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STRIKING PLATE FOR DISINTEGRATING MILL

Filed Oct. 26, 1964

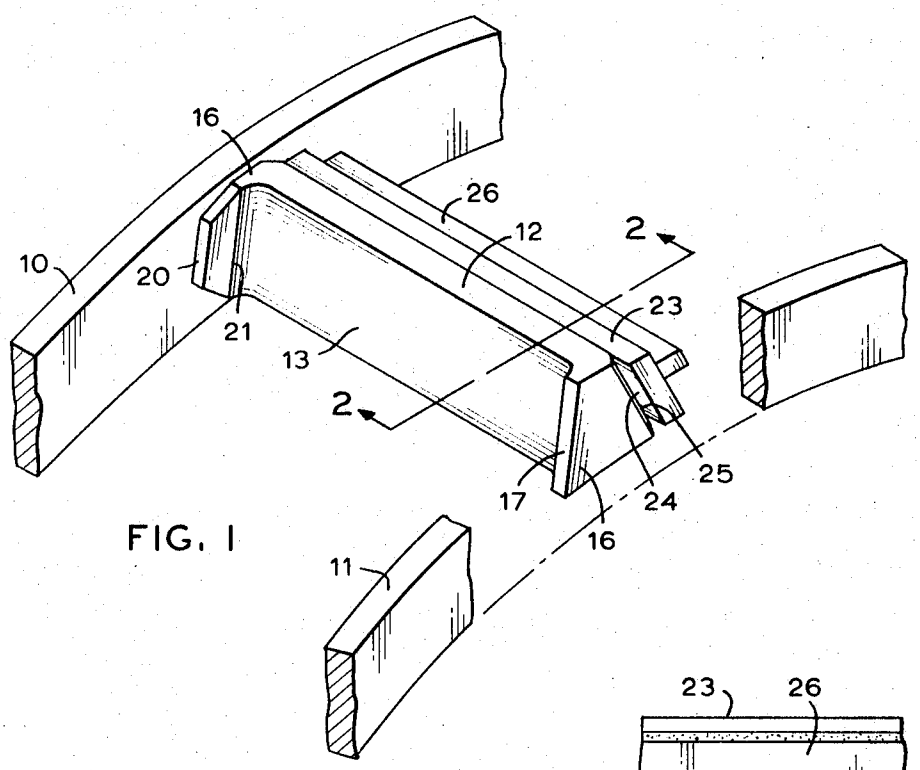


FIG. 1

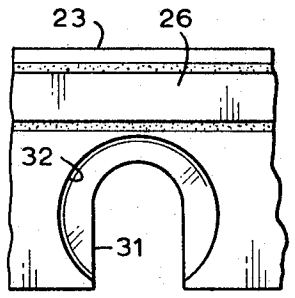


FIG. 3

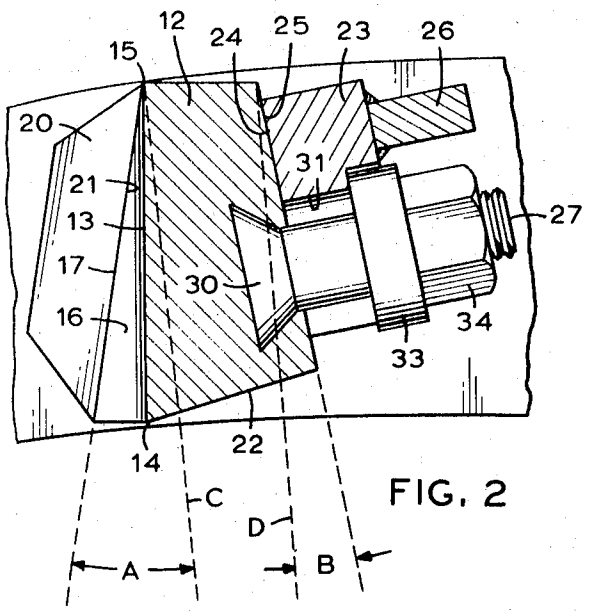


FIG. 2

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STRIKING PLATE FOR DISINTEGRATING MILL

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ABSTRACT OF THE DISCLOSURE

The replaceable striker plate, which has a leading impact face, extends between opposite rotor rings of a disintegrating mill and provides the basis of an impact system. The striker plate is preferably thickened at its inside edge and is so shaped at its ends as to be retained in position by a wedge action on the striker plate by a keeper plate on one side and a back-up structural member on the other side. Fasteners interconnect the striker plate and the structural member. The provision of forwardly extending flanges at each end of the striker plate, renders the joint between the striker plate and the keeper plates less susceptible to wear.

