Dec. 24, 1929. C. D. BARR ET AL 1,740,886

HOT BLAST CUPOLA

Original Filed March 24, 1928 2 Sheets-Sheet 1

Fig. 1,

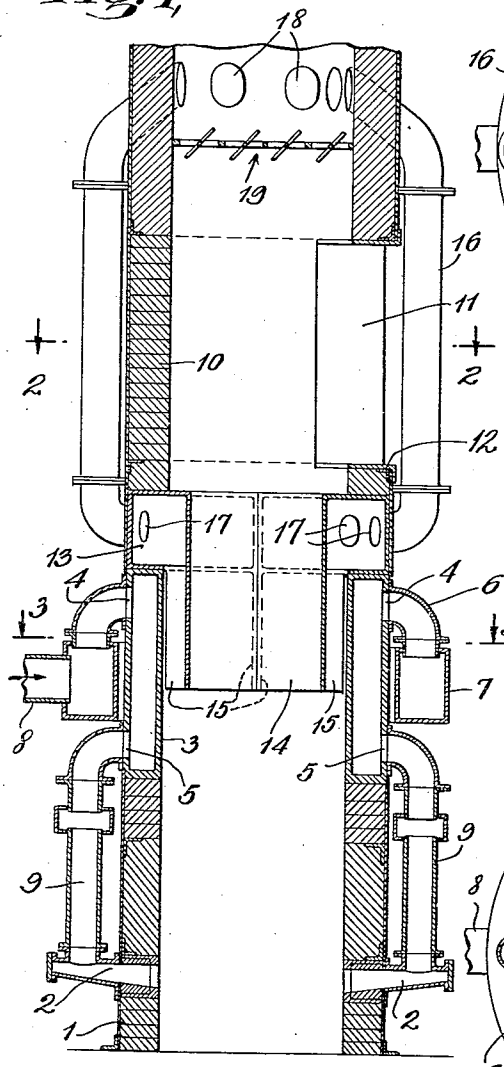


Fig. 2,

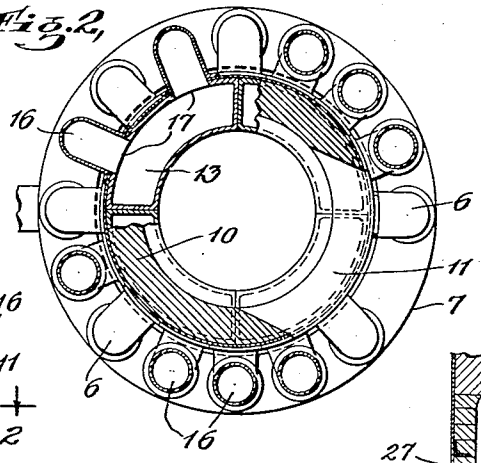


Fig. 4,

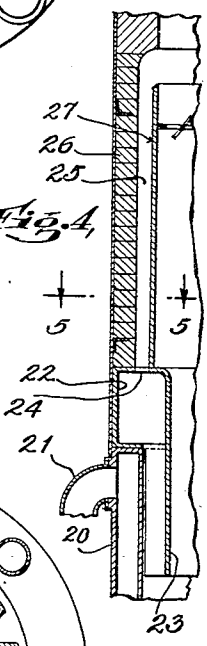


Fig. 3,

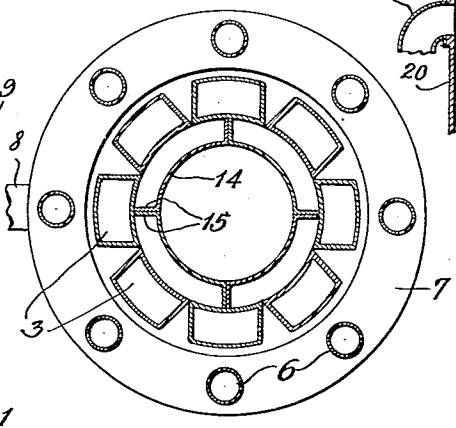
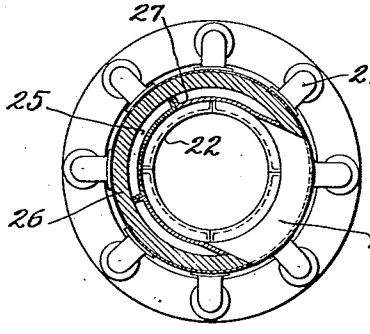


Fig. 5,



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Original Filed March 24, 1928 2 Sheets-Sheet 2

