

July 25, 1967

G. NAMY
REGULATION OF THE COLLECTION OF GASES FROM THE
OXYGEN REFINING PIG IRON

3,332,676

Filed July 12, 1965

2 Sheets-Sheet 1

Fig. 1

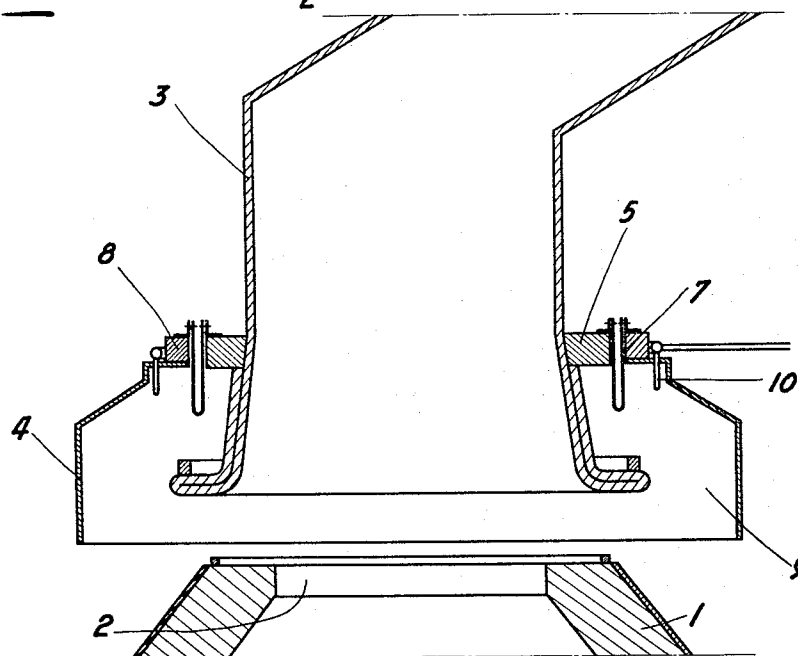
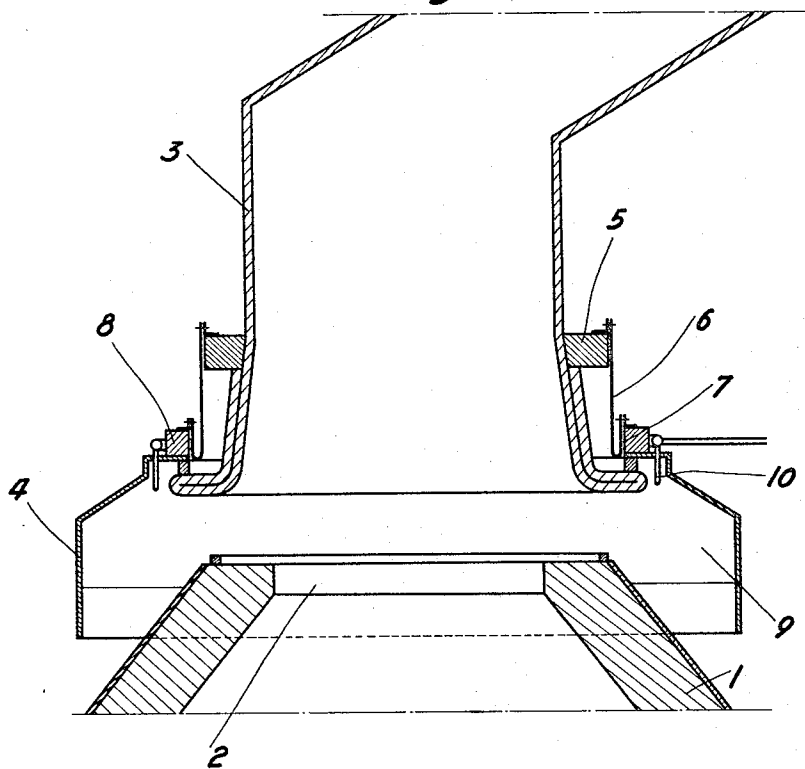


