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(54) CONE ECCENTRIC CRUSHER

(57) An eccentric cone crusher comprising a housing (1) having an external crushing cone (2), within which is positioned an internal crushing cone (3) having a shaft (4) and a driving excenter (8) mounted on said shaft, which excenter is adapted to rotate about said shaft. The excenter is positioned inside a bearing-based cylindrical sleeve (9) mounted within a housing cavity, which cavity accommodates a driving element (12) of the excenter. The crushing cones define a discharge slot (11) between them.

The cylindrical sleeve (9) is implemented as the driver for the excenter. The driving element (12) is loosely accommodated in said sleeve, with a radial gap (10), the dimension of said gap being greater than that of the discharge slot.

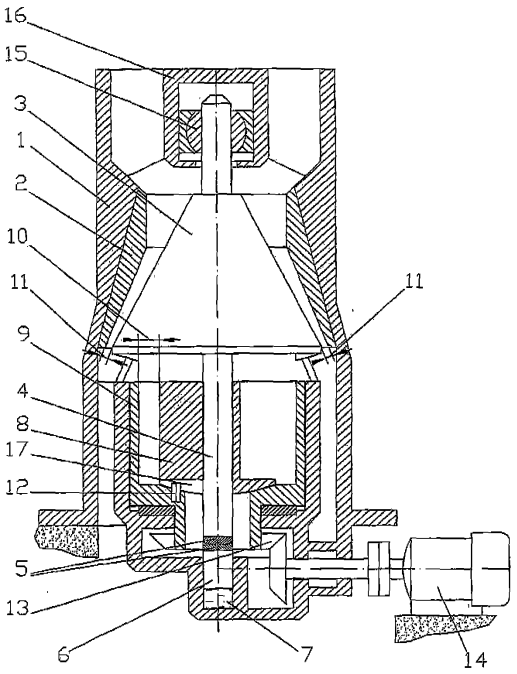

FIG 1

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Description

[0001] The invention relates to an eccentric cone crusher used for fine crushing, and can be suitably used in the construction and mining industries.

[0002] Processes of crushing and comminution in industries consume 20% of the entire power generated in the world. More than 18% of said processes are consumed by various types of mills whose efficiency does not exceed few percents. In this connection, there has been a strong trend to partially transfer the comminution operations to crushers whose efficiency reaches 10 to 20%. For this reason a number of crushing stages is increased continuously, closed cycles are introduced, control over processes is rendered automatic, etc.

[0003] About 125 years have passed since the first eccentric crusher was created, almost everywhere used in the world practice, but its basic design has not changed, while the crushing degree has increased from 4 to 6. For this reason the crusher designers as ever are attempting to improve a degree of crushing so that to reduce the number of crushers used in comminution facilities.

[0004] Known is the eccentric cone crusher (USSR Inventor's Certificate No. 886971 of 09.10.78, IPC B 02 C), comprising an external cone and an internal cone on whose shaft is mounted an excenter provided with four radially disposed electromagnetic pushers. An advantage of this type of a driving unit consists in its capability of performing the functions of a safety element for any over-load events occurring in a crusher. But a degree of crushing and productivity still remain low. Besides, the pushers' electromagnetic drives require an intense cooling thereof, hence additional power consumption is needed.

[0005] Also known is the eccentric crusher (Inventor's Certificate No. 394097 of 24.0172, B 02 C) comprising an external cone and internal cone whose shaft is positioned in an excenter and provided, on its shank, with an unbalanced rotor whose centre of gravity is disposed in counter-phase with respect to the excenter, with the capability of rotating synchronously with said excenter. Such design always allows pressing the cone shaft against the thin side of the excenter both in the idle and operation modes. Thus, in this arrangement reliability of the excenter is significantly improved by virtue of elimination of the shaft's "play" in the excenter and elimination of any peak loads emerging within the excenter. However, the degree of crushing has increased only by one unit, without any improvement of capacity.

[0006] Another analogue of the claimed invention is the cone crusher (USSR Inventor's Certificate No. 580895 of 09.07.74, IPC B 02 C), comprising an external cone and internal cone, whose body is coupled to an excenter via a three-pivot shaft; the upper pivot being disposed within the internal cone body, and the middle cone being disposed in the crusher housing, the lower pivot being disposed in the excenter.

[0007] Such leverage system ensures almost double gain in terms of the developed crushing force, and allows crush particularly hard materials, but this system fails to increase productivity and improve a degree of crushing.

