No. 725,490. PATENTED APR. 14, 1903.

E. H. SCHWARTZ.

FURNACE.

APPLICATION FILED APR. 9, 1902.

NO MODEL. 2 SHEETS—SHEET 1.

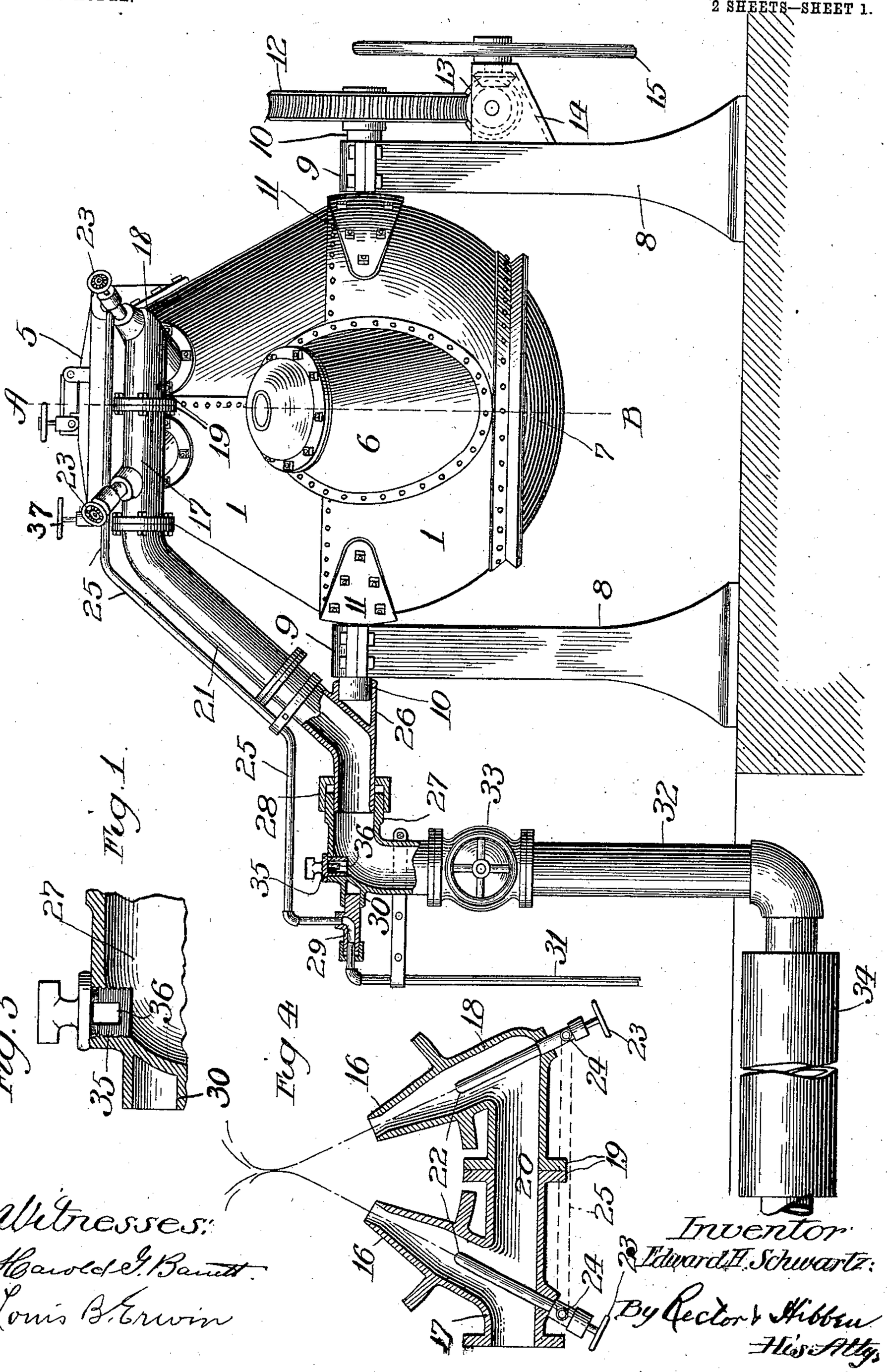

Fig. 1.