This invention relates generally to improvements in a striking plate and to an impact means incorporating the striking plate between a pair of spaced rings of a rotor in a disintegrating mill.

The distintegrating mill in which the present invention can be utilized is fully disclosed in applicants' U.S. Patent No. 3,047,243, issued July 31, 1962, the disclosure being incorporated in and referred to by this application.

Disintegrating mills of the type designated as internally fed impact cage mills are employed to reduce solid granular materials, such as stone, ore or other similar material, to a finer particle size. The material is forced to travel outwardly by centrifugal force because of rotation of the cages of the mill, and as the particles of material move radially outwardly, they are struck by suitable impact means formed in the cages which shatter or disintegrate the material to reduce it to smaller size.

It is an important object of the present invention to provide an improved striking plate construction that realizes a far greater wear life than those plates previously used. In addition, such construction enables a more effective connection to and between the rings of a rotor in the cage assembly of the disintegrating mill, and yet enables a quicker and easier replacement when necessary.

An important object is realized by the provision of an elongate plate having a leading impact face with an inner edge and an outer edge, and having a greater thickness in the region of the inner edge than at the outer edge for greater rigidity, stability and strength.

Another important objective is achieved by the provision of integral flanges at each end of the plate, the flanges extending forwardly of the leading impact face so as to eliminate joints between the plate and the rotor rings in the plane of the impact face at which excessive wear could occur. It is further advantageous in this regard to provide the end flanges with inner faces that are rounded integrally into and merged with the leading impact face.

Still another important object is afforded by the structural arrangement of the end flanges relative to the leading impact face such that the flanges project forwardly beyond the impact face a greater distance adjacent the inner edge of the plate than at the outer edge.

An important objective is attained in that the end flanges are provided with wedging surfaces located at an angle to the leading impact face, the angle opening from the outer edge to the inner edge of the plate.

Another important object is achieved by the provision of an impact means adapted for use between a pair of spaced rings of a rotor in a disintegrating mill, the impact means including a striking plate having a leading striking face, and means engaging integral end flanges on the plate to hold the striking plate to the rotor rings.

Yet another important objective is realized by the construction of the end flanges so that retaining means cooperate therewith to wedge the end flanges in holding the striking plate to the rotor rings.

An important object is afforded in that the integral end flanges extend forwardly of the leading impact face to provide wedging surfaces adapted to be arranged at an angle to a radius of the rotor rings, the wedging surfaces engaging keeper bars to wedge the striking plate and hold it securely in position on the rings under centrifugal force of the plate upon rotation of the rotor.

Another important objective is attained by the provision of a structural member attached to the rings and engaging the back side of the striking plate, and of fastening means detachably securing the plate to the structural member.

It is an important objective to provide a striking plate and an impact means in which such striking plate is utilized which is simple and durable in construction, economical to manufacture, highly efficient in operation, and which can be readily installed or repaired by anyone with little or no instruction.

The foregoing and numerous other objects and advantages of the invention will more clearly appear from the following detailed description of a preferred embodiment, particularly when considered in connection with the accompanying drawing, in which:

FIG. 1 is a fragmentary perspective view of the impact means between rotor rings, one ring being broken away for clarity;

FIG. 2 is an enlarged cross sectional view as seen along line 2—2 of FIG. 1, and

FIG. 3 is a fragmentary rear elevational view of the back-up structural member.

Referring now by characters of reference to the drawing, the striking plate **12** and the impact means in which the striking plate **12** is used are fully disclosed. The multiple cage type disintegrating mill in which the striking plate **12** and the impact means are utilized is fully disclosed in U.S. Patent No. 3,047,243, such disclosure being incorporated by reference in this application.

