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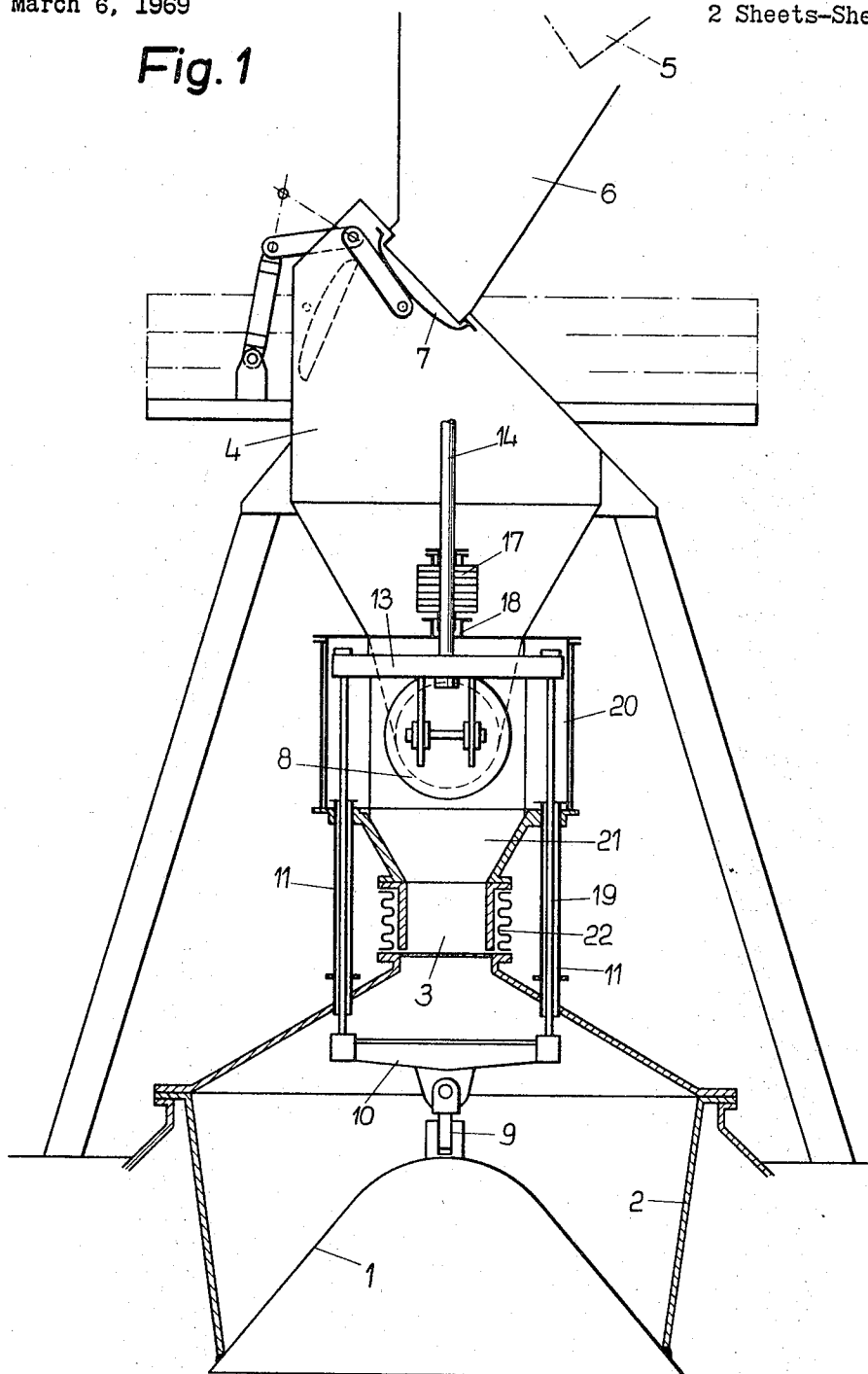
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FURNACE TOP DISTRIBUTOR FOR HIGH PRESSURE SHAFT FURNACES

