June 26, 1928. 1,675,255

A. H. COPLAN

CUPOLA

Filed June 10, 1927 2 Sheets-Sheet 1

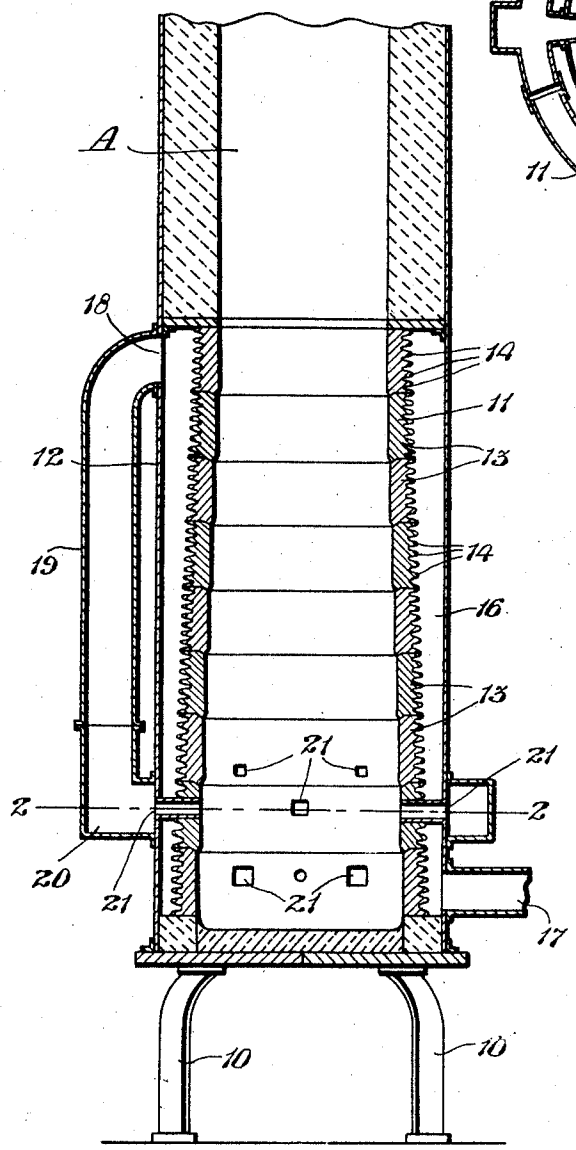


FIG. 1.

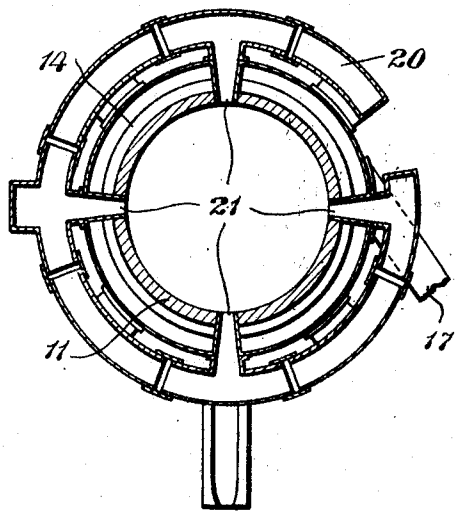


FIG. 2.

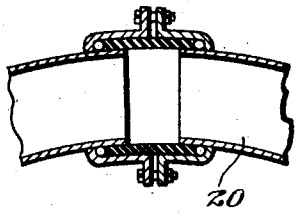


FIG. 3.

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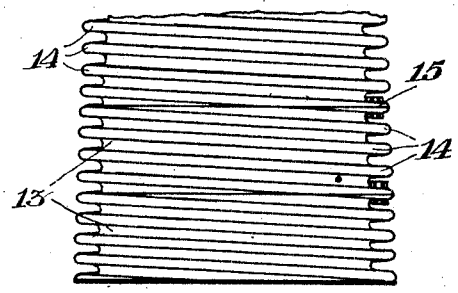


FIG. 7.