As disclosed in U.S. Patent No. 3,047,243, a disintegrating mill of the multiple cage type is shown in FIG. 1 in which a first rotor is mounted for rotation in one direction and a second rotor is mounted for rotation in the opposite direction. The material to be treated is fed into the central chamber defined between the rotor and then passes outwardly to the periphery of the apparatus as it is processed. The first rotor includes a pair of annular rows of impact means that are disposed alternately with a pair of annular rows of impact means provided on the second rotor such that the particles of the material to be treated will be forced to change direction abruptly as they pass from one row outwardly to another row.

The apparatus is shown in FIGS. 2 and 3 of the drawings of U.S. Patent No. 3,047,243. This apparatus includes a housing mounted upon a suitable support, and a feed chute sealed to the housing and in communication with the central portion of the interior of the housing. One end of the feed chute is in communication with the lower open end of the storage bin adapted to hold a solid granular material or the like, which is to be treated. A conventional feeder assembly of the vibrating type is disposed at the upper end of the feed chute.

The rotor mechanism and the structural arrangement generally of the impact means in such rotor mechanism

are clearly disclosed in FIGS. 4 and 5 of U.S. Patent No. 3,047,243 and fully described in such specification. The present invention relates to an improved striking plate and impact means utilized in the rotor mechanism.

Referring now by characters of reference to FIG. 1 of the present drawing, it is seen that the rotor includes a pair of spaced, substantially parallel annular rings **10** and **11**. As is usual and as is taught by U.S. Patent No. 3,047,243, the impact means are mounted between the rings **10** and **11**. While one of the impact means is illustrated in FIG. 1, it will be understood that the other impact means are identical in structure.

An elongate striking plate **12** extends between the rotor rings **10** and **11**, the striking plate **12** including a leading impact face **13** defined by an inner edge **14** and an outer edge **15**. It will be noted that the striking plate **12** is thicker in the region of the inner edge **14** than at the outer edge **15**.

Formed integrally at each end of the striking plate **12** is a flange **16** adapted to seat contiguously against the inside surfaces respectively of the rotor rings **10** and **11**. The end flanges **16** extend forwardly of the leading impact surface **13** to provide a substantially U-shaped front surface. It will be importantly noted that this substantially U-shaped front surface avoids a joint or crack between the striking plate **12** and the rotor rings **10** and **11** in the plane of the impact face **13**. Emphasizing this distinct structure, the inner faces of the end flanges **16** are rounded integrally into and merged with the leading impact face **13**.

For reasons which will later appear upon more detailed description of parts, each of the end flanges **16** project forwardly of the leading face **13** a greater distance at the inner edge **14** than at the outer edge **15** to provide a forward wedge surface **17** that is inclined at an angle to the leading face **13**, the angle opening from the outer edge **15** to the inner edge **14**. When the striking plate **12** is assembled in the impact means between the rotor rings **10** and **11**, the wedge surfaces **17** of the end flanges **16** are disposed at an angle A to a radius C of the rotor.

A keeper bar **20** constituting a wedge-retaining means is secured as by welding to the inside surface of each of the rotor rings **10** and **11**. These keeper bars **20** include inclined rear margins **21** that engage the wedge surfaces **17** of the end flanges **16**. It will be noted that the keeper bars **20** serve to wedge the striking plate **12** in position under the centrifugal force exerted by the striking plate **12** upon rotation of the rotor.

It will also be noted that the thickness of the keeper bars **20** closely approximates the thickness of the end flanges **16** at their wedge surfaces **17** to provide relatively flush inner surfaces therebetween. These joints between the rear margins **21** of the keeper bars **20** and the wedge surfaces **17** of the end flanges **16** are located a substantial distance forwardly of the plane formed by the leading impact face **13** so that any wear created by material traveling over the impact face **13** and along the inner faces of the end flanges **16** substantially in the plane of such impact face **13** will not cause any wear at the joints formed by the keeper bars **20**. Consequently, because of the structure of the striking plate **12**, the wear of such striking plate **12** is reduced to an absolute minimum.

