L. WHITTAKER.

FURNACE.

APPLICATION FILED JULY 31, 1908.

941,480. **Patented Nov. 30, 1909.**

2 SHEETS—SHEET 1.

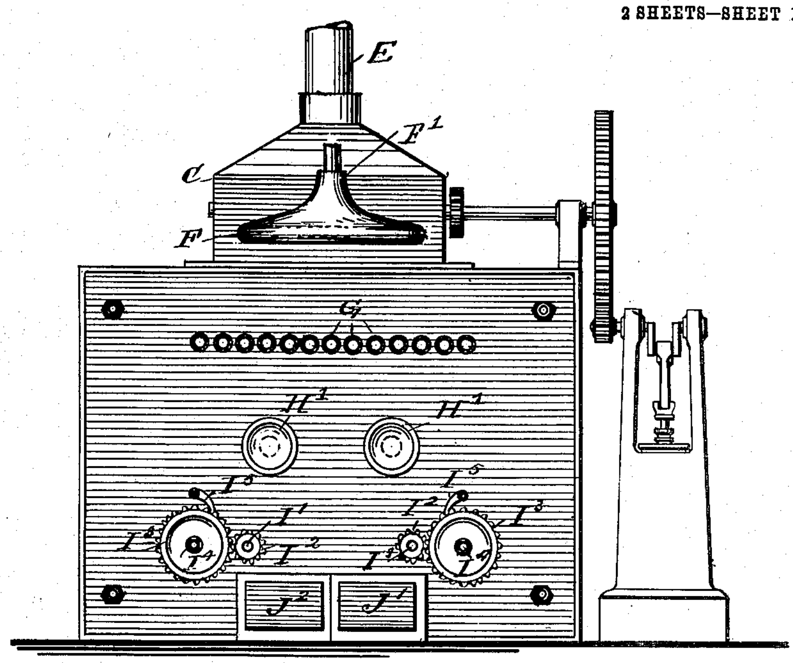

Fig.1

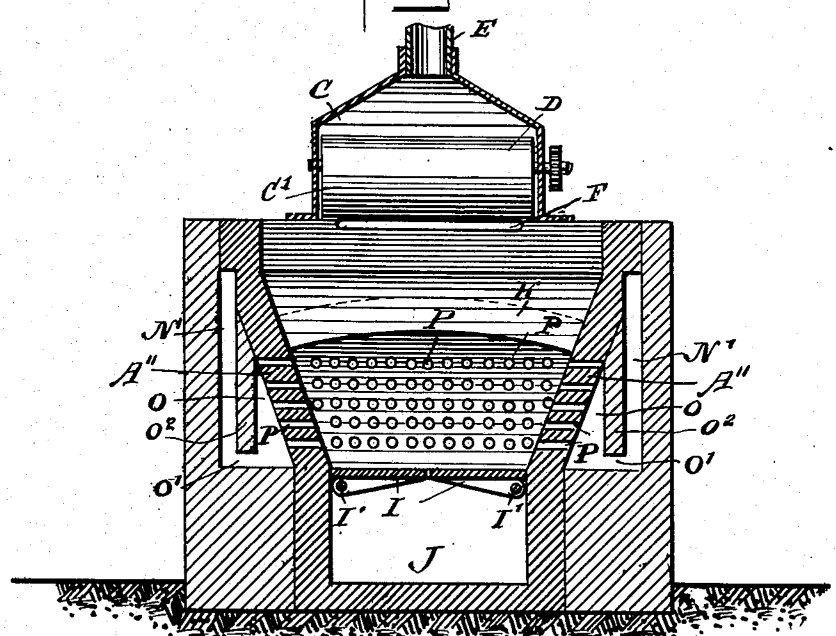

Fig. 3.

WITNESSES

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2 SHEETS—SHEET 2.

