United States Patent

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[73] Assignee **Bureau De Recherches Geologiques Et Minieres**
Paris, France
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[33] **France**
[31] **108,129**

[54] **BAR-TYPE ROTARY CRUSHERS**
7 Claims, 6 Drawing Figs.

[52] **U.S. Cl.** **241/74**
[51] **Int. Cl.** **B02c 17/02,**
B02c 17/10, B02c 17/22
[50] **Field of Search** 241/84, 85,
179, 180, 181, 182, 183, 74, 176–8

[56] **References Cited**
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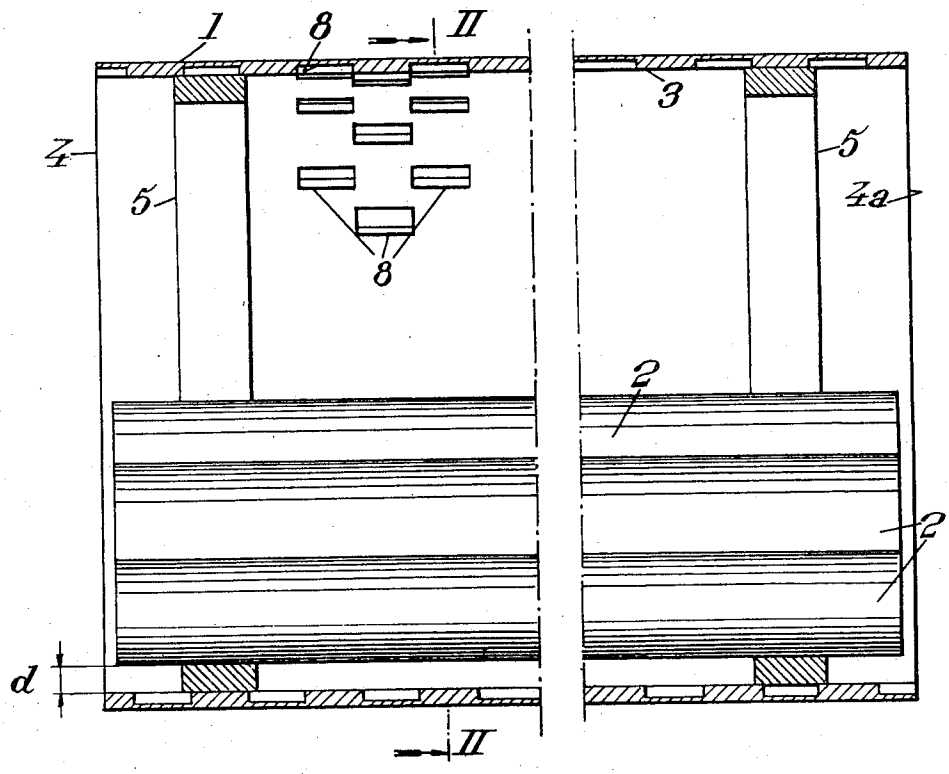
Primary Examiner—Donald G. Kelly
Attorney—Waters, Roditi, Schwartz & Nissen

ABSTRACT: The crusher has a rotary, generally cylindrical structure, of substantially horizontal axis, which contains free cylindrical or prismatic bars adapted to crush the products introduced into this cylindrical structure. Two girdles are disposed on the interior lateral wall of the cylindrical structures. These girdles form the runway for the bars, and separate the bars from the lateral wall of the cylindrical structure, this separation being greater than the dimensions of the large particles of the products to be crushed.



