Dec. 9, 1941. O. L. COFFEY 2,265,227

STACK FOR FURNACES

Filed June 28, 1939

Fig. 1

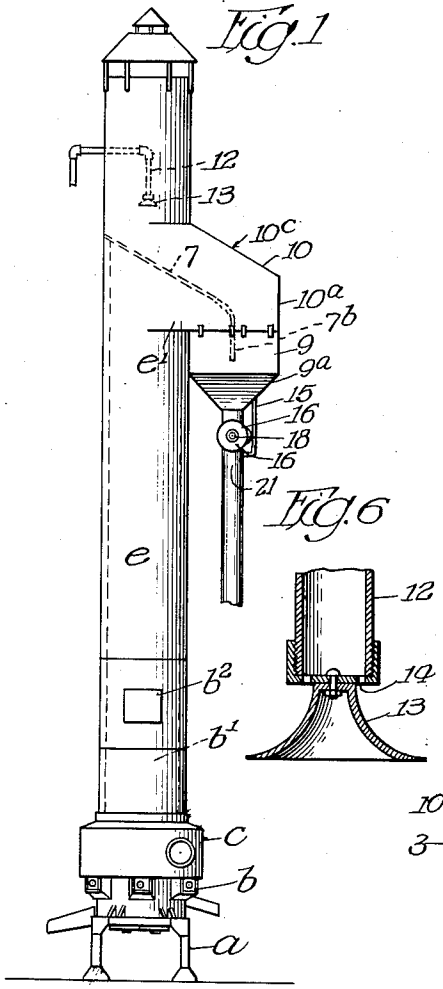


Fig. 6

Fig. 3

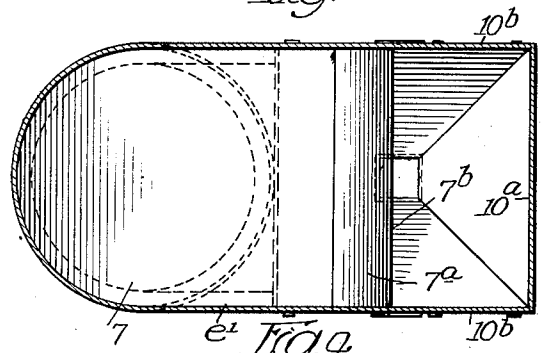


Fig. 4

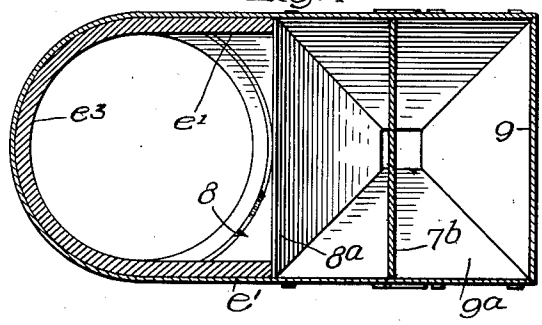


Fig. 2

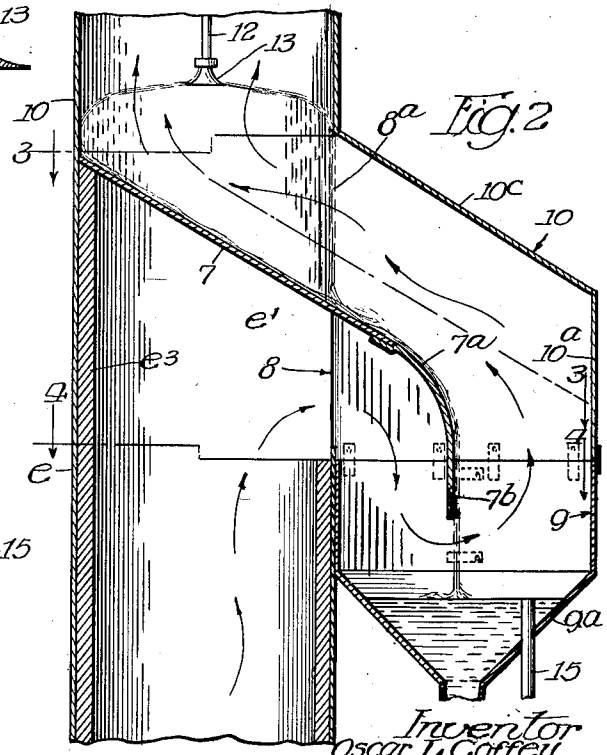
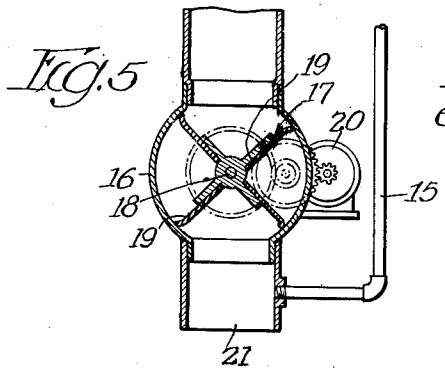


