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(54) LINING ARMOR PLATE FOR A CASING OF A HAMMER MILL

AUSKLEIDENDE PANZERPLATTE FÜR EIN GEHÄUSE EINES HAMMERWERKS

PLAQUE DE BLINDAGE DE GARNITURE POUR UN BOÎTIER D'UN BROYEUR À MARTEAUX

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Description

[0001] The present invention relates to a lining armor plate for a casing of a hammer mill.

[0002] The invention has application, in particular, in hammer mills used for milling refuse of various types (constituted by materials such as plastic, rubber, ferrous and non-ferrous metals, glass, rubble, wood, etc.), as an inner lining of the casing containing a rotor with hammers.

[0003] In the recycling sector, hammer mills are known for refining apparatuses, and are used to mill refuse with a sizing of approximately 30 mm, which may optionally originate from a previous processing stage for breaking up the refuse, in order to obtain a sizing of maximum 2 mm at the end of the processing. Such reduced sizing serves mainly to select the material with gravimetric boards. Secondly, it has been observed that during the processing and in the various stages of passing through the recycling stations, stainless steel takes on a magnetic charge and the sizing reduction enables separation with special magnets.

[0004] The sector has therefore an evident interest in taking maximum advantage of the potential of hammer mills for milling refuse.

[0005] Nowadays hammer mills are known which comprise a cylindrical casing which defines a receptacle for a roller-type rotor which is provided with milling hammers. In particular, fixed hammer mills and movable hammer mills are known, the latter being movable because they are installed so that they can tilt.

[0006] The casing is provided with an entry channel for the material to be milled and with an exit channel for discharging the milled material. The transit of material occurs by pneumatic conveyance, by aspirating the material at the entry of the mill.

[0007] The casing is provided, on the inner walls, with lining armor plates which have longitudinal channels that make it possible to channel and conduct the material being processed toward the exit channel.

[0008] Such linings favor the pneumatic conveyance of the material toward the exit from the casing. However, it has been found that the material channeled in the channels of the armor plates no longer comes into contact with the hammers of the mill and slides therein up to the region where it exits from the casing.

[0009] The dimensions of the channel determine the dimensions of the material that is milled, because it can be such that it does not protrude sufficiently from the armor plates for it to be touched by the hammers, instead continuing on its way toward the exit. As a consequence, the mill mills less than its capacity and its performance is reduced.

[0010] Furthermore, the material that is not adequately milled often has a size range that exceeds the optimal design size for subsequent processing (typically smaller than 5 mm), thus causing damage and anomalous wear of the machines on the subsequent stages. Material in a size range that exceeds the design size must be reprocessed with other machines and therefore with other investments and costs. A lining armor plate for a casing of a hammer mill comprising recesses is disclosed in US3966126 A.

[0011] The aim of the present invention is to provide a lining armor plate for a hammer mill, which is capable of improving the known art in one or more of the above mentioned aspects.

[0012] Within this aim, an object of the invention is to provide a lining armor plate that is capable of improving the performance of the hammer mills in which it is installed.

[0013] Another object of the invention is to increase the milling ratio of the hammer mills in which the armor plate according to the invention is installed.

[0014] Another object of the invention is to limit the investments and costs for obtaining the correct size ranges of the materials to be recycled.

[0015] Furthermore, the present invention is to overcome the drawbacks of the known art in an alternative manner to any existing solutions.

[0016] Another object of the invention is to provide a lining armor plate that is highly reliable, easy to implement and of low cost.

[0017] This aim and these and other objects which will become better apparent hereinafter are achieved by a lining armor plate for a casing of a hammer mill, characterized in that it has a surface that is contoured with parallel series of recesses which extend along a same longitudinal direction and are alternated with regions without recesses.

[0018] Further characteristics and advantages of the invention will become better apparent from the detailed description that follows of a preferred, but not exclusive, embodiment of the lining armor plate according to the invention, which is illustrated for the purposes of non-limiting example in the accompanying drawings wherein:

- Figure 1 shows a first variation of an armor plate according to the invention;
- Figure 2 shows a second variation of an armor plate according to the invention;
- Figure 3 shows a hammer mill in which the armor plate according to the invention is mounted.

