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2,676,915

DEVICE TO PACK COAL IN COKE OVENS

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2 Sheets-Sheet 1

Fig.1

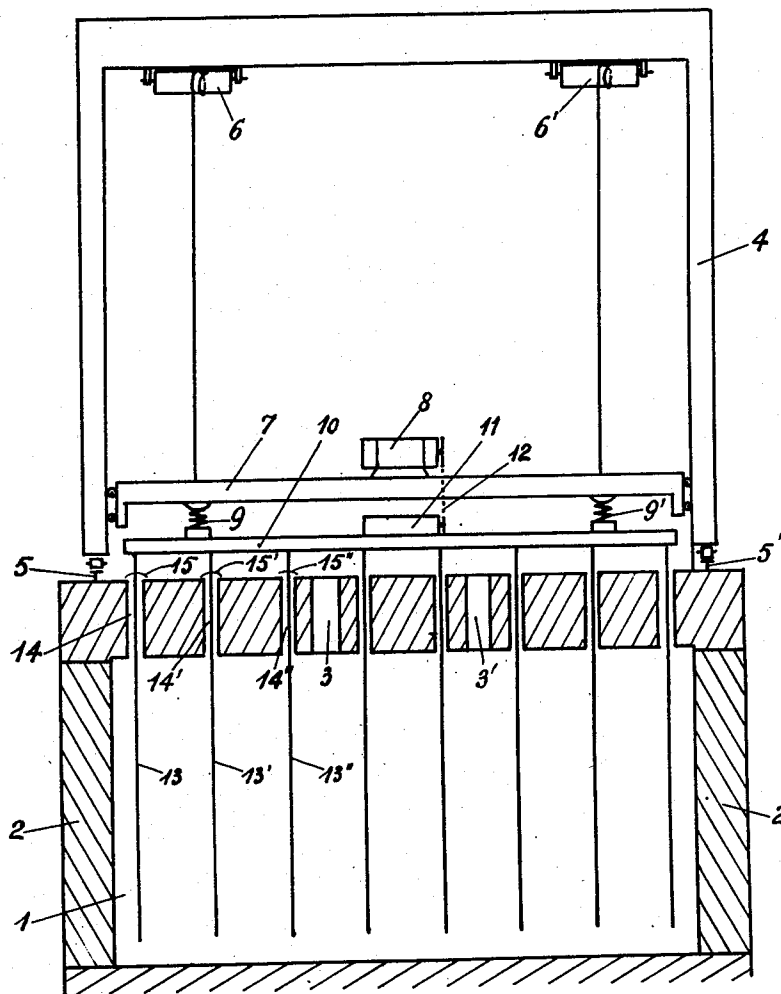
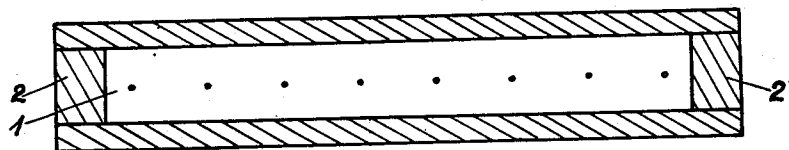