[0008] Known is the eccentric cone crusher, adopted as the prototype for the claimed invention (US Patent No. 4339087 of 08.09.80, IPC B 02 C), comprising a housing having an external crushing cone, within which cone disposed is an internal crushing cone provided with a shaft, on which shaft rotatably mounted is a driven excenter; said excenter being positioned inside a bearing-based cylindrical sleeve secured in a housing cavity, and also comprising a drive element for the cone. This crusher is equipped with a hydraulic support for the internal cone, and for this reason the crushing force, in the course of operation, may insignificantly vary due to rising and lowering of the cone. This crusher shows a degree of crushing higher than in the previously recited analogues, and reaches value of 7.

[0009] This invention is directed to provision of a crusher capable of replacing two conventional crushing-comminuting arrangements, each developing the degree of crushing of 4. Said goal of this invention can be attained through increasing a degree of crushing performed by the proposed crusher to 20 to 30, with concurrent improvement of productivity of crushing at least by 20%.

[0010] The above-mentioned crusher is to be realized as follows:

An eccentric cone crusher comprises a housing having an external crushing cone, within which cone disposed is an internal crushing cone with a shaft and a driven excenter mounted on said shaft, which driven excenter is adapted to rotate about the shaft; said excenter being disposed inside a bearing-based cylindrical sleeve, which sleeve is secured in a housing cavity, which cavity also accommodates a driving element of the excenter. This crusher is characterized in that the cylindrical sleeve is implemented as the driver for the excenter, which element is accommodated in said sleeve loosely, with a radial gap therebetween, dimension of said gap being greater than that of the discharge slot defined between the crushing cones;
said cylindrical sleeve further comprises a driving element that is inserted into a groove in the excenter and transmits torque to said excenter, such that freedom of circular oscillations is unrestricted.

Fig. 1 shows a longitudinal section the proposed crusher, in its static state.
Fig. 2 shows the working portion of the crusher, in one of its operational states, as crushing takes place.

[0011] The "radial gap" term (reference numeral 10 in Figs. 1 and 2) denotes the distance between the excenter 8 and the cylindrical sleeve 9 on the closed side.

[0012] The term of "discharge slot" (reference numeral 11 in Figs. 1 and 2) denotes the half sum of the radial

distances between bases of the internal and external cones.

[0013] The "closed side" term denotes the side of the maximal approach of the inner surface of the cylindrical sleeve 9 and the external surface of the excenter 8 (Fig. 2).

[0014] Design of the proposed crusher is shown in Fig. 1.

[0015] The crusher comprises a housing 1 having an external crushing cone 2 that interiorly accommodates an internal crushing cone 3, whose shaft 4 is supported, via a spherical support 5 consisting of a thrust journal and a thrust bearing, by a piston 6 of a hydraulic cylinder 7 disposed in the housing 1. On the shaft 4 mounted is an excenter 8 which excenter is adapted to rotate about said shaft and is positioned inside a bearing-based cylindrical sleeve 9 having a radial gap 10 whose dimension exceeds that of a discharge slot 11 defined between the cones 2 and 3.

[0016] The cylindrical sleeve 9 is coupled to an electric motor 14 through a pair of gears 13.

[0017] The upper portion of the shaft 4 is positioned in a cross-piece 15 by means of a pivot 15. A driving element 12 at its one side is rigidly secured on the cylindrical sleeve 9, and at its other side said element is inserted into a groove 17 of the excenter 8.

[0018] Prior art taught that for improving such characteristics of a crushing device as an increased degree of crushing, improved productivity and operational reliability, a number of conditions must be met in accord. Among such conditions, the major ones are: operation with a maximally allowable discharge slot, and a relative freedom of circular oscillations of the internal crushing cone. To satisfy these conditions, any rigid kinematic constraint between the internal and external cones must be excluded.

[0019] To accomplish said purpose, in the proposed design the excenter 8 that drives the internal cone 3 is mounted inside the cylindrical sleeve 9, with the radial gap 10 therebetween. On said cylindrical sleeve 9 secured is the special driving element 12 inserted into the groove 17 of the excenter 8. The groove 17, in terms of its design, may be implemented as the open or closed groove, provided that a relatively free, especially radial, movement of the driving element 12 in said groove will be ensured.