[0019] With reference to the figures, the armor plate according to the invention, generally designated by the reference numeral 10, has, as an advantageous peculiarity, a surface that is contoured with parallel series of recesses 11 which extend along a same longitudinal direction and are alternated with regions without recesses.

[0020] In particular, the recesses 11 extend along the direction of travel of the material being processed within the casing 12 of the mill, from an entry region to an exit region.

[0021] Figures 1 and 2 respectively show two versions of armor plate according to the invention, which differ in the dimensions of the recesses 11.

[0022] Figure 3 shows a hammer mill 13, for milling refuse, in which armor plates 10 are mounted.

[0023] The mill 13 comprises a substantially cylindrical casing 12 with two heads, which defines a receptacle for a roller-type rotor 14 with peripheral milling hammers 15.

[0024] The motor 12 and the rotor 14 are conveniently connected by way of transmission belts 16 and in a conventional manner.

[0025] The casing 13 is provided with an entry channel 17 for the material to be milled and with an exit channel for the milled material.

[0026] Preferably, the entry channel 17 and the exit channel have inlets for connection to the casing 13 which are arranged on respective heads 17a, 18a and along directions that are parallel to the direction of the rotation axis 19 of the rotor 14. In particular, the entry channel 17 is on one side, the righthand side in the illustration, in the upper part of the casing 12, which acts as a lid to be closed over the rotor 14, while the exit channel is on the opposite side to the previous one, on the side where the processed material exits.

[0027] The conveyance is pneumatic and is implemented in a known manner with an aspiration at the entry.

[0028] The mill 13 illustrated is a movable hammer mill 15, in that the hammers oscillate, but the same inventive concept described can also be applied to fixed hammer mills, both of which are conventional per se.

[0029] In particular, the armor plate 10 shown in Figure 1 is adapted to be installed in a fixed hammer mill, while the armor plate 10 shown in Figure 2 is adapted to be installed in a movable hammer mill 13, as shown in Figure 3.

[0030] The recesses 11 advantageously extend along the direction of travel of the material being processed within the casing 12, from an entry region to an exit region.

[0031] The armor plate 10 is modular and adapted to cover, with other, similar armor plates 10, the inner surface of the casing 12, as shown in Figure 3.

[0032] It has in fact a substantially plate-like shape structure and in cross-section it is shaped like a circular arc, in order to follow the curvature of the surface of the casing 12.

[0033] The recesses 11 are distributed substantially uniformly on the surface of the armor plate 10. In the variation shown in Figure 1, recesses of shorter length, which are adapted to be arranged in the casing at the fixed hammers of the rotor 14, alternate with longer recesses. In this manner the material is free to travel longer paths by sliding toward the exit inside the longer recesses, where there are no hammers.

[0034] In the variation shown in Figure 2 and in Figure 3, on the other hand, the recesses 11 are of equal length.

[0035] In both cases, the distribution of recesses 11 is uniform apart from dedicated seats for the insertion of screws to affix the armor plate 10 to the casing 12.

[0036] Operation of the armor plate according to the invention is the following.

[0037] A plurality of armor plates 10 is installed in the hammer mill 13 to line the inner surface of its cylindrical casing 12, arranging them side-by-side and affixing them to the casing 12 by way of affixing screws.

[0038] During use of the mill 13, the material to be milled is introduced into the casing 12 through the entry channel 17 and conveyed with air by way of aspiration at the exit.

[0039] During rotation of the rotor 14, the material being processed is pushed radially outward, against the lining armor plates 10. Here the recesses 11, because they have a longitudinally-extended shape structure and are aligned, convey the material being processed toward the region for exiting from the casing 12, and at the same time they force its return toward the hammers 15, in the manner explained below.

[0040] Substantially, the recesses 11 constitute preferential passages for the material, in which the material is channeled toward the exit from the casing 12. Each row of recesses 11, aligned and alternated with regions without recesses, can be likened to a fragmented channel, i.e. in which there are walls in its length that are substantially perpendicular to its direction of extension, and the direction of the flow of channeled material, indicated with X in Figures 1 and 2. With the recesses, such walls are constituted by the perimetric wall 11a of each individual recess, in a direction substantially perpendicular to the direction in which the material travels each recess.