Fig. 5



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STACK FOR FURNACES

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Application June 28, 1939, Serial No. 281,509

3 Claims. (Cl. 261—126)

The invention relates to furnaces and more particularly to the separation or removal of objectionable carbon, sulphur, cinders and odors from the gases produced in the furnace to prevent their escape to atmosphere around the stack.

One object of the invention is to provide a stack-construction which includes means for washing the stack-gases discharged from the combustion chamber to eliminate the odors therein before the air leaves the stack.

Another object of the invention is to provide a stack-construction which includes means for efficiently separating the carbon and particles from the gases in the stack from the melting chamber of metallurgical furnaces and collecting them for suitable disposition and preventing them from being discharged from the stack to the surrounding atmosphere.

Other objects of the invention will appear from the detailed description.

The invention consists in the several novel features which are hereinafter set forth and are more particularly defined by claims at the conclusion hereof.

In the drawing: Fig. 1 is a side elevation of a cupola embodying the invention. Fig. 2 is a vertical section through the portion of the stack equipped with the separating and washing means. Fig. 3 is a horizontal section on line 3—3 of Fig. 2. Fig. 4 is a horizontal section on line 4—4 of Fig. 2. Fig. 5 is a vertical section through the wheel for discharging the material separated from the stack-gases from the hopper into which they are deposited. Fig. 6 is a detail section of the spray nozzle.

The invention is exemplified as applied to a cupola or melting furnace which is mounted upon a supporting structure *a* and comprising tuyères *b*, a wind-box *c* and a stack *e*, the lower portion of which is provided with a melting chamber b^1, and a charging-door b^2. The stack is of sufficient height to produce the requisite draft and the separating and washing means are connected to the stack and disposed a suitable distance, for example, eight or ten feet from the upper end thereof.

The improved separating means comprises deflector-means for directing the stack-gases to one side of the stack and then back into the continuation of the stack. This means includes an inclined wall 7 which extends across the stack and downwardly from one side thereof to the other side and arrests the upward flow of and deflects the gases downwardly through an opening 8 formed in one side of the stack wall 7. The refractory e^3 of the stack extends to the under side of wall 7. The stack has straight side-portions e^1 between opening 8 and the opposite cylindrical side of the stack to provide a passage, rectangular in cross-section, and of sufficient area from the stack to opening 8. An opening 8^a is formed in the stack above the deflector and opening 8, through which the gases are returned to continuation of the stack above the deflector-wall 7. The side-portions e^1 of the stack adjacent opening 8^a are also straight to form a return opening rectangular in cross-section and of sufficient area for the flow of gases. A housing is provided at one side of, and is laterally offset relatively to, the stack. This housing forms a passage which extends downwardly along the inner side of the deflector, under the lower end thereof and upwardly and inwardly at the outer side of the deflector through which the gases flow from the outlet opening 8 to the return opening 8^a. The housing comprises an upper built-in section 10, the inner side of which is open and in communication with openings 8, 8^a. Section 10 comprises an inclined roof 10^c substantially parallel to the inclined wall 7, straight side-walls 10^b joined to the straight side-portions e^1 and an outer cross-wall 10^a. The housing with straight side-portions e^1 forms a passage which is rectangular in cross-section and extends under, across and over the deflector. The housing also comprises a lower section 9 which depends from and is removably secured to housing-section 10 and comprises rectangular walls meeting the side and outer cross-walls of housing-section 10 and a hopper-bottom 9^a.

