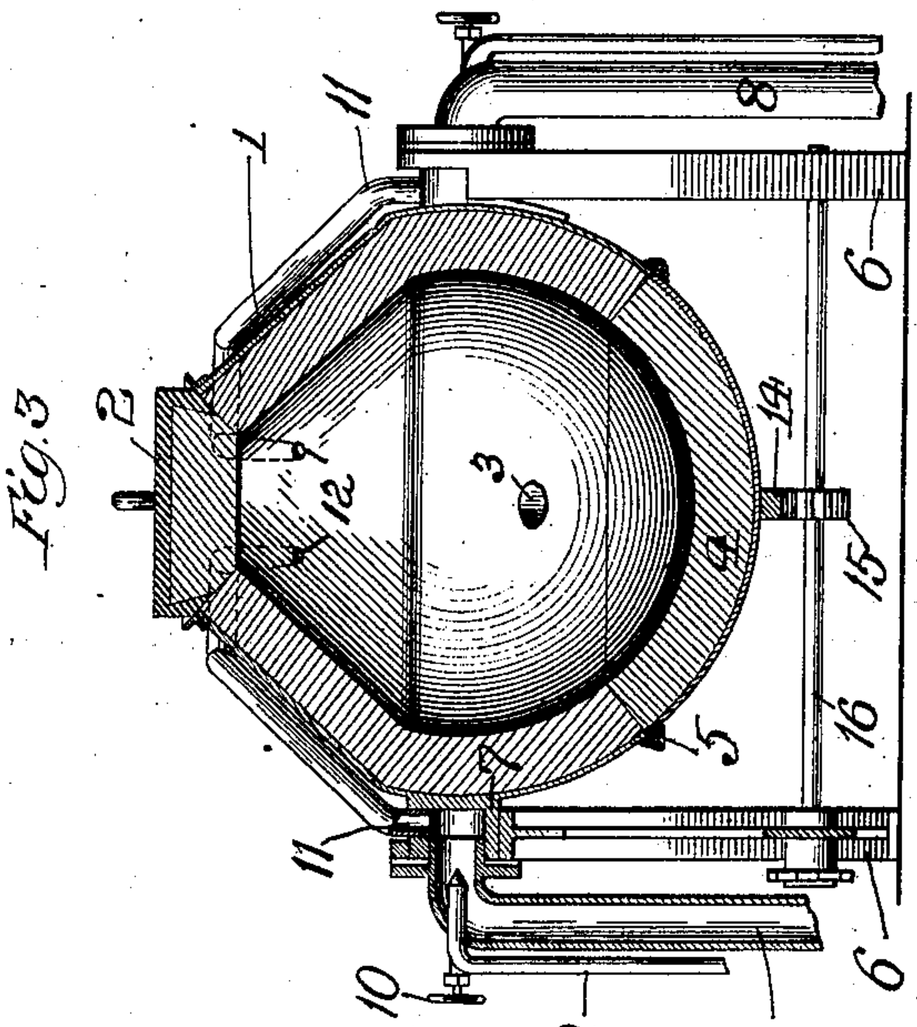

Fig. 3

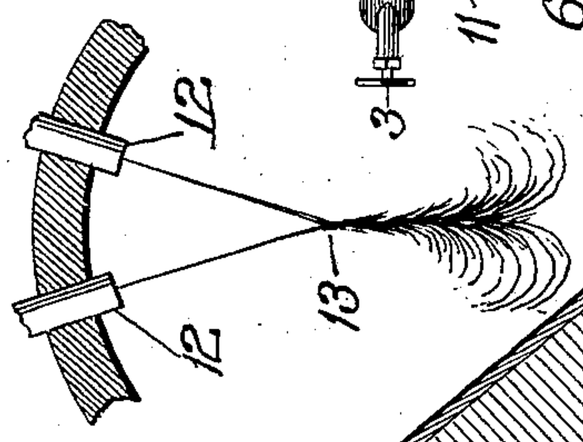

Fig. 4

Fig. 1.

Witnesses:

Harold G. Barnett.

Peter J. Alter.

Inventor:

Edward H. Schwartz

By Rector & Hibben

Attorneys.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

EDWARD H. SCHWARTZ, OF CHICAGO, ILLINOIS, ASSIGNOR TO THE HAWLEY DOWN DRAFT FURNACE COMPANY, OF CHICAGO, ILLINOIS, A CORPORATION OF ILLINOIS.

METHOD OF MELTING AND TREATING METALS.

SPECIFICATION forming part of Letters Patent No. 708,783, dated September 9, 1902.

Application filed June 13, 1901. Serial No. 64,370. (No specimens.)

To all whom it may concern:

Be it known that I, EDWARD H. SCHWARTZ, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Method of Melting and Treating Metals, of which the following is a specification.

