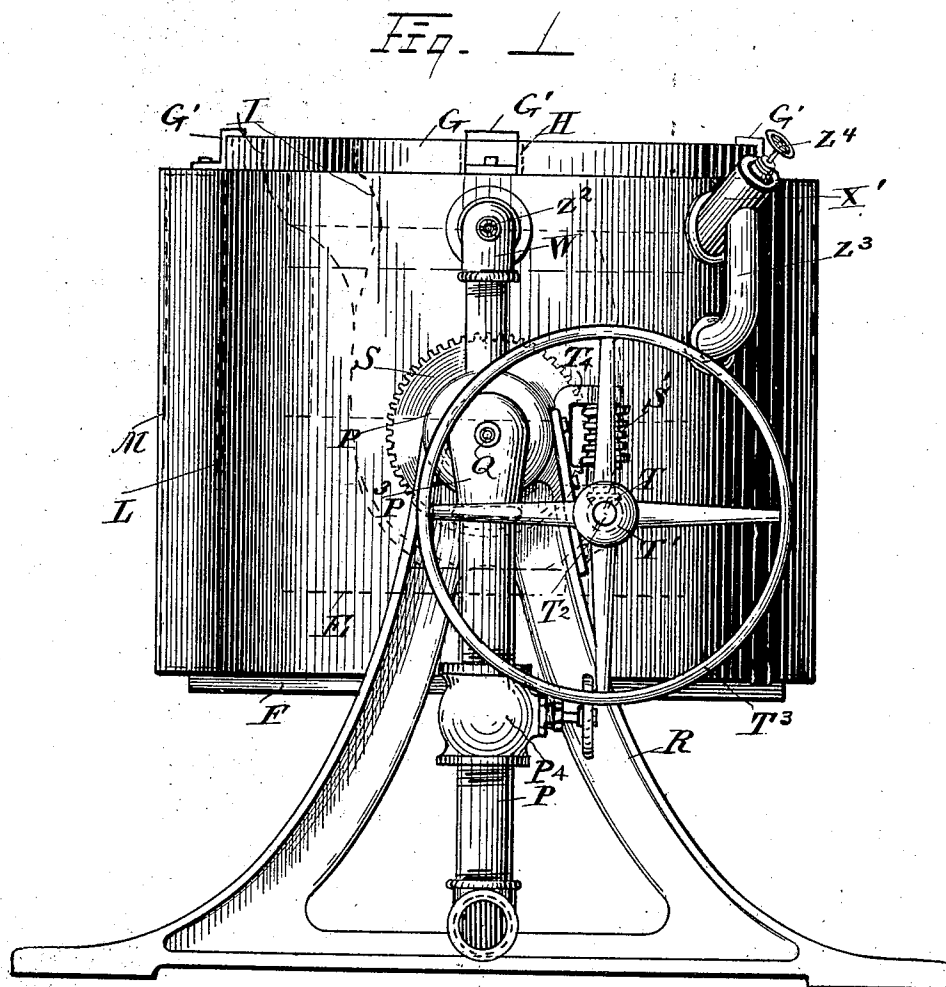


Dec. 19, 1922.