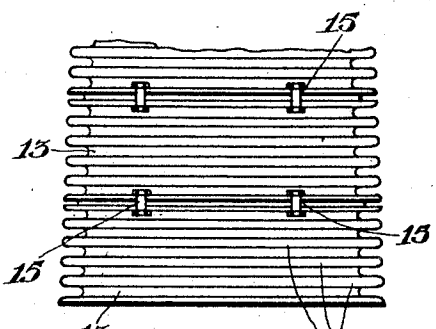


FIG. 5.

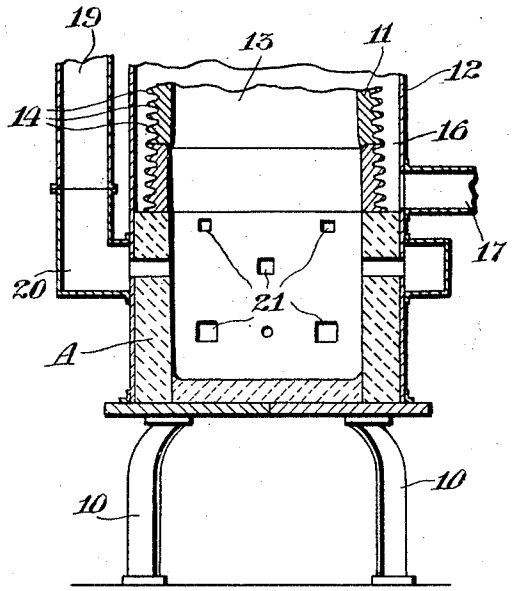


FIG. 4.

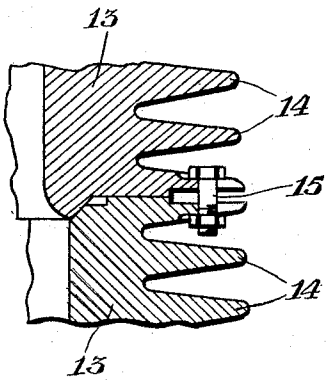


FIG. 6.

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Patented June 26, 1928. 1,675,255

UNITED STATES PATENT OFFICE.

ARCHIBALD HYMAN COPLAN, OF OTTAWA, ONTARIO, CANADA, ASSIGNOR TO ECONOMY METAL PRODUCTS CORPORATION, OF NEW YORK, N. Y., A CORPORATION OF NEW YORK.

CUPOLA.

Application filed June 10, 1927. Serial No. 197,934.

This invention relates to improvements in and connected with cupolas and the objects of the invention are the saving of fuel in cupola furnaces by utilizing the heat from the cupola to heat the blast of air before it enters the tuyères of the cupola.

Further objects are to provide an improved cupola furnace of durable and simple construction of maximum efficiency with a minimum consumption of fuel.

A still further object is to provide an improved furnace of this description in which a cyclonic effect is automatically imparted to the blast of air when encountering the heat generated by the furnace thereby providing a saving in fuel and a reduction in the time within which iron can be melted.

The invention consists in replacing, or substituting for, the refractory lining of the cupola and in spaced relationship to the wall or casing of the furnace a lining of specially made heat resisting steel formed on the outside with fins or corrugations adapted in combination with the air blast intake and a heated air discharge communicating with the tuyères of the furnace to impart a cyclonic effect to the air blast while subject to the heat generated in the body of the cupola.

In short the invention consists in automatically imparting to the air blast, while being superheated, a cyclonic effect and delivering it in superheated condition to the tuyères of the furnace.

Cupolas heretofore and at present in use have been made to preheat the blast but they have not so far proven satisfactory. No attempt, however, appears to have been made to preheat the blast by delivering it tangentially into a metal heating chamber taking the place of the refractory lining and adapted in its construction to impart a cyclonic effect to the blast while circulating through the chamber and around the hottest portion of the cupola thereby uniformly and intensely preheating the blast to an extent which was heretofore impossible and simultaneously delivering it, by direct discharge at a point removed from the intake and out of alignment therewith, to the tuyères of the furnace in superheated condition.