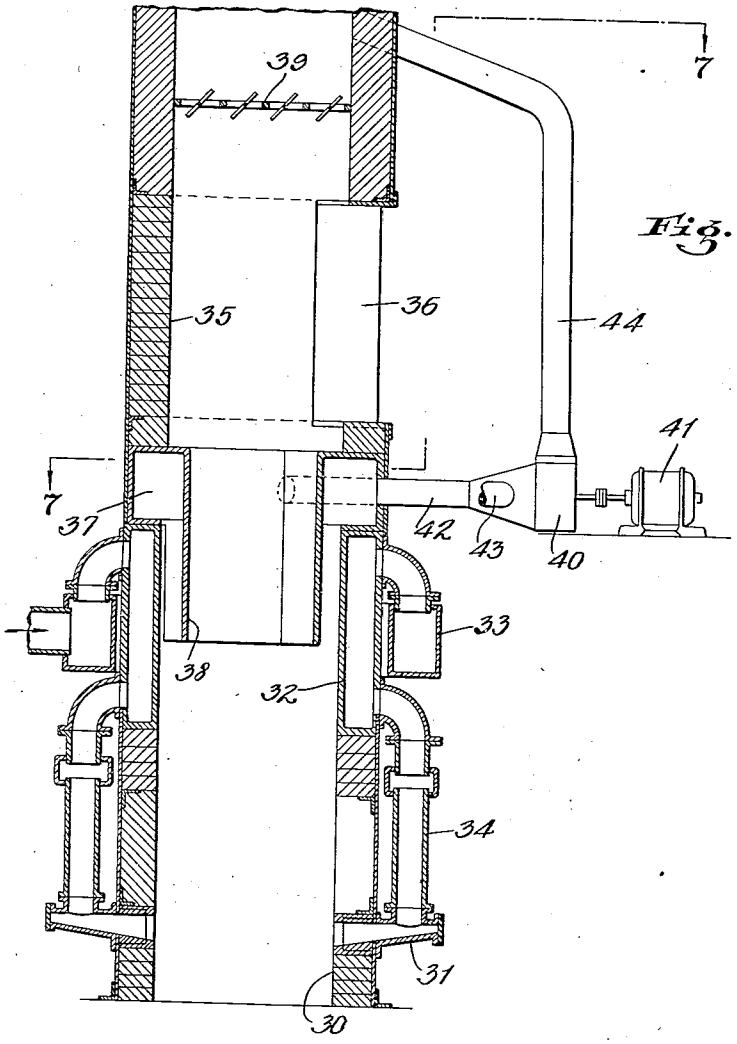


Fig. 6,

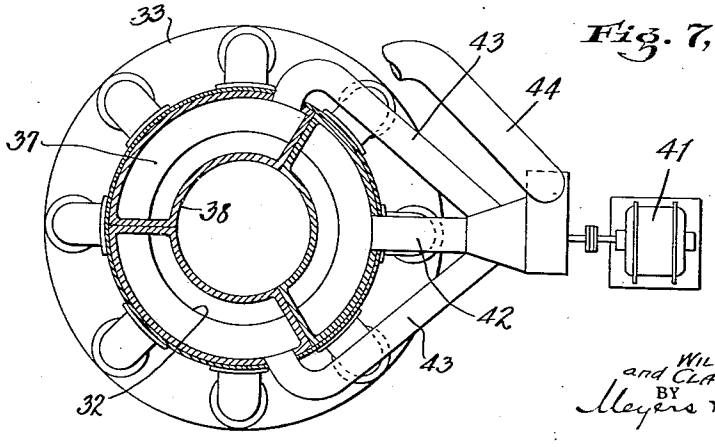


Fig. 7,

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UNITED STATES PATENT OFFICE

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HOT-BLAST CUPOLA

Application filed March 24, 1928, Serial No. 264,456. Renewed November 9, 1929.

This invention is an improvement in cupola operation, and more particularly in mechanism for removing the products of combustion from direct contact with the charge above the melting zone.

In the normal operation of the cupola, either hot or cold blast it is charged and ignited in the regular way, and with the blowers going the melting proceeds. The melting zone, that is the zone of intense heat, is within three feet above the tuyères, and the gases of combustion move up through the stock in their passage through the stack.

Bad effects are occasioned by this, one of which is the dissolving of the carbon from the coke passing down to the melting zone, thus reducing the efficiency of the coke to a considerable extent. Another is the deposition of sulphur on the coke and iron, sometimes in an amount which imparts to the coke and iron a white washed appearance. The melted iron picks up the sulphur, increasing the sulphur content to an extent such that it is detrimental to the making of good gray iron castings.

One of the primary objects of the present invention is the provision of mechanism in connection with a cupola for enabling the withdrawal of the combustion gases from the interior of the cupola, at a point above the melting zone, and without impairing the drawing effect of the stack draft on such gases.

Another object is the construction and arrangement of such mechanism in a manner to avoid interference with the normal functions of the cupola, and to depart as little as possible from the usual construction.