J. A. GASKILL.
TILTING FURNACE,
FILED JAN. 12, 1920.

1,439,409

3 SHEETS-SHEET 1



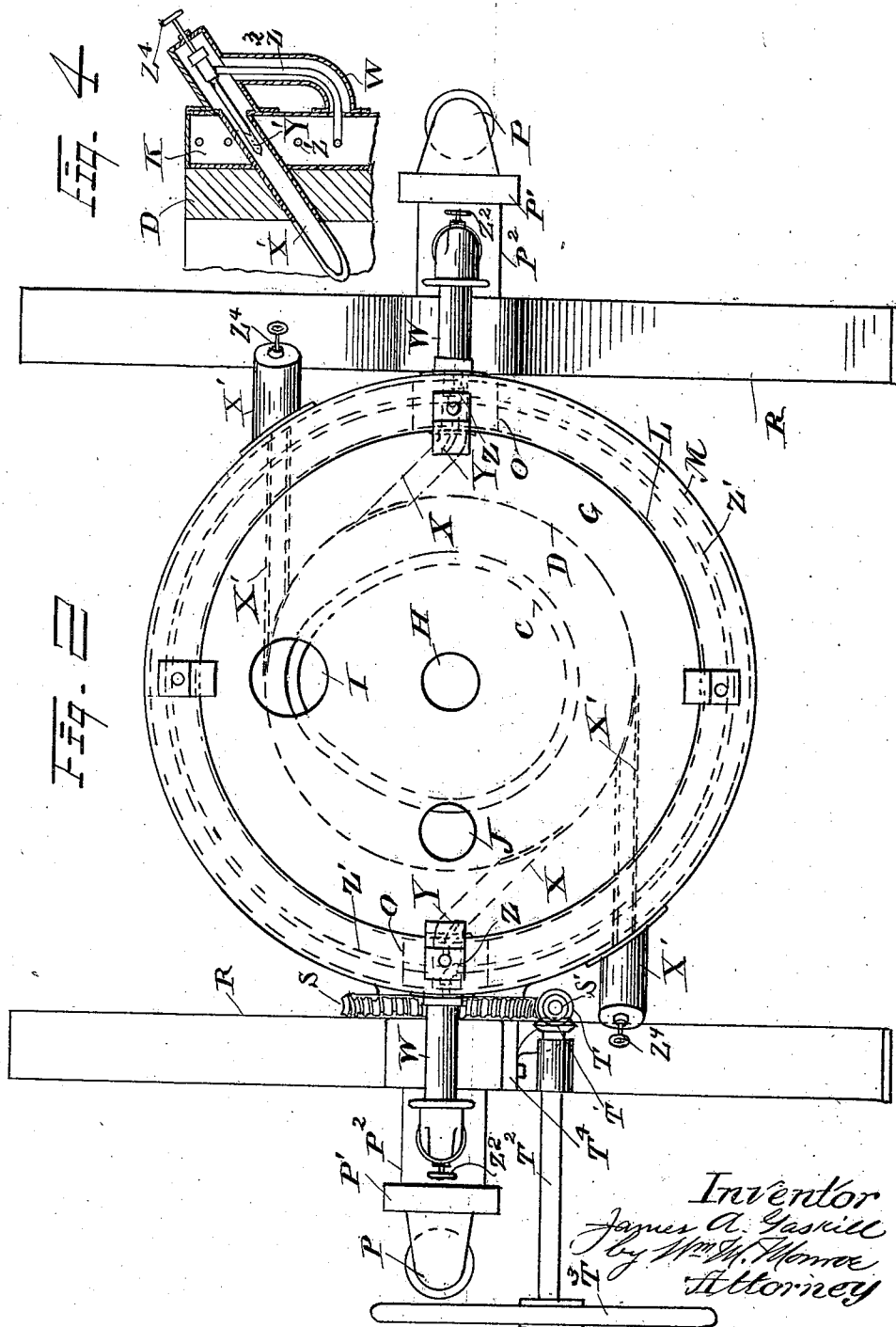
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3 SHEETS-SHEET 2