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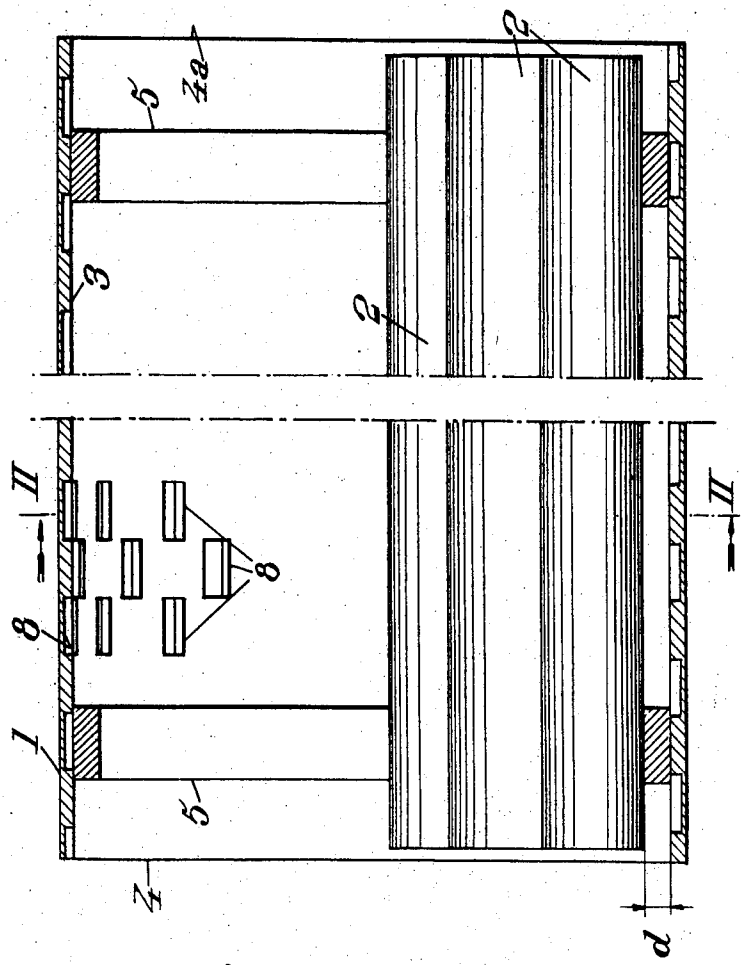

Fig. 1.

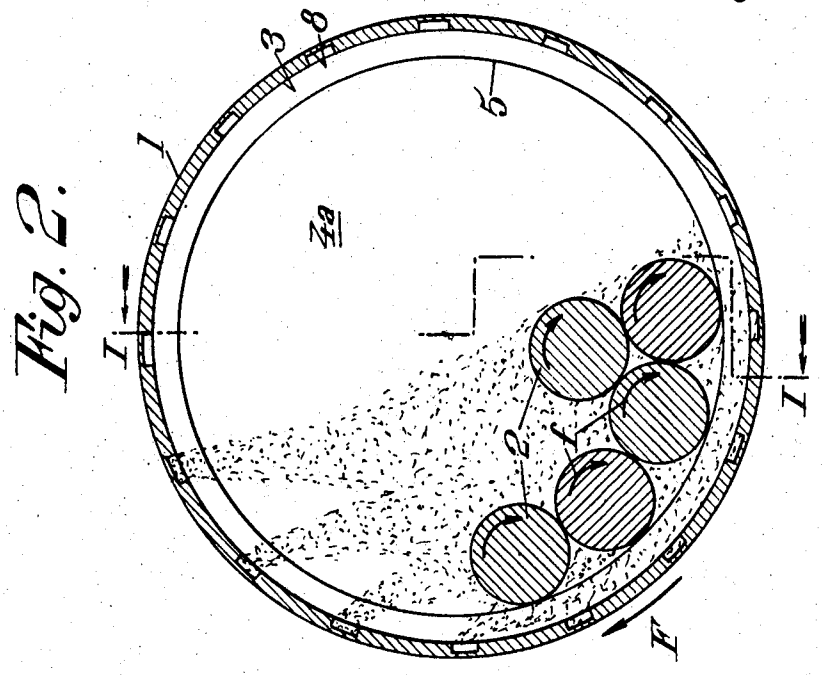

Fig. 2.

Fig. 4.