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2 Sheets-Sheet 1

Fig. 1



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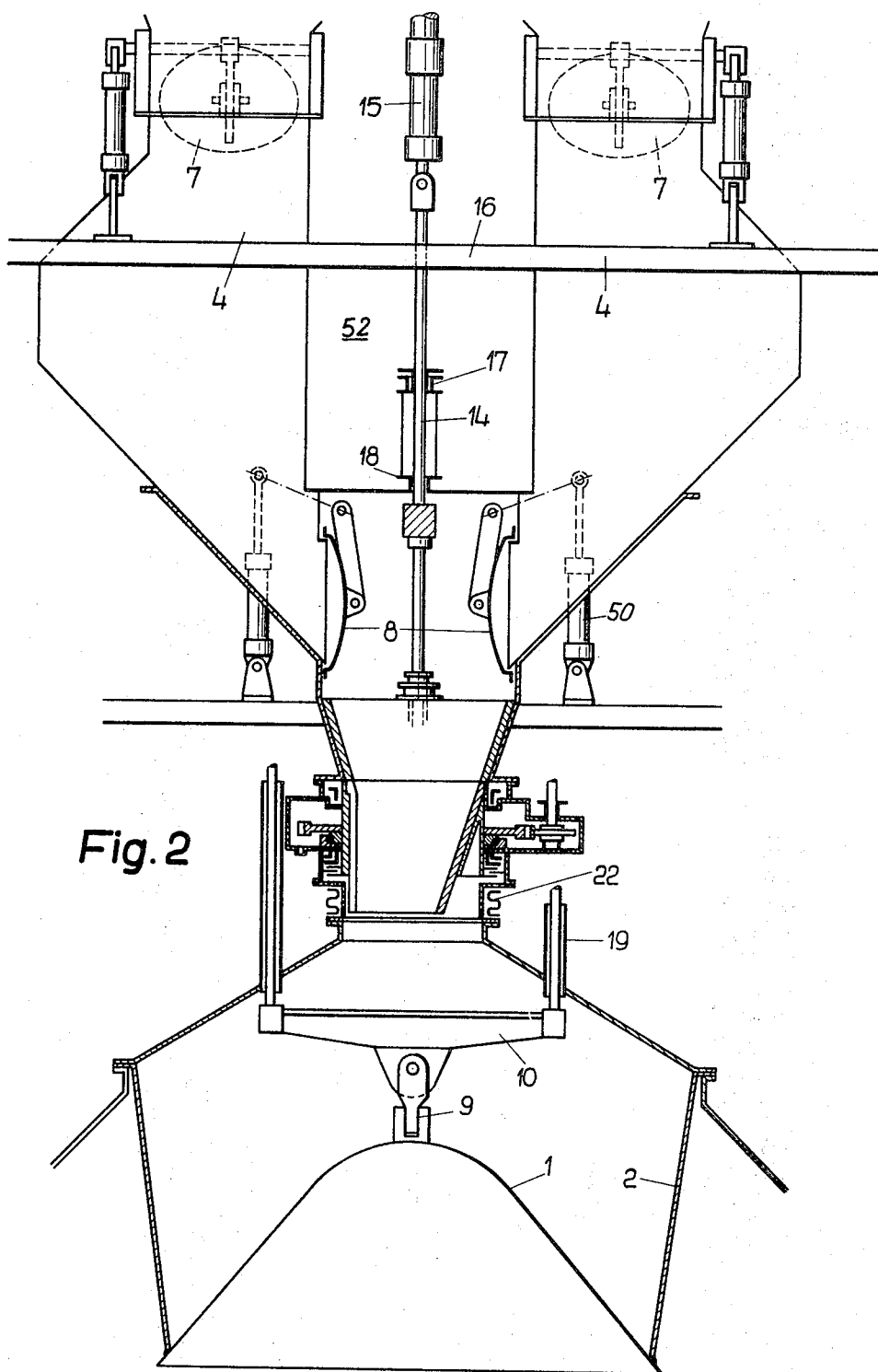
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FURNACE TOP DISTRIBUTOR FOR HIGH PRESSURE SHAFT FURNACES

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6 Claims

ABSTRACT OF THE DISCLOSURE

A top distributor for charging a shaft furnace or blast furnace which is operated under high pressure includes a plurality of feeding ducts having sealing flaps or valves which are alternately operable and closable and which selectively discharge into a sluice chamber arranged above the furnace top distributor. The material is conveyed further by a distributing arrangement above the charging surface which is located to operate out of the range of the sealing seats and sealing flaps which are located and operated to facilitate charging into the sluice chamber and discharging chamber and discharging from the sluice chamber to the furnace without pressure loss and without functional wear to the sealing flap closing surfaces. A key or distributor housing is located below the sluice chamber and receives the charging material therefrom through a lateral connection into a central supply line. The supply line is located above the key in a position to define sealing passages for adjusting rods of a lifting and lowering mechanism from a bell which closes the bottom of the key but may be shifted by the lifting and lowering mechanism to distribute the material out of the lower end of the key and into the furnace chamber.

SUMMARY OF THE INVENTION

This invention relates, in general, to the construction of metallurgical furnaces and, in particular, to a new and useful distributor for shaft or blast furnaces which are operated under high pressures.