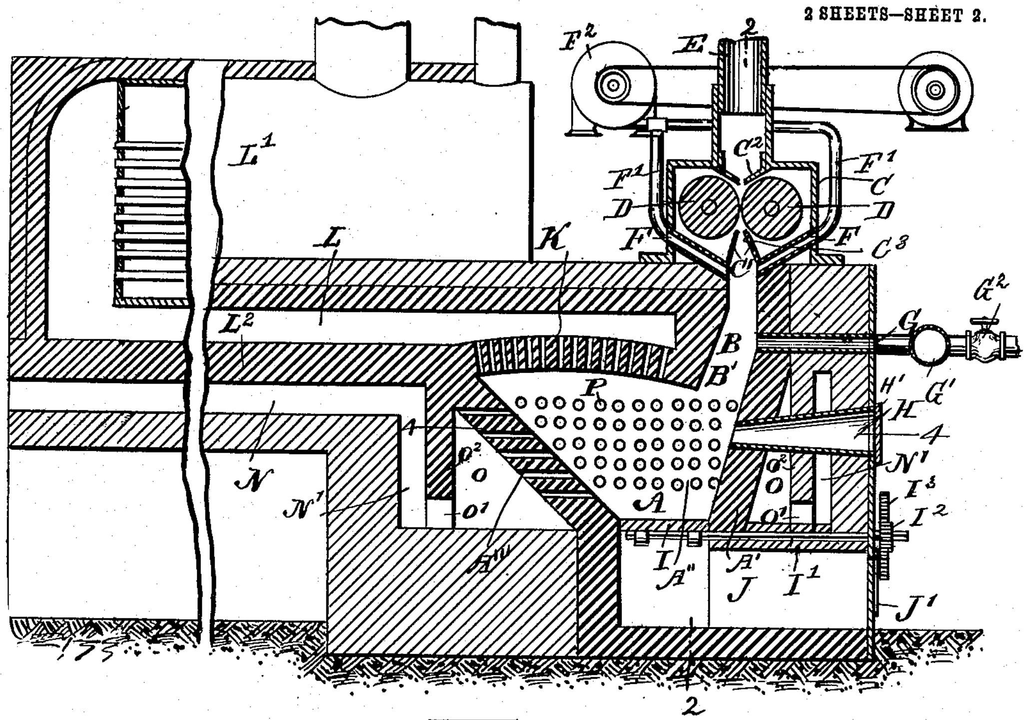

Fig. 2.

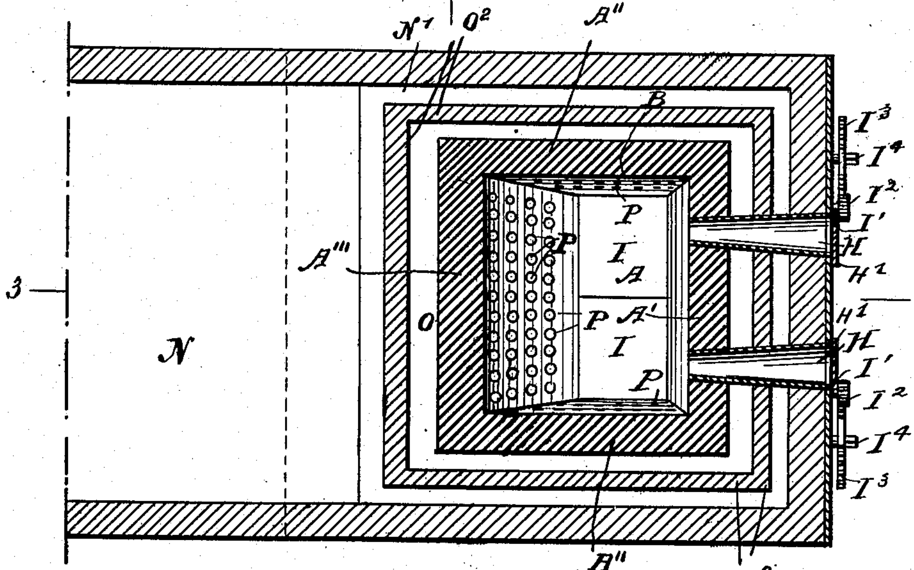

Fig. 4.

WITNESSES

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UNITED STATES PATENT OFFICE.

LEE WHITTAKER, OF BUTLER, PENNSYLVANIA.

FURNACE.

941,480. Specification of Letters Patent. Patented Nov. 30, 1909.

Application filed July 31, 1908. Serial No. 446,269.

To all whom it may concern:

Be it known that I, LEE WHITTAKER, a citizen of the United States, and a resident of Butler, in the county of Butler and State of Pennsylvania, have invented a new and Improved Furnace, of which the following is a full, clear, and exact description.

My invention relates to furnaces and particularly to furnaces especially adapted for use in melting glass, reducing iron or steel or wherever great heat is necessary and where the heat furnished should be free from soot, smoke and obnoxious gases.

The object of my invention is to provide an improved furnace which shall be adapted to generate the maximum amount of heat from a given quantity of fuel, and of such construction that the heat generated therein may be readily utilized.