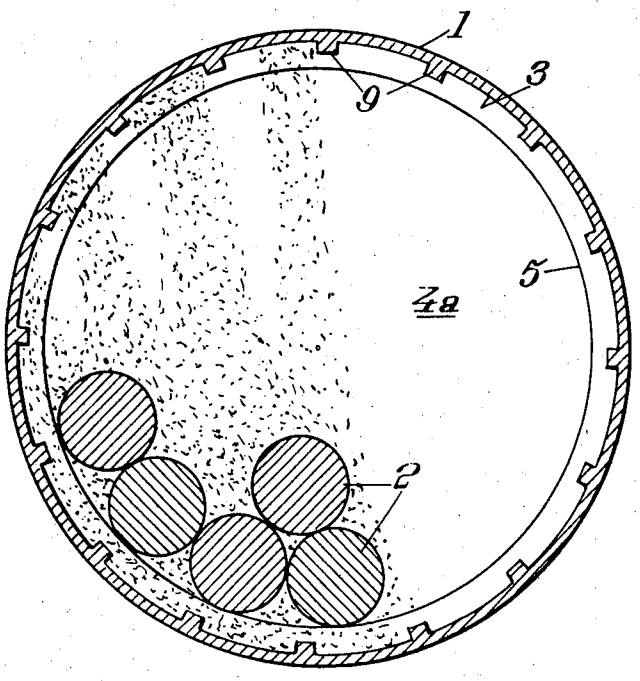

Fig. 3.

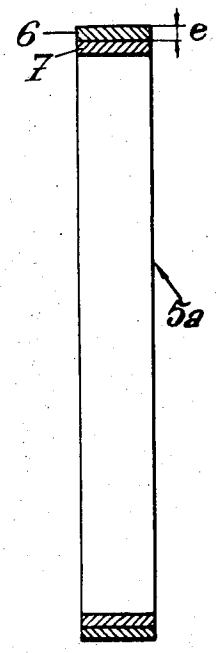

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Fig. 6

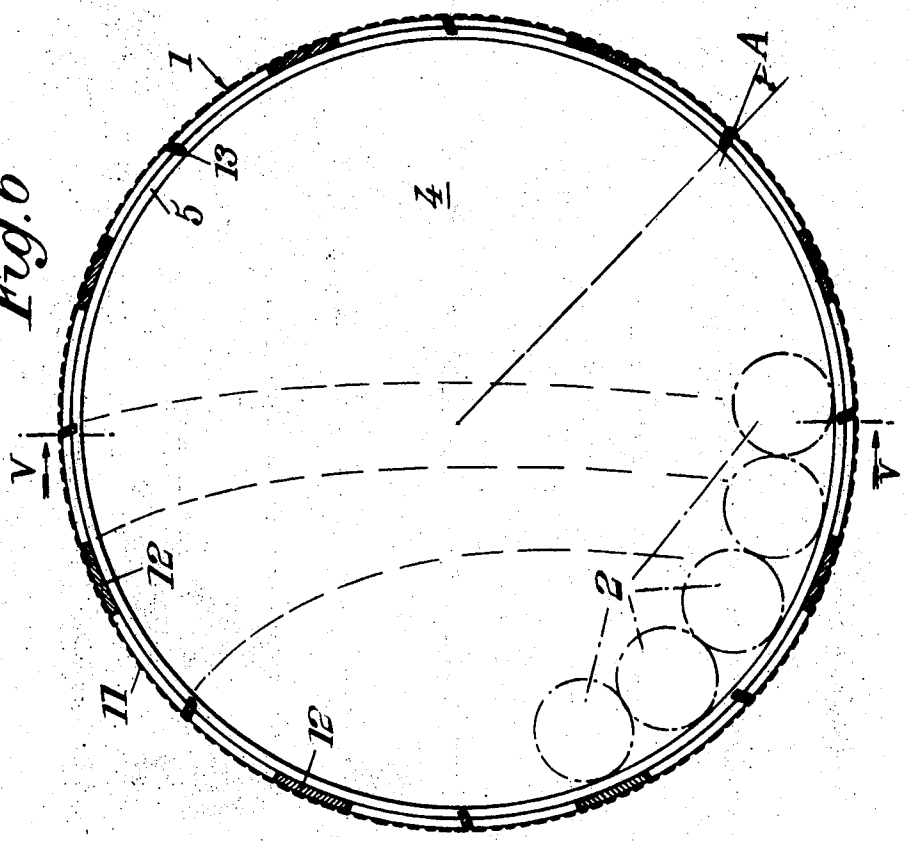
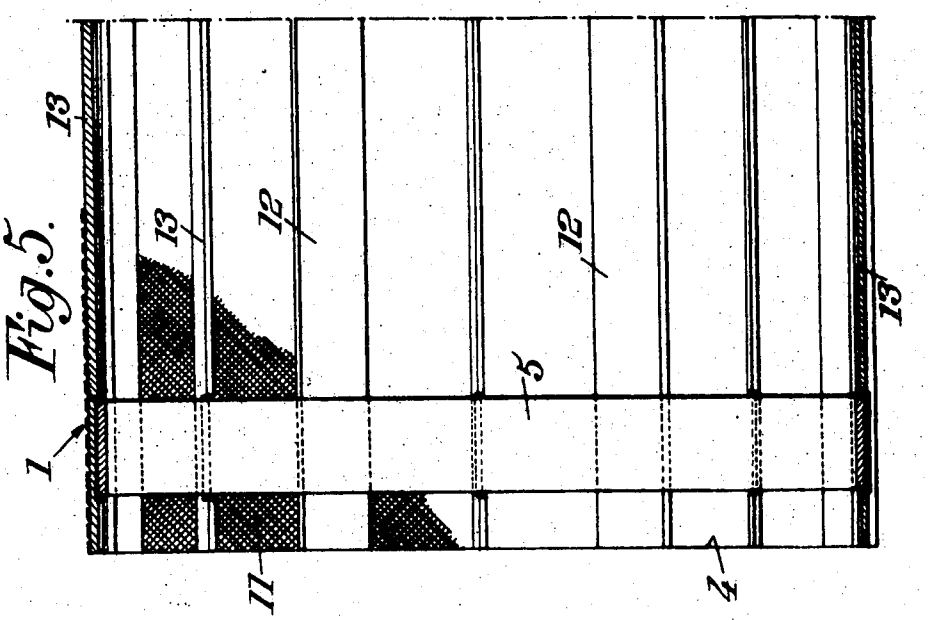