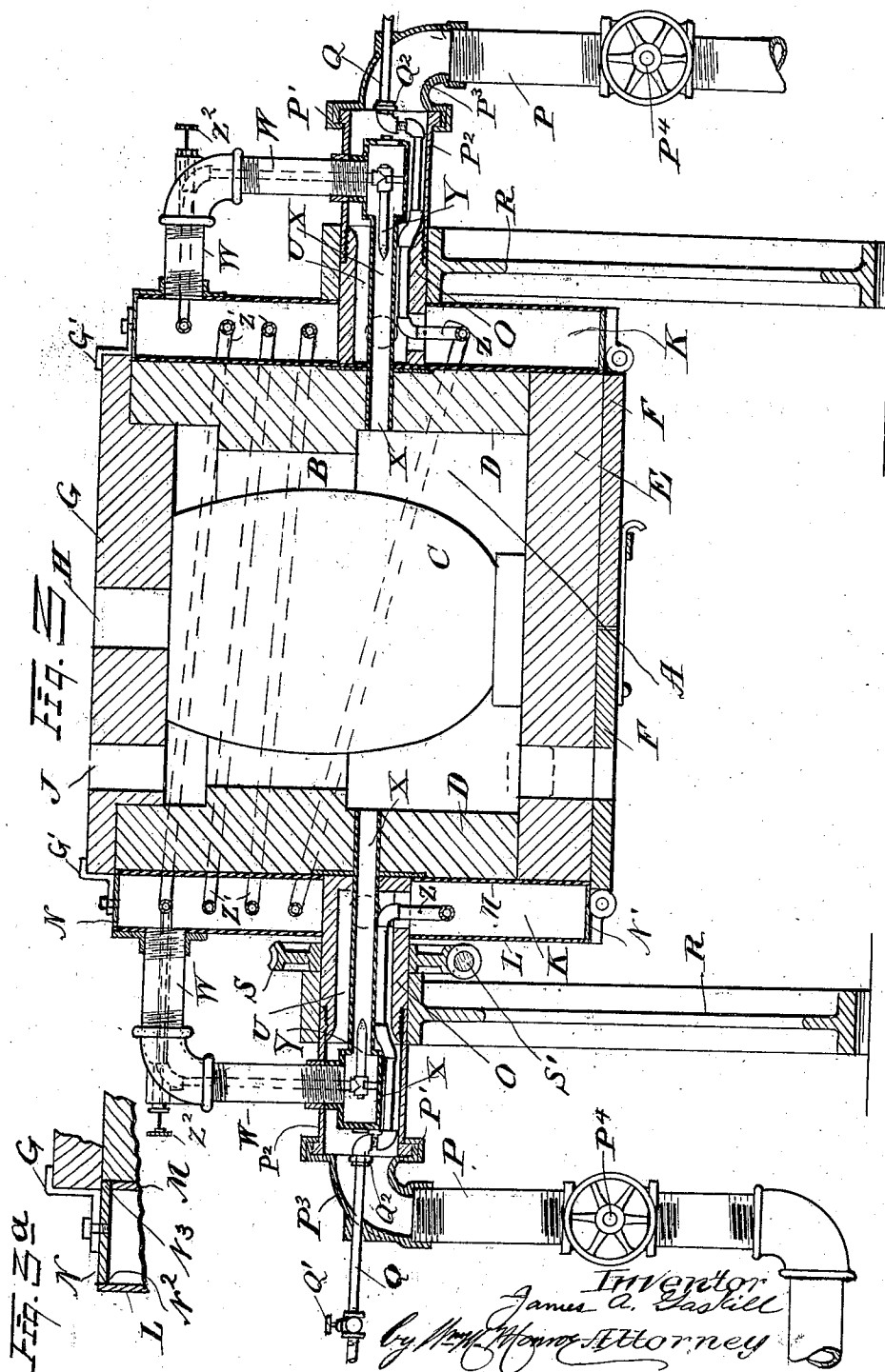


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3 SHEETS SHEET 3



UNITED STATES PATENT OFFICE.

JAMES A. GASKILL, OF CLEVELAND, OHIO.

TILTING FURNACE.

Application filed January 12, 1920. Serial No. 350,756.

To all whom it may concern:

Be it known that I, JAMES A. GASKILL, a citizen of the United States, and resident of Cleveland, in the county of Cuyahoga and State of Ohio, have invented certain new and useful Improvements in Tilting Furnaces, of which I hereby declare the following to be a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same.

The objects of the invention are to provide a furnace for melting steel and other metals in which burners for oil or gas or liquid tar are employed and in which preheated air under pressure supplies the blast for the burners and by means of which controllable degree of temperature ranging from 300° to 3500° Fahrenheit is readily obtained.

The invention particularly relates to the adaptation of the idea of a preheated air blast to a furnace mounted upon trunnions and capable of being tilted for convenience in pouring the hot metal.