With these and other objects in view the invention consists in the construction and novel combination of parts fully described hereinafter, illustrated in the accompanying drawings, and pointed out in the claims appended hereto, it being understood that various changes in the form, proportion, size and minor details of construction within the scope of the claims, may be resorted to without departing from the spirit of the invention.

In the drawings forming a part hereof:—

Fig. 1 is a vertical section through a type of cupola provided with the improvement.

Figs. 2 and 3 are sections on the lines 2—2 and 3—3 respectively, of Fig. 1.

Fig. 4 is a section similar to Fig. 1 of a part of a cupola showing an alternate arrangement.

Fig. 5 is a section on the line 5—5 of Fig. 4.

Fig. 6 is a view similar to Fig. 1 of an alternate construction.

Fig. 7 is a section on the line 7—7 of Fig. 6.

In the embodiment of the invention shown in Figs. 1 to 3 inclusive, the cupola is shown for convenience as of the type forming the subject matter of our copending application Serial No. 233,381, filed November 15, 1927, and includes a shell of metal, and a lining of refractory material, usually of integral structure.

The cupola includes the usual base 1, and the tuyères 2 opening at the base. Above the base is the cupola body 3 composed of hollow sections, arranged in annular conformation, and resting upon the base, the sectional construction being clearly shown and described in the above mentioned application.

Each section 3 has an opening 4 at its top, and another opening 5 at its bottom, the said openings being in the external wall as shown. The opening 4 of each section is connected by a pipe or elbow 6 with a bustle pipe 7, to which air is delivered by the blowers in the usual manner, the connection with the blowers being indicated at 8.

The opening 5 of each section is connected by a pipe 9 with a tuyère 2, the arrangement being such that the air supplied by the blowers circulates from the bustle pipe through the pipe 6 and the openings 4 to the sections, and through the sections, leaving by way of the opening 5, the pipes 9 and the tuyères. The cupola is completed by the usual top indicated at 10, and is provided with a charging opening 11, the top resting upon the charging door sill 12, and the cupola has the usual stack or chimney not shown.

In order to enable withdrawal of the heated gases of combustion, prior to their contact with the coke and iron in the body of the cupola, a circulating box 13 is ar-

ranged in the wall of the cupola immediately below the charging door, the said box extending entirely about the cupola, with an outside diameter equal to the inside diameter of the cupola shell, it being understood that the body of the cupola in the present instance is composed of an outer metallic shell, and an inner lining of refractory material.

The inside diameter of the box is less than the inside diameter of the body lining, usually about one foot less, so that the box extends into the chamber of the cupola in a radial direction about six inches. The box is approximately two or three feet in depth.

From the bottom of the inner wall a tubular apron 14 extends downwardly into the cupola, the apron being of cylindrical form, and in effect a continuation of the inner wall of the circulating box. Since the internal diameter of the body is less than that of the cupola lining, the apron is spaced apart from the inner wall of the cupola a distance corresponding to the inward extension of the charging box, to provide a passage adjacent the cupola wall for the gases of combustion, and the lower end of the apron is above the melting zone.

Preferably the structure including the box and the apron is sectional, as indicated in Fig. 2, being in the present instance, composed of four similar sections. Each section includes a chamber which is a part of the circulating box, and a depending wall which is a part of the apron. The ends of the box sections abut and are connected in any suitable manner, and the apron sections have lapping side flanges 15 extending radially outward, and abutting the cupola wall at their free edges, so that a passage is provided for each section of the charging box, for conducting the gases of combustion thereinto.

The charging box communicates with the stack above the charging door, by means of a plurality of pipes 16. The charging box has a number of openings 17 in its outer wall, with which the lower ends of the pipes communicate, and similar openings 18 are provided in the cupola wall above the charging door, with which the upper ends of the pipes communicate. A damper 19 of any preferred form, in the present instance, a louver construction, is arranged transversely of the cupola just below the openings 18, and it will be apparent that when the damper is closed, the draft of the stack will be through the pipes 16, instead of through the portion of the cupola above the apron 14.

With the damper open, there is circulation through the body of the cupola and through the pipe 16, and the relation of the gases passing through the cupola and through the pipe 16 may be varied to any desired extent. The gases of combustion tend to flow along the walls of the cupola, and flow naturally into the circulation box, so that the provision of the circulation box and apron does not impede the natural draft through the stack. Because of the intense heat of the combustion gases just above the melting zone, it is not practicable to lead them off at this point, but in the present construction, they are taken away at a point as low as is practicable.