A further object of my invention is to provide a furnace as mentioned which shall consume practically all of the gases generated and all of the fuel supplied thereto to the end that the heat conducted therefrom to be utilized shall be substantially free from smoke, soot and obnoxious gases.

A further object of my invention is to provide a furnace adapted to burn fuel of substantially any kind particularly in a crushed or pulverized state, and equipped with means for supplying liquid or gaseous fuel thereto.

A further object of my invention is to provide a furnace adapted to burn solid pulverulent fuel, or liquid or gaseous fuel, and so constructed that the change may be made from one to the other without extinguishing the fire or cooling the furnace.

A further object of my invention is to provide a furnace which shall be free from grate bars or other metal parts in the fire box to burn out, thereby increasing the length of time which the furnace may be used without shutting down for repairs.

A further object of my invention is to provide a furnace equipped with a combined fuel and air feed and means for admitting heated air into the fire box, and so constructed that the ashes may be readily removed from the fire box and from the ash pit without admitting cold air to the former.

Other objects will appear hereinafter.

With these objects in view my invention consists generally in a furnace provided with a fire box of inverted conical or pyramidal shape, a perforated arch substantially covering said fire box and a fuel and air mixing chamber extending through said arch into said fire box.

My invention further consists in a furnace having a fire box equipped as above mentioned, an ash pit arranged beneath said fire box a hinged closure for the bottom of said fire box and a closure for said ash pit, said closures being independently operable in order that the ashes may be removed from the fire box while the ash pit is closed and from the ash pit while the fire box is closed, thus preventing the entry of cold air into the furnace while removing the ashes.

My invention further consists in a furnace having a fire box of inverted, conical or pyramidal form, the walls of said fire box being perforated, a perforated arch substantially covering said fire box, a flue extending substantially horizontally from a point above said arch, an air space surrounding said fire box, and an air inlet arranged beneath and extending substantially parallel with said flue and communicating with said air space, and an apron depending from the upper edge or top of the walls of said fire box dividing said air space into an inner and outer air chamber, said chambers communicating at the bottom or lower edge of said apron.

My invention further consists in various details of construction and arrangements of parts all as will be fully described hereinafter and particularly pointed out in the claims.

My invention will be more readily understood by reference to the accompanying drawings forming a part of this specification and in which,

Figure 1 is a front elevation of a furnace embodying my invention in its preferred form, Fig. 2 is a vertical longitudinal section of the same, Fig. 3 is a vertical transverse section on the line 2—2 of Fig. 2, and Fig. 4 is a horizontal section taken on the line 4—4 of Fig. 2.

Referring now to the drawings, A indicates the fire box defined by the inwardly and downwardly converging front wall A′, side walls A″ and rear wall A‴, the box being thus of inverted frusto-pyramidal form. The walls A′ and A″ are preferably but slightly aslant whereas the rear wall

A''' is considerably inclined. Extending over the fire box from the top of the rear wall, and substantially covering the same is a perforated arch K. This terminates a short distance from the front wall A' forming a fuel feed opening B'. Extending downwardly through the opening B' and tangential to the fire box is a fuel mixing chamber B closed at the top by a casing C in which are mounted fuel feed rollers D. The fuel is fed to the rollers, which are driven in any suitable manner, through a feed pipe or chute E, the fuel being distributed over said rollers substantially uniformly throughout their length by the spaced flanges C^2. The fuel passes in a thin sheet from the rollers through a slot or opening C^3 formed by a pair of converging flanges or plates C'.

F indicate air nozzles substantially coextensive in width with the rollers D and supplied by air through the feed pipes F'. The nozzles F discharge diagonally, inwardly and downwardly against the descending sheet of fuel and thoroughly mixes with the same in the chamber B before entering the fire box. The cool air which enters through the air nozzles F keeps the fuel below the ignition temperature until the mixture is injected into the fire box at the opening B'. In this way all of the heat of the fuel is obtained within the fire box where it may be utilized.

L indicates the flue which extends substantially horizontally from a point above the arch K. The draft created by the flue L is usually sufficient to draw in an adequate supply of air through the nozzles F but in case at any time this is found insufficient the air may be forced into the furnace by means of a driven fan F^2.