For reasons of competition, it is desired to increase the output of blast furnaces so as to increase the production of crude or pig iron. The present frame diameters of about 8 meters have to be enlarged for this purpose. In doing so, considerable problems arise in respect to the distribution and passage of gas. It was necessary to prepare and process all the raw materials to be charged to the furnace properly in order to obtain satisfactory uniformity, gas flow speed, pressure and intensity. Efforts of blast furnace operators to crush and sieve the raw materials so as to obtain a suitable narrow grain structure range for the blast furnace burden has met with some success. Further, fine-grained material which is not suitable for the operation has been agglomerated into pieces by sintering or pelletizing. In spite of many difficulties, which are partly of chemical and partly of physical nature, blast furnace operators succeeded in operating at pressures of about 500 mm. water column in a uniform manner. However, in the past, additional measures had to be taken in order to obtain favorable gasification of the furnace charge. The distribution of the gas flow can be influenced by the wind distribution in front of the gas forms. The introduction of oil made it possible to reduce the amount of coke. In this connection, it should be considered that the coke consumption per ton of crude iron should be as low as possible. In spite of all these measures, a correct distribution of the raw materials which are charged to the furnace is still of decisive importance for proper operation of the furnace. Even in re-

spect to furnaces of customary dimensions, considerable difficulties are encountered in respect to uniform charging. If the gas distribution is non-uniform, serious operational difficulties may occur due to the occurrence of zones of different content of CO₂ gas. This is most undesired and blast furnace operators know the serious consequences resulting therefrom.

It is also difficult to recognize in time when such improper gasification takes place. It will thus be appreciated that the distribution of the charge over the entire furnace cross section is of primary importance because this distribution forms the basis for the subsequent phenomena that take place in the furnace. It follows that the manner in which the furnace top distributor operates strongly influences the physical preconditions for an optimum distribution of all the raw materials. If the distribution is effected in an improper manner, correction thereof can hardly be made. In the past, some attempts have been made to solve the difficulties in respect to uniform gasification of the charge by using additional auxiliary means as, for example, furnace top distributors with baffle skirts which were intended to homogenize the furnace charge. However, due to the enlargement of the frame diameter to about 10 meters and due to the desired increase of the output, it has become necessary to employ high pressure methods. The presence of higher pressures facilitates the ore reduction and, moreover, the higher pressures contribute in solving the difficult problems of the gasification. At this state of the development, the known blast furnaces with a bell-like furnace top distributor according to McKee are entirely unsatisfactory. According to the double bell principle, two functions have to be fulfilled at the same time, a fact which is particularly disadvantageous. Together with the filling funnel or hopper and the distributor key, the two bells form a gas sluice for the material to be charged to the furnace. After filling onto the lower bell, the latter, due to lowering, serves as a means for distribution onto the charging surface. It has been shown that when the charging gas pressures are increased by using stronger blowing at the blowing form and a corresponding throttling of the charging gas discharge to a pressure of about 1 atmosphere at the charge, the life of the charging bells will be much reduced. The heat of the furnace space causes distortion of the bells, a fact which is particularly noticeable if the bells have large diameters. This distortion causes leakage, the leakage being rapidly increased due to the friction wear by the ore which constantly flows over the surfaces of the bells. The shortening of the life of the bells makes the entire procedure economically unsound. For this reason and based on these experiences, an increase in the charging gas pressure to 2–2.3 atmospheres in order to obtain maximum ore reduction is not possible.

Generally, the problem of maintaining the pressure can be solved by using special sealing flaps within a sluice chamber which is arranged in front of the furnace top distributor.

The invention therefore has as its premise a furnace top distributor for a shaft of blast furnace which is operated under higher pressure, particularly for blast furnaces which are operated according to high pressure methods and which have a sluice chamber arranged in front of the furnace top distributor. The material to be charged to the furnace is introduced into the sluice chamber by means of sealing flap passages which are alternatively openable and closable. The material is then further conveyed by means of a distributing arrangement arranged above the charging surface. Such an arrangement solves the problem of the wear of the sealing surfaces due to the discharge of the material because the sealing seats and the sealing flaps may be situated outside the path of the material to be charged. However, such a construction

in no way considers the further conveying of the material to the distributing arrangement. The bell distributors which have been used until now are not suitable in their known constructions for a distribution of the blast furnace burden which is sufficiently gasified. The bells are suspended at the bell rods which penetrate the sluice chamber as described, for example, in *Journal of Metals*, February 1966, pages 231 ff. The rod of the lower bell is guided within the hollow rod of the upper bell. The material which exits from the passage or exit of the sluice chamber is, due to the presence of these rods, divided into two partial flows and in doing so is deflected in directions which do no longer permit a trouble-free charging of the entire enlarged charging surface. This deficiency, of course, becomes more pronounced when the frame diameter is enlarged. The material flows then in a downward direction in uncontrollable partial flows and only at some areas of the circumference of a bell.