Fig. 5.



BAR-TYPE ROTARY CRUSHERS

The present invention relates to crushers of the type that comprise a rotary cylinder (or a rotary, generally cylindrical structure) having a substantially horizontal axis and containing free, cylindrical or prismatic bars adapted to crush the products introduced into this cylinder.

The chief object of this invention is to provide crushers of this type which fulfill well the various requirements of practice, and in particular, which are light in weight, in which the wear of the lateral wall of the cylinder is reduced and in which the disadvantages associated with this wear are eliminated at least to a considerable extent whilst increasing output by the prompt removal of sufficiently crushed particles, which leads to the decrease or the elimination of overcrushing.

A crusher of the type in question is provided, on the interior lateral wall of the cylinder, with at least two removable or easily replaceable girdles, forming the runway for the bars and separating these bars from the lateral wall of the cylinder, the separation being greater than the dimensions of the large particles of the product to be crushed and the lateral wall of said generally cylindrical structure comprises a screen rolled on a cage formed by stringers parallel to the axis of rotation of said generally cylindrical structure and fixed to terminal walls of said generally cylindrical structure.

The invention will be easily understood from the following particular embodiments, given merely by reference to example, with reference to the accompanying drawings, in which:

FIG. 1 shows, in longitudinal section along I–I of FIG. 2, a crusher of the type concerned;

FIG. 2 shows, in profile and in section along II–II of FIG. 1, the same crusher;

FIG. 3 shows, in section, a variant of a detail of FIG. 1;

FIG. 4 shows, in a view similar to that of FIG. 2, a variant of another detail of FIGS. 1 and 2;

FIG. 5 shows, in longitudinal section along V–V of FIG. 6, an embodiment of a crusher according to the invention; and

FIG. 6 shows, in profile and in cross section, the same crusher as FIG. 5.

With regard to the crusher in its overall aspect, it is constructed in any appropriate manner such that it comprises a rotary cylinder (or generally cylindrical structure) adapted to receive the products to be crushed and containing cylindrical (or prismatic) bars 2, the dimensions of the cylinder 1 and of the bars 2, as well as the number and the weight of these bars, being determined according to the nature of the products to be crushed and the output required of the crusher.

