United States Patent [19]

Mahr

[11] **3,759,404**

[45] **Sept. 18, 1973**

[54] **CHARGING DEVICE FOR A SHAFT FURNACE**

[75] Inventor: **Rene Mahr**, Luxembourg, Luxembourg

[73] Assignee: **Societe Anonyme des Anciens Establissements Paul Wurth**, Luxembourg, Luxembourg

[22] Filed: **May 27, 1971**

[21] Appl. No.: **147,592**

[30] **Foreign Application Priority Data**

May 27, 1970 Luxembourg 60996

[52] **U.S. Cl.** **214/37**, 266/27

[51] **Int. Cl.** **F27b 11/12**

[58] **Field of Search** ..... 214/35 R, 36, 37; 266/27

[56] **References Cited**

UNITED STATES PATENTS

955,885	4/1910	Kennedy	214/37
3,476,374	11/1969	Colijn	266/27
3,302,805	2/1967	Tsutsumi	214/37
3,533,522	10/1970	Schneider	214/35 R

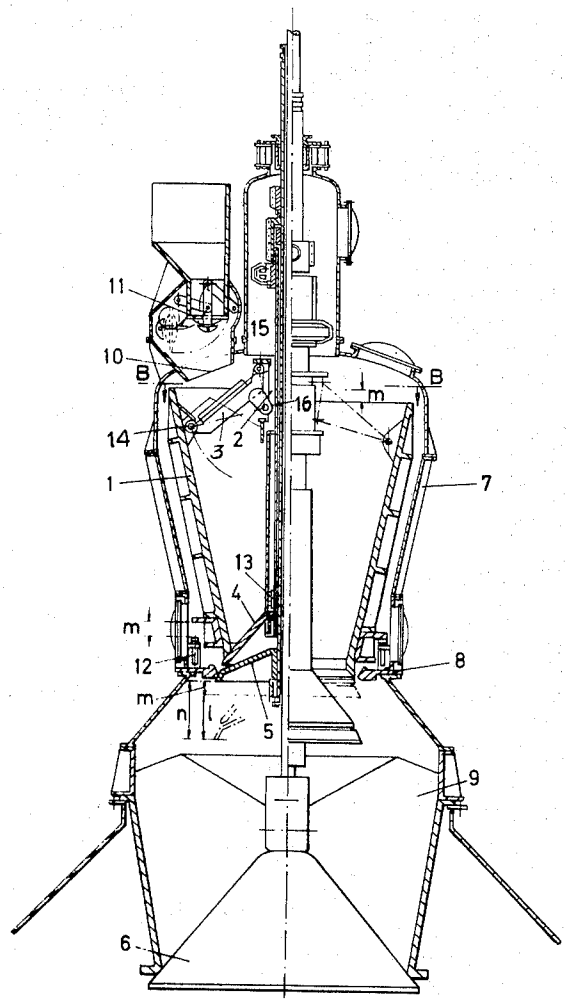
Primary Examiner—Robert G. Sheridan

Attorney—Holman & Stern

[57] **ABSTRACT**

A charging device for a shaft furnace in which a lower chamber is defined between two charging bells suspended on longitudinally movable shafts. An upper chamber contains a rotatable hopper. The hopper is supported by three arms connected between the inner surface of the hopper and a sleeve enclosing the shafts on which the bells are suspended.