[0020] The design provides for the radial gap 10 having a greater dimension than that of the discharge slot 11. This ratio of said dimensions allows: on the one side, increase dimension of the discharge slot to its maximally allowable value, without restricting a relative freedom of circular oscillations of the internal cone 3; and, on the other side, when dimension of the slot diminishes to its minimal value, dimension of the radial gap still will be greater than zero, so that contact of the cone with the cylindrical sleeve, i.e. the failure-fraught situation, will be prevented. Said arrangement is shown in Fig. 2: cones 2 and 3 have touched one another, and the remaining free space in the radial gap 10 does not let the excenter 8 strike against the cylindrical sleeve 9.

[0021] This design of the driving unit allows the excenter 8 and, consequently, the internal cone 3 doing the circular oscillations, with a relatively free amplitude and trajectory. In this case said freedom of the internal cone 3 is restricted only by dimension of the discharge slot 11 defined between the internal 3 and external 2 cones.

[0022] The possibility to increase dimension of the discharge slot 11 to its maximally allowable value results in an increased quantity of the processed feed, i.e. allows operation on a thick layer, which circumstance provides a more efficient process of its intra-layer destruction, which in turn leads to an improved degree of crushing and greater productivity of crushing.

[0023] The crusher operates as follows:

[0024] From the motor 14 the developed torque, via the pair of gears 13, is transmitted to the cylindrical sleeve 9 that - by means of the driving element 12 - rotates the excenter 8. The latter develops the centrifugal force and causes the internal cone 3 to rotate circularly. The cone 3 also acquires the centrifugal force, which force combines with the cone's force to exert the crushing force, by virtue of which crushing force, so obtained, the feed is subjected to the intra-layer destruction within the recess defined by the crushing cones.

Example of embodiment of the invention.

[0025] The proposed design was tested in the eccentric cone crusher having the following parameters: diameter of the crushing cone: 750 mm; installed output of electric motor: 90 kW. As the feed used was the auriferous ore having hardness of 20 according to Protodyakonov scale, size being minus 90 mm.

[0026] Size of the final product, in the open-cycle operation mode, 95% of the product was smaller than 4 mm, productivity - 42 t/h.

[0027] When the same ore was processed using the prototype, which is the cone crusher "H 2800C" of "Sandvik Rock Processing" (SE) of the analogous type and dimensions, i.e. diameter of the crushing cone: 750 mm; installed output of electric motor: 90 kW, 100% of the final product were 100% smaller than 18 mm, productivity - 46 t/h.

[0028] Hence, for the purpose to achieve the result contemplated by this invention, using the prototype, needed is the second unit, for example - crusher "H 2800EF", which crusher allows obtain from the feed having size of minus 18 mm, such size of the final product wherein percentage of smallness of less than 5 mm will be 80%, productivity being 30-40 t/h.

Conclusions:

[0029]

1. The claimed distinguishing features allow bring

about the condition under which the cylindrical sleeve owing to the presence of the radial gap does not restrict the radial movement of the excenter and the internal crushing cone, which circumstance ensures the technically required degree of compression of the feed layer between the cones, so that to produce the desired granulometric composition of the final product.

2. In this crusher, a degree of crushing can be controlled within the range of 4 - 30. That is, from one and the same lump sized about 100 mm, 100% of the final product having smallness less than 20 mm or 5 mm can be obtained, so that operation of only one unit instead of two units will be possible.

3. Owing to the ratio of dimensions of the discharge slot and radial gap, crushing can be done with a greater dimension of said slot - in comparison with the relevant analogues. This results in an increased productivity of crushing at least by 20%, indices of a feed being similar.

[0030] Consequently, the distinguishing features of the proposed invention are the necessary and sufficient features to realize the goal contemplated by the invention.

Claims

1. An eccentric cone crusher,
comprising a housing (1) having an external crushing cone (2),
within which is positioned an internal crushing cone (3) having a shaft (4)
and a driving excenter (8) mounted on said shaft, which excenter is adapted to rotate about said shaft; said excenter being positioned inside a bearing-based cylindrical sleeve (9) mounted within a housing cavity, which cavity accommodates a driving element (12) of the excenter, said crushing cones defining a discharge slot (11) between them;
characterized in that said cylindrical sleeve (9) is implemented as the driver for the excenter, said driving element (12) being loosely accommodated in said sleeve, with a radial gap (10), the dimension of said gap being greater than that of the discharge slot.