In this device all the parts, the melting chamber, an air preheating and pressure equalizing chamber to which heat is transmitted from the melting chamber, and burners for fluid oil or tar are included in one unitary structure.

By this means an efficient furnace is constructed which is compact in shape and occupies a small space for installation, and is an improvement in efficiency and practicality over the oil burning furnaces now in use with which a pre-heated air blast is not employed.

In the present device the air is preheated and is delivered under a uniform amount of pressure and a uniform degree of temperature to all the burners which are evenly spaced about the melting chamber and crucible, so that the crucible is enveloped in flame, and all parts are subjected to an even temperature, and to a preheated and perfectly dry air blast, which materially prolongs the life of the crucible and furnace lining.

The air blast is supplied from an unobstructed annular chamber enclosing the melting chamber and is heated by heat transmitted therefrom, and the air in this chamber is placed under a constant and uniform amount of pressure throughout by means of external blowing mechanism, and the air

and oil supply pipes pass through the trunnions of the furnace so as not to interfere with the tilting of the furnace.

The invention also includes the method of superheating the fuel oil prior to entering the burners by enclosing the oil supply pipes in the heated air chamber, which has the effect of heating and vaporizing the fuel oil practically to the point of a combustible gas before it enters the burners. It also insures the unobstructed flow of oil in cold weather.

It also includes a burner nozzle, or burner nozzles for the fuel oil and a tube or tubular chamber open at the inner end within which the highly rarefied fuel oil and superheated air in a highly rarefied or gaseous condition are commingled, under pressure, before entering the melting chamber and are therefore in a condition to ignite instantaneously in the melting chamber.

The burners also discharge tangentially of the wall of the melting chamber so that the blast will not impinge directly upon the crucibles, and the air being dry the crucibles are not corroded or cut away as would occur as a result of the action of a damp cold blast directed upon them.

The invention includes a swivelled connection for the fuel oil and air supply pipes, permitting the tilting of the furnace, valves for controlling air and oil supply and a worm wheel and worm for operating the furnace, which mechanism permits the furnace to stand at any desired angle without movement.

The invention is hereinafter further described, shown in the accompanying drawings and specifically pointed out in the claims.

In the accompanying drawings Fig. 1 is a side elevation of the device; Fig. 2 is a plan thereof; Fig. 3 is a vertical longitudinal section thereof; Fig. 3^a is a section showing the manner of constructing the shell of the outer chamber; Fig. 4 is a vertical section of an additional burner entering the chamber at the upper end.

In these views A is the melting chamber having preferably a narrowed zone B intermediate of its top and bottom to confine the flame to the walls of the crucible C; D is the fire brick lining and E the bottom formed of fire brick; F, F, are hinged bottom doors which can be opened in case the melting chamber becomes clogged or re-

quires a new lining; G is the cover which shuts down closely upon the crucible and is provided with a charging opening H, a pouring opening I, and a gas outlet J. This cover fits tightly down over the crucible and protects the metal from the flame in the combustion chamber, and prevents the metal from absorbing impurities or gases that may be generated in the combustion chamber. By so sealing the crucible the amount of oxidation of the metal is less than in other furnaces. Clips G, G' secure the cover detachably in place.

Enclosing the sides of the melting chamber is shown the annular air chamber K, which is formed of cylindrical steel sheets L, M, and circular heads N and N' preferably welded thereto.

In Fig. 3^a, a detail of one of these heads is shown with the edges alternately abutting and overlapping the sides at N², N³ to lock the parts in place.

O, O, are hollow trunnions upon which the furnace is supported and through which the supply pipes for air and oil P and Q respectively pass.

R, R, are standards upon which the trunnions are mounted, S is a worm wheel and S' a worm engaging therewith, and operated by means of bevel gears T and T' and shaft T² and wheel T³ mounted in a bracket T⁴. Each trunnion is provided with a longitudinal passage U communicating downwardly with the air chamber at its inner end and with the air inlet pipe P² at its outer end. This pipe communicates with the air supply pipe P' and elbow P³ through a swivelled connection P' between the air inlet pipes P and P² and elbow P³ and permits the trunnion to revolve with the furnace and a similar swivelled connection Q² upon the fuel supply pipe is employed for the same purpose. P and P⁴ are supply valves on the air pipes.