Fig. 2



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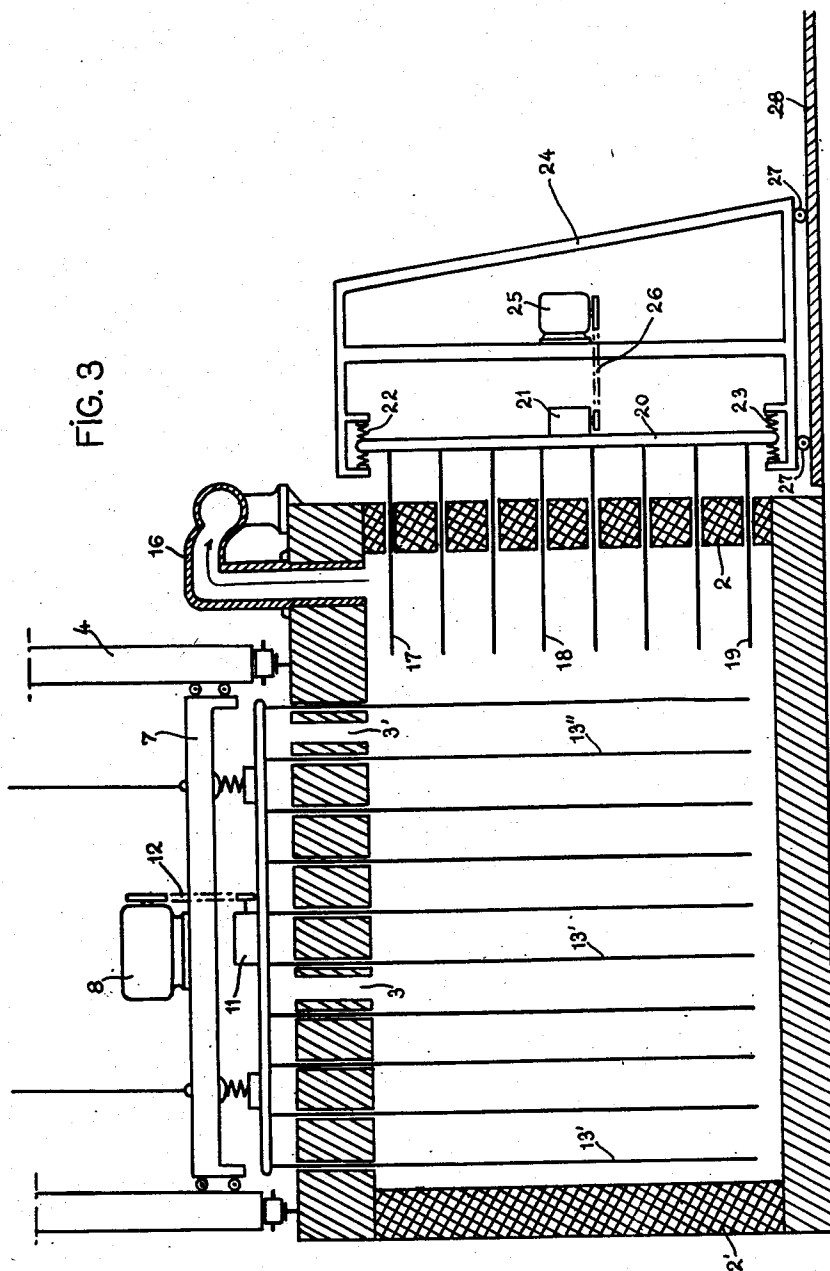
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DEVICE TO PACK COAL IN COKE OVENS

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5 Claims. (Cl. 202—262)

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The present invention relates to a process for treating coal fines and like finely divided solid fuels preparatory to carbonization in a coke oven, and to apparatus for carrying the process into effect. It is an object of the invention to provide means enabling coal fines which have not hitherto been considered suitable for coking, to be used to produce satisfactory qualities of coke.

Heretofore, it has been the practice for treating coal fine of that kind to use a punning machine which compresses, outside of the coke oven, the charge of previously slightly damped fines into cakes, which are then fed in a compartment of the coke oven. As the size of these cakes reaches often about 3.50 m. in height, 0.50 m. in width and 12 meters in length, it becomes necessary to use for the punning very large and expensive machines. Further, on account of the height of the load, it is necessary to proceed with the charging of the machine and with the punning of the cake in several operations, which requires considerable time, for instance twenty minutes. To end, imperfectly punned cakes can crumble when they are introduced in the compartment of the coke oven, thus entailing difficult clearing operations, together with a great loss of time.

The process according to the present invention allows the grade of the coke to be improved, when using fines of a quality which up to now required a previous punning and this with much simpler and less expensive means. The process applies also to compounds including together coal fines easy to carbonize and coal fines more difficult to carbonize, allowing thereby, if suitable coals are scarce, to partly substitute for them coals which, if used alone, should prove unfit for coking. The process is characterized in that the charges of coke fines are subjected, in the compartments of the coke oven or in a cell outside of the oven, preferably immediately after the charging and for a short time, to a vibration treatment, at a rather high frequency, ranging for instance about 5,000 vibrations in a minute, reaching through the entire bulk of the paste.

The density of the charge can be increased and the grade of the product improved by varying the frequency during the operation, for instance from 8,000 to 20,000 vibrations in a minute.

In some cases, it may be advantageous to incorporate in the charge of coke fines, some products facilitating the sliding of the particles over each other, for instance some mineral oils or waste oil.

The apparatus to carry into effect the above mentioned process is constituted by a set of vi-

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brating members, for instance stems or bars, in the shape of a herse or of a portcullis, each of said members being introduced in the compartment of the oven through an individual aperture which shall be obturated when the vibrating members have been taken away from the charge of fines filling the compartment.

Owing to the invention, the compartments in the coke oven can be loaded through a straight discharge from the trucks containing the fines and the set of vibrating members is introduced immediately after the loading or before the end of said loading. It must be noted that the penetration of the vibrating stems or bars inside the bulk of coal fines is effected quite easily. The increase in density of the coal fines resulting from the treatment according to the invention is equal to or higher than the increase resulting from the punning, whilst the machinery to be used is by far simpler and cheaper and the duration of the process is reduced to a few minutes. Further, when the vibrations are applied to the bulk of coal fines in the compartments of the coke oven, the loading conditions of said oven are greatly simplified. In addition, the vibrations equalize and flatten the upper surface of the bulk, allowing thereby the upper level of the fines to be raised and the vacant space between the coal and the vault to be reduced, thus improving the output performance of the oven.