Fig. 5

Fig. 4

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3

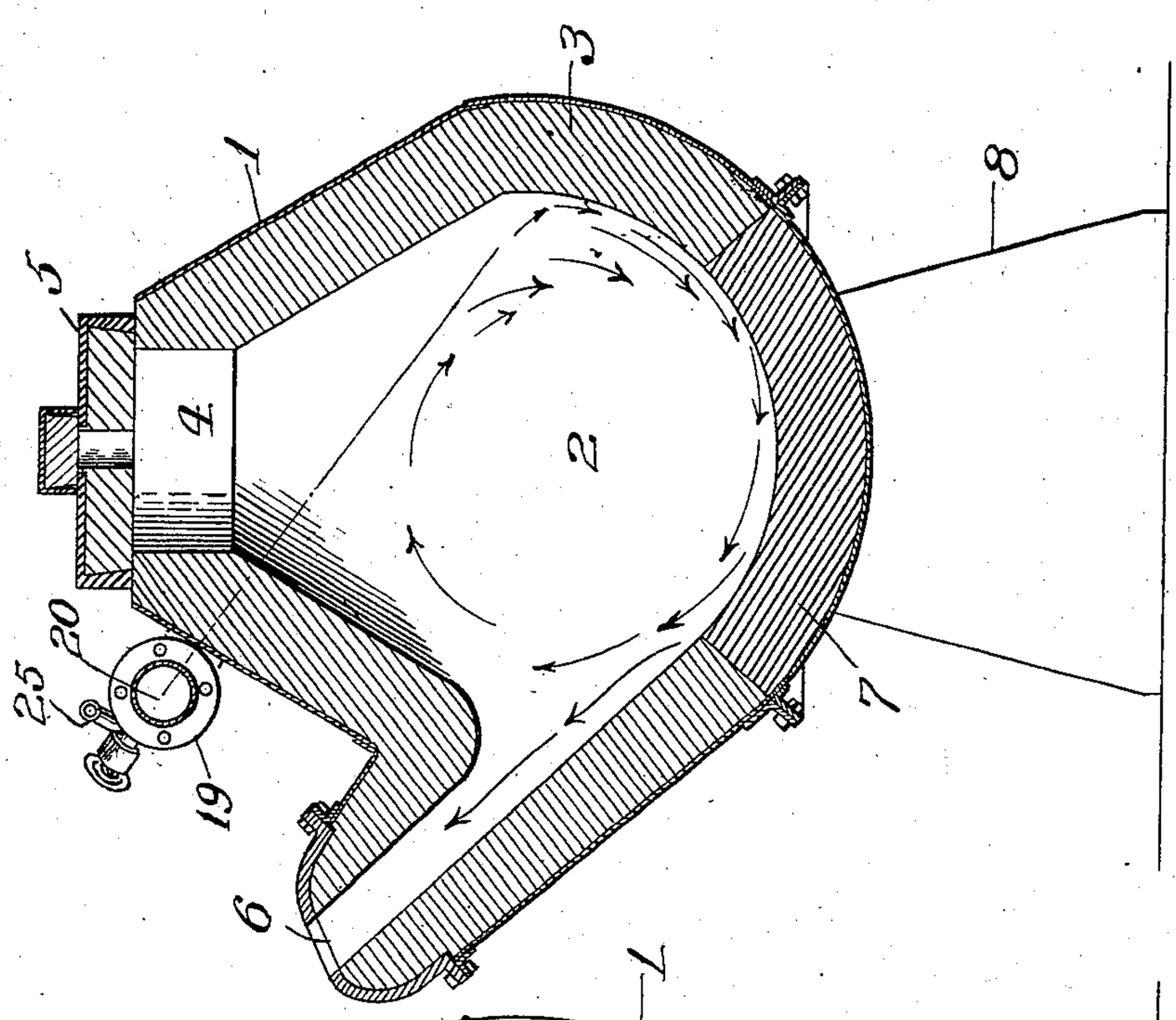
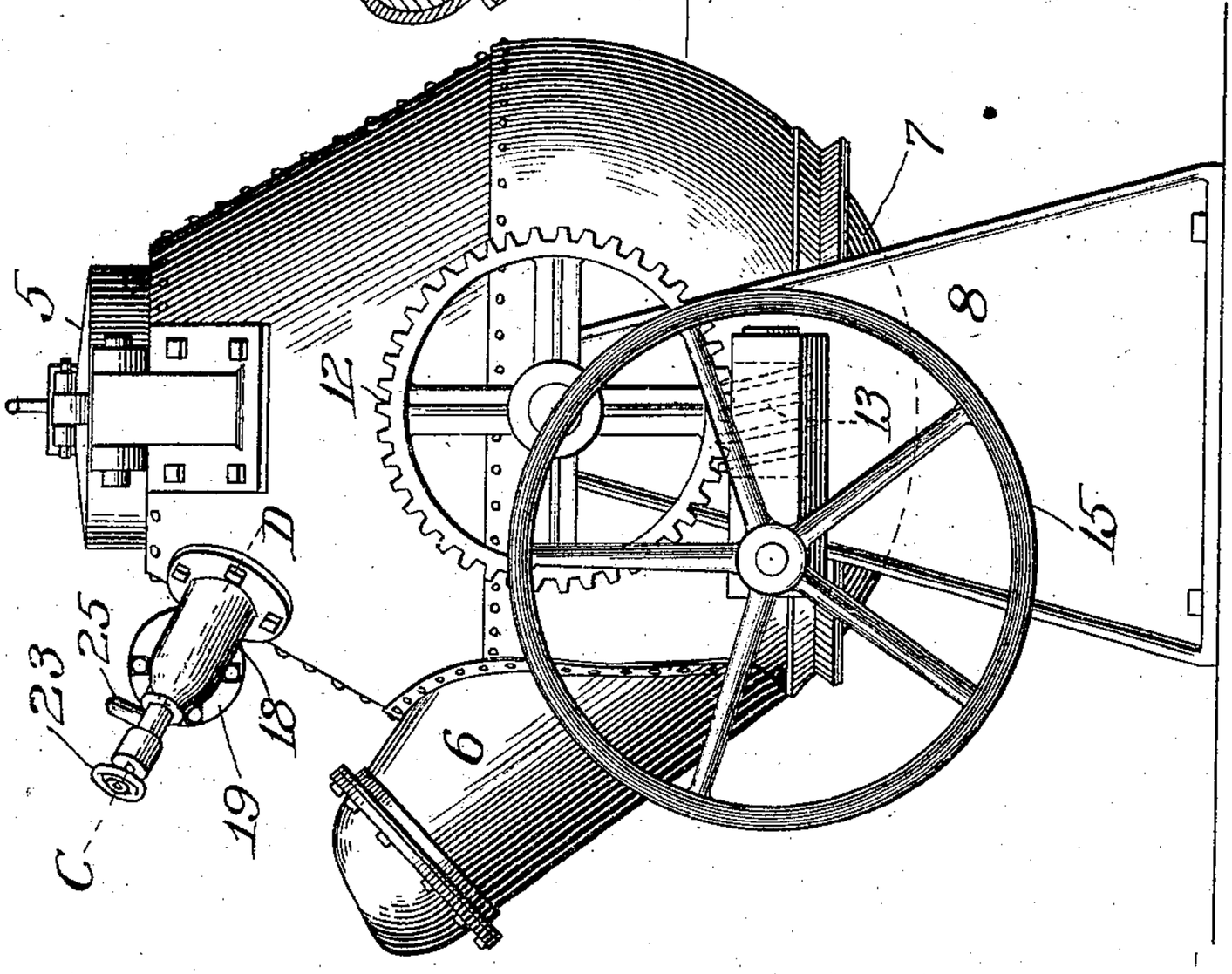


