C. DELLWIK.

METHOD OF AND APPARATUS FOR AGGLOMERATING FINE ORES, METALLIFEROUS RESIDUES, &c.

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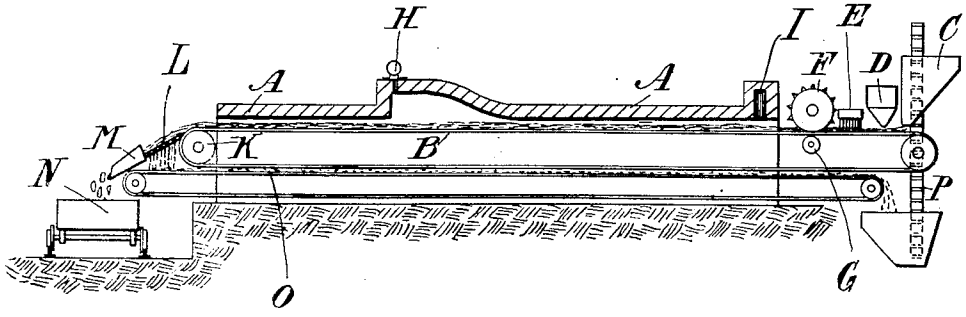

Witnesses:
Harry A. Knuth

Inventor:
Carl Dellwik

UNITED STATES PATENT OFFICE.

CARL DELLWIK, OF LONDON, ENGLAND.

METHOD OF AND APPARATUS FOR AGGLOMERATING FINE ORES, METALLIFEROUS RESIDUES, &c.

1,039,706. Specification of Letters Patent. Patented Oct. 1, 1912.

Application filed May 27, 1910. Serial No. 563,810.

To all whom it may concern:

Be it known that I, CARL DELLWIK, a subject of the King of Sweden, residing at London, England, have invented certain new and useful Improvements in the Method of and Apparatus for Agglomerating Fine Ores, Metalliferous Residues, and the Like, of which the following is a specification.

This invention relates to a certain new and useful method of and apparatus for agglomerating or sintering a portion only of a given mass of fine ores, cement, flue dust, metalliferous residues and the like into larger pieces which are more suitable than the fine material for subsequent treatment, for instance treatment wherein metals are to be extracted therefrom.

Hitherto the binding together of fine materials, such as are included in those above mentioned, has been conducted mainly on two different lines. One way was, and still is, to form the material into blocks or briquets either with or without a binding material. Generally these briquets are afterward calcined at a high temperature to give them sufficient cohesion. The other way, which even now is still used, was to pass the material, with or without a binding material, through a highly heated revolving kiln placed at a slight angle so that the material was slowly fed forward through the kiln by its rotation. Under the action of the heat and the rotation of the furnace, the material became agglomerated into irregular nodules. According to the present invention, which differs from both these methods of procedure, a method of agglomerating or sintering finely divided metalliferous or other materials consists in forming the material into a layer preferably of uniform conformation or thickness with or without the addition of a binding agent and applying heat mainly to the upper surface of the layer to agglomerate the material only for a portion of its depth from the upper surface, and thereby produce a sintered crust, while the layer of fine material under this sintered crust serves to protect the supporting surface from the heat.

It is to be understood that the production of a sintered crust upon the surface of a mass of finely divided material is well known to be an incident in a complete sintering of that mass. But in such case the gradual extension of the crust throughout the whole mass occurs because the heating action is likewise permitted to take effect throughout the whole extent of the mass, so that, at the finish, there is no longer a crust or surface layer distinguishable from the remainder. Also in the manufacture of briquets a crust forms over all the exterior surfaces. But in both these cases the heating effect is operative throughout the entire body of the aforesaid mass or throughout the briquet.

A preferred method of carrying the invention into effect comprises the following operations:—The fine material is spread in a layer of suitable thickness on a conveyer or on a series of trucks or carriages, and is passed thereon through a furnace or kiln. This furnace is heated to a sufficiently high temperature to cause the upper part of the material to bake or sinter together into a solid mass. The agglomerated crust breaks or is broken into pieces considerably larger than the original particles of fine material. Any material which has not been sufficiently heated, and which therefore remains in finely divided or incompletely aggregated form, can be separated out, say by a grating lying in its path. This material may be conveyed back to the charging end of the furnace, and again passed through it. As the materials to be treated by this process are generally poor conductors of heat, the heat penetrates only very slowly into the layer of material, and during the time it is exposed to the heat it is sintered or agglomerated only to a certain depth from the surface. The material is therefore charged on the conveyer or trucks in a layer of such depth that it is agglomerated or sintered only through a portion of its thickness, and the bottom part of the layer then serves to protect the conveyer or trucks from the heat of the furnace, and prevent the agglomerated material from adhering to the supporting surface. The material of the bottom part of the layer is subsequently separated out in the manner above suggested and is again passed through the furnace; the heat lost as this material cools is, nevertheless, small owing to the low specific heat of such materials.

The furnace is preferably of considerable length and is heated some distance from the discharge end, and the flame and products of combustion travel toward the charging

end. The air for combustion is pre-heated by being passed over the surface of the agglomerated material, while the incoming material is dried and pre-heated before reaching the zone of agglomeration.