Fig. 2

Inventor:
Gerald Namy
BY Baldwin & Wright
Attorneys

July 25, 1967

G. NAMY
REGULATION OF THE COLLECTION OF GASES FROM THE
OXYGEN REFINING PIG IRON

3,332,676

Filed July 12, 1965

2 Sheets-Sheet 2

Fig. 3

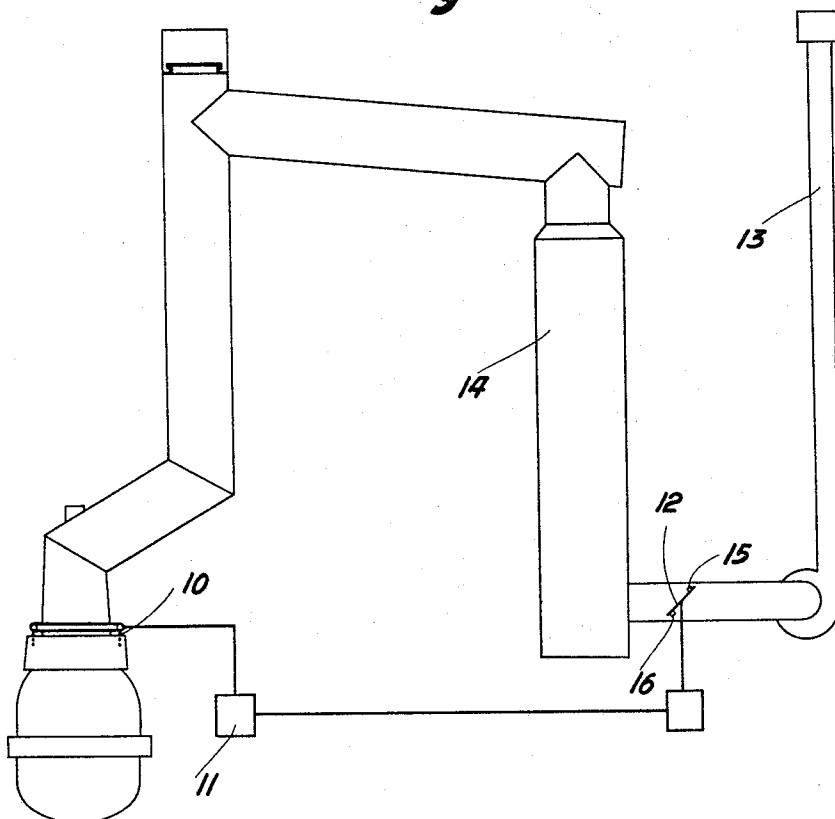
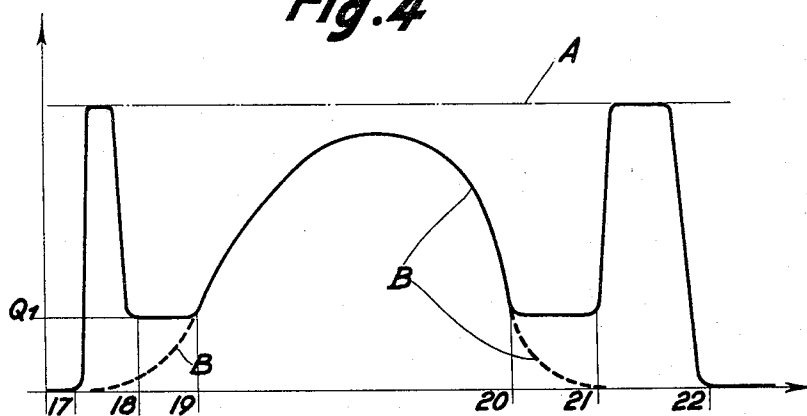


Fig. 4



Inventor:
Gerald Namy
BY Baldwin & Wright
Attorneys

1

3,332,676

REGULATION OF THE COLLECTION OF GASES FROM THE OXYGEN REFINING PIG IRON

Gerald Namy, Saint-Etienne, France, assignor to Societe Anonyme: Compagnie des Ateliers et Forges de la Loire St-Chamond-Firminy-St-Etienne-Jacob Holtzer, Paris, France, a corporation of France

Filed July 12, 1965, Ser. No. 471,151

Claims priority, application France, July 16, 1964, 981,857 (addition Jan. 11, 1965, 1,426)

10 Claims. (Cl. 266—35)

The present invention relates to improvements in the collection, evacuation, and recuperation of gases originating from the pneumatic refining of pig iron, particularly by means of pure oxygen, and also to the regulation of such collection.

For various reasons it is advantageous to prevent the combustion, at the nose of a converter (or retort or crucible) operated with pure oxygen, of the gases originating from the refining and composed largely of carbon monoxide CO.

