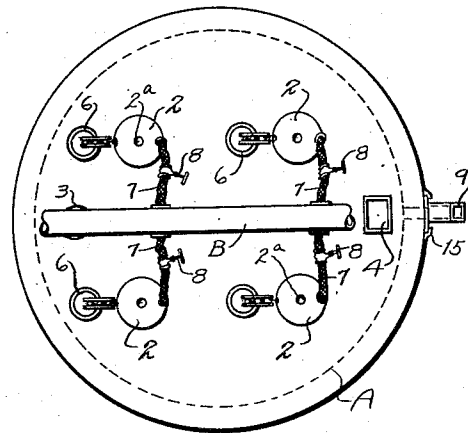
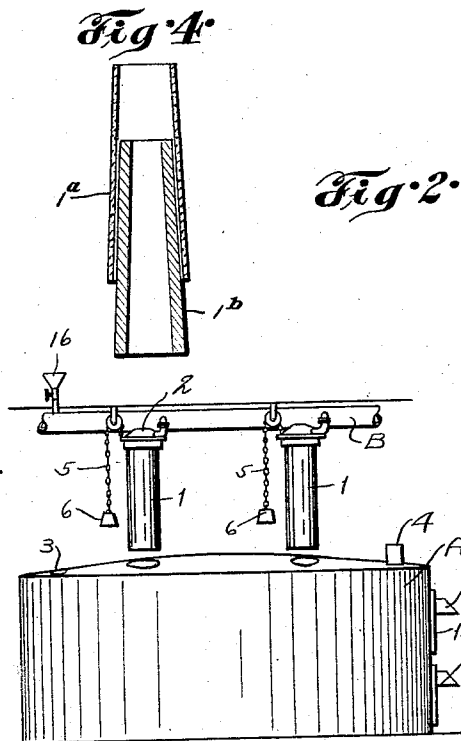
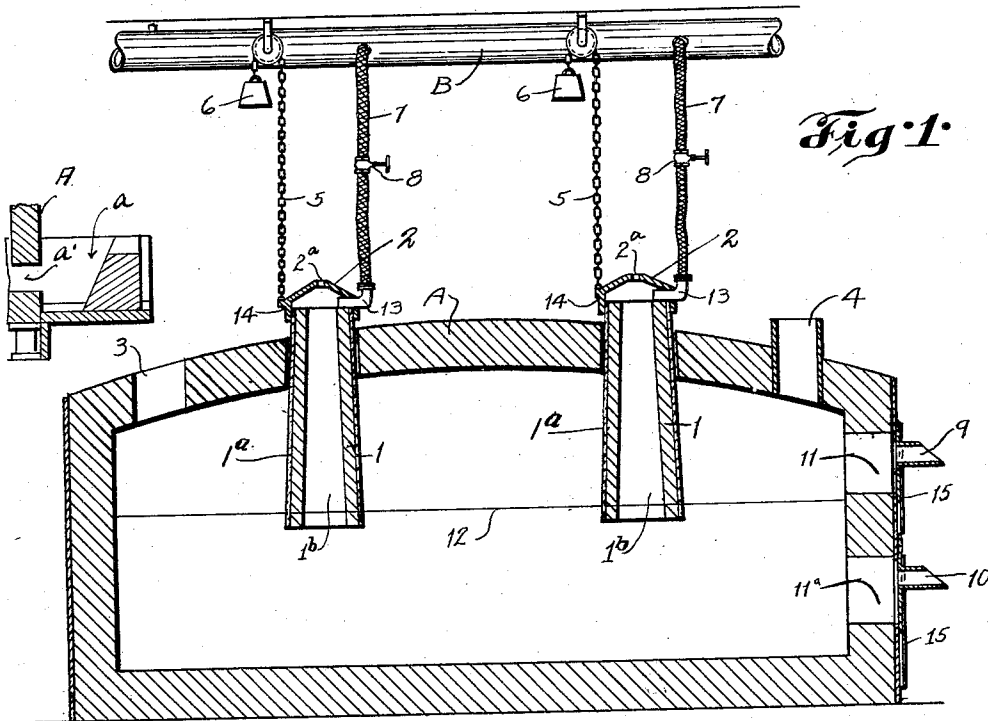


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T. M. KEKICH
CONVERTING FURNACE
Filed Dec. 31, 1927

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Inventor

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Fig. 3.

By *Watson & Coleman.*

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UNITED STATES PATENT OFFICE

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CONVERTING FURNACE

Application filed December 31, 1927. Serial No. 243,960.

This invention relates to converting furnaces, and particularly to furnaces for treating liquid matte.

The general object of the invention is to provide a furnace of this character which will do away with the costly and difficult process of roasting and concentrating the ore or matte, which is not only costly but inefficient and which often renders it necessary to concentrate the matte of sulphide ores and remelt this matte, my improved furnace, however, doing away with this necessity when used in connection with a smelting furnace.