It will be noted that the striking plate **12** is cut away at the radially inward trailing surface **22** to provide a path for particles passing closely adjacent the plate **12**. This angle at which the plate **12** is cut away may be defined as a relief angle since the plate is relieved at the trailing edge. This relief angle position required for minimum interference with the paths of the treated particles will vary because of various conditions, such as the diameter of the rotors, the speed at which they are rotated and the types of material being processed. However, regardless of these different conditions, the optimum relief angle is considered to be one of approximately 135 degrees with respect to a radius of the associated rotor. In any

event, the relief angle must be greater than a 90 degree angle with respect to the radius. The range for the relief angle is one from greater than a 90 degree angle to substantially a 135 degree angle with respect to a radius. This feature is fully described in U.S. Patent No. 3,047,243.

When the striking plate **12** is disposed so that the trailing surface **22** is disposed at the desired relief angle, the wedging surfaces **17** on the end flanges **16** are disposed at an angle A to the same radius C in order to afford a wedging action with the keeper bars **20**.

Extending between and attached to the spaced rotor rings **10** and **11** is a structural member **23** having a front face **24** that contiguously abuts a rear face **25** of the striking plate **12**. It will be importantly noted that the abutting faces **24** and **25** are arranged at an angle B to a radius D of the rotor such that the structural member **23** acts as a wedge to hold the striking plate **12** against the centrifugal force exerted by the striking plate **12** upon rotation of the rotor. Thus it is seen that the abutting wedge surfaces **17** and **21** at the front of the striking plate **12** and the abutting wedging faces **24** and **25** at the rear of such plate **12** converge outwardly and tend to retain the striking plate **12** against outward movement caused by centrifugal force.

Attached as by welding to the structural member **23** is a ledge member **26** extending between the rotor rings **10** and **11**, the ledge member **26** affording reinforcement to the structural member **23** to enhance rigidity. The structural member **23** provides a back-up for the striking plate **12** and absorbs the crushing forces transmitted to it by the striking plate **12** upon operation of the mill.

A plurality of bolts **27** are secured to and carried by the striking plate **12**. Specifically, each of the bolts **27** includes a frusto-conical head **30** embedded in the striking plate **12** and arranged so that the shank of the bolt **27** extends rearwardly through and beyond the rear face **25**. In the preferred embodiment, there are provided a plurality of such bolts **27** in regularly spaced relation along the length of the striking plate **12** between the rotor rings **10** and **11**.

The structural member **23** is provided with a plurality of bottom-open slots **31** adapted to receive the bolts **27** when the striking plate **12** is disposed relative to the structural member **23** with the respective faces **25** and **24** in abutment. These slots **31** are located below the reinforcing ledge member **26**. Formed in the rear face **25** of the structural member **23** about each of the slots **31** is a circular recess **32** that is adapted to receive a compatible lock washer **33** located over the associated bolt **27**. It will be apparent that when the lock washer **33** is located in the recess **32**, the washer **33** engages the structural member **23** in a manner to preclude withdrawal of the bolt **27** through the bottom-open slot **31**. Therefore, it will be understood that these lock washers **33** temporarily hold the striking plate **12** in assembly with the structural member **23** until the nuts **34** are threadedly attached to bolts **27** and tightened up against the lock washers **33**.

It is thought that the functional advantages of the impact means and the striking plate **12** incorporated in such impact means have become fully apparent from the foregoing detailed description of parts, but for completeness of disclosure, the installation of the impact means and the replacement of the striking plate **12** will be briefly described.

First, the structural member **23** is disposed between and secured as by welding to the rotor rings **10** and **11**, the structural member **23** being angularly disposed so that the front wedge face **24** is located at an appropriate angle B to a rotor radius D for the purpose previously described in detail. Then, the striking plate **12** is located in front of the structural member **23** and the rear face **25** is put against the wedge face **24** of the structural member **23**. To accomplish this disposition, the bolts **27** are inserted into the bottom-open slots **31**. Washers **33**

are slipped over the bolts **27** and fitted into the recesses **32**, the lock washers **33** cooperating with the structural member **23** to hold the striking plate **12** temporarily in assembly with the structural member **23** by precluding movement of the bolts **27** out of the bottom-open slots **31**. Then, the nuts **34** are threaded tightly onto the bolts **27** to fix the striking plate **12** securely.