Dependent on the furnace zone, the cone-like ring layer formed by a bell is either higher or lower. This phenomenon has, in the past, and in respect to smaller furnaces which did not operate according to high pressure method, caused blast furnace burden or irregular distribution which was undesired, although perhaps not fatal. However, in blast furnaces which operate with a large and rapid output and with higher pressures, this phenomenon is not tolerable.

The present inventive construction improves the flow conditions of the material when it exits from the sluice chambers in order to prevent premature demixing and in order to be able to control the supply of the material in an improved manner.

In accordance with the invention, it is proposed that a distributing member which is suspended within the furnace space is held by means of adjustable members which extend outside a supply line. The supply line conveys the material from the sluice chamber into the furnace space and the adjusting members are connected to a single drive element which transmits the adjusting movement. The material is moved in a closed flow guided by the supply line and reaches the distributing member in a vertical direction and is distributed from there in a more uniform manner than has hitherto been possible toward two or several sides. This may be accomplished, for example, by the presence of a so-called Parry bell. When the flow of the material in the prior art construction was influenced prior to its impact onto the distributor member, such influence imparted the material with an undesired direction so that improper distribution often took place. This disadvantage is completely avoided by the present invention.

In high pressure methods, the prevention of pressure losses is of essential importance. For this purpose, the invention provides that the gas pressure which prevails in the guide casings for the adjusting members corresponds to that of the furnace space pressure. In this manner, gas losses are prevented at the passage areas of the adjusting members.

According to a further advantageous measure of the invention, the single drive element for all the adjusting members is arranged within the supply line, but outside the path of the charging material. At the beginning, the adjusting members also remain within the space which is charged with gas pressure. This means that within the guide of the adjusting members, there prevails the same pressure as in the furnace space. No disturbance of the material flow is possible, so that the advantage of the invention takes place on the entire path from the sluice chamber up to the distributing arrangement.

Any passage of the adjusting member, be it for the bells or for the portions of armor skirts, has in the past been critical since at the passage areas furnace gases had a tendency to flow out. The invention makes a reduction of the number of sealing areas possible because the driv-

ing element for the adjusting members consists of a linearly movable piston rod of thrust driving mechanism which passes through an opening which can be sealed. For example, this may be accomplished by a hydraulic piston drive or by the shaft of a rotary mechanism.

According to a further feature of the invention, the distributing member is a single bell at which there is secured a stirrup-like holding means. At the circumferential zone of the furnace space there are connecting areas for the adjusting members. The adjusting members may be secured both in the rim portion of the bell diameter or they may be situated outside to such an extent that the bells are not influenced at all and the material is deflected toward all directions in a uniform manner.

Accordingly, it is an object of the invention to provide a distributor for charging particularly blast or shaft furnaces which operate on high pressures which include one or more sluice chambers having means for receiving materials from one or more periodically opened connecting chargers and which discharge onto a central supply chute located above a furnace key having a bottom opening which is closed by a bell which is opened and closed by a connecting mechanism which is sealed by surrounding ducts communicating with the supply chute.

A further object of the invention is to provide a charging and feeding system for furnaces which include means for sealing the charging openings and operating mechanisms.

A further object of the invention is to provide a furnace distributor which is simple in design, rugged in construction and economical to manufacture.

The various features of novelty which characterize the invention are pointed out with particularity in the claims annexed to and forming a part of this specification. For a better understanding of the invention, its operating advantages and specific objects attained by its use, reference should be had to the accompanying drawings and descriptive matter in which there is illustrated and described a preferred embodiment of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

In the drawings:

FIG. 1 is a somewhat schematic vertical section of a distributor constructed in accordance with the invention; and

FIG. 2 is a side elevation partly in section of the distributor shown in FIG. 1.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to the drawings, in particular, the invention embodied therein comprises a furnace top distributor formed by a bell 1 arranged to close the bottom of a housing or key 2. A chute or supply line 3 is connected to the top of the key 2.

In accordance with the invention, one or more sluice chambers may connect laterally into the supply line 3 as regulated by the opening and closing valves or flaps 8 by fluid piston and cylinder combinations 50 (FIG. 2). Charging material is selectively dumped into the sluice chambers 4, for example, by a skip charging device 5 which feeds into a funnel 6. The material can be repeatedly supplied to sluice chambers 4 from the funnel 6 according to the operating requirements.