Another object is to provide a converting furnace with means whereby air may be forced beneath the surface of the charge to thereby convert the matte more effectually than heretofore, and for this purpose to provide a plurality of tuyères through which compressed air may be discharged into the charge beneath the surface thereof, the tuyères being capable of being raised entirely out of the furnace if desired or lowered down into the furnace to any desired degree below the surface of the molten metal, and further this means providing for forcing air under pressure and in any desired volume through the matte throughout any part of the converter to thus expel impurities sulphur and the like.

In the accompanying drawing:—

Figure 1 is a sectional view of a converting furnace having tuyères constructed in accordance with my invention;

Figure 2 is a top plan view of the furnace on a reduced scale;

Figure 3 is a side elevation of the furnace on the same scale as in Figure 2;

Figure 4 is a sectional view through one of the tuyères with the inner lining displaced.

Referring to the drawing, A designates a furnace, which is shown diagrammatically and may be of any suitable character and is, of course, lined with refractory fire-brick or like refractory material. The top of this furnace is provided with a charging opening 3 and with a chimney or flue 4 for allowing the gases and fumes to pass from the furnace. Openings 11 and 11^a are provided in the fire-brick lining of the furnace through which the

overflow spout or skimming spout 9 passes for the waste or slag and through which the tapping spout 10 passes for drawing off the metal. Each spout 9 and 10 carries a sliding plate 15 sliding in suitable guides upon the wall of the furnace and acting to normally close these openings 11 and 11^a or close those portions of the openings above or below the spouts 9 or 10. Thus the spouts 9 and 10 may be lowered in unison with the sinking of the level of the matte in the furnace.

The top of the furnace is provided with a plurality of openings through which the tuyères 1 are disposed. These tuyères, as illustrated, taper upwardly and are mounted within the openings in the top of the furnace for vertical movement. Each of the tuyères preferably consists of an inner lining which may be of metal of an outer section or covering of refractory material and designated 1^b. Each tuyère at its upper end is closed or partially closed by a cap 2 having an opening 2^a through which a punching rod may be passed when necessary. The cap 2 is engaged with the top of the tuyère in such manner that strain applied to the top of the cap will lift the tuyère.

For the purpose of lifting or counterbalancing the tuyère, I provide for each tuyère a chain 5 passing over a pulley supported in any suitable manner and having a counterweight 6, as shown in Figure 1. Above the furnace A is disposed an air pipe B having air under pressure and connected to any suitable source of supply (not shown). Associated with each tuyère is a flexible hose 7 having therein a valve 8. This hose extends to the pipe B and communicates with the interior thereof and at its lower end each pipe B is provided with an elbow 13 passing through the cap 2 and communicating with the interior of the tuyère. It will be seen that each tuyère is capable, therefore, of being raised or lowered to any desired extent and, as shown in Figure 1, when the tuyères are lower they extend down beneath the surface of the molten metal in the furnace.

In Figure 3, I have shown the tuyères as raised entirely out of the furnace, and in Figure 1 the tuyères are lowered so as to bring

their lower ends below the surface of the charge.

The converting furnace which I have heretofore described is designed to be used in connection with a smelting furnace, a fragmentary portion whereof is shown in Figure 1 and designated A. It is to be understood that this smelting furnace constitutes no part of my invention. Figure 1 shows a sectional view of the overflow spout a and a' designates a tap hole which is plugged while the smelting furnace is in operation. When this plug is removed, the molten material from the smelting furnace runs into my converting furnace through the opening 3, molten metal and slag discharging directly from the overflow of the smelting furnace into my converting furnace. With the construction described, the tuyères and discharge spouts adjusably mounted in the wall of the furnace may be lowered in unison with the sinking of the level of the matte in the furnace. By increasing the diameter of the tuyères downward, the tuyères act to discharge air diffusively into the matte.

It will be seen that by having the smelting furnace and converting furnace disposed so that the slag and molten metal may be transferred directly into the converting furnace, I do away with cranes and motors which are ordinarily necessary for moving the molten contents of the smelting furnace in one part of the building to the converters in another part of the building. My converting furnace eliminates the necessity of roasting in order to remove the impurities in the matte and these impurities will be eliminated in my furnace. Matte produced in present-day smelting furnaces is often as low in grade as 5%. This matte can be converted in my type of converting furnace by using air volume through a plurality of tuyères, the tuyères being spaced in the converting furnace adjacent to the side walls and throughout all parts of the converting furnace wherever necessary and need not be placed in any one special position, as is the practice in converters now in use.