The charge of the oven can also be vibrated beforehand in an annexed cell, outside the oven and, after having been vibrated, be shovelled into the oven. In such event, an apparatus very similar to the one hereafter described is used.

The invention can of course be applied not only to the high temperature coking carried on to prepare the oven coke but also to the low temperature coking and more broadly to any carbonization or distillation of a solid fuel in a state of division or of powderiness.

By way of example, a form of embodiment of the device according to the invention will be described hereafter and illustrated in the annexed drawing, as applied to a metallurgical coke oven of the type which treats the fines of Lorraine (France).

The Figure 1 is a vertical transverse section of a compartment of a coke oven equipped with the apparatus according to the invention.

The Figure 2 is an horizontal cross section half way up a compartment.

The Figure 3 illustrates, in an elevation section, a modified embodiment.

The coking oven, as shown in the drawing, in-

cludes several parallel masonned coking chambers such as 1, equipped with fore and rear doors 2, 2' and, on the top, with charging holes 3, 3' through which the fines are discharged in the chamber from a truck running on the oven. The device according to the invention includes a gantry or travelling crane 4 running on the rails 5, 5' and brought successively above each of the chambers 1 immediately after the charging or before the end of their charging. On this travelling crane are winches 6, 6' the cables of which support a cross girder 7 carrying a motor 8 and connected through elastic devices such as the shock absorbers 9, 9' with a second vibrating cross girder 10 which carries a vibrator 11 of any suitable type, driven by the motor 8 through a belt 12. On the traverse girder 10 are fitted vibrating members 13, 13', 13'' a. s. o. which consist for instance in bars, stems or pipes, equidistant and forming a herse or portcullis over the whole length of the compartment into which they can be introduced through small individual apertures 14, 14', 14'' which are obturated during the vibrating process by small plates 15, 15', 15''... a. s. o., fixed to the vibrating members. The handling of the vibrating device from the travelling crane 4 can also be carried on by means of a rack device instead of the winches. If desired, the travelling crane can be substituted by an ordinary gantry mounted on the coal car.

The distances of the vibrating stems to each other, to the walls and the back end of the oven and the power of the vibrator are selected so that all the bulk of fines shall be vibrated but without applying any appreciable vibration to the walls of the compartment to avoid damages in course of time. In the practice, an interval of about 35 cm. between the vibrating stems has been found satisfactory during trials with compartments having about the same width and with the use of rather small vibrating powers. The section of the vibrating members can be in the shape of a circle, a rectangle, a cross, or be oblong or the like according to the kind of the material to be vibrated. In some cases, the vibrating members can consist of plates.

In the case of ovens having a great length, it is possible to use several herses, each being constituted by a set of bars carried by a traverse girder and hanging all on the same travelling crane. One can also foresee to vibrate individually each member of the herse.

As above indicated, the vibrating members are introduced in the bulk of fines immediately after the charging or during the charging, are vibrated during a few minutes and taken away: the apertures 14 are then obturated. The vibrating members which bring about the packing of the material leave in the compressed bulk after their removal channels, showing more or less according to the hygrometric state of the bulk, which allow the expansions to take place without transmitting a pressure to the vertical walls of the oven, or, at least, reduce these pressures.

According to an alternate embodiment, the vibrating members are arranged horizontally and introduced in the compartment 1 through holes provided in the doors 2, 2': the vibrating device, in such a case, is carried by trucks running in a parallel line with the fore and/or rear face of the oven and brought in succession opposite each compartment.

The Figure 3 is concerned with the case in which the compartments of the coking oven are equipped near their ends with pipings such as 16,

for the exhaust of the gases produced during the coking, thus hindering the introduction of vibrating members in the end zone of the oven. To vibrate also the fines in this zone, it has been foreseen, according to the invention to add to the above described apparatus as illustrated in Figs. 1 and 2, horizontal vibrating elements 17, 18, 19 which are introduced in the bulk through apertures arranged in the door 2, of the oven compartments. The setting and the actuation of these vibrating members can be carried on in a manner similar to that of the vertical members, these members 17, 18, 19 being fixed on a vertical support 20, on which is set a vibrating device 21: this support is mounted with the shock absorbers 22, 23, on a small beam 24 supporting an engine 25 which drives the vibrating device through the belt 26. The beam 24 is integral with a movable stand which can be moved on the ground by means of rollers 27 running on rails 28.

According to an alternative a vibrating device with horizontal vibrating elements such as those numbered 17, 18 and 19, is associated to the other end of the oven and also includes driving means similar to those described above.

In the case of an oven having a small length, the charge can be vibrated simply with the help of horizontal spindles introduced through the side doors of the compartment.