In order that my invention may be more fully understood reference is now had to the accompanying drawings in which like characters of reference indicate corresponding parts in each figure, and in which

Figure 1 is a vertical section through my improved cupola furnace.

Figure 2 is a section on the line 2—2 of Figure 1.

Figure 3 is a sectional detail of the adjustable hot air conduit.

Figure 4 is a section of a slightly modified form of furnace.

Figure 5 is a detailed view of the steel sections showing the fins on the outside in substantially horizontal position.

Figure 6 is an enlarged detail showing the joining of the steel sections.

Figure 7 is a detail of the sections showing the fins spirally formed.

Referring now more particularly to the drawings in which an example of my invention is disclosed, A designates the cupola as a whole mounted on suitable supporting standards 10.

In carrying out my invention and referring to the figures generally, I substitute for the ordinary refractory lining a lining 11 spaced from the outer wall 12 and here shown as comprising a plurality of superimposed sections 13 formed with fins or corrugations 14 and adjustably secured together as at 15 to provide, as illustrated in Figure 1, a heat resisting spaced steel lining from substantially the bottom of the furnace to adjacent the top.

As illustrated in Figure 7, the corrugations or fins, when the sections are assembled, are of spiral formation although, as illustrated in Figure 5, they may be horizontal if desired, the object, as previously described, being to automatically impart to the air blast circulating in the space 16 between the fin formed face of the lining and the outer wall of the furnace a cyclonic effect. Furthermore, as illustrated in Figure 4, this specially made heat resisting steel lining can be arranged to extend partially or entirely throughout the interior of the cupola.

The bottom of the furnace is the air blast intake 17 which, it will be seen by referring to Figure 2, is adapted to introduce the air blast tangentially to the cupola circulating chamber, while out of alignment

therewith and substantially at the top of the lining 11 is the preheated air discharge 18 in the wall of the furnace, both the openings 17 and 18 communicating with the air heating chamber 16, the preheated air discharge 18 being connected by a conduit 19 with an air belt conduit 20 surrounding the outside of the furnace and registering with the tuyères 21 therein.

This air belt conduit 20 is formed of adjustably connected sections, as shown in Figure 3, so that it can be adapted to any size of cupola without much trouble or expense.

As shown in Figure 2, the tuyères 21 communicating with the air belt 20 are preferably V-shaped from the outside inwardly so that the preheated blast of air will be delivered simultaneously from different points in the form of a spray over the centre of the fire in the cupola. As the air is delivered in the form of a blast by any well known means into the intake 17, it strikes the corrugated or fin formed face of the heat resisting lining 11 and has automatically imparted to it a cyclonic upward movement contacting with the hottest area of the cupola to be intensely preheated by the heat radiating from the lining of special heat resisting and heat absorbing steel.

In this way the current of cold air converted into a blast by a fan or other means enters the bottom of the heating chamber tangentially and encounters the corrugated or finned wall thereof having imparted to it a whirling cyclonic movement in radiating the heat from the furnace gradually ascending until it reaches the direct discharge opening 18 in communication with the conduit 19 and the air belt 20 and thence to the tuyères 21.

It will further be noted, a point which has not been mentioned before, that the cyclonic circulation of the air blast causes it to be more uniformly heated in its travel through the heating chamber and also provides in the more or less tortuous path of its travel through the fins or corrugations that it is intensely preheated.

As many changes could be made in the above construction and many apparently widely different embodiments of my invention, within the scope of the claims, constructed without departing from the spirit or scope thereof, it is intended that all matter contained in the accompanying specification and drawings shall be interpreted as illustrative and not in a limiting sense.

What I claim as my invention is:—

1. In a cupola furnace, an outer casing, a lining of heat resisting steel spaced from the outer casing and formed with spirally wound fins or corrugations, an air blast intake adjacent the bottom of the lining, an air discharge opening at the top of the lining and out of alignment with the air blast intake, a conduit without the furnace communicating with the air discharge opening, an air-tight air belt embracing the outside of the furnace connected to said conduit and communicating with the tuyère holes of the furnace.