For supporting and rotating the cylinder 1 about a substantially horizontal axis, any suitable device can be used, such as, for example, that which is described in British Pat. Specification No. 1,025,219 published Apr. 6, 1966 in the name Bureau de Recherches Geologiques et Minieres. Furthermore, devices are provided for introducing into the cylinder the products to be crushed and for evacuating the crushed products.

In the known prior art apparatuses, the rotation of the cylinder 1 makes the bars 2 roll in contact with the lateral wall 3 and the products are crushed not only between the bars, but also between each of these bars and the lateral wall 3. Thus rapid wear of this wall is produced, which leads to the necessity of constructing the cylinder with hard and costly materials of constructing the cylinder with hard and costly materials or of covering it with removable thick expendable plates resulting in an increase of the weight of the cylinder (due to the weight of the plates and their fastenings) and of the supporting and driving mechanisms and an increase of the power of the motor necessary for making the cylinder rotate, and of the consumption of this motor.

In order to palliate these disadvantages, according to a feature of the present invention, the cylinder 1 is provided, preferably in the neighborhood of each of its terminal walls 4 and 4*a* (shown schematically in FIG. 1), with interior girdles 5 fixed with the lateral wall 3 of the cylinder 1 in a manner by which they can be easily mounted or dismounted (such as by means of screws, for example). The distance separating the two girdles 5 is less than the length of a bar 2, so that these girdles form the runway for the bars 2 and separate these bars from the lateral wall 3 by a distance *d* (FIG. 1) that is chosen greater than the dimensions of the large particles (and in general of the largest of these particles) of the products to be crushed introduced into the cylinder 1. The excess of this distance *d* over the dimensions of the largest particles to be crushed is normally chosen equal to the amount of wear of the girdles that takes place in an economically favorable duration of use.

During crushing, the rotation of the cylinder 1 (in the sense of the arrow F, FIG. 2) makes the bars 2 roll (in the sense of the arrows *f*) on the girdles. Due to the separation *d* existing between the bars 2 and the lateral wall 3, the crushing takes place in practice between the bars 2 themselves, to the exclusion of any crushing between these bars and the lateral wall 3.

Each of the runway girdles is either formed in a single piece (for example, of steel), or formed by two coaxial rings 6 and 7 engaged one in the other, like the girdle 5*a* of FIG. 3. The exterior ring 6 (which can, for example, be made of steel) has a thickness *e* equal to the dimension of the large particles introduced into the crusher. The interior ring 7 makes contact with the bars 2 and is thus subjected to wear during operation of the crusher. The interior ring can advantageously be made of steel, or again of a rubber having a high resistance to the wear due to the rolling and the friction of the bars 2 and it is fixed in a removable manner by any appropriate means (such as screws, for example) to the exterior ring 6, in order to be able to be rapidly replaced when it has reached a given degree of wear.

Advantageously means are provided adapted to collect the material accumulated at the bottom of the cylinder 1 and to lift this material during the rotation of the cylinder in order next to dump it on and between the bars 2 thus permitting this material to be crushed again. According to a first solution, these means are formed by pockets 8 (FIGS. 1 and 2), formed in the lateral wall 3 and disposed either in quincunx, as shown in FIG. 1 where there is shown a part of the lateral wall 3 provided with its pockets, or along the entire length of the cylinder.

According to the feature shown in FIG. 4, these means are formed by ribs disposed on the lateral wall 3 in a direction at least approximatively longitudinal.

The pockets 8 can either be blind, in which case their sole function is to lift the material accumulated at the bottom of the cylinder 1, or pass through the wall of the cylinder 1 and open at the exterior through a screened window, according to a variant not shown. In this case, the pockets have a double function:

- on the one hand, to lift the material, as described previously;
- on the other hand, to assure the evacuation through the screened windows of the particles sufficiently crushed to pass through the screen.

The dimensions of the mesh of the screen are chosen as a function of the dimensions of the particles that it is desired to obtain.

Increasing the number of screened windows improves the evacuation of the sufficiently crushed material, which considerably decreases the overcrushing. The output of the crusher is thus increased since less energy is spent in the useless crushing of products which have already reached the required dimensions.