The air entering the preheated air chamber under pressure is delivered through air supply pipes W of less diameter than the air inlet pipes P to the elongated commingling tubes or chambers X which are open at their inner ends and discharge into the melting chamber tangentially of its walls.

By means of the compression of a large volume of air in the superheated air chamber detained in this manner an unvarying constant amount of pressure will be supplied to the commingling tubes and the temperature also will be uniformly distributed to all the commingling tubes.

These tubes together with the fuel oil nozzles Y, Y, comprise the burners.

The fuel oil enters the superheated air chamber at Z and passes through the coils Z' spirally wound through this chamber. These coils finally emerge through the smaller air supply pipes W into the central commingling tubes X and communicate di-

rectly with the nozzle Y for the fuel oil. Valves Q' control the flow of fuel through the supply pipes Q and valves Z² control the flow of the rarefied fuel from the coils Z' to the burner nozzle Y.

In this manner the preheated air stored in the compressed air chamber transmits its heat to the fuel oil, so that the fuel oil issues in a vaporous condition from the nozzles Y and is thoroughly commingled with the preheated air in the commingling tubes before entering the melting chamber, in which it instantly ignites. Also if the oil is heavy a constant flow is provided under all atmospheric temperatures.

The flames also enwrap the crucible but do not directly impinge upon it, and the air being hot and dry and the heat being uniformly distributed the crucibles are not subjected to changes in temperature and are not corroded or cut into as when a cold moist blast is employed.

It is understood that the furnace can be operated with only one or with several burners. In Fig. 1 the construction of additional burners is shown. These burners are positioned closely adjacent to the top of the furnace and are inclined both downwardly, and tangentially of the wall of the melting chamber. Air is supplied to these burners from the preheated air chamber K through air pipes W' which extend from the sides thereof and the fuel oil pipes Z² traverse these air pipes.

The burners are similar to those previously described in construction and comprise the fuel nozzle Y' the commingling tube or chamber X' and the controlling valve 23. This addition doubles the degree of heat obtained and reduces the time of melting and increases materially the amount of the production.

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

1. In a tilting furnace, in combination, a melting chamber, annular chamber for hot air encircling the melting chamber, trunnions upon which said annular air chamber and melting chamber are pivotally supported, supports for said trunnions, burners in said trunnions, discharging tangentially of the walls of said melting chamber, each burner comprising an elongated commingling tube open at its inner end, and a nozzle for fuel oil spaced from the inner end of said commingling tube, a passage for air under pressure in each trunnion, said passages communicating with said annular air chamber, passages leading from said annular air chamber to said commingling tubes in said trunnions, air supply pipes communicating with said air passages in said trunnions, said fuel oil supply pipes entering said annular air chamber through said trunnions and traversing said annular air chamber, and

also traversing said air passages leading to said commingling tubes, said fuel oil pipes communicating with said nozzles in said commingling tubes.

5 2. In a tilting furnace, in combination, a melting chamber, annular chamber for hot air encircling the melting chamber, trunnions upon which said annular air chamber and melting chamber are pivotally supported, supports for said trunnions, burners in
10 said trunnions, discharging tangentially of the walls of said melting chamber, each burner comprising an elongated commingling tube open at its inner end and a nozzle for fuel oil spaced from the inner end of
15 said commingling tube, a passage for air under pressure in each trunnion, said passages communicating with said annular air chamber, passages leading from said annular air chamber to said commingling tubes in said
20 trunnions, air supply pipes communicating with said air passages in said trunnions, said fuel oil supply pipes entering said annular air chamber through said trunnions and
25 traversing said annular air chamber, and also traversing said air passages leading to said commingling tubes, said fuel oil pipes communicating with said nozzles in said commingling tubes and swivelled connections
30 for said air and fuel oil supply pipes.