When the oven has been equipped with a device to prepare the charge of fines in a container outside the oven and to shovel the charge into the compartment by means of a piston like member, the vibrations intended for compacting this charge can also be applied to the charge, according to the invention, outside the oven, by means of the herse of Fig. 1. The density of the charge is thus strongly increased, helping thereby the coking of some coals or compounds of coals and preventing the risk of collapse when the cake is fed into the coking chamber of the oven.

What I claim is:

1. In a plant for the carbonization of coal fines, a chamber wherein the fines are charged, a movable frame, carried by said movable frame a device for generating mechanical vibrations, a herse provided with parallel metallic bars, means for connecting said herse to said vibrating device for imparting longitudinal vibrations to said rods, said rods being arranged perpendicularly to one of the walls of said chamber and being slightly shorter than the wall of the chamber which is parallel to said herse, means provided on said movable frame for introducing and withdrawing the said herse into and from the charge of coal fines in said chamber, the spacings between two successive parallel rods of the herse being substantially equal to the distance between the walls of the chambers which are parallel to the plane containing the herse, whereas the power of the vibrating device is adapted to impart vibrations to the whole of the bulk of the fines without substantially reaching the walls of the chamber.

2. In a plant for the carbonization of coal fines including an oven comprising a plurality of parallel coking chambers and means for charging coal fines into said chambers, rails arranged along one of the walls of said oven, a frame movable on said rails, carried by said frame an adjustable device for producing mechanical vibrations, a herse comprising a series of parallel rods arranged perpendicularly to said wall of the oven and having a length slightly shorter than that of the walls of the chambers which are parallel to the herse, means for connecting said herse to the

vibrating device whereby longitudinal vibrations are imparted to said rods, apertures provided in the walls of said chambers which are perpendicular to the herse and corresponding to the rods of said herse, means for displacing the herse together with the vibrating device for introducing and withdrawing said rods into and from the charge of coal fines in said chambers, the spacings between two successive parallel rods of the herse being substantially equal to the distance between the walls of the chambers which are parallel to the plane containing the herse, whereas the power of the vibrating device is adapted to impart vibrations to the whole of the bulk of the fines without substantially reaching the walls of the chamber.

3. A plant for the carbonization of coal fines according to claim 2, wherein a travelling crane is arranged on the top of the oven to be successively brought above each of the coking chambers, means for suspending to said travelling crane the vibrating device and a vertical herse and for vertically displacing same, the vaults of the coking chambers having holes along their longitudinal axis corresponding to the rods of the herse and means for closing said holes after the withdrawal of the vibrating rods.

4. In a plant for the carbonization of coal fines including an oven comprising a plurality of parallel coking chambers of which the vaults are provided near one of their ends with exhaust pipings, the combination comprising a travelling crane arranged on the top of the oven and adapted to be successively brought above each of the coking chambers, a device for producing mechanical vibrations, a herse comprising a series of parallel equidistant vertical rods and extending throughout the length of the oven except the end portion occupied by the exhaust pipes, means for connecting said herse to the vibrating device whereby longitudinal vibrations are imparted to said vertical rods, means for suspending said herse and said vibrating device to said travelling crane and apertures provided in the vault of each chamber and corresponding to the rods of the vertical herse, a truck arranged to move parallel to the side wall of the oven neighbouring the exhaust pipes, carried by said truck a second device for generating mechanical vibrations and a second herse comprising horizontal bars uniformly spaced in a vertical plane and perpendicular to the side wall of the oven, said second herse being operatively connected to said second vibrating device and the horizontal rods having a

length corresponding to the length of the end portion of the coking chambers free from the vertical vibrating rods, apertures provided in the side walls of said chambers corresponding to the horizontal rods and means for horizontally displacing said second herse and second vibrating device for introducing and withdrawing said herse in the coking chambers, the spacings between the rods of both vertically and horizontally vibrating herse being equal to the width of the coking chambers.

5. In a plant for the carbonization of coal fines comprising a series of parallel coking chambers provided with a port at their ends, rails arranged parallel to at least one of the walls of the oven provided with said ports, a frame movable on said rods to be successively positioned in front of each of said ports, carried by said frame an auxiliary open cell having substantially the same shape and volume as one coking chamber, means for charging coal fines in said cell, a device for producing mechanical vibrations, a herse comprising parallel vertical and equidistant rods spaced the one from another, said spacings being equal to the width of said cell, a row of vertically spaced holes provided in each of said ports corresponding to said rods, means for operatively connecting said herse to the vibrating device to impart to said rods longitudinal vibrations and means for introducing and withdrawing the herse into and from the fines charge in the cell through the holes of the port, and means for pushing the vibrated charge of fines contained in said auxiliary cell into the coking chamber in front of which the movable frame carrying the cell has been brought.

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