A maximum value can be given to the surface of the screened windows by forming the lateral wall of the generally cylindrical structure 1 by a screen 11, according to the embodiment shown in FIGS. 5 and 6. The screen 11 is curved and applied externally on stringers 12 and flats 13 disposed along the generatrices of a cylindrical surface and formed, for example, by elements interconnecting the terminal walls 4 and 4*a* of the cylindrical structure. Thus a frame is obtained in the form of a squirrel cage on which the screen 11 is fixed. The stringers

or principal elements **12** are disposed so that their width develops normal to the radial directions. The flats or auxiliary elements **13**, which are not so wide as the principal elements **12**, are disposed so that their width is oriented in a direction forming an acute angle A with the radial direction. This acute angle A is determined, according to the dimensions and the speed of rotation of the crusher, so that the flats **13**, for a suitable sense of rotation of the crusher, scrape and lift the products accumulated at the bottom of the cylindrical structure, and then make them fall into the interior of the sector occupied by the crushing bars **2**, and not beyond this sector. The flats **13** can have a radial height greater than the radial thickness of the stringers **12**. The principal elements **12** also contribute to the scraping and to the lifting of the products accumulated at the bottom of the cylindrical structure. The elements **12** and **13** are regularly distributed around a circumference whose center is located on the axis of rotation of the cylindrical structure **1** and are used, preferably, in equal numbers, for example eight of each type. The dismantable girdles **5**, on which the bars **2** roll, are fixed (for example by screws) on the stringers **12**.

As can be seen from the above description, the present invention provides a crusher which remedies the disadvantages mentioned hereabove of the conventional bar-type crushers having expendable plates which carry out a part of the crushing between each bar and the cylinder, without the reduction of output which a man skilled in the art might normally expect in view of the elimination of this part of the crushing. At equal weight, the elimination of the expendable plates permits the dimensions of the cylindrical structure of the crusher to be obtained which surpasses the reduction mentioned above. The output is also increased by the elimination of the sufficiently crushed products, which leads to the decrease or the elimination of overcrushing, by means of the cylindrical structure whose lateral wall is formed by a screen. The extreme facility of construction of such a structure, shown in FIGS. **5** and **6**, should be mentioned, as well as its lightness, On the other hand, at equal output, it is possible to construct a crusher which is lighter than a conventional crusher and which does not require as much driving power or as high a consumption of energy.

Furthermore, with respect to crushers of smaller dimensions, whose cylinder is made of a piece of very hard material, crushers according to the present invention are cheaper and have a greater longevity.

The invention should not be limited to the various embodiments described by way of example, since numerous modifications or changes are possible (for example the bars could be prismatic instead of cylindrical) without departing from the spirit or scope of this invention.

I claim:

1. A crusher comprising a generally cylindrical structure arranged to be rotated about its axis disposed in a substantially horizontal position, said structure comprising a plurality of stringers distributed evenly around, at the same radial distance from and parallel to said axis and fixed to terminal walls of said structure to form a cage, at least two girdles being fixed to the radially inner surfaces of said stringers to form circular runways, a plurality of crusher bars loosely supported on the inside of said runways, and a screen curved and applied around said cage.

2. A crusher according to claim **1**, wherein said girdles each comprise two coaxial rings engaged one in the other, the interior ring being expendable, fixed in a removable manner to the exterior ring, and having an inner surface of circular cross section.

3. A crusher according to claim **1**, wherein said generally cylindrical structure comprises, an interior lateral wall, and flats thereon adapted to collect and lift particles accumulated below said girdles and then to dump the lifted particles on the bars during rotation of said generally cylindrical structure.

4. A crusher according to claim **3**, wherein said flats are arranged so that their width is oriented in a direction forming an acute angle with the radial direction.

5. A crusher according to claim **3**, wherein said flats have a radial height greater than the radial thickness of the stringers.

6. A crusher according to claim **3**, wherein said flats are arranged so that their width is oriented in a direction forming an acute angle with the radial direction, and wherein they have a radial height greater than the radial thickness of the stringers.

7. A crusher according to claim **2**, wherein said structure comprises an interior lateral wall and flats thereon adapted to collect and lift particles accumulated below said girdles and then to dump the lifted particles on the bars during rotation of the cylindrical structure, said flats being of a radial height greater than the radial thickness of the stringers and arranged so that their width is oriented in a direction forming an acute angle with the radial direction.