1 Claim, 2 Drawing Figures



PATENTED SEP 18 1973

3,759,404

SHEET 1 OF 2

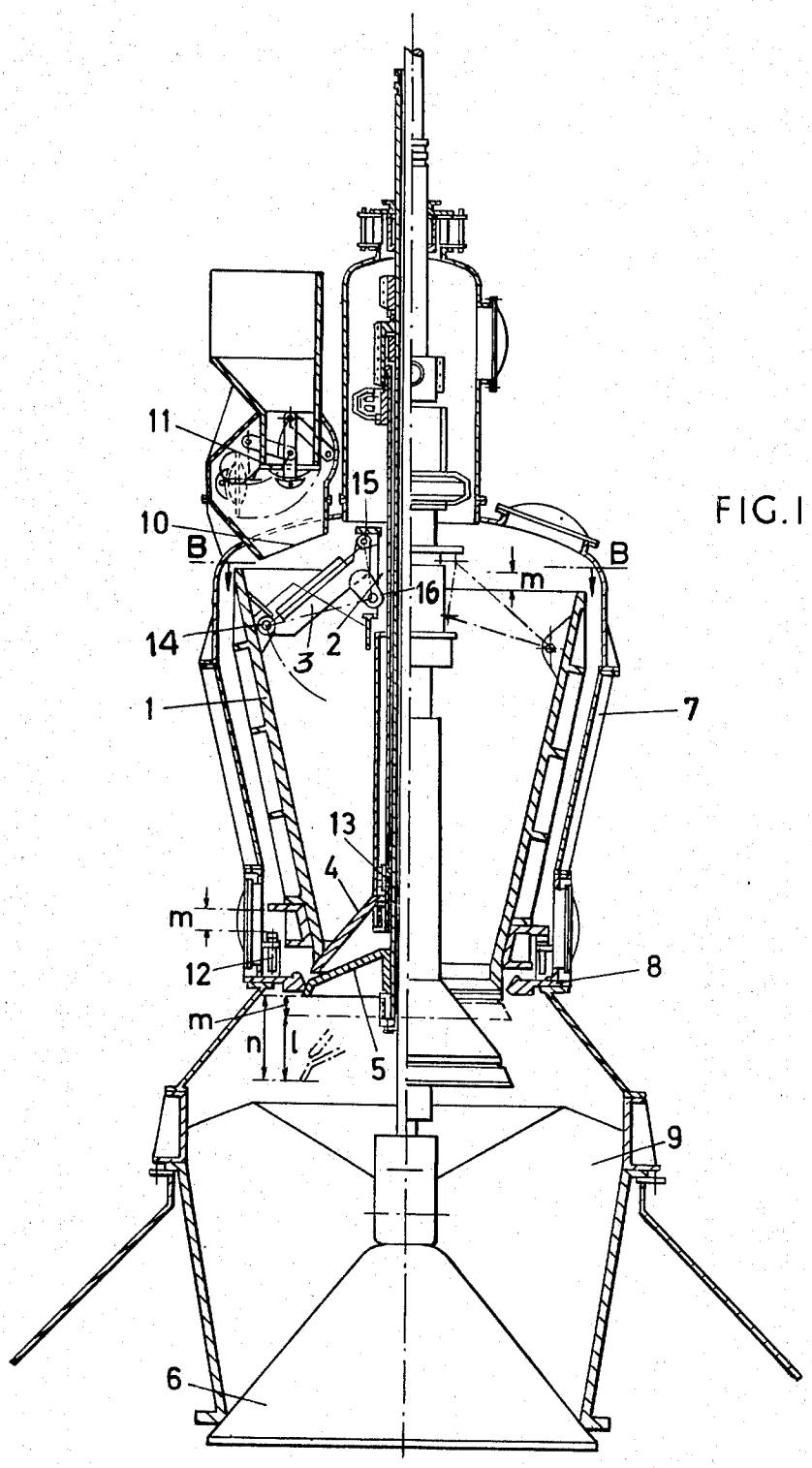


FIG. 1.

INVENTOR
RENE MAHR

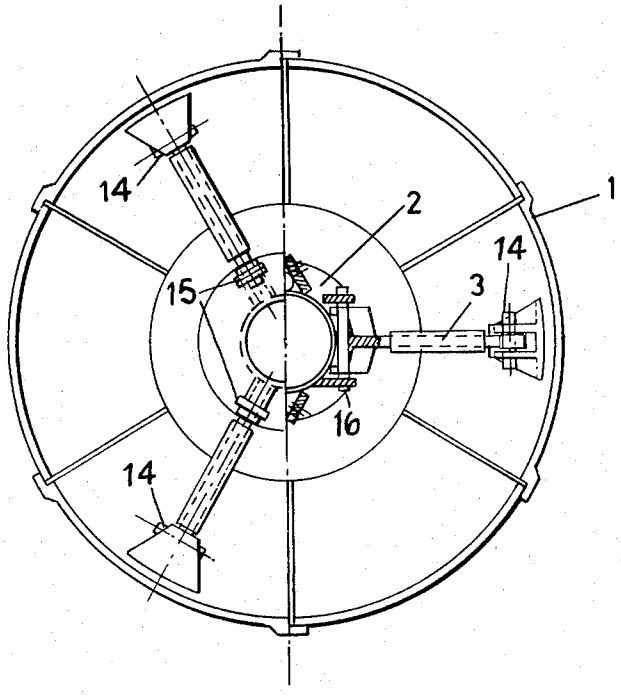


FIG. 2.