Among the methods at present known for achieving this aim, mention will first be made of one which provides a sliding collar adapted to be raised between the hood and the nose of the converter, and in which tightness is obtained by applying the collar against the armour of the converter, while suction is effected by any known means. In order to obtain complete tightness, it is possible to inject a gas into the joint existing between the collar and the converter. This method has the advantage of being simple, but it entails the risk of an invasion of the collection installation in the case of frothing or the overflowing of slag.

Another method consists of utilizing a hood which is not fluid-tight, situated at some distance above the converter nose, and in which a very accurate draught regulation system always maintains in the hood a pressure substantially equal to the ambient atmospheric pressure. In this way the hot gases coming from the converter can be recovered practically without combustion. In order to effect the regulation of the draught in the hood, a regulation chain has been proposed which utilizes as information the difference between the pressure prevailing in the bottom part of the hood and the ambient atmospheric pressure; the regulation then has the object of maintaining this difference at a set value equal to zero. Use may also be made of a chain the information of which is supplied by a temperature measurement permitting the situation of the "floor" of the collected gases to be ascertained, the "floor" of the collected gases being the level which separates the collected gases from the ambient air.

It has likewise been proposed to utilize, for the collection of the refining gases escaping from a converter not having a fluid-tight joint between the hood and the converter, a hood characterized in that it comprises a top part the horizontal section of which is adapted to the stream of gas to be collected and extended by a widened bottom part forming an enlargement around the converter nose. In this device the enlargement or skirt disposed below the hood serves two important purposes: it prevents temporary parasitic discharge outside the hood, and permits expansion of the gases at the base of the hood, forming a buffer capacity widening the range of adjustment of draught regulation, and thus facilitating the work of the regulating devices. In fact, in a hood having a bottom widening, temporary disequilibrium between the flow of gas leaving the converter and the flow of gas drawn in by the draught means produces a variation of the level of gas less rapid and less great than in the case of a simple hood of dimensions equivalent to those of the top, unwidened part.

2

The object of the present invention is to improve in a particularly advantageous manner the industrial regulation of the collection of gases during refining, and also the blowthrough operations to be carried out at the beginning and end of each refining operation.

The work and experiments of the applicants have in fact made it clear to them that the regulation of collection acted most satisfactorily when the following conditions were fulfilled:

The measurements of pressure in the skirt are made in a calm zone of the latter, in order to be protected against splashes of solid and liquid material and in order that the measurement may not be influenced by the flow or the agitation of the gas;

The diameter of the hood and that of the nose are substantially close to one another, while the diameter of the skirt, which is considerably greater bears a ratio to the diameter of the nose which is determined in dependence on operating conditions, and preferably of the order of 1.5 to 2.5;

The height overlap of the skirt over the converter nose is as great as possible, for example of the order of 1 metre for usual equipment, in such a manner as to keep the floor of the gas inside the skirt in all circumstances;

A constant value is imposed on the difference between the pressure measured in the skirt, at a given level in the calm zone referred to above, and the pressure measured in the ambient air at the same level: this constant value corresponds to the static excess pressure produced by the layer of hot gas imprisoned in the skirt;

It has moreover been found that the preferable position for taking pressure in the calm zone under the skirt is situated at the level of the base of the hood.

A "layer" of hot gas is intentionally formed therefore in the skirt, and this layer isolates the gas produced by the converter from the atmosphere and thus facilitates the production of a recovered gas having a high CO content.

Taking these observations into account, the present invention has as object a device for regulating the collection, without combustion, of gases originating from the oxygen refining of pig iron, by means of a hood provided at its base with a skirt disposed sealingly on the hood and mounted without a fluid-tight joint between the skirt and the converter, said device being essentially characterized in that the skirt has a diameter substantially greater than that of the converter nose, in a ratio preferably ranging from 1.5 to 2.5, that the diameter of the hood and that of the nose have substantially equal values, that the overlapping in height of the skirt over the nose has as great a value as possible, and in any case is greater than 0.50 metre and in practice of the order of about 1 metre, a constant pressure difference or set pressure being maintained between at least one point of a calm zone inside the skirt and a point outside the skirt and situated preferably, but not essentially, at the same level as said inside point.