My invention relates to what may be termed a "melting-furnace;" and it consists of the novel and useful method or process of melting and treating metals, more particularly brass, malleable iron, and steel, said method being characterized by the application of a blast or blasts of hydrocarbon or oxyhydrocarbon flame directly upon the metal until melted, after which by the tilting of the melting-furnace the blast may be caused to penetrate and agitate the molten metal, and thereby bring about the necessary reactions for purifying or freeing the metal from metalloids.

For the purpose of affording a clear and definite understanding of my invention, but without any intention of limitation thereof, I have chosen to show a form of melting-furnace in which my method may be conveniently practiced, although such method may be practiced by other forms of apparatus and constructed on the same general principles.

In the accompanying drawings, Figure 1 is a sectional elevation of the selected melting-furnace taken on line 1 1 of Fig. 2 and enlarged as compared with the other figures of the drawings. Fig. 2 is a plan view of the furnace. Fig. 3 is a sectional elevation on the line 3 3 of Fig. 2, and Fig. 4 is a diagrammatic view showing the general course and action of the blasts or jets from the burners.

The construction of the melting-furnace and the method herein claimed will be described more or less together. This furnace comprises a shell 1, substantially hemispherical at the bottom and truncated conical at its top, which has a charging-opening adapted to be closed by a door 2. Communicating with the lower portion of the furnace is a lateral spout or opening 3, which extends obliquely upward and serves both as a vent for the escape of gases, &c., and also as a discharge or tap for drawing off the molten metal. The bottom of the furnace is made as a removable section 4, held to the other part of the casing or furnace by means of bolts 5 or in any other suitable and desired manner. The interior of the furnace is suitably lined with refractory material. The furnace is adapted to oscillate in a frame composed of the two upright standards 6, having at their upper ends suitable bearings adapted to receive the hollow trunnions on the opposite side of the furnace. In the present instance two air-supply pipes 8 enter the hollow trunnions, while the oil or gas is introduced into the air-supply through the two pipes 9, governed by valves 10, the same constituting hydrocarbon or oxyhydrocarbon burners. Pipes or passages 11 communicate with the trunnions and constitute mixing-chambers and are adapted to convey the vapor to the two burners 12. These burners are so directed downwardly and convergingly toward the wall opposite to that in which they are located as to focus their jets at the point 13 (see Fig. 4) substantially at the central vertical axis of the furnace, after which the jets separate outward and away from each other, and are finally deflected laterally and downwardly with a whirling movement and then forwardly, so that the flame at the time of its complete combustion and greatest heat will be in direct and intimate contact with the metal supplied to the furnace. A general idea of the direction and action of the jets of flame will be understood from the diagrammatic view, Fig. 4. By simply manipulating suitable valves governing the air-supply and the gas or oil supply it is possible to obtain an oxidizing-flame, either a reducing or neutral flame. For instance, by increasing the proportion of oil or gas the flame may be changed from an oxidizing-flame to a reducing-flame. Suitable mechanism is used for tilting or oscillating the furnace, the mechanism here shown consisting of a rack 14, secured to the bottom of the furnace and adapted to be engaged by a pinion 15, mounted on the cross-shaft 16, bear-

ing at its ends in the standards 6. The furnace having been charged with metal through the top or charging door, the vapor-jets are started and ignited in any suitable way. The vapor is raised to an extremely-high temperature and complete combustion occurs toward the bottom of the furnace in contact with the metal itself, which rapidly becomes melted by this direct and forcible application of flame thereupon. In the above operation either the neutral or the reducing flame or the oxidizing-flame may be used, depending upon the character of the metal to be melted, and in the same melting operation the flame may be changed from one to the other of said kind of flames, as may be determined by the operator. In the melting of brass it may be desirable to first start with a flame having a suitable excess of carbon, after which the excess of carbon may be increased, and finally the flame may be changed to be substantially the same in character as the flame first applied. The flame which is applied to the metal as above stated is a whirling or rotating flame, which sweeps across the metal. In the present instance and by preference this flame is a flame composed of a plurality of flame-jets emanating from the upper portion of the furnace above the plane of the vent-opening. These flame-jets, being downwardly directed and converging, combine to form a single flame, which by striking the opposite curved wall of the furnace is given a rotating movement across and in contact with the metal before finding exit through the vent-opening. This flame is therefore caused to move rearwardly above the metal and thence downwardly and forwardly over and in contact with the metal, and in practice such flame makes a complete circle by sweeping across the metal a second time before passing out through the vent-opening, which is arranged below the point of entrance of fuel into the furnace. If it is desired to purify or free the molten metal (more particularly iron and steel) of metalloids, the bottom of the furnace is tilted or oscillated forward—that is, to the left (see Fig. 1)—to such a position that the molten metal will be in the direct path of the blast or jets, but in front or rather below the focusing-point of these blasts or jets, whereby the latter will penetrate the molten metal and keep it in a state of violent agitation. At the same time the hydrocarbons will cause the necessary reactions for bringing about the purification of the metal. By tilting or oscillating the furnace in the opposite direction the metal can be poured off through the vent opening or spout. It is understood that the pipes 8 have a swiveling connection with the hollow trunnions, so as to permit the oscillation above described. My novel process therefore consists broadly in the application to the metal of a flame whirling or rotating in a substantially vertical plane and arranged to sweep across and in contact with the metal, and a second feature contemplates the penetration of molten metal by the flame itself. When the furnace is in its upright position, as shown in the drawings, at which time the actual melting takes place, either a reducing-flame or a neutral flame may be employed, as determined by the operator. When, however, the furnace is tilted, as hereinbefore referred to, the mass of molten metal will be brought into the path or line of direction of the jets, which will thereupon strike against and penetrate such mass, and the flame of the jets will be such as desired by the operator, according to the particular character of the metal being treated and the particular character of product sought. In this novel stage of the treatment of some metals, such as brass, it will be understood that either a reducing-flame or a neutral flame may be used, while in the case of steel and malleable iron, for instance, an oxidizing-flame may be used. Particularly in the case of brass and the like this penetration of the molten mass by the flame itself is of importance and utility, inasmuch as it gives that violent agitation or boiling and the consequent results which occur when, as in ordinary practice, the molten brass is "poled," as it is called—that is, stirred by a long wooden pole, usually of green birch-wood. In case the brass, copper, or bronze becomes of the same condition as results from "overpoling" under the old process, and thereby becomes brittle, it may be brought back to proper condition by passing free air through the furnace or by using my oxidizing-flame.