Fig. 2



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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.

FURNACE.

SPECIFICATION forming part of Letters Patent No. 725,490, dated April 14, 1903.

Application filed April 9, 1902. Serial No. 102,103. (No model.)

To all whom it may concern:

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

My invention pertains to a furnace in which a gaseous or equivalent fuel is employed for the purpose of melting or in any manner treating metals of all kinds, as well as smelting or otherwise treating their ores, which furnace is of the same general character and operation as that described in my two previous United States patents issued on September 9, 1902, Nos. 708,782 and 708,783.

My present invention comprises certain new and useful improvements in the structure of the furnace and the various fixtures or attachments thereof, whereby a more efficient furnace of the character described is provided.

In the drawings, Figure 1 is a front elevation of the melting-furnace complete, with a portion of the air and oil pipes in section; Fig. 2, a side elevation of the furnace; Fig. 3, a central section of the furnace on the line A B of Fig. 1. Fig. 4 is an enlarged section of the burners on the line C D of Fig. 2, and Fig. 5 a detail view of a regulating-valve for the air-supply.

My furnace, herein shown, comprises a shell 1, substantially spherical in general outline and having an interior furnace-chamber 2, also substantially spherical, particularly as to its lower portion, which chamber is provided with a lining 3 of suitable refractory material. The furnace-chamber has a top charging-opening 4, closed by a door 5, and also a lateral opening or spout 6, which inclines or extends obliquely upward, so as to form a vent-opening, and a top or spout, whereby the gases and products of combustion may escape and the molten metal may be poured off when desired. Inasmuch as this vent-opening becomes highly heated, owing to the passage therethrough of the products of combustion, it forms an excellent tap or spout for pouring off the molten metal because of the heated condition thereof. The bottom of the furnace is preferably made as a removable section 7, held to the other portion of the furnace by bolts or in any other suitable manner. As herein shown, the shell or casing of the furnace is made of plates, which are riveted together, and the spout 6 is also formed of plates riveted to the shell. This spout is preferably provided at its outer end with a cap-piece 6^a, provided with an opening corresponding to the vent-opening and preferably bolted to the spout 6.

The furnace is adapted to oscillate in the frame, which is here shown as composed of two standards 8, having at their upper ends suitable bearings 9 to receive trunnions 10, which in the present instance extend laterally beyond their bearings in the standards and form a part of a casting, whose flat curved portion 11 is bolted or otherwise secured to the casing or shell. Suitable means are provided to oscillate the furnace, and, as herein shown, a worm-gear 12 is secured to the right-hand trunnion (see Fig. 1) and is driven by a worm 13, rotatable in bearings 14 on one of the standards 8. Through suitable gearing the worm is in turn driven by the hand-wheel 15.

Projecting through one side or wall of the furnace above the vent-opening 6 is a pair of burners, which are convergingly arranged and downwardly directed, so as to focus the jets of gas and flame at a point at or near the central vertical axis of the furnace, where such meeting jets combine to form a single flame, which strikes the opposite side or wall of the furnace in an oblique direction, as illustrated in Fig. 3. Inasmuch as the place of contact of the flame against this wall of the furnace is downwardly curving, as shown in the drawings, the flame will be deflected downwardly and will be given a rotating or whirling movement in a vertical plane before being permitted to escape through the vent-opening. The flame will thus sweep across the metal to be melted and treated and will have one or more complete rotations within the furnace-chamber before escaping through the vent-opening, all as diagrammatically illustrated in Fig. 3 of the drawings.

The burners may be suitably constructed and properly supplied with the necessary gas, preferably hydrocarbon gas, and in the drawings is illustrated an efficient arrangement and construction for the purpose intended.

As shown, the burners form part of the two castings 17 and 18, having meeting flanges 19 bolted together and provided with an air-supply passage 20, connecting with the air-supply pipe 21, which is bolted to the casting 17. The above construction is an efficient one in actual practice; but it is obvious that the details of construction and arrangement may be varied in many particulars without departing from the spirit of my invention. As shown more clearly in Figs. 1 and 4, each burner is supplied with an oil or gas injector 22, provided with a hand or controlling valve 23. Each injector communicates, through the branch pipe 24, with an oil-supply 25, which, as shown in Fig. 1, is attached to and runs parallel with the air pipes and passages 20 and 21.

In order that the furnace may be oscillated without disturbing the connections of the air-supply pipes, the air-pipe 21 is provided with a socket 26 to receive the projecting end of the left-hand trunnion, Fig. 1, and has a swing-joint or swiveling connection with the elbow 27, but held in place by the coupling-ring 28. Likewise a similar swing-joint provision is made for the oil-pipe by extending the lower end of the latter into a cylinder or block 29, swiveled in the socket 30, formed in the elbow 27, which block has a passage communicating between such pipe 25 and the stationary supply-pipe 31, also swiveled on said block, and which is connected to a suitable source of oil-supply.