In these circumstances, no correction due to the existence of dynamic effects need be made to the static pressure measurements made in the calm zone, as defined above, that is to say in a zone which splashes of solid or liquid material coming from the converter are practically unable to reach and in which the velocities of the gas are low. The choice of a relatively large dimension for the diameter of the skirt, and also for the overlapping height, makes it possible to avoid having to act very often on the draught which effects the regulation, for the purpose of correcting the small accidental variations occurring in the "buffer volume" of gas; the particular dimensions of the skirt make it possible in fact to select a constant value for the set pressure. This difference in pressure is in general between 1 and 1.5 mm.

3

water column depending on the adjustment made. The difference in pressure measured at the top of the skirt, when it is equal to the set value, corresponds in fact to a zero difference in pressure at the base of the skirt.

The value of the set pressure applied thus remains constant during the blast; nevertheless, for reasons of safety in operation it is advantageous to operate at the beginning and end of the blast with gas collection accompanied by combustion, in order to form in the gas circuit buffers of neutral gas which blow through the installation. For this purpose the value of the set pressure applied remains constant, and use is made of a device in which the damper enabling the draught to be regulated comes against a mechanical stop instead of being closed completely, thus putting the regulation out of action, although only at the limit position.

The result is that the device according to the invention operates with numerous advantages, which include the following:

It is easy to arrange for each collection phase without combustion to be preceded and followed by a phase of collection with combustion and thus to effect easily the blowing through of the installations by the known neutral gas buffer method. At the beginning of the blast, as the gas flow increases, the gas floor is formed and is lowered inside the skirt, and the regulation soon intervenes so that the operation is very quickly being carried out with collection without combustion. Similarly, when towards the end of the blast the flow of oxygen is reduced, the gas floor rises, the regulation ceases to act because the damper encounters its stop; there is then collection with combustion, which once again supplies a protective buffer, giving full security between the blast with gas collection without combustion and the termination of the blast;

It is consequently easy to blow the installation through at the beginning and end of each blast;

The operation is carried out with simple means, because it is not necessary to change the set pressure value, owing to the presence of the mechanical damper stops;

Because of the position of the pressure pick-ups, the measurement utilised for the regulation of draught is unaffected by the effects of variations of gas flow in the hood.

In the case where the refining container is a converter which must be able to be tipped, the skirt is movable by rotation around a vertical or horizontal axis, by longitudinal coaxial displacement with the hood, or by any other known means. The skirt is mounted on the hood in such a manner as to provide complete fluid-tightness; when the skirt is movable, this fluid-tight mounting may comprise a telescopic tube or a foldable or windable curtain, with the optional interposition of an annular seal of any type.

It will be seen immediately that the device according to the invention actually provides a substantial simplification of the regulation because of the gas buffer formed between skirt and converter under the general conditions described above, which are moreover such that the vertical displacement of the gas floor will be as slight as possible. Another advantage of this device is that the response times permitted for the regulation may be longer.

In the accompanying drawing there is illustrated diagrammatically and by way of non-limitative example a device having a movable skirt hood according to the invention.

FIGURE 1 is a view in vertical section of the device with the skirt lowered;

FIGURE 2 is a view in vertical section of the device with the skirt raised;

FIGURE 3 illustrates diagrammatically the flue damper control permitting regularisation of the draught of gases drawn in;

FIGURE 4 shows a curve of inspired gas flows plotted against time.

4

FIGURES 1 and 2 show the converter 1 with its nose 2; the hood 3 has its open bottom end situated at a certain height above the nose 2.

According to the invention, the hood 3 supports the skirt 4, which is widened towards the bottom and which, without touching it, surmounts over a height of the order of 1 metre the top part of the converter 1; the skirt 4 is attached sealingly to the hood 3 and is widened out at the bottom near the nose 2 of the converter 1. The seal between skirt 4 and hood 3 is constituted by an annular element 5 secured to the hood and supporting a foldable curtain 6, the bottom end 7 of which is straightened and fixed to a ring 8 forming the top of the skirt neck. When it is desired to tip the converter 1, it is sufficient to raise the skirt 4 by any suitable means, not illustrated, parallel to its vertical axis coaxial with that of the hood; the skirt 4 then assumes the position illustrated in FIGURE 2, the curtain 6 being folded parallel to the axis of the hood.

When the skirt 4 is lowered (FIGURE 1), the adjustments of the draught and/or temperature are such that in the space 9 contained between the converter and the skirt a buffer of gas is formed; this gas buffer practically prevents the admission of outside air and the escape of gas. Pressures are measured at a series of pressure picking points 10 disposed in a horizontal plane in a circle in a calm zone, at the top of the skirt and outside the bottom edge of the hood and generally coaxial therewith.