My type of converting furnace eliminates the use of the wind box and air entrance at the bottom of the converters which are necessary at present and further eliminates the necessity of having the tuyères enter the converting furnace through a special lining at the bottom of the furnace, which is very costly and not permanent. Furthermore, the power cost is reduced, as in my converting furnace the air is delivered into the converting furnace from the top of the charge so that the gravity of the molten metal does not operate against delivery and reception of the air. The cost of smelting is lowered by using my type of converting furnace owing to the fact that the matte is reduced to a minimum leaving a clear and free slag, thereby elimi-

nating entirely the cost of re-smelting. At the same time production is increased 50% over that of present furnaces.

Of course, it will be understood that a plug is used to close the opening 3 when the molten metal and slag is not being discharged from the smelting furnace A. Preferably also a silica bin 16 is connected to the air line, as shown in the drawings, in order to feed silica along with the air into the converting furnace for the purpose of forming slag. Attention is particularly called to the fact that in my converting furnace the tuyères discharge near the surface of the charge, that is adjacent the surface of the charge, and the tuyères do not extend down to the bottom of the furnace. I am aware of the fact that it is old to provide a tuyère extending into the converting furnace and discharging near the bottom thereof, but in that case the air is discharged at the bottom of the molten charge against the gravity of the molten charge and under these circumstances a proper volume of air cannot be forced into the charge. In my construction, the air is discharged into the upper portion of the molten metal so that the air is not discharged against the gravity of the molten metal and thus I can force a relatively large volume of air into the molten charge and into the converter.

A further advantage is secured in my invention in that the air does not have to be forced down into the molten metal with such pressure as causes the molten metal to be disturbed, agitated and thrown out through the openings 3 and 4. This is almost inevitable where the tuyères discharge adjacent the bottom of the furnace because the air pressure must be so great under these circumstances that the molten metal is heaved up and thrown out.

It is to be understood that the tuyères discharge the air downward into the molten charge and the air penetrates downwardly through the charge for the reason that the tuyères are placed on a higher level and discharge near to the surface of the charge. While I do not wish to be limited to this, yet preferably the tuyères are constructed as shown in detail in Figure 4, that is each tuyère consists of an inner lining or tube of metal over which is slipped an outer refractory casing 1^b. The tube 1^a is tapered so that when the outer casing reaches the end of tube 1^a it cannot fall off.

While I have illustrated diagrammatically a particular form of furnace, I do not wish to be limited to this as it is obvious that the furnace might be changed in form without departing from the spirit of the invention as defined in the appended claims and the detailed construction of the tuyères and the manner of lifting them might be modified to some extent.

I claim:—

1. A converting furnace of the character described having a hollow interior and having vertical slots in one wall thereof for the discharge therethrough of slag and molten metal respectively, discharge spouts communicating with the separate slots and vertically adjustable whereby they may be lowered in unison with the sinking of the matte within the furnace, a plurality of tuyères projecting downwardly into said furnace and each communicating with a source of air under pressure above the furnace, each discharging immediately below the surface of the matte so as to penetrate the matte the greatest effective distance from the floor of the furnace, and means whereby the tuyères may be adjustably lowered as the level of the matte sinks.
2. A converting furnace of the character described, having a top, separate discharge spouts for slag and molten metal communicating with the interior of the furnace and vertically movable so as to be lowered with the sinking level of the matte, air discharging means extending downward through the top of the furnace and projecting into the upper surface of the matte whereby to inject air downwardly from the upper to the lower surface of the matte, and means whereby the air discharging means may be lowered downwardly as the level of the matter drops.
3. In a converting furnace, a top having tuyère openings therein, a fixed air supply pipe above the top, a series of tuyères disposed in said openings and vertically adjustable therethrough and projecting into the furnace, flexible hose connections between said air supply pipe and the tuyères, means for supporting said tuyères for vertical adjustment whereby the tuyères may be shifted downward to penetrate just below the surface of the matte, and separate means adjustably engaging said furnace wall and movable to positions conformable to the changing level of the matte for discharging the slag and molten metal from the furnace.
4. A converting furnace for the treatment of nonferrous metals having openings in one end thereof, these openings being vertically elongated and positioned to communicate respectively with the slag surface of the matte and with the subsurface thereof to allow for discharging slag and metal respectively through said openings, a pair of horizontal spouts each being of a diameter less than the height of the openings, means carried by the spouts supporting the spouts and shiftable vertically across said openings and closing the openings above and below the spouts whereby the spouts may be vertically adjusted to conform to various levels of slag and metal in the furnace.
5. In a converting furnace having an opening in the upper portion thereof, a tuyère ex-

tending into said opening arranged to project into slag content of the furnace and adjustable vertically relative thereto, means for directing air under pressure through said tuyère, a side wall embodied in said furnace having a pair of openings disposed on different levels, a spout leading from the lowermost of said openings for discharging molten metal from the furnace, and a spout in the uppermost of said side wall openings adjustable vertically therein for discharging slag from the furnace.

In testimony whereof I hereunto affix my signature.

THOMAS M. KEKICH.

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