3. In a tilting furnace, in combination, a melting chamber, an annular chamber encircling the same, hollow trunnions upon which said air chamber and melting chamber are pivotally mounted, said hollow trunnions providing air passages leading to said
35 annular air chamber, air supply pipes communicating with said hollow trunnions, elongated commingling tubes enclosed in said hollow trunnions and discharging into said melting chamber, air pipes of less diameter than said air supply pipes connecting
40 said annular air chamber and said commingling tubes in said trunnions, said air pipes rotatable with said furnace, a nozzle for liquid fuel in each commingling tube, supply pipes for liquid fuel, passing through said hollow trunnions and coiled within
45 said annular air chamber, said liquid fuel supply pipes passing through said smaller air pipes and communicating with said nozzles for liquid fuel in said commingling tubes, valves for controlling the admission of air into said air supply pipes, and valves
50 for controlling the supply of liquid fuel to said liquid fuel supply pipes.

4. In a furnace, in combination, a melting chamber, an annular air chamber encircling the same, and heated thereby, a
60 multiple number of burners passing through both of said chambers at different levels, each burner comprising an elongated commingling tube and a nozzle therein for liquid fuel, air passages connecting said
65 commingling chambers with said annular

air chamber, and supply pipes for liquid fuel communicating with said nozzles, said supply pipes for liquid fuel passing through the walls and lining of said heated annular air chamber, and said connecting air pas- 70 sages.

5. In a unitary tilting furnace, a melting chamber, trunnions upon which said melting chamber is pivotally mounted, a support for a crucible therein, cover sealing
75 said crucible and provided with charging and pouring openings, and with an outlet for the products of combustion, a crucible mounted upon said support, an annular air chamber encircling said melting chamber, 80 burners comprising elongated commingling tubes, passing through said annular air chamber and trunnions and wall of said melting chamber and fuel nozzles therein, said burners discharging tangentially of the
85 wall of said melting chamber between said wall and said crucible, external pipes for supplying the air chamber with air, external pipes connecting said air chamber and said commingling tubes, supply pipes for
90 said fuel nozzles passing through said trunnions, and supply passages for air passing through said trunnions, said supply pipes for said fuel nozzles and supply pipes for air, said fuel supply pipes passing through
95 said trunnions and said air supply pipes passing through said trunnions into said external air chamber.

6. In a furnace, in combination, a melting chamber, an air chamber for hot air encircling the same, trunnions upon which
100 said chamber is mounted, supply pipes for air entering said air chamber through said trunnions, supply pipes for fuel passing through said trunnions, burners passing through said air chamber and through the
105 wall of said melting chamber and discharging tangentially of the wall of said melting chamber, each burner including an elongated commingling tube and a nozzle for
110 fluid fuel, said nozzles positioned at the outer end of said commingling tubes, providing an extended unobstructed commingling passage therein, exterior air pipes connecting said annular air chamber with said
115 commingling tubes, said nozzles communicating with said fuel supply pipes.

7. In a furnace, in combination, a melting chamber, an air chamber for hot air encircling the same, trunnions upon which
120 said chamber is mounted, supply pipes for air entering said air chamber through said trunnions, supply pipes for fuel passing through said trunnions, burners passing through said air chamber and through the
125 wall of said melting chamber and discharging tangentially of the wall of said melting chamber, each burner including an elongated commingling tube and a nozzle for fluid fuel, said nozzles positioned at the outer end 130

of said commingling tubes, providing an extended unobstructed commingling passage therein, exterior air pipes, connecting said annular air chamber with said commingling tubes, said nozzles communicating with said fuel supply pipes, said fuel pipes passing through said annular hot air chamber and heated therein prior to entering said nozzles.

8. In a furnace, a melting chamber, a pair of substantially horizontal and oppositely spaced burners for fluid fuel and air discharging tangentially of the wall of said chamber into said chamber at one level, and a pair of oppositely spaced similar burners discharging into said chamber at another level, said second mentioned burners arranged to discharge tangentially of said wall, and also at a vertical angle into said furnace.