2. The eccentric cone crusher according to claim 1, **characterized in that** the driving element (12) is inserted into a groove in the excenter and transmits torque to said excenter, such that freedom of circular oscillations is unrestricted.

3. The eccentric cone crusher according to claim 1 or 2, **characterized in that** the driving element (12) is rigidly secured on the cylindrical sleeve (9), and at its other side said driving element is inserted into a groove (17) of the excenter (8).

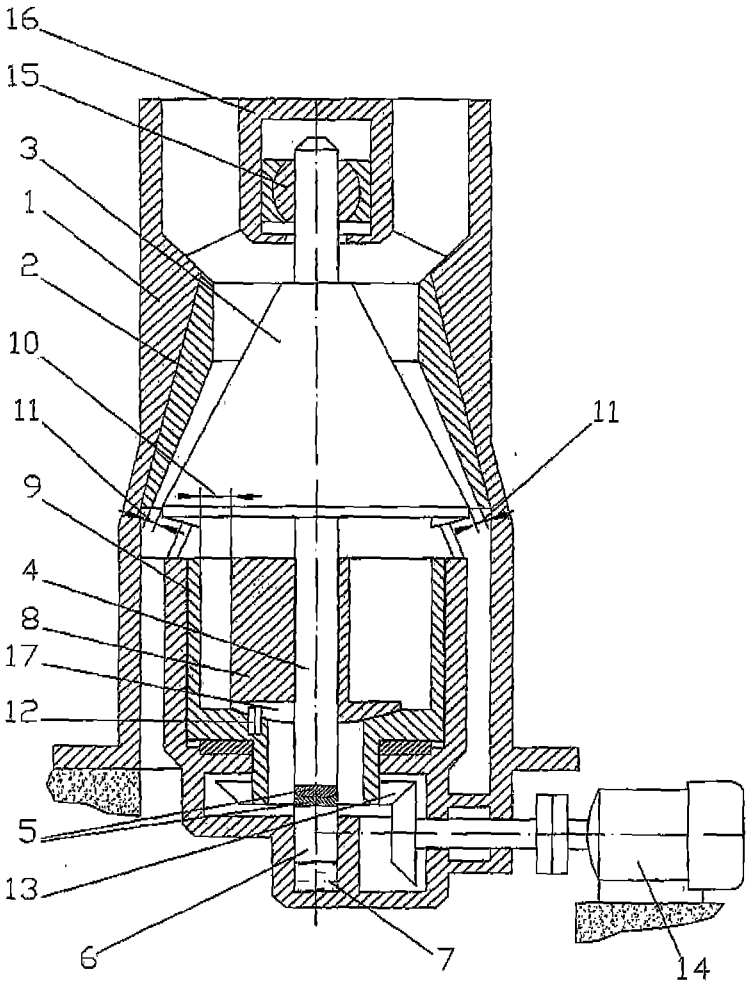

FIG 1

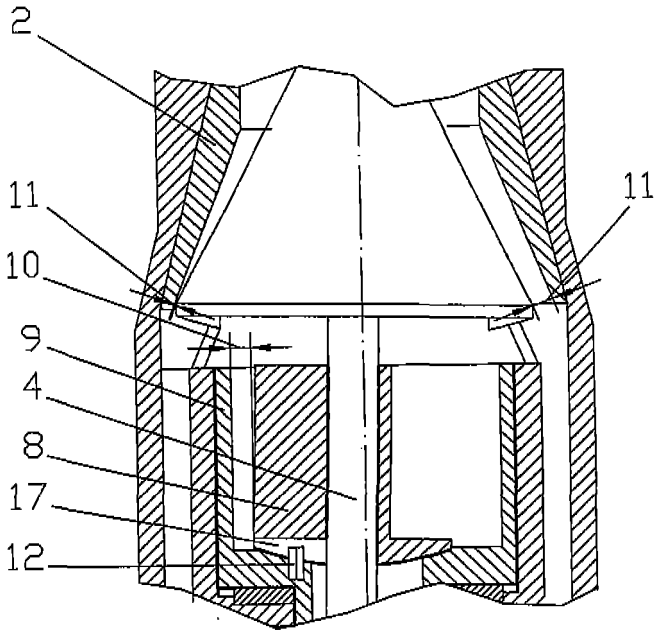

FIG 2

REFERENCES CITED IN THE DESCRIPTION

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Patent documents cited in the description

- SU 886971 **[0004]**
- SU 580895 **[0006]**
- US 4339087 A **[0008]**