Air is supplied from any suitable source through the stationary upright pipe 32, which is provided with a shut-off valve 33. In practice it has been found that where a blower is used to supply the necessary air the air pulsates, and the effect is noticed by objectionable pulsations of flame, &c., in the furnace-chamber, whereas it is desirable that the pressure through the burners be substantially uniform and constant, according to the regulation made by the operator. Hence as the blower is a convenient apparatus to supply the sufficient volume of air means have been devised to overcome the above objection without dispensing with the blower, such means here consisting of a tank or chamber 34 of suitable dimensions and forming part of the air-supply passage. This tank forms an equalizing medium or storage-reservoir in which a substantially constant air-supply is maintained, so that the pulsations caused by the blower will not be transmitted to the furnace-chamber, but will be in fact absorbed in such equalizing chamber or tank.

It is desirable that the amount of air supplied to the burners be regulated by the operator independently of and without disturbing the shut-off valve, and to this end the elbow 27 is provided with a screw-threaded vent-opening near its top, which is regulated by the screw-plug 35, which is hand-manipulated and which is provided at its screw portion with the transverse opening, which by the screwing upward of the plug is adapted to be put into communication with the vent-opening, and thereby relieve or vent to atmosphere a portion of the air supplied through the air-pipe, so that a less amount of air will be supplied to the burners. This arrangement forms a convenient and efficient means for regulating the amount of air to a nicety.

By simply manipulating the valves governing the air and gas or oil supply it is possible to obtain the proper character of jet or flame necessary for the particular melting, reduction, or refining of the metal being treated. It is thus possible to obtain an oxidizing-flame, a reducing-flame, and a carborizing-flame. For instance, by increasing the proportion of oil or gas with respect to the air-supply by regulation of the valve 37 on the oil-supply pipe the flame may be changed from an oxidizing-flame to a reducing-flame.

The furnace having been charged with metal through the charging-door and such furnace being in its normal upright position, as shown in the drawings, 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 or approximately in contact with the metal itself, which rapidly becomes melted by this application of flame thereupon. As hereinbefore stated, the burners are directed downwardly and convergingly toward the furnace-wall opposite to that in which they are located, so as to cause a whirling of the flame and heated gases around in the furnace-chamber before their exhaust through the vent-opening, the jets after focusing spreading out in a broad flame of great heat.

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. 2)—to such a position as that the molten metal will be in the direct path of the blast or jets, so that the same 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. As will be clearly apparent from an examination of the drawings, the rotation of the hand-wheel 15 will rotate the worm-gear 12 and transmit a tilting movement to the furnace through the trunnion. By the employment of the worm a positive and powerful movement is possible.

While it is preferred to employ a gaseous fuel produced from petroleum or the like, yet it is evident that the proper flame may be obtained from other sources, even powdered coal might be utilized, although the same is not as desirable as the gaseous fuel of petroleum owing to the presence of sulfur in

the coal, which sulfur has a deleterious effect in the treatment of metal. Furthermore, I contemplate using my invention wherever applicable, and while my furnace is herein described as for melting and treating metals, yet it will be understood that I employ these terms in the general sense for all treatments of metals, as well as of their ores.

I claim—

1. In a furnace the combination of a casing, a pair of independently-removable burners secured to the casing and to each other to form a continuous air-passage and a gas or oil injector for each twyer.

2. In a furnace, the combination of a casing or furnace-chamber, a pair of connected burners projecting into the casing and having flanges secured thereto and also having flanges at their meeting ends.

3. In a furnace, the combination of a casing, a pair of burners secured to the casing and to each other, a gas or oil injector for each burner, separate regulating-valves for the injectors, a gas or oil supply pipe and a valve for said pipe.

4. The combination of a casing forming a furnace, a pair of burner-heads 17 and 18 arranged at one side only of the furnace and having the converging burners 16, injectors 22 in said heads, said heads being secured together to form a passage 20 and an air-supply pipe 21.