The keeper bars **20** are then secured to the inner faces of the rotor rings **10** and **11**, each keeper bar **20** having its rear margin **21** engaging the wedge surface **17** of one of the end flanges **16**. It will be understood that the rear margins **21** of the keeper bars **20** engage the wedge surfaces **17** at an angle A to the rotor radius C. During rotation of the rotor rings **10** and **11**, the keeper bars **20** provide a wedging action that tends to restrain the striking plate **12** against any outward movement that would otherwise be produced by the centrifugal force exerted on the striking plate **12**. Also, it will be understood that the angular disposition of the abutting faces **24** and **25** between the rear of the striking plate **12** and the front of the structural member **23** cooperates with the wedging action of keeper bars **20** in opposing this centrifugal force.

If for any reason the striking plate **12** wears or becomes damaged to an extent that it must be removed and replaced, this assembly enables such procedure to be accomplished readily. For example, the nuts **34** are unthreaded and the lock washers **33** are slipped off of the bolts **27**. Then, the striking plate **12** can be removed from between the keeper bars **20** and the structural member **23** by withdrawing it inwardly, the bolts **27** moving outwardly through the bottom-open slots **31**. A new striking plate **12** is inserted upwardly between the keeper bars **20** and structural member **23**, the bolts **27** moving into the bottom-open slots **31**. The lock washers **33** and nuts **34** are then applied as described previously.

In some instances, the keeper bars **20** are worn and must be replaced at the same time. This is a simple procedure in that the worn keeper bars **20** are removed and new ones are secured in their place to the rotor rings **10** and **11**. It is understood that these new keeper bars **20** are disposed in the same manner so that their wedging rear margins **21** engage the coacting wedging surfaces **17** of the end flanges **16**.

Although the invention has been described by making detailed reference to a single preferred embodiment, such detail is to be understood in an instructive, rather than in any restrictive sense, many variants being possible within the scope of the claims hereunto appended.

We claim as our invention:

1. A striking plate for a disintegrating mill comprising:

(a) an elongate plate having a leading impact face with inner and outer edges, and

(b) integral flanges at each end of the plate extending forwardly of the leading impact face for a greater distance adjacent the inner edge than at the outer edge.

2. A striking plate for a disintegrating mill comprising:

(a) an elongate plate having a leading impact face with an inner edge and an outer edge, and

(b) integral flanges at each end of the plate,

(c) each flange extending forwardly of the leading impact face to provide a wedging surface located at an angle to the leading impact face, the angle opening from the outer to the inner edge.

3. A striking plate for a disintegrating mill comprising:

(a) an elongate plate having a leading impact face with an inner edge and an outer edge, the plate being thicker in the region of the inner edge than at the outer edge,

(b) integral flanges at each end of the plate, the flanges extending forwardly of the leading impact face to provide a substantially U-shaped front surface, the end flanges having inner faces that are rounded integrally into and merged with the leading impact face, and

(c) each end flange projecting forwardly beyond the leading impact face to provide a wedge surface located at an angle to the leading impact face, the angle opening from the outer edge to the inner edge.

4. In an impact means adapted for use between a pair of spaced rings of a rotor in a disintegrating mill:

(a) a striking plate having a leading impact face with inner and outer edges,

(b) the plate being thicker in the region of the inner edge than at the outer edge, and

(c) means wedgingly engaging the ends of the impact face of the striking plate, the means adapted to hold the striking plate to the rings.

5. In an impact means adapted for use between a pair of spaced rings of a rotor in a disintegrating mill:

(a) a striking plate having a leading impact face with an inner edge and an outer edge,

(b) integral flanges at each end of the plate, the end flanges extending forwardly of the leading impact face a greater distance adjacent the inner edge than at the outer edge to provide wedge surfaces adapted to be arranged at an angle to a radius of the rotor, and

(c) means wedgingly engaging the wedge surfaces of the end flanges to hold the striking plate to the rings.