INVENTOR
RENE MAHR

CHARGING DEVICE FOR A SHAFT FURNACE

BACKGROUND OF THE INVENTION

The present invention relates to a charging device for a shaft furnace and is particularly applicable to blast furnaces operating at high top pressure.

Shaft furnaces, particularly blast furnaces, are usually equipped with a device for the distribution and dispersal of the raw materials for charging (iron ore, flux, coke) which is normally a hopper open at its upper end and two charging bells. The smaller of these two bells is situated at the lower end of the distributor hopper and serves as a base part therefor while the larger bell, situated at a lower level, controls the release of the burden into the furnace.

In cases where the shaft furnace operates with a high top pressure, traditional charging systems using a single chamber, delineated by the two bells, present problems of gastightness and resistance of parts to abrasion. To overcome these problems, the charging system can be designed so that it has a double chamber, that is to say, two gastight chambers, the lower of which is defined between two charging bells.

Among the solutions proposed for the execution of this device with a double chamber, one of the oldest consists in fitting three bells to the furnace, the uppermost one of which (small bell) is surmounted by the normal distributor hopper, usually a rotating hopper.

Another solution is to omit the rotating distributor hopper and to replace it by a distributor spout located inside a gastight chamber.

A further solution is to arrange around the rotating distributor hopper a gastight casing having as its base the smaller bell and at its upper end the necessary orifices to allow the raw materials to pass into the hopper, with these orifices being further provided with sealing devices to ensure the gastightness of the casing.

This device has in particular the advantage that it results in only a very small increase in the height of the charging system and it also ensures an even distribution of the raw materials in the hopper, and therefore in the furnace. It has been found to be of particular interest when the rotating distributor hopper is provided with a device enabling it to slide perceptibly along the longitudinal axis of the furnace, while the small bell, which constitutes the mobile base part of this hopper, can if necessary be provided with a wear-resistant protection member. In fact, when a distributor hopper of this type is used, the advantages of the double chamber charging system are increased, wear on the sealing joints of the large bell, is reduced and a considerable simplification of the design of the various seals is obtained, especially the seals surrounding the hopper, the seals against which the small bell presses when in a raised position, and the joints which, in the usual mounting systems of the bells, separate the members supporting the small bell from those supporting the large bell. In this connection, it should be noted that it is essential, if the joint against which the small bell presses when in a raised position is to be protected, that the sliding hopper covers the joint in question when in its lower position.

OBJECTS AND SUMMARY OF THE INVENTION

The object of the present invention is to provide of a device for the charging of shaft furnaces, in which the double chamber principle is used, having a rotating distributor hopper, and in which the rotating and mounting members of this hopper are positioned around the mounting shafts of the bells.

The present invention provides a charging device for a shaft furnace, comprising an upper chamber and a lower chamber, the lower chamber being defined between two charging bells suspended on longitudinally movable shafts, the upper chamber containing a rotatable hopper, the hopper being supported by at least three arms connected between the inner surface of the hopper and a sleeve enclosing the shafts on which the bells are suspended.

The arms may advantageously be at the upper end of the hopper, but in such a manner that they do not substantially impede the passage of the raw materials.

Also in accordance with the invention the lower end of the hopper can be maintained in a centered position in order to prevent any radial displacement of the hopper that might occur as a result, for example, of the passage of lumps of material, if the base of the hopper, constituted by the upper bell or a wear cone protecting it, is separated from the hopper. This centering can be effected either by means of lateral guides attached to the internal wall of the upper chamber surrounding the hopper, or preferably by means of central guide shoes, which are easily replaceable.

An advantageous variation of the charging device in accordance with the invention consists in arranging the arms to be retractable, for example by rotation around a pivot forming part of the sleeve, when the arms are disconnected from the hopper. This variation facilitates replacement of the hopper elements when they comprise a number of segments held in position by an assembly ring, or when the shaft furnace in a single piece, contains internal fitting plates or plaques.