The pressure readings taken at 10 are translated by the regulator 11 in controlling the opening or closing of the draught damper 12 situated upstream of the chimney 13 and downstream of the device 14 for freeing gases from dust (FIGURE 3). The draught damper 12 is adapted to pivot between two stops 15 and 16. As has previously been explained, these two stops 15 and 16 have the object of putting the regulation control out of action by any known means, in a position of the damper which is not entirely closed, in order to collect the gases with combustion by the air originating from the outside at the very beginning and at the very end of a refining operation.

FIGURE 4 shows diagrammatically the inspired gas flows in an installation equipped in accordance with the invention, in the successive phases of a refining operation (the maximum flow of the fan is indicated at A).

(a) At 17, the suction fan is operated, the draught damper 12 is open, the oxygen nozzle is lowered into the converter, and the blast commences. A small flow of converter gas mixed with a very large excess of air (maximum draught) is drawn in.

(b) At 18 (commencement of blowing through the installation) the damper 12 is closed and has come against the stops 15 and 16; a much smaller flow of gas than previously is then drawn in, but still entailing combustion of the converter gases and a certain excess of air.

(c) At 19 (end of blowing through of the installation) the gas flow emitted by the converter rejoins the flow of inspired gas, so that inspiration of outside air is prevented; collection of gases without combustion commences, and the damper 12 serves as draught regulator.

(d) At 20 (end of automatic regulation) the end of the refining is approaching; the flow B of the gas emitted by the converter reduces and the damper 12 again strikes against its stop.

(e) At 21 the end of the blast occurs. The damper 12 is opened wide to blow through the installation.

(f) At 22, the suction fan is stopped.

What I claim is:

1. In a device for controlling the captation without combustion of the gases resulting from the refining of pig iron through oxygen comprising a converter having an outlet for the gases, a hood positioned generally in axial alignment with said outlet, said hood having two annular telescoping sections, the outer section being positioned in external telescoping relationship with said outlet, said

5

outer section having a diameter appreciably greater than the diameter of said outlet, the inner section being positioned in axially spaced relation to said outlet and having a diameter generally equal to the diameter of the outlet, closure means positioned between the two sections remote from said outlet for closing the space between the two sections thereby forming an annular area radially outwardly of said outlet closed at the end of the area remote from the outlet, said area forming a quiescent zone for gases, means positioned in said annular area for detecting the pressure of the gases in said area, and means including said detecting means for maintaining a substantially constant pressure differential of the gases between the annular area and the atmosphere.

2. The device as defined in claim 1 wherein the diameter of the outer section of the hood ranges between 1.5 and 2.5 times the diameter of the inner section.

3. The device as defined in claim 1 wherein the axial overlapping distance of the outlet and the outer section is approximately 0.5 meter.

4. The device as defined in claim 1 wherein said detecting means are a plurality of detectors defining pressure picking points disposed in an identical plane.

5. The device as defined in claim 1 wherein said inner section includes a terminal edge disposed radially inwardly of said outer section, and said detecting means are a plurality of detectors defining pressure picking points disposed in a circle generally coaxial with said terminal edge.

6

6. The device as defined in claim 2 wherein the axial overlapping distance of the outlet and the outer section is approximately 0.5 meter.

7. The device as defined in claim 2 wherein said detecting means are a plurality of detectors defining pressure picking points disposed in an identical plane.

8. The device as defined in claim 2 wherein said inner section includes a terminal edge disposed radially inwardly of said outer section, and said detecting means are a plurality of detectors defining pressure picking points disposed in a circle generally coaxial with said terminal edge.

9. The device as defined in claim 3 wherein said detecting means are a plurality of detectors defining pressure picking points disposed in an identical plane.

10. The device as defined in claim 3 wherein said inner section includes a terminal edge disposed radially inwardly of said outer section, and said detecting means are a plurality of detectors defining pressure picking points disposed in a circle generally coaxial with said terminal edge.

References Cited

UNITED STATES PATENTS

2,954,244	9/1960	Austin	285—11
3,111,400	11/1963	Hoff	75—60
3,118,759	1/1964	Okaniwa et al.	75—60
3,154,406	10/1964	Allard	75—60
3,216,713	11/1965	Imaida et al.	75—60
3,218,158	11/1965	Dumont-fillon	75—60

BENJAMIN HENKIN, *Primary Examiner*.