I claim—

1. The method of melting metals which consists in combining a plurality of flame-jets into a single flame, giving this flame a whirling movement and bringing it into contact with the metal to be melted; substantially as described.

2. The method of melting metals which consists in introducing into a melting-chamber from one side only thereof and at a point above the metal a plurality of downwardly-directed flame-jets which meet and combine into a single flame, and causing the flame to rotate in a vertical plane and in contact with the metal; substantially as described.

3. The method of melting metals which consists in combining a plurality of flames into a single flame and causing this flame to move downwardly and thence forwardly over and in contact with the metal; substantially as described.

4. The method of melting metals which consists in causing a flame to move rearwardly above the metal, thence downwardly and forwardly over and in contact with the metal and then to sweep a second time rearwardly, downwardly and forwardly over and in contact with the metal and thence out from the furnace; substantially as described.

5. The method of melting metals which consists in causing a flame to move laterally over and in contact with the surface of the metal,

thereby melting it, and then changing the direction of movement of the flame relative to the metal and causing it to impinge directly upon and penetrate into the body of molten metal; substantially as described.

6. The method of melting metals which consists in causing a flame to move laterally over and in contact with the surface of the metal, thereby melting it, and then bringing the molten metal directly into the path of the flame and causing the flame to impinge directly upon and penetrate into the body of molten metal; substantially as described.

7. The method of melting metals which consists in causing a flame to rotate downwardly upon and thence forwardly over and in contact with the surface of the metal, thereby melting it, and then changing the direction of movement of the flame relative to the metal and causing it to impinge directly upon and penetrate into the body of molten metal; substantially as described.

8. The method of melting metals which consists in causing a hydrocarbon-flame to rotate downwardly upon and thence forwardly over and in contact with the surface of the metal, thereby melting it, and then changing the direction of movement of the flame relative to the metal and causing it to impinge directly upon and penetrate into the body of molten metal; substantially as described.

9. The method of melting metals which consists in combining a plurality of flames into a single flame, causing such flame to move laterally over and in contact with the surface of the metal, thereby melting it, and then causing such flame to impinge directly upon and penetrate into the body of molten metal; substantially as described.

10. The method of melting metals which consists in causing a flame to enter a furnace-chamber containing the metal and move rearwardly above the metal and thence downwardly and forwardly over and in contact with the metal, and removing the products of combustion from the furnace at such a point that they do not come in contact with the entering flame at a point below that of entrance of fuel into the furnace; substantially as described.

11. The method of melting metals which consists in combining a plurality of flames into a single flame and causing this flame to move downwardly and thence forwardly over and in contact with the metal, and removing the products of combustion from the furnace at a point below that of entrance of fuel into the furnace; substantially as described.

12. The method of melting brass which consists in applying to the brass to be melted a flame which at its first application contains a certain excess of carbon and subsequently an increased excess of carbon; substantially as described.

13. The method of melting brass which consists in applying to the brass to be melted a flame having a certain excess of carbon, then a flame having an increased excess and finally a flame similar to the one first applied; substantially as described.

EDWARD H. SCHWARTZ.

Witnesses:
S. E. HIBBEN,
LOUIS B. ERWIN.