METHOD OF BLOWING-IN BANDED BLAST FURNACES

Inventors:

WILLIAM A. ABBETT, JR.
and FLOYD C. DIAZ,

by: Donald L. Dalton
their Attorney.
UNITED STATES PATENT OFFICE

METHOD OF BLOWING-IN BANKED BLAST FURNACES

William A. Abbott, Jr., and Floyd C. Diaz, Duluth, Minn., assignors to United States Steel Corporation, a corporation of New Jersey

Application December 17, 1952, Serial No. 326,554

5 Claims. (Cl. 75—41)

This invention relates to an improved method of starting blast furnaces after they have been banked.

When a blast furnace is shut down for a prolonged period, it is usually "banked"; that is, it is charged with coke only, and its tuyères are sealed. Stack effect alone is relied on to maintain slow combustion and thus keep the furnace hot. The usual method of starting a banked furnace is to blow air, optionally enriched with oxygen, through some of the tuyères adjacent the iron notch and sometimes through the iron notch itself. Durfee et al. Patent No. 2,468,780 discloses an improved method in which all the tuyères are sealed and air is introduced exclusively through the iron notch. Reference can be made to this patent for a detailed discussion of the difficulties encountered in blowing-in a banked furnace, but briefly the main difficulty is in remelting the mass of material that accumulates on the furnace bottom. It is often necessary to cast iron several times from the cinder notch before this mass is sufficiently molten to cast from the iron notch. Commonly the blowing-in period consumes at least 48 hours before the bottom is hot enough to permit proper operation.

We have found that previous methods of blowing-in banked furnaces do not distribute the heat properly in the regions where it is needed. Only the periphery of the furnace a few feet in front of the tuyères and iron notch is heated sufficiently during the blowing-in period. The rest of the furnace bottom does not readily become hot enough to clean out the burnt coke, heavy scrap, and scabs along the furnace walls, some of which material likely falls loose during the bank. We believe that the inability of previous methods to retain and distribute heat through the bottom of the furnace accounts for the excessive time they require.

An object of the present invention is to provide an improved furnace starting method which conserves heat in the furnace bottom and utilizes this heat more efficiently than previous methods with which we are familiar, thereby shortening the time required for blowing-in.

A more specific object is to provide an improved method of blowing-in a banked blast furnace in which the top portion of the furnace is pressurized and the gases are discharged horizontally through a special discharge pipe inserted in the cinder notch, thereby utilizing all the heat at the bottom of the furnace where it is needed.

The manner in which we have accomplished these and other objects of the invention is illustrated in detail in the accompanying drawings, in which:

Figure 1 is a diagrammatic horizontal sectional view through the tuyères of a banked blast furnace showing our preferred way of applying the blast to blow-in the furnace, and our way of discharging the products of combustion in accordance with the present invention;

Figure 2 is a fragmentary vertical sectional view through the iron and cinder notches taken on line II—II of Figure 1;

Figure 3 is a side elevational view on a larger scale of a preferred construction of discharge pipe; and

Figure 4 is a vertical sectional view of the discharge pipe taken on line IV—IV of Figure 3.

Figures 1 and 3 show part of a blast furnace of usual construction which includes a wall 10, twelve tuyères T-1 to T-12, an iron notch 13 near the bottom, and a cinder notch 14 somewhat above the iron notch and circumferentially spaced therefrom. The cinder notch has a large cinder cooler 15, an intermediate cooler 16 and lugs 17 (Figure 2). The furnace has the usual dusting pipe 18, tuyère stocks 19 and blow pipes 20 for supplying preheated air to the tuyères during normal operation. The furnace is banked and the bottom contains skull 21 around the outside and coke 22 in the central region.

In blowing-in the furnace, heat can be applied initially in any desired way. Nevertheless we prefer the way disclosed in the aforesaid Durfee et al. patent, since it allows the blast to enter the furnace at the lowest possible point, and we have illustrated the heat thus applied in our drawings. As shown in Figure 2, the skull 21 is dug out opposite the iron notch 13. A pipe 23 is inserted through this notch and into the coke 22. This pipe is connected with one of the tuyère stocks 19 via piping 24, which contains a valve 25 and a pressure gauge 26. All the tuyères T-1 to T-12 are sealed.