In the construction of Fig. 1, the products of combustion are carried from the circulation box to the stack outside the cupola. It is, however, possible and practicable to carry them inside the wall, and such an arrangement is shown in Figs. 4 and 5, wherein the cupola body sections are indicated at 20, and the connection to the bustle pipe at 21. The circulation box 22 corresponds to the construction of Fig. 1, in so far as concerns the box proper and the apron 23. The openings, however, for the escape of gases from the box are in the top, instead of in the outer face, the said openings being indicated at 24.

The passages 25 corresponding to the passages through the pipe 16 are between the refractory lining 26 of the upper part of the cupola and an inner shell 27. The inner surface of the shell is flush with the inner face of the top of the cupola as shown in Fig. 4, and the passages 25 are arc shaped as shown in Fig. 5. The tops of the passages are just above the charging door, which is indicated at 28 in Fig. 5, and it will be understood that the construction is provided with a damper similar to that of Fig. 1, and for the same purpose, the damper being just below the top of the shell 27. In this construction the gases of combustion are taken off by the apron at a suitable point above the melting zone, and pass into the circulation box. From and through the passage 25 they pass to the stack, communicating therewith above the damper.

In the embodiment of the invention shown in Figs. 6 and 7, the cupola has the base 30, the tuyères 31, and a body 32, all which may be like the corresponding parts of Fig. 1. The bustle pipe 33 delivers to the tops of the body sections, and pipes 34 lead from the bottoms thereof to the tuyères. The top 35 of the cupola and the charging door are like the corresponding parts of Fig. 1.

A circulation box 37 is arranged between the top and the body, in the same manner as the box 13 of Fig. 1 is arranged, and the said box has the tubular apron 38 like that of Fig. 1. Instead, however, of connecting the charging box with the stack above the damper 39 by a plurality of connections, a single connection is provided, and a door or fan is arranged in the connection.

The fan or blower indicated at 40 is driven by a suitable motor 41, and the inlet of the blower is connected to the circulation box by a plurality of connections, indicated at 42 and 43 respectively. As shown in Fig. 7, the circulation box is composed of three sections, instead of four, as in Fig. 2, and one

of the pipes 42 or 43 is connected with each section, as clearly shown in Fig. 7.

A pipe 44 connects the outlet of the fan or blower with the stack above the damper 39, and it will be apparent from the construction that the draft may be direct through the apron, or indirect by way of the circulation box, the fan and the stack. The operation is the same as that shown in Fig. 1, with the additional feature of regulation of the draft through the circulation box.

What is claimed as new is:—

1. A cupola having tuyères and a charging door and means to by-pass the combustion gases from a selected point above the tuyères and the melting zone to the cupola above the charging door, said means including a damper above the door, a tubular apron above the melting zone and spaced from the cupola wall, and connections between the space about the apron and the cupola above the damper.

2. A cupola having tuyères, a charging door, and a damper above the door, means to by-pass the combustion gases from a selected point above the tuyères and the melting zone to the cupola above the damper, said means including a tubular apron of a cross section similar to that of the interior of the cupola and spaced apart from the walls thereof, and conduits for conducting the combustion gases from about the apron to the space above the damper.

3. In cupola construction, an annular circulation box interposed in the body of the cupola below the charging door, and having an apron depending therefrom, said apron of tubular conformation and spaced apart from the cupola wall to enable the flow of combustion gases into the circulation box, and communications between said box and the cupola above the charging door.

4. In cupola construction, an annular circulation box interposed in the body of the cupola below the charging door, and having an apron depending therefrom, said apron of tubular conformation and spaced apart from the cupola wall to enable the flow of combustion gases into the circulation box, a damper arranged transversely of the cupola above the charging door, and communication between the circulation box and the cupola above the charging door.

5. A cupola having tuyères, a charging door, and a damper above the door, means to by-pass the combustion gases from a selected point above the tuyères and the melting zone to the cupola above the damper, said means including an annular chambered box inset in the cupola wall and extending beyond the inner face thereof and provided with a tubular apron depending from the inner surface of the box and providing a space between said apron and the cupola wall, the box having openings communicating with the space, and passages leading from the box to the interior of the cupola above the damper.

6. In a cupola having tuyères, and a charging door, an annular box inset in the cupola wall and extending beyond the inner face thereof and provided with a tubular apron depending from the inner face of the box and providing an annular space between said apron and the cupola wall, the box having openings communicating with the space, and passages leading from the box to the interior of the cupola above the charging door.

7. In a cupola having tuyères and a charging door, a tubular apron within the cupola below the charging door and spaced apart from the cupola wall to form an annular space, the top of the apron connected with the cupola wall, and connections leading from said space to the cupola above the charging door for by-passing the products of combustion past the charging door.

Signed at Birmingham, in the county of Jefferson and State of Alabama, this 2nd day of March, A. D. 1928.

CLARENCE DALE BARR.
WILLIAM D. MOORE.