On account of the shape of the fire-box, its lower end or bottom is comparatively small and is provided with a closure or closures I, and beneath said closures and extending to the front of the furnace is the ash pit J having the closures J', J^2. The closures I are solid or imperforate, and prevent the access of cold air to the fire box from beneath. The closures I take the place of the usual grate bars and are mounted to swing upon rods or pintles I' which extend through the front wall of the furnace and provided at their outer ends with pinions I^2 which mesh with larger pinions I^3 mounted on the front of the furnace. The shaft of the pinion I^3 is provided with a squared wrench hold by means of which the same may be turned and a latch or dog I^5 is provided to hold the members I in closed position. To clear the fire box of ashes the members I are swung downwardly into the ash pit by means of the gearing above described, the doors J' and J^2 of the ash pit being closed to prevent access of cold air. The members I are then closed after which the doors of the ash pit may be opened and the ashes removed.

H indicates poke holes extending through the front of the furnace in the fire box and provided with the closures H'.

The fire box is surrounded by an air space which is co-extensive in height therewith and depending from the upper edge of the inclined walls of the fire box are depending vertical walls O^2 forming an apron which divides said air space into inner and outer air chambers N' and O. Apertures O' at the bottom or lower edge of the apron form a communication between said air chambers. Extending from the upper rear edge of the chamber N' is an air intake N which is arranged beneath the flue L, parallel therewith and separated from the same by a thin wall L^2.

Extending through the front wall of the furnace into the mixing chamber B is a transverse row of pipes G connected by a common supply pipe G' provided with a valve G^2. When solid fuel is not available or when it is found more desirable to burn liquid or gaseous fuel the latter may be admitted through the pipes G. It is obvious that with this construction a change of fuel may be made without putting out the fire or cooling the furnace.

The furnace is adapted to burn substantially any kind of solid fuel such as coal, coke, shavings, saw-dust, tan-bark or the like. In using the furnace the fuel is fed to the mixing chamber in a thin sheet by the rolls D and the flue draft of the furnace draws in air through the nozzle F, on each side of the sheet of fuel. The fuel thus becomes mixed with substantially enough air to entirely consume the same when ignited and the mixture is injected tangentially and downwardly into the fire box. The gases of combustion strike against the perforated arch K and are broken up thereby so that the intense heat of the furnace will more readily consume the same. The intensely heated and burning gases soon raise the temperature of the arch to white heat after which all the gases passing through the perforations in the arch will be practically entirely consumed as will also any smoke or soot which happens to be formed within the furnace, although by thoroughly mixing the fuel with an adequate supply of air before introducing the same into the furnace but little smoke is formed. The heat thus produced and conducted through the flue L will be substantially free from smoke, soot and obnoxious gases and may be readily used for any purpose where a great heat is required. To insure an adequate supply of air the walls A'' and A''' of the furnace are provided with a plurality of perforations P which form a communication be-

tween the fire-box and the inner air chamber O. The flue draft of the furnace draws the air through the inlet N where it is partially heated by being adjacent to the flue L, the air passing into the outer chamber N′ where it is distributed uniformly around the fire box, thence under the apron into the inner air chamber O where it is further heated before being injected into the fire box. Consequently, no cold air is admitted to the fire box except that admitted through the nozzles F and which is mixed with the fuel.

It is obvious that as all of the fuel, including the gases of combustion, is completely consumed or burned within the fire box, a maximum amount of heat from a given quantity of fuel is obtained, and that the heat generated will be free from carbon, obnoxious gases and other products of combustion which would render the same unfit for such use as melting glass and the like.

The furnace may be used with fuel of any kind, solid, liquid or gaseous and the change from one to the other may be made without shutting down the furnace or cooling the same. By completely burning the fuel the flues do not become clogged, which is a source of common annoyance to firemen, hence the device may be readily kept up to its maximum efficiency.

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

1. In a furnace, a fire box having inwardly and downwardly inclined side walls, a perforated arch substantially covering said fire box, a fuel and air mixing chamber arranged at one side of said arch and opening into said fire box, means for feeding fuel through said mixing chamber into said fire box and means for injecting cool air into said mixing chamber and mixing the same with the fuel in sufficient quantities to maintain the fuel in the mixing chamber below the ignition point, substantially as described.

2. In a furnace a fire box defined by inwardly and downwardly extending walls, said walls being perforated, a perforated arch substantially covering said fire box, a flue extending from above said arch, an outer wall spaced from said fire box walls forming an air space surrounding said fire box and substantially co-extensive in height therewith, an apron depending in said air space from the upper edge of said walls dividing said space into inner and outer air chambers, an air passage extending parallel with said flue and discharging into said outer air chamber, and said chambers being in communication beneath the lower edge of said apron, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

LEE WHITTAKER.

Witnesses:
THEO. G. HOSTER,
EVERARD B. MARSHALL.