In accordance with the present invention, the top portion of the furnace is pressurized to keep gases from escaping via this route. Such pressure can be applied in any known way, but since only a small pressure is required, it is usually sufficient merely to adjust the bleeper valves. To furnish an escape for the gases, a horizontally extending pipe 27 is inserted through the coolers 15 and 16 of the cinder notch 14 into the coke 22. As shown in Figures 3 and 4, the pipe 27 preferably has a compressed inner end 28, inlet slots 29 in its sides, and an annular flange 30 adjacent its outer end. Said flange has notches
2,660,524

3 in its circumference adapted to receive the cooler lugs 17 to hold the pipe in place. Preferably a larger pipe 32 is placed over the outer end of the pipe 27 to direct the flow of the escaping gases. Regardless of the heating method used, combustion is mainly confined to the lower part of the furnace, since there is no escape route for the gases through the top. Instead gases can escape only in a horizontal direction through the pipe 27.

When the initial heat is applied in the preferred manner already described, the tuyères are opened at intervals after the pressure builds up, as indicated on the gauge 26. Preferably the first tuyères opened are T-12 and T-11, which are adjacent the iron notches on the side opposite the cinder notch. The other tuyères are opened in sequence around the furnace after appropriate intervals. As each tuyère is opened, the wind is increased and the top pressure increased to compensate for the greater wind volume. After several tuyères are open, the iron notch can be plugged and the blast introduced exclusively via the tuyères, and still later the pipe 27 can be removed and the gases discharged in their normal manner through the furnace top.

A specific example of how we have applied the foregoing method to blow-in a banked furnace is as follows:

The furnace has been five-banked for six weeks. Preliminary to blowing-in the furnace, its iron and cinder notches were cleaned out and the equipment illustrated in Figure 2 was installed. All the tuyères were blocked with clay. A hot air blast of 6000 cubic feet per minute at 600° F. was being through the iron notch. The bleeders at the top of the furnace were adjusted to give a top pressure of approximately 10 inches of water. This condition was maintained for approximately four hours with most of the gases discharging through the pipe in the cinder notch. By this time the pressure indicated by the gauge in the piping to the iron notch was increasing. The two tuyères closest to the iron notch on the side away from the cinder notch were opened. The wind was increased to 20,000 cubic feet per minute, and the top pressure increased to produce maximum discharge through the pipe in the cinder notch. One hour later the next tuyère in line leading away from the cinder notch was opened and the wind increased to 25,000 cubic feet per minute. Shortly thereafter the pipe in the iron notch burned off; the burned pipe was removed and a small cast made from this notch.

Next the iron notch was stopped with a mud gun and the blast continued through the open tuyères. At two hour intervals each succeeding tuyère in line was opened and the wind increased 5000 cubic feet per minute. The top pressure was adjusted with each increase in wind to furnish maximum safe discharge of gases through the pipe in the cinder notch. A cast was made six hours after the pipe was removed from the iron notch, at which time there were five tuyères open and a wind of 35,000 cubic feet per minute.

After this cast the pipe was removed from the cinder notch and the regular monkey cooler installed. The wind was placed at 55,000 cubic feet per minute and the gas brought down and used to heat the stoves. The rest of the tuyères were opened progressively toward the cinder notch and the blast was increased to 45,000 cubic feet per minute, which was held until all the tuyères were open. The furnace was placed on a four-hour casting schedule with all the iron recoverable from the iron notch. The entire operation required less than twelve hours.

From the foregoing description and specific example it is seen that the present invention affords a simple method for blowing-in banked blast furnaces and greatly expedites the operation. The advantages are possible because of the horizontal flow of gases across the hearth section of the furnace, which flow cleans out metallic pockets and heats this part of the furnace in the shortest possible time.

While we have shown and described only a single embodiment of the invention, it is apparent that modifications may arise. Therefore, we do not wish to be limited to the disclosure set forth but only by the scope of the appended claims.

We claim:
1. A method of starting a banked blast furnace comprising applying air to the bottom part of the furnace and discharging the resulting gases through the cinder notch.
2. A method of starting a banked blast furnace comprising applying air to the bottom part of the furnace, pressurizing the top part of the furnace, and discharging the resulting gases through the cinder notch.
3. A method of starting a banked blast furnace comprising blowing-in air to the bottom part of the furnace through the iron notch, pressurizing the top part of the furnace, and discharging the resulting gases in a horizontal direction through the cinder notch.
4. A method of starting a banked blast furnace comprising sealing all the tuyères, blowing-in air to the bottom part of the furnace through the iron notch, pressurizing the top part of the furnace to prevent escape of gases, and discharging the gases in a horizontal direction through the cinder notch.
5. A method of starting a banked blast furnace comprising sealing all the tuyères, blowing-in air to the bottom part of the furnace initially only through the iron notch, pressurizing the top part of the furnace to prevent escape of gases, discharging the gases in a horizontal direction through the cinder notch, and opening the tuyères at intervals commencing with the tuyère adjacent the iron notch on the side opposite the cinder notch.

WILLIAM A. ABBETT, JR.
PLOYD C. DIAZ.

No references cited.