The deflector comprises a laterally and downwardly curved wall 7^a, which is a continuation of inclined wall 7 and a vertical wall 7^b which is a downward continuation of wall 7^a. The wall 7^b terminates in the housing-section 9 above the hopper-bottom to provide a passage through which the gases can flow from one side of the deflector to the other.

Hopper-bottom 9^a of housing-section 9 forms a receptacle below the lower end of wall 7^b for water over which the gases are deflected laterally as they pass under the lower end of wall 7^b of the deflector. An over-flow pipe 15 terminates in the lower section 9 of the housing to maintain a column of water therein with which the gases will contact and whereby the solid particles, which are arrested and separated by wall 7^b of the deflector, will be trapped by the water in the hopper.

A supply of water under pressure is delivered from a suitable source to a pipe 12 in the center of the stack above the deflector-wall 7. Pipe 12 is provided at its lower end with an annular concave spreader 13 onto which water from pipe 12 is discharged through ports 14. The spreader discharges the water from the center of the stack outwardly across the stack above opening 8a against the wall of the stack above the deflector 7. This spray produces a curtain of water on and around the inner face of the stack and downwardly across opening 8a. Some of the water falls onto the top of deflector-wall 7 and flows downwardly and laterally over and cools the deflector-plate 7 to prevent its destruction by the hot gases from the melting furnace which impinge against the under side of the deflector. The water descending across opening 8a and that flowing over wall 7 flows around curved wall 7a and on the outer face of wall 7b of the deflector and descends in the form of a curtain between the lower end of wall 7b and the column of water maintained in the housing-section 9.

In operation, the gases from the melting chamber pass upwardly through the stack e and impinge against the under side of deflector-wall 7 which is cooled by the water flowing over the upper face thereof. The deflected gases pass laterally and downwardly through opening 8 along the inner side of walls 7a, 7b to the column of water in housing-section 9. Next the gases pass outwardly and laterally through the curtain of water between the lower end of wall 7b and over the column of water in section 9 to the upward passage between the deflector and the outer side and roof-wall of housing-section 10. Next the gases pass upwardly and inwardly through the curtain of water flowing vertically across the opening 8a between the housing-section 10 and the continuation of the stack above deflector-wall 7 and through the spray from spreader 13. Some of the gases also flow over the stream of water flowing over the deflector. All the water discharged from pipe 12 will flow into the hopper at the bottom of section 9 where a column of predetermined height is maintained by overflow pipe 15. The gases from the melting chamber are cooled as they impinge against the underside of deflector-plate 7, are washed as they pass through the curtain of water between the lower end of wall 7b and the column of water in the hopper. The heavier particles of carbon and other materials in the gases are separated from the gases as they pass across the lower portion of the housing and deposited into the water in the hopper. The interruption and deflection of the gases by the deflector causes sufficient retardation to render effective the washing of the particles from the gases by the curtain of water between wall 7b and the water in the hopper and separate the particles from the gases so they will be deposited in the housing. The gases, after they have passed through the curtain of water in the lower housing-section 9, and as they pass upwardly and back into the top extension of the stack, are again washed by the curtain of water across the opening 8a between the upper housing-section 10 and the stack above wall 7 so that a second washing of the gases and separation of finer particles will be effected. These particles will be carried into the hopper with the water. Some of the gases also impinge against the water flowing over the top of wall 7 which further assists in separating particles which have escaped the previous washing. Lastly, the gases pass through the spray discharged across the stack from spreader 13 to effect a final washing thereof. This repeated separation and washing of the gases results in separating substantially all the impurities therefrom and causes them to be deposited into the hopper. The particles entrained in the water as the gases flow upwardly and laterally through the housing are all discharged into the hopper. This construction results in effectively removing all the carbon from the gases and much of the sulphur and objectionable odors before the gases escape from the stack. In practice, pieces of charcoal resulting from the wood used in separating the melt, are occasionally carried off with the gases at the end of the melt. The apparatus disclosed effectively traps such pieces in the water in the hopper.