[0041] When the material encounters such walls 11a, it is forced to return toward the rotor 14 and therefore to collide with a hammer 15.

[0042] The larger amount of material that is consequently milled results in an increase in the milling ratio, which goes from about 3:1 (incoming material with an average diameter of 15-20 mm and outgoing of 8-10 mm) to 5.5:1 (incoming material with an average diameter of 25-30 mm and outgoing of 4-6mm) and in an increase in the wear of the armor plates and of the hammers, which is simply solved by making them in cast metals.

[0043] The increase in processed material also results in an increase in the power used. However, overall, an apparatus in which there is a hammer mill provided with the armor plate according to the invention is still economically advantageous, in terms both of energy consumption and of installation and maintenance costs, because the material does not need to pass to a subsequent processing machine.

[0044] The armor plate according to the invention therefore improves the performance of the mills in which it is installed, by bringing the material to be milled to a size range as small as 0-2 mm, for subsequent gravimetric selection. Bringing material in the correct size range to enter the subsequent stage of the plant makes it possible to operate the subsequent machine correctly, with greater efficiency and fewer problems of anomalous wear and unforeseen malfunctions, further increasing the performance of the entire recycling plant.

[0045] In practice it has been found that the invention fully achieves the intended aim and objects by providing

a lining armor plate which improves the performance of the hammer mills in which the casing is installed, and by virtue of which it is possible to limit the overall investments and costs of processing.

[0046] The invention thus conceived is susceptible of numerous modifications and variations, all of which are within the scope of the appended claims. Moreover, all the details may be substituted by other, technically equivalent elements.

[0047] In practice the materials employed, provided they are compatible with the specific use, and the contingent dimensions and shapes, may be any according to requirements and to the state of the art.

[0048] Where technical features mentioned in any claim are followed by reference signs, those reference signs have been included for the sole purpose of increasing the intelligibility of the claims and accordingly, such reference signs do not have any limiting effect on the interpretation of each element identified by way of example by such reference signs.

Claims

1. A lining armor plate for a casing of a hammer mill, **characterized in that** it has a surface that is contoured with parallel series of recesses (11) which extend along a same longitudinal direction and are alternated with regions without recesses, said recesses (11) extending along the direction of travel of the material being processed within the casing (12) from an entry region to an exit region.

2. The armor plate according to claim 1, **characterized in that** it is modular and adapted to line, with other, similar armor plates (10), the internal surface of said casing (12).

3. The armor plate according to one or more of the preceding claims, **characterized in that** it has a substantially flat shape structure and is shaped like a circular arc in cross-section.

Patentansprüche

1. Eine auskleidende Panzerplatte für ein Gehäuse eines Hammerwerks, **dadurch gekennzeichnet, dass** sie eine Oberfläche hat, die mit parallelen Reihen von Vertiefungen (11) konturiert ist, welche sich entlang einer selben Längsrichtung erstrecken und mit Bereichen ohne Vertiefungen abwechseln; wobei die Vertiefungen (11) sich entlang der Vorschubrichtung des Materials, das im Gehäuse (12) verarbeitet wird, von einem Eintrittsbereich zu einem Austrittsbereich erstrecken.

2. Die Panzerplatte gemäß Anspruch 1, **dadurch gekennzeichnet, dass** sie modular und ausgebildet ist, um mit anderen ähnlichen Panzerplatten (10) die innere Oberfläche des Gehäuses (12) auszukleiden.

3. Die Panzerplatte gemäß einem oder mehreren der obigen Ansprüche, **dadurch gekennzeichnet, dass** sie eine im Wesentlichen flache Struktur hat und im Querschnitt kreisbogenförmig ist.

Revendications

1. Plaque de blindage de revêtement pour un corps d'un broyeur à marteaux, **caractérisée en ce qu'**elle a une surface qui est profilée avec des séries d'évidements (11) parallèles qui s'étendent le long d'une même direction longitudinale et qui alternent avec des régions sans évidement, lesdits évidements (11) s'étendant le long de la direction de déplacement du matériau qui est traité dans le corps (12) d'une région d'entrée vers une région de sortie.