2. In a cupola furnace, an outer casing, a lining of heat resisting steel spaced from the outer casing to form a continuous heating chamber between the lining and the casing, the outer surface of the lining being formed with spirally wound fins or corrugations.

3. In a cupola furnace and in combination with the casing of the furnace, a lining of special heat resisting material spaced from the casing and formed on one side with spirally wound corrugations or fins and a smooth surface on the other or inner side and air intake and discharge openings out of alignment and at opposite extremities of the lining whereby the air blast while being preheated has imparted to it a cyclonic effect.

4. In a cupola the combination with the outer casing, of a lining of heat resisting steel spirally corrugated and spaced from the casing to form a heating chamber, means for delivering an air blast tangentially into said chamber, an air discharge out of alignment with and removed from the air blast intake whereby a cyclonic effect is imparted to the air blast in circulating through said chamber, an air-tight belt conduit communicating with the tuyère holes of the furnace and air-tight duct means connecting the belt with the air discharge.

5. In cupola furnaces the combination with a casing and in spaced relationship thereto to form a heating chamber, of a lining formed of a plurality of sections of special steel having their outer faces formed with spirally wound fins and adjustably secured together, a tangential air blast intake at one end of the chamber and a preheated air discharge opening at the opposite end of the chamber.

6. A cupola furnace having the refractory lining replaced by a specially prepared steel lining in spaced relationship to the wall of the furnace to form a heating chamber, the outer face of said lining being formed with spirally wound fins adapted to impart a whirling movement to the air within the chamber whereby said air is more uniformly and more intensely preheated in its passage through the chamber.

7. A cupola furnace having the refractory lining replaced by a specially prepared steel lining in spaced relationship to the wall of the furnace to form a heating chamber, the outer face of said lining being formed with spirally mound fins adapted to impart a whirling movement to the air within the chamber whereby said air is more uniformly and more intensely preheated in its passage through the chamber, means for supplying

an air blast at one end of said chamber, and means out of alignment with the aforementioned means and in the opposite end of the chamber for discharging the preheated air, and means without the chamber for communicating with the air discharge means for delivering the preheated air to the tuyère holes of the furnace.

8. In a cupola furnace the combination with the outer casing of a lining adapted to replace the refractory lining in whole or in part and spaced from said casing to form a heating chamber, the inner surface of the lining being smooth and the outer surface of said lining being formed with spirally wound corrugations or fins whereby a blast of air entering the chamber is simultaneously heated and has imparted to it a cyclonic effect to more uniformly and more intensely preheat the air in its circulation through the chamber.

9. In cupola furnaces and the like the combination with the outer casing and a metal lining spaced therefrom to form a heating chamber and having the wall of the lining specially corrugated within the chamber, of means for delivering an air blast tangentially to said chamber whereby a cyclonic effect is imparted to the air blast in its circulation through the chamber and means for discharging the preheated air from the heating chamber.

10. In cupola furnaces and the like the combination with the outer casing and a metal lining spaced therefrom to form a heating chamber and having the wall of the lining specially corrugated within the chamber, of means for delivering an air blast tangentially at one end of said chamber whereby a cyclonic effect is imparted to the air blast in its circulation through the chamber, means for discharging the preheated air at the other end of the heating chamber, and means without the furnace for delivering the preheated air to the tuyère holes of the furnace.

11. In a furnace of the character described, the combination with an air heating chamber adapted to replace the refractory lining of the furnace in whole or in part and having the walls suitably corrugated, of means for delivering an air blast tangentially to said chamber, and means for discharging the preheated air blast from said chamber at points in the chamber remote from each other.

12. A cupola furnace having a portion of the lining replaced by an air heating chamber, means for supplying a current of air to said chamber, means associated with the walls of the chamber for imparting a cyclonic effect to such air current, and means for discharging the preheated cyclonic current of air to the interior of the furnace.

13. The within described method of preheating an air blast for cupola furnaces and the like which consists in creating a current of air under pressure, delivering the current of air within a restricted space, imparting to said current of air a cyclonic effect, and preheating the air while imparting to it such cyclonic effect.

In witness whereof I have hereunto set my hand.

ARCHIBALD H. COPLAN.