The invention will be described further, by way of example only, with reference to the accompanying drawings, in which:

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a vertical section through a charging device on the upper end of a shaft furnace, illustrating two positions of the upper bell; and

FIG. 2 is a view taken along the line B—B of FIG. 1, being a plan view of the distributor hopper.

DETAILED DESCRIPTION OF THE INVENTION

Since the system for rotation of the hopper does not form part of the present invention, it is not described here. It is, however, described in our co-pending U.S. Pat. application Ser. No. 147,593, filed simultaneously with this application.

The drawings, which are not to scale, show a distributor hopper **1**, having a rotating drive system which drives a sleeve **2** connected to the hopper **1** by three arms **3**. Each arm **3** is attached to the hopper **1** by a pin **14**, and to the sleeve **2** by an upper pin **15** and a lower pin **16**. The arms **3** can be retracted from the hopper by being swung downwardly about the pins **16** after removal of the pins **14** and **15**. The distributor hopper **1** rests by its own weight on a base part **4**, which tapers upwards and serves as a wear-resistant protection cone for a small bell **5**. A large bell **6** is arranged in the usual manner, delineating a gastight chamber **9** between the two bells **5, 6**. The wear cone **4** and the two charging bells **5, 6** are mounted on shafts which are lowered and raised from above the furnace.

A gastight casing 7 surrounds the distributor hopper 1. The casing 7 rests and is fixed in a gastight manner on an upper ring-shaped part 8 of the chamber 9 situated above the large bell 6. This gastight casing is closed at its lower end by the small bell 5, and has at its upper end, which serves as a cover for the distributor hopper 1, inlet orifices 10 for the raw materials. These inlet orifices 10 are provided with sealing valves 11 to ensure the gastightness of the casing 7 and are surmounted by a shallow spout, a so-called receiving spout, through which the skip or similar loading device (not shown) unloads the raw materials into the furnace.

The charging device illustrated in the drawings, functions in the following manner:

The raw materials are emptied through the receiving spout by the loading devices and are introduced into the distributor hopper 1 when the sealing valves 11 on the upper part of the gastight casing 7 are opened. During this process, the lower end of the distributor hopper 1 rests against the wear cone 4 and the small bell 5 is pressed up agsinst the base of the gastight casing 7.

After the raw materials have been emptied into the distributor hopper 1, the sealing valves 11 are reclosed, and when the pressure in the upper and lower chambers has been balanced by the introduction of pressurized gas into the upper chamber through an inlet valve and piping system (not shown), the shaft supporting the small bell 5 is lowered. Since the hopper 1 rests on the wear cone 4, it follows this movement, the wear cone 4 being vertically connected to the small bell 5. The three elements (sliding hopper 1 wear cone 4, and small bell 5) therefore move downwards together until the lower end of the hopper 1 seats on a thrust block 12 to seal the joint. The small bell 5 and the wear cone 4 continue their descending movement, releasing the charge in the hopper, which is then deposited on the large bell 6. When the charge has been released, the charging device returns to its original position.

During the course of its movement with the small bell 5, the hopper 1 is guided both by the sleeve 2 located at its upper end and by the wear cone 4 on which its lower end rests. The wear cone 4 is itself guided by central bearing shoes 13.

In FIG. 1, *n* represents the total distance travelled by the small bell 5, *m* represents the distance travelled before the hopper 1 seats on the block 12, and l represents the actual separation between the bell 5 and hopper 1 in the vertical direction.

I claim:

1. A charging device for a shaft furnace, comprising an upper chamber, a lower chamber communicating with the upper chamber, an upper charging bell in the upper charging chamber, and a lower charging bell below the lower chamber, a rotatable hopper in the upper chamber, substantially vertical shafts passing through the hopper and constituting the longitudinal axis of the hopper, the shafts being longitudinally movable, the bells being carried by the shafts, a sleeve enclosing the shafts, at least three arms connected between the inner surface of the hopper and the sleeve, whereby the hopper is supported and which serves as guiding means for the hopper, a first removable pivot connection between each arm and the hopper, a second removable pivot connection between each arm and the sleeve, and a third pivot connection between each arm and the sleeve located beneath said second removable pivot connection whereby upon removal of said first and second pivot connections, the arms can be swung downwardly about said third pivot connections.

* * * * *