9. In a furnace, a melting chamber, a pair of substantially horizontal and oppositely spaced burners for fluid fuel and air discharging tangentially of the wall of said chamber into said chamber at one level, and a pair of oppositely spaced similar burners discharging into said chamber at another level, said second mentioned burners arranged to discharge tangentially of said wall, and also at a vertical angle into said furnace, an annular air chamber encircling said melting chamber, means for supplying hot air from said annular chamber to said burners, and means for supplying fluid fuel to said burners.

10. In a tilting furnace, in combination, a combustion chamber, an air chamber encircling the same and heated thereby, trunnions on which said chamber is mounted, elongated commingling tubes passing through the walls of both chambers and through said chambers, external air supply pipes connecting said commingling tubes at their outer ends with said air chamber, nozzles for fluid oil in the outer extremities of said commingling chambers and supply pipes for fluid fuel, said supply pipes passing through said trunnions and supply pipes for air passing through said trunnions and communicating with said encircling air chamber.

11. In a furnace, in combination, a combustion chamber and an air chamber encircling the same and heated thereby, trunnions upon which said chambers are tiltably mounted, an elongated commingling tube passing through the walls of both chambers and through one of said trunnions, an external air supply pipe connecting said commingling tube at its outer end with said air chamber, a nozzle for fluid fuel in the inner extremity of said commingling tube and a supply pipe for said air chamber and a supply pipe for fluid fuel, said supply pipes passing through said trunnions.

12. In a furnace in combination, a melting

chamber, an external chamber mounted thereon containing air preheated by said melting chamber, trunnions connecting said chambers, said furnace pivotally supported upon said trunnions, air passages in said trunnions, said air passages communicating with said air chamber at their inner ends, air supply pipes, swivelled connections with the outer ends of said trunnions with said air supply pipes, external air pipes connecting the said air chamber with said air passages in said trunnions, and burners in said trunnions, said burners extending through the walls of said furnace, said burners comprising, commingling passages communicating with said external air pipes, and nozzles for liquid fuel, and fuel supply pipes passing through said trunnions and communicating with said nozzles.

13. In a furnace, a revolvable combustion chamber, an enveloping air chamber therefor for preheated air, trunnions upon which said combustion chamber is mounted, axial passages leading through said trunnions, air supply pipes leading to said trunnion passages, downwardly directed passages leading from said trunnion passages into said enveloping air chamber, commingling chambers or passages in said trunnion passages discharging into said combustion chamber, and downwardly directed passages positioned above said trunnions and leading from said enveloping air chamber into said commingling chambers or passages, and fuel burner nozzles discharging into said commingling chambers or passages.

14. In a furnace, a revolvable combustion chamber, an enveloping air chamber therefor for preheated air, trunnions upon which said combustion chamber is mounted, axial passages leading through said trunnions, air supply pipes leading to said trunnion passages, downwardly directed passages leading from said trunnion passages into said enveloping air chamber, commingling chambers or passages in said trunnion passages, discharging into said combustion chamber, and downwardly directed passages positioned above said trunnions and leading from said enveloping air chamber into said commingling chambers or passages, and fuel burner nozzles discharging into said commingling chambers or passages, and fuel supply pipes leading to said burner nozzles through said trunnion passages.

15. In a furnace, a revolvable combustion chamber, an enveloping air chamber therefor for preheated air, trunnions upon which said combustion chamber is mounted, axial passages leading through said trunnions, air supply pipes leading to said trunnion passages, downwardly directed passages leading from said trunnion passages into said enveloping air chamber, commingling chambers or passages in said trunnion passages,

discharging into said combustion chamber, for controlling the flow of fuel and air 10
and downwardly directed passages positioned above said trunnions and leading through said fuel and air pipes.
from said enveloping air chamber into said In testimony whereof, I hereunto set my
5 commingling chambers or passages, and fuel hand this 7th day of January 1920.
burner nozzles discharging into said commingling chambers or passages, and fuel
supply pipes leading to said burner nozzles
through said trunnion passages, and valves

JAMES A. GASKILL.

In presence of—

WM. M. MONROE,
S. W. SANGSTER.