5. The combination of a casing or furnace-chamber having a burner for air and gas or oil, an air-supply pipe having a shut-off valve and means for regulating the air-pressure independently of said valve.

6. The combination of a casing or furnace-chamber having a burner for air and gas or oil, an air-supply pipe having a shut-off valve and a separate valve governing a vent-opening in the air-supply pipe between the shut-off valve and the burner.

7. The combination of a casing or furnace-chamber having a burner for air and gas or oil, and an air-supply pipe having a shut-off valve and having a vent-opening between said valve and the burner and a regulating-valve for said opening comprising a plug 35 provided with an opening 36 and screwing into the vent-opening.

8. The combination of an oscillating casing or furnace 1 mounted to tilt or oscillate on trunnions, stationary oil and air supply pipes 31 and 32 respectively, a burner in said furnace and connections between the burner and said supply-pipes and independent of the trunnions, said connections being capable of swiveling on said supply-pipes.

9. The combination of a casing 1 formed of plates and having an interior lining of refractory material, standards 8, trunnions comprising the trunnion proper 10 and a flat portion 11 secured to the casing and arranged to bear in said standards, and a burner entering said casing and having supply connections constructed and operating independent of the trunnions.

10. The combination with the standards 8 of a casing or furnace having trunnions bearing in said standards and projecting therebeyond, a burner for said furnace, an air-pipe 21 for said burner and provided with a socket 26 to receive the trunnion, and a stationary air-supply pipe 32 with which the pipe 21 has a swiveling connection.

11. The combination with the standards 8, of a casing or furnace having trunnions bearing in said standards and projecting therebeyond, a burner for said furnace, an air-pipe 21 for said burner and provided with a socket 26 to receive the trunnion, a stationary air-supply pipe 32 communicating with pipe 21 and having a socket 30, a block 29 received by the socket 30, a fuel-pipe 25 communicating at one end with the burner and at the other with the block and a stationary fuel-supply pipe 31 with which the block has a swiveling connection.

12. The combination of a furnace mounted to tilt or oscillate on trunnions and having a burner for supplying the flame of oil, gas, or the like, air and oil or gas supply pipes which are stationary, and swing-joint connections arranged between said burner and said supply-pipes and independent of said trunnions; substantially as described.

13. In a furnace of the class described, the combination of a furnace shell or casing, a pair of joined burner-heads secured to the shell or casing and having meeting flanges 19 secured together, said heads comprising a casing having an air-supply passage 20 and converging nozzles 16 entering the side of the shell or casing, and injector-pipes 24 passing through the side of the burner-casing and arranged axially of the nozzles 16, and hand-valves 23 for regulating the supply of gas or oil through said injector-pipes; substantially as described.

14. The combination of a tiltable furnace having trunnions, a burner device arranged on the furnace to discharge therein flame of oil, gas or the like, stationary air and fuel supply pipes having adjacent to one trunnion a swiveling connection with the burner device and arranged in axial alinement with such trunnion, a worm-gear connected with the other of said trunnions, and a worm for operating said gear.

15. The combination of a tiltable furnace having trunnions, a stationary supporting-frame in which such trunnions are mounted, a burner arranged on the furnace to discharge flame therein and having air and fuel pipes movable with the furnace, stationary air and fuel supply pipes arranged adjacent one of the trunnions and having swing-joint connection with said movable pipes in axial alinement with the trunnions, a worm-gear connected with the other of said trunnions, and a worm for operating said gear.

16. The combination of a tiltable furnace having trunnions, a stationary supporting-frame in which such trunnions are mounted, a burner arranged on the furnace to discharge flame therein and having air and fuel pipes movable with the furnace, stationary air and fuel supply pipes arranged adjacent one of the trunnions and having swing-joint connection with the movable pipes in axial alinement with the trunnions, a worm-gear connected with the other of said trunnions, a bracket on said supporting-frame, a worm mounted in said bracket and meshing with the worm-gear, and means for actuating said worm.

17. The combination of a tiltable furnace having trunnions, a stationary frame having bearings in which such trunnions are mounted and beyond which they extend laterally, a burner, and air and fuel pipes therefor arranged on the furnace and movable therewith, the air-pipe being mounted upon one of the extended trunnions, stationary air and fuel supply pipes having swing-joint connection with the movable pipes, a worm-gear connected with the other extended trunnion, and a worm on the frame for actuating the gear.