6. In an impact means adapted for use between a pair of spaced rings of a rotor in a disintegrating mill:

(a) a striking plate having a leading impact face with an inner edge and an outer edge, the plate being thickest in the region of the inner edge,

(b) integral flanges at each end of the plate, the end flanges extending forwardly of the leading impact face to provide a substantially U-shaped front surface, the end flanges having inner faces that are rounded integrally into and merged with the leading impact face,

(c) the end flanges projecting forwardly of the leading impact face a greater distance at the inner edge than at the outer edge to provide wedge surfaces adapted to be arranged at an angle to a radius of the rotor, and

(d) means adapted to be attached to the rings, the means wedgingly engaging the wedge surfaces of the end flanges to hold the striking plate to the rings.

7. In an impact means adapted for use between a pair of spaced rings of a rotor in a disintegrating mill;

(a) an elongate striking plate adapted to extend between the rings,

(b) integral flanges at each end of the plate including wedge surfaces adapted to be arranged at an angle to a radius of the rotor,

(c) means adapted to be attached to the rings, the means wedgingly engaging the wedge surfaces of the end flanges under centrifugal force of the striking plate upon rotation of the rings,

(d) a structural member adapted to be attached to the rings, the structural member engaging the back side of the striking plate, and

(e) fastening means detachably securing the plate to the structural member.

8. An impact means as defined in claim **7**, in which:

(f) the back side of the striking plate and the front side of the structural member have abutting wedge surfaces adapted to be arranged at an angle to the radius of the rotor and cooperate with the first said wedge surfaces to hold the striking plate against centrifugal force.

9. An impact means as defined in claim **7**, in which:

(f) the fastening means includes bolts attached to and carried by the striking plate, the bolts extending out

the back side of the plate and extending selectively through the structural member, and

(g) coacting nuts threadedly engaging the bolts and clamping the plate to the structural member.

10. An impact means as defined in claim **9**, in which:

(h) the structural member is provided with bottom-opening slots receiving the bolts extending from the striking plate and extending selectively through the structural member,

(i) the structural member being provided with a recess in the back side of the structural member in the region of each slot and surrounding the associated bolt, and

(j) a washer located about each bolt and located in the associated recess to preclude unintentional withdrawal of the bolt from the slot.

11. In an impact means adapted for use between a pair of spaced rings of a rotor in a disintegrating mill:

(a) an elongate striking plate adapted to extend between the rings, the striking plate including a leading impact face,

(b) integral flanges at each end of the plate, the end flanges extending forwardly of the leading impact face to provide a substantially U-shaped front surface, the end flanges including inner faces that are rounded into and merged with the leading impact face,

(c) the end flanges being provided with wedging surfaces adapted to be arranged at an angle to a radius of the rotor,

(d) a keeper bar adapted to be attached to each ring, each keeper bar wedgingly engaging the wedge surface of one of the end flanges under centrifugal force of the striking plate upon rotation of the rings,

(e) a structural member adapted to be attached to the rings, the structural member engaging the back side

of the striking plate at an angle to the radius of the rotor to cooperate in holding the striking plate against centrifugal force, the structural member being provided with a plurality of slots that are open at the bottom, and

(f) fastening means including a plurality of bolts attached to and carried by the striking plate, the bolts extending out the back side of the plate and extending selectively through the slots of the structural member, and

(g) coacting nuts threadedly engaging the bolts and clamping the plate to the structural member.

12. In an impact means adapted for use between a pair of spaced rings of a rotor in a disintegrating mills:

(a) an elongate striking plate extending between the rings, the plate including wedge engagement surfaces at each end of the plate arranged at an angle to the radius of the rotor,

(b) integral flanges at each end of the plate,

(c) means attached to the rings and wedgingly engaging the wedge surfaces at each end of the striking plate under centrifugal force of the striking plate upon rotation of the rings,

(d) a structural member attached to the rings and engaging the back side of the striking plate, and

(e) fastening means detachably securing the plate to the structural member.

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