O. NIELSEN

METHOD OF INTRODUCING ADDITIONAL AGENTS INTO METALLURGICAL BATHS

Filed Dec. 4, 1924

Inventor:
Otto Nielsen

by: J. J. Vining Attorney.
My invention relates to a new method of introducing additional agents into metallurgical baths, and more especially to a method of adding chemical substances to inert metallurgical baths, for instance in connection with the refining process for copper, and the chief object of my invention is to obviate the disadvantages of the so-called poling process, that is the process of refining, which essentially consists in adding poles of green wood to the metallurgical bath, in order to bring about the refining, according to my invention the process of refining is carried out in two successive steps, viz: first, introducing into the molten mass of the bath an agent in gaseous form or a stream of oxidizing gas, and thereupon introducing a reducing agent, which may be gaseous, liquid or also solid, in the latter case in ground or crushed condition.

In order to explain my invention more fully, I may refer, for example, to the refining process for copper by treating the same in raw condition in a reverberatory furnace. This process, as known, is carried out by blowing compressed air through a tube into the bath of molten copper. In modern practice the tube serving for the introduction of the compressed air terminates below the surface of the bath, in order to have the oxidation proceed most effectively. The entire copper bath will thus be mechanically agitated, as if being in a state of boiling, by the action of the gas rising from the end of the tube; the motion of the bath thereby will greatly assist the gas introduced thereinto in being distributed all over the mass of copper in substance. If thus the impurities contained in the latter have been removed, the copper will take up oxygen as if in solution, and it will at this time be in an intermediate condition, in which it is only partly or imperfectly refined. In this case the percentage of oxygen contained in the copper will amount to about 0.6 percent. In order to complete the process of refining, this amount of oxygen must also be removed from the bath and this had heretofore been effected by the above-mentioned process of poling, that is by introducing poles of green wood into the bath. The steam and hydrocarbons thus introduced will act on the bath in such a way, that the steam will cause the bath to be greatly agitated and the hydrocarbons will take up the oxygen contained in the bath, thus exerting a reducing effect thereon, until the desired degree of deoxidation is attained. The wooden poles are then removed and the process of refining by poling is completed.

This process of refining by "poling" the bath is very crude and the object of my invention is to provide a more efficient process of refining. I am aware of the fact, that as a substitute for the poling process there had been proposed to employ tar-oil or petroleum, that is liquid fuels. This process, however, has been utterly unsuccessful for two reasons. Firstly, to introduce a substance of the kind mentioned into the bath is connected with danger, and secondly, the liquid fuel thus introduced into the bath will only to a small extent be utilized for the purpose of reduction, so that the efficiency of this process will necessarily be very poor.

By the refining method according to my invention, the introduction of the liquid fuel as a reducing and refining agent may be carried out absolutely without danger, and a complete reduction of the bath will be attained with a very small quantity of oil or other reducing agents. The process according to my invention, as may be mentioned by the way, has been employed in actual practice and has met with a complete success.

In order to properly meet the conditions existing in the bath, when the refining is intended, the fact must be taken into consideration, that the temperature of the furnace amounts to from 1200 to 1300 degrees centigrade. By introducing the oil or other reducing agent into the bath through the tube, even if terminating above the level of the bath, there will be heavy puffing, not to say an explosion, and the oil will be burnt up by the oxygen of the air and thus be utilized only to a very small extent for the desired purpose of bringing about a reduction of the copper. In addition to this, if the orifice of the tube terminates below the level of the bath, the tube would either melt away or become clogged up, so that it will be unable to perform the desired functions.

My invention will be more fully understood by reference to the accompanying drawing, which represents diagrammatically an example of an arrangement and combination of parts, by which my invention may be carried out in practice. In the drawing D designates the furnace containing the metallurgical bath, for instance molten copper containing oxygen.
The container A is filled with a suitable reducing agent, which in the present case may be an oil, or also a reducing substance in ground or crushed solid condition, such as for instance calcium carbide, charcoal, or the like. The steel-bottle B contains a compressed gas of suitable character, such as for instance carbonic acid, nitrogen, or the like, or also steam which may be substituted for these gases. The bottle B is provided with a valve e, which is connected with the container A by the tube f. The container A is provided with a safety valve g at its top and with an outlet pipe h at its bottom, the outlet pipe h being provided with a cock or valve h', by means of which it may be connected with the pipe f'. The latter is connected to the pipe f at the point f, indicated in the drawing. The junction f of the pipe f and the pipe f', as well as the junction f of the outlet pipe h of the container with the horizontal part of the pipe f', serves for the successive introduction of the two reducing agents into the bath. According to my invention, said agents being contained in the bottle B and the container A respectively. A further valve or cock i is provided on the pipe f' between the junctions f and f.

The device described will operate as follows. Supposing the copper-bath be in proper condition in the furnace D for commencing with the process of refining, the device may be put in operation by opening the valve e, the valves i and h, being closed at this time; the gas contained in the bottle B will now be able to pass into the container A. In order to facilitate the passage of gas from the bottle B into the container A, the safety valve g provided on the latter may be lifted for a short time. The end of the pipe C, which joins the outlet pipe h and the pipe f, at the point of junction f, is introduced at its orifice into the bath contained in the furnace D, as shown in the drawing and thereupon the valve i is opened for some time. After a certain time the valve i is again closed, thus preventing an immediate supply of gas from the container B to the bath of the furnace D, and the valve h is now opened. By this a part of the liquid agent contained in the container A will be forced through the outlet pipe h into the pipe C and through the orifice of the same into the bath of the furnace D. The tank G containing the compressed gas, contained in compressed condition in the bottle B, will displace the air contained in the pipe conduit terminating in the pipe C, before the orifice of the latter is being introduced into the bath. The orifice of the pipe C may be positioned below or imm}

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