18. The combination of a tiltable furnace arranged to tilt or rock on trunnions and provided with a burner, a separate air and a fuel supply pipe connected to said burner and movable with the furnace, a stationary air-supply pipe communicating with a source of supply and a swing-joint connection between the movable and the stationary air-supply pipe.

19. The combination of a tiltable furnace having a burner arranged to discharge therein flame of oil, gas or the like, trunnions on the furnace on which it tilts or rocks, an air and a fuel supply pipe communicating with said burner, a block arranged to rock with the furnace on the line of the axis of said trunnions and having a fuel-supply passage communicating with said fuel-supply pipe, and means for supplying said block with fuel.

20. The combination of a furnace arranged to tilt on trunnions and provided with a burner, separate air and fuel pipes connected to said burner and movable with the furnace, the air-pipe being connected at its lower end to one of the trunnions and movable in unison therewith, stationary air and fuel supply pipes, and means independent of the trunnions for connecting said stationary and movable pipes and uninfluenced by the tilting movements of the furnace.

21. The combination of a tiltable furnace having a burner arranged to discharge a flame therein, trunnions for the furnace on which it rocks or tilts, a fuel-supply pipe communicating with the burner, a source of fuel-supply, and a block arranged to rock in unison with the furnace and having a longitudinal and a lateral passage communicating with each other, the latter of which passages is in communication with said fuel-supply pipe and the former of which with said source of fuel-supply.

22. The combination of a tiltable furnace having a burner arranged to discharge a flame therein, trunnions for the furnace on which it rocks or tilts, an air-supply pipe communicating with said burner, a fuel-supply pipe also communicating therewith, a block arranged to rock with the furnace on the line of the axis of said trunnions and having a fuel-supply passage, an end cap secured to the end of said block and a stationary fuel-pipe passing through said cap and communicating with the said fuel-supply passage.

23. The combination, with a supporting-frame, of a tiltable shell or furnace-body having trunnions bearing in said frame, a burner for said furnace-body, a fuel-supply pipe communicating with the burner, an air-pipe 21 connected to said furnace-body and communicating with said burner, the outer end of said pipe extending on a line of the axis of the trunnions, and a stationary air-supply pipe with which the air-pipe 21 has a swiveling connection.

24. The combination, with a supporting-frame, of a shell or furnace-body having trunnions bearing in said frame, a burner for said furnace-body, an air-pipe 21 connected to said furnace-body and communicating with said burner, the outer end of said pipe extending on a line of the axis of the trunnions, a stationary air-supply pipe with which the air-pipe 21 has a swiveling connection, and a fuel-pipe 25 also communicating with the burner and arranged to swivel upon said stationary air-pipe.

25. The combination of a tiltable furnace having a burner, trunnions for the furnace on which it rocks or tilts, fixed or stationary air and fuel pipes, and means independent of the trunnions for connecting said pipes and the burners and uninfluenced by the rocking or tilting movements of the furnace.

26. The combination, with a supporting-frame, of a shell or furnace-body having trunnions bearing in said frame, a burner for said furnace-body, pipes connected to the furnace and movable therewith for supply of air and fuel respectively to the burner, and stationary air and fuel supply pipes on which the movable pipes are arranged to swivel on a line of the axis of the trunnions.

27. The combination of a tiltable furnace having trunnions on which it rocks or tilts as an axis, a burner entering said furnace at a point above its axis, a stationary fuel-supply pipe, a fuel-supply pipe communicating with said burner and swiveled to said stationary pipe on a line of the axis of the furnace, and a separate pipe for supplying air to said burner.

28. The combination of a tiltable furnace having trunnions on which it rocks or tilts as an axis, a burner entering said furnace at a

point above its axis, and separate air and fuel supply pipes connected to said burner and communicating between such burner and a source of supply of air and fuel respectively.

29. The combination of a tiltable furnace having trunnions on which it rocks or tilts as an axis, a burner entering said furnace at a point above its axis, separate air and fuel supply pipes communicating with said burner and movable with the furnace, and stationary air and fuel supply pipes on which the said movable pipes are arranged to swivel.

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