2. Plaque de blindage selon la revendication 1, **caractérisée en ce qu'**elle est modulaire et adaptée pour revêtir, avec d'autres plaques de blindage (10) similaires, la surface intérieure dudit corps (12).

3. Plaque de blindage selon l'une ou plusieurs des revendications précédentes, **caractérisée en ce qu'**elle a une structure de forme substantiellement plate et présente en section transversale une forme d'arc de cercle.

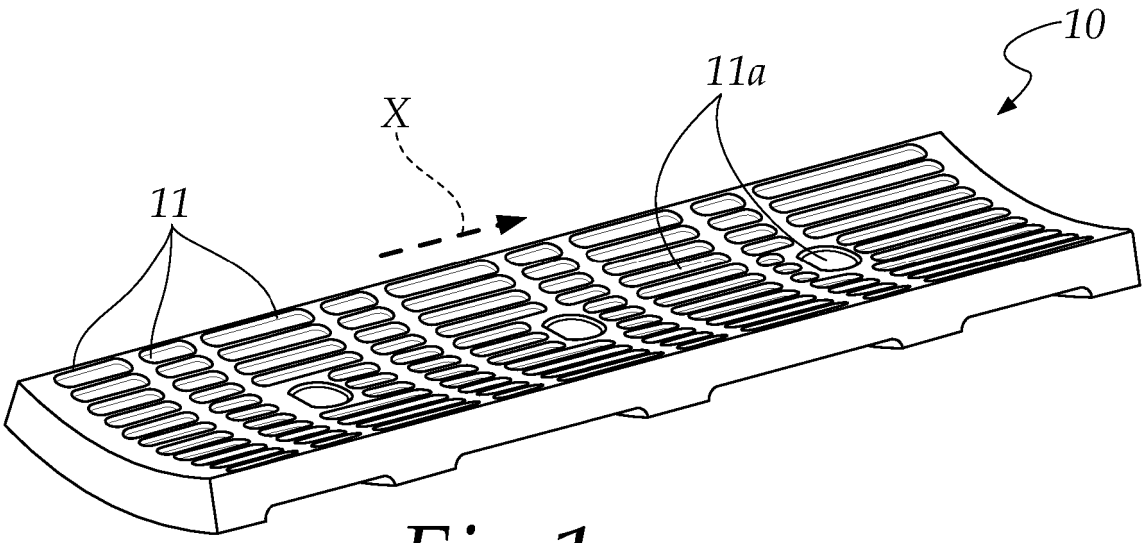

Fig.1

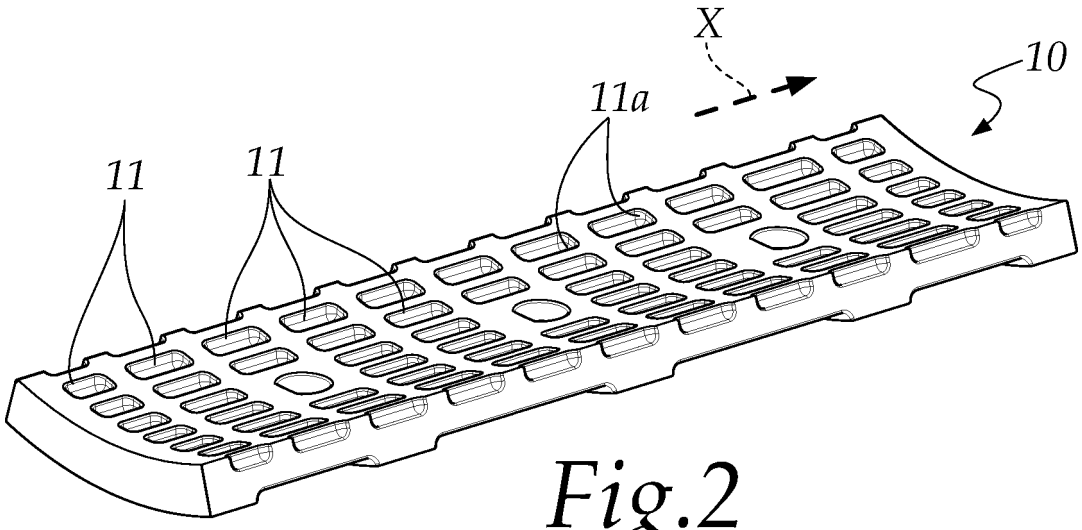

Fig.2

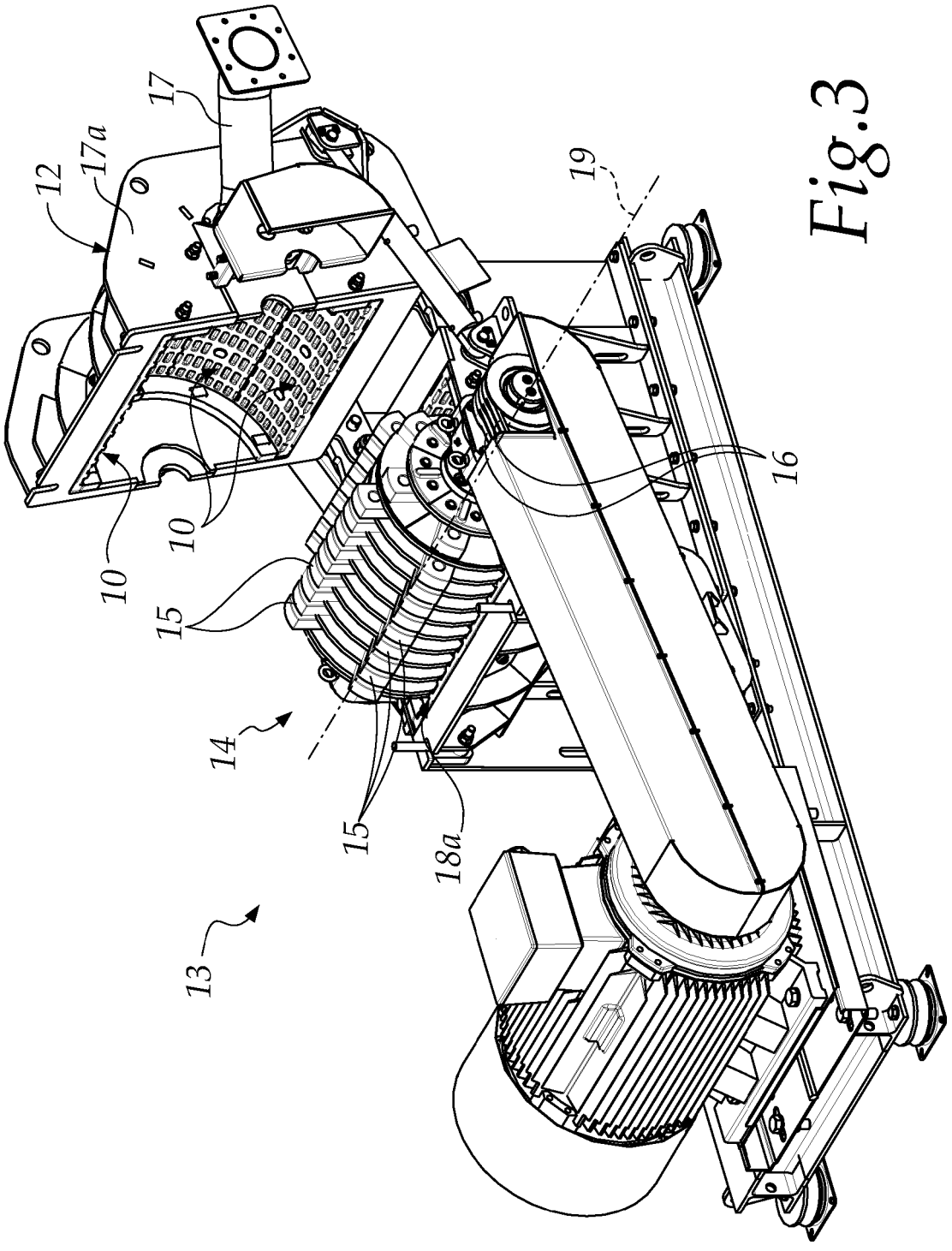

Fig.3

REFERENCES CITED IN THE DESCRIPTION

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