The actuation of an upper sealing flap 7 between the funnel 6 and the sluice chambers 4 is performed when the lower flap 8 is closed, so that no gases can escape from the furnace space (not shown) through the gap between lowered bell 1 and key 2.

The bell 1 functions as a distributor permitting flow out of the key 2 around the periphery of the bell. The bell 1 is suspended on a pivot bearing 9 of strong suspension frame construction. The suspension frame includes a traverse member 10 carrying bearing 9 which is suspended on the lower ends of a pair of adjusting rods

11. Both rods 11 are connected at their upper ends to a further traverse member 13. The traverse member 13, in turn, is connected to a piston rod 14 of a hydraulic drive 15 (see FIG. 2). The hydraulic drive 15 is advantageously arranged in a space 52 between two sluice chambers 4. The assembly and servicing of the individual parts in this space can be readily accomplished through the running web or recess 16. A sealing bearing 17 is located in the space 52 and it can be controlled in respect to gas permeability. The bearing 17 can be readily observed in the region of the passage opening 18 for the piston rod 14.

The adjusting rods 11 extend within guide housings 19 which, in turn, are connected to side portions 20 of the upper portion of the supply line 3 at locations in front of the lower sealing flaps 8, 8 of the associated sluice chambers 4, 4. The pressure which prevails above the bell propagates uniformly through the guide housings 19 into the side portions 20 so that no gas losses can occur through the guide housings 19.

The gas which exits from the lower sealing flap opening 8 is forced to flow through a funnel portion 21 adjacent the side portion 20 and into the lower end of the supply line 3 in a collective manner.

In FIG. 2, the traverse 10 is shown as being offset by 90° in order to show the constructions of the guide housings 19, 19. A sealing member 22 which absorbs the heat expansion also prevents an outflow of charging gases between the key 2 and the sluice chamber 4. The invention fills an important gap in the state of the art in respect to the supply of the charging material from a sluice chamber to the distributing device in the furnace space of a blast furnace.

What is claimed is:

1. An apparatus for charging furnaces operating at high gas pressures, comprising a key housing defined at the charging location of the furnace and having a bottom opening, a supply line connected into the top of said key housing, sluice chamber wall means defining at least one sluice chamber having a supply connection into said supply line and having a charging connection above said supply connection, upper flap means for closing and opening said supply connection, lower flap means for opening and closing said charging connection, a distributor member closing the bottom opening of said key housing, a drive element for shifting said distributor member to regulate the distribution of material delivered through the opening of said key housing, said drive element being located above said supply line and having at least one connecting rod extending to said distributor member for adjusting the position of said distributor member in respect to the opening of said key housing, and sealing means for sealing said connecting rod communicating with said key housing and said supply line.

2. An apparatus, according to claim 1, wherein said connecting rod comprises a first connecting rod of a frame

including a lower transverse member pivotally carrying said distributor member and an upper transverse member located within said supply line, said first connecting rod portion connecting one end of said upper transverse member to one end of said lower transverse member and a second connecting rod connecting the opposite end of said lower transverse member, said sealing means comprising a duct defined around each of said first and second connecting rods and extending between said key housing and said supply line.

3. An apparatus, according to claim 1, wherein said drive element comprises a piston rod located exteriorly of said supply line but extending into said supply line and being sealed therewith, the charging connection of said sluice chamber into said supply line being located on one side of said supply line in a position to discharge the material into the supply line at a location away from said drive member, said piston rod and said connecting rods.

4. Apparatus, according to claim 1, wherein said drive element comprises a fluid pressure operated piston and cylinder combination, said connecting rod comprising one rod portion of a connecting frame having an upper transverse member located in said supply line and a lower transverse member located in said key housing, a second connecting rod comprising the other member of said connecting frame, a sealing duct defined around each of said connecting rods at the location at which it extends between said supply line and said key housing to provide for a pressure in said connecting ducts equivalent to that of the furnace space, said connecting rods of said frame being located on each side of the connection of said sluice chamber into said supply line out of the path of the flow of the material therethrough.

5. An apparatus, according to claim 4, wherein said distributor member comprises a single bell arranged to close the opening of said key housing, said bell being pivotally suspended at a central location above its peak to said lower transverse member of said frame.

6. An apparatus, according to claim 4, including a sluice chamber arranged on each side of said connecting line and each terminating at its lower end in a charging connection extending into a respective side of said connecting line, said frame being located across said connecting line transversely to the charging openings of each sluice chamber on each side of said connecting line.

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ROBERT G. SHERIDAN, Primary Examiner

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