The quality of the ore or other finely-divided substance may make it desirable to use a binding agent of any convenient kind, say either organic to be burned away or mineral which remains incorporated with the material. This may be added either before, or preferably after, the material has been charged on the conveyer or trucks. It may also be desirable to pack the material to make it more compact. This is preferably done by passing the conveyer or trucks under a heavy roller or equivalent device which may either pack the material with a flat surface or make indentations which will expose a larger surface to the heat of the flame. By suitably indenting the surface the resulting sintered material may be more readily broken into pieces of a convenient size.

This method may, of course, be used in combination with any other device for treatment of the material in question, such for instance as rotary drums or kilns, or shaft furnaces or any other suitable arrangement for drying or heating the material.

A convenient apparatus for use in carrying out the method hereinbefore described is shown in longitudinal section in the accompanying drawing.

This apparatus consists of a long furnace A through the length of which runs a conveyer B of suitable construction. At the charging end, that is to say the end where the upper portion of the conveyer enters the furnace, the conveyer extends somewhat outside of the furnace. The material is charged on the conveyer by means of a hopper C or in any other suitable manner to insure that it is spread in a layer of even thickness on the conveyer. If the character of the material is such that the use of a binding agent, say organic or mineral, is desirable, a reservoir D for such agent may be placed in front of the hopper C and provided with means to regulate according to requirements the quantity of binding agent supplied therefrom. Preferably some suitable means, for instance in a form resembling a harrow or comb E, is provided for mixing the binder with the material to suitable depth. If it is desired to pack the material more tightly means for this purpose are provided, for instance in the form of a heavy roller F, and the weight of this is then preferably taken up by a supporting roller G below the conveyer. If desired, the material may be indented by providing the roller with suitable indenting projections. The furnace is preferably heated some distance from the opposite or discharge end for instance by a gas burner H, in the neighborhood of which the highest heat develops, and the flame and products of combustion travel in the opposite direction to the course of the material, to the chimney flue I at the charging end of the furnace. The air for combustion enters the furnace at the discharge end. The air in its passage over the agglomerated material therefore becomes highly heated before its arrival at the point of combustion, while the agglomerated material is cooled by the air and the incoming material is dried and pre-heated by the hot combustion gases before arriving at the zone of intense heat where the agglomeration takes place.

At the discharge end of the furnace the conveyer passes over a roller K. At this point it is desirable to introduce means for separating the agglomerated material from that which has been insufficiently heated. A suitable device for this purpose consists of a grating L over which the agglomerated material slides into the chute M which delivers it into the receiving trucks or other means of transport N. The insufficiently agglomerated material which falls through the grating L is preferably collected on a second conveyer O situated below the conveyer B and moving in the opposite direction. This conveys the material back to the charging end where it is returned to the hopper C or directly to the conveyer B by means of an elevator P or other suitable means from which it again passes through the furnace.

It is obvious that various modifications may be made in the construction of the furnace, for instance in place of the conveyer a series of slowly moving or intermittently moving flat carriages or trucks may be employed so that they traverse the furnace from end to end.

What I claim as my invention and desire to secure by Letters Patent is:—

1. The method of agglomerating or sintering finely divided material, which consists in forming the material into a layer, and applying heat to one surface of the layer to agglomerate the material for a part only of its depth from the heated surface.

2. The method of agglomerating or sintering finely divided material, which consists in forming the material into a layer, adding a binding agent to the material, and applying heat to one surface of the layer to agglomerate the material for a part only of its depth from the heated surface.

3. The method of agglomerating or sintering finely divided material, which consists in forming the material into a layer, compressing the layer, and applying heat to one surface of the layer to agglomerate the material for a part only of its depth from the heated surface.

4. The method of agglomerating or sinter-

ing finely divided material, which consists in forming the material into a layer, indenting the surface of the layer, and applying heat to the indented surface to agglomerate the material for a part only of its depth from the heated surface.

5. The method of agglomerating or sintering finely divided material, which consists in forming the material into a layer, progressively moving the material toward a source of heat to agglomerate it for a part only of its depth from the heated surface, and then progressively moving the material away from the source of heat to cool the material.

6. The method of agglomerating or sintering finely divided material, which consists in forming the material into a layer, and continuously moving the layer past a source of heat to agglomerate the material for a part only of its depth from a heated surface.

7. The method of agglomerating or sintering finely divided material, which consists in forming the material into a layer, compressing the layer, continuously moving the layer past a source of heat to agglomerate the material for a part only of its depth from the heated surface, separating out the agglomerated material, and repeating the process on the unsintered material.

8. The method of agglomerating or sintering finely divided material, which consists in forming the material into a layer, adding a binding agent to the material, compressing the layer, continuously moving the layer past a source of heat to agglomerate the material for a part only of its depth from the heated surface, separating out the agglomerated material, and repeating the process on the unsintered material.

9. Apparatus for agglomerating or sintering a layer of finely divided material, comprising a furnace, a traveling conveyer passing through said furnace, a hopper for feeding the material onto said conveyer in the form of a layer, and means for compressing the layer.

10. Apparatus for agglomerating or sintering a layer of finely divided material, comprising a furnace, a traveling conveyer passing through said furnace, a hopper for feeding the material onto said conveyer in the form of a layer, and means for indenting the layer.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

CARL DELLWIK.

Witnesses:
HARRY B. BRIDGE,
PERCY HEWITT.