In the operation of melting furnaces the separated material, particularly the fines, carbon and cinders, accumulate very rapidly, sometimes, for example, at the rate of 100 pounds per hour and they will pack in the hopper unless they are kept in motion or discharged at a sufficiently rapid rate to displace the solid matter collected in the bottom of the hopper and prevent it from accumulating and packing solidly in the hopper and obstructing the passage under the deflector. For disposing of the separated material the lower end of the hopper-bottom 9a is connected to a casing 16 of a paddle-wheel 17 which is secured to a shaft 18 which is journaled in said casing. This wheel comprises a hub and elastic blades 19 for maintaining contact with the casing to prevent escape of the water around the wheel. This wheel is slowly and continuously operated by an electric motor 20 which is mounted on casing 16 and connected to drive wheel 17 through suitable reduction gearing so that the solid matter will be forcibly displaced from the hopper to prevent its accumulation and so that a column of water will be retained on the hopper bottom 9a over which the gases pass and with which some of them contact as they pass through the curtain of water flowing from the lower end of the deflector. The volume of water discharged with the solid material by the wheel is less than the supply so that the water column of the desired height will be maintained in the hopper. A pipe 21 is connected to the outlet side of casing 16 for delivering the separated matter to a collector or to the sewer. Overflow pipe 15 also discharges into pipe 21.

The invention exemplifies means for washing the gases discharged from a furnace to separate the carbon and other materials therefrom and to greatly reduce the odors in the gases discharged from the extension of the stack above the washing means. In passing around the deflector and through the offset housing all flames are extinguished so that no flames are visible as the gases leave the stack. The apparatus is simple in construction and efficient in operation.

The invention is not to be understood as restricted to the details set forth, since these may be modified within the scope of the appended claims, without departing from the spirit and scope of the invention.

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

1. In apparatus for cleaning combustion gases, a vertically extending conduit for the gases having an opening in one side thereof, a downwardly inclined deflector extending from one side of and

completely across the conduit and through the opening intermediate its upper and lower ends and beyond the other side of the conduit and having a vertically depending terminal extending below the lower end of the opening, for directing all the gases through the lower portion of the opening and downwardly at said other side of the conduit, a housing offset and projecting only from said other side of the conduit and forming a passage for directing the gases from the lower portion of the opening and along the under side of the projecting portion of the deflector around the lower end of and over the top face of the deflector and through the upper portion of the opening back into the continuation of the conduit above the deflector, and a spraying device above the opening, for discharging water transversely across the conduit above the deflector so the gases in the conduit flowing upwardly from the deflector will pass through the spray and so that water from the spray will flow over the upper face of and cool the deflector, the lower portion of the housing being extended to form a water-receiving chamber below the vertically depending terminal of the deflector.

2. In apparatus for cleaning combustion gases, a vertically extending conduit for the gases having an opening in one side thereof, a downwardly inclined deflector extending from one side of and completely across the conduit and through the opening intermediate its upper and lower ends and beyond the other side of the conduit and having a vertically depending terminal extending below the lower end of the opening, for directing the gases through the lower portion of the opening and downwardly at said other side of the conduit, a housing offset and projecting only from said other side of the conduit and forming a passage for directing the gases from the lower portion of the opening and along the under side of the projecting portion of the deflector around the lower end of and over the top face of the deflector and through the upper portion of the opening back into the continuation of the conduit above the deflector, and a spraying device above the opening for discharging water transversely across the conduit above the deflector so the gases in the conduit flowing upwardly from the deflector will pass through the spray and so that water from the spray will flow over the upper face of and cool the deflector and so that some of the water will flow across the opening above the deflector, the lower portion of the housing being extended to form a water-receiving chamber below the vertically depending terminal of the deflector.

3. In apparatus for cleaning combustion gases, a vertically extending conduit for the gases having an opening in one side thereof, a downwardly inclined deflector extending from one side of and completely across the conduit and through the opening intermediate its upper and lower ends and beyond the other side of the conduit and having a vertically depending terminal extending below the lower end of the opening, for directing the gases through the lower portion of the opening and downwardly at said other side of the conduit, a housing offset and projecting only from said other side of the conduit and forming a passage for directing the gases from the lower portion of the opening and along the under side of the projecting portion of the deflector around the lower end of and over the top face of the deflector and through the upper portion of the opening back into the continuation of the conduit above the deflector, and a spraying device above the opening for discharging water from above onto the deflector so it will flow over the upper face of and cool the deflector, the lower portion of the housing being extended to form a water-receiving chamber below the lower end of the deflector, the water being discharged from the deflector in a curtain across the gases as they pass under and around the lower end of the deflector.

OSCAR L. COFFEY.