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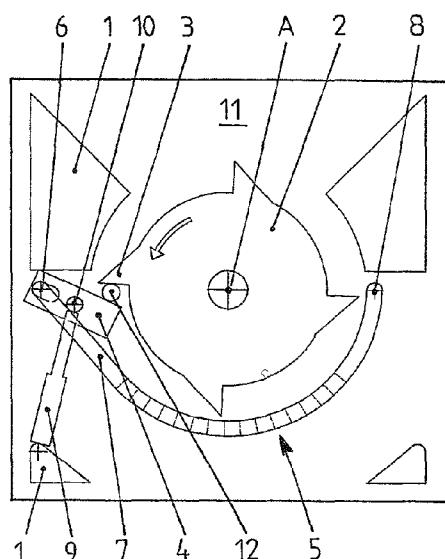
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[Continued on next page]

(54) Title: CRUSHER



(57) Abstract: The invention relates to a crusher for crushing solid material, the crusher comprising a frame (1); at least one crusher rotor (2) arranged rotatably to the frame and having crusher blades (3) secured to the circumference thereof; a yielding counterblade structure (4) arranged for cooperation with the crusher blades (3) of the rotor for concurrently crushing and cutting said material and for yielding when encountering non-crushable material (12) and when overloaded; and a yielding and downwardly openable set of screens (5) below the crusher rotor (2), whereby the counterblade structure (4) is linked to the frame (7) of the set of screens (5) and made turnable towards it with respect to the pivoting shaft (6) in a yield situation; and the set of screens (5) is linked to the crusher frame on the opposite side of the crusher rotor (2) with respect to the counterblade structure (4) and its pivoting shaft (6) and made downwardly collapsible about the pivoting shaft (8) of the set of screens (5).

**Fig. 2**



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## Crusher

### Background of the invention

**[0001]** The invention relates to a crusher for crushing solid material, the crusher comprising a frame; at least one crusher rotor arranged rotatably to the frame, including crusher blades secured to the circumference thereof and crushing the material; a yielding counterblade structure arranged for co-operation with the crusher blades of the crusher rotor to concurrently crush and cut said material, the counterblade structure being arranged to yield when encountering non-crushable material and when overloaded; and a yielding, downwardly openable set of screens that is arranged below the crusher rotor at a selected axial distance from the crusher blades of the crusher rotor.

**[0002]** On the basis of the running rate the crushers may be divided into two categories: fast and slow running crushers. Fast running crushers are efficient, but they require a feed free from impurities, because, due to a high circumferential speed of the crusher rotor, their structures cannot be protected by automatically released safety means. Additional drawbacks include, *inter alia*, a fire risk, noise and harmful dust.

**[0003]** Slow running crushers are considerably better suited for crushing various fuel chips, but, due to a slow circumferential speed of the crusher rotor, they are often relatively limited in capacity. Whereas a rise in the circumferential speed implies an increased risk of crusher damage, and this has been tried to prevent by structures whose counterblades give way, when foreign, hard objects or pieces, typically of metal, are caught between the blade and the counterblade.

**[0004]** By using screen meshes surrounding the lower side of the crusher rotor it is possible to better achieve the desired piece size, and it may be possible to avoid construction of a separate screening system that requires large investments.

**[0005]** Known are crusher solutions that include a yielding counterblade, i.e. one that evades a foreign object, or, both a yielding counterblade and a separately openable set of screens. These solutions are complex to implement and they require specific control circuits which have to be controllable in such a manner that they operate synchronously, or one is to confine to manual use only.

**[0006]** Also known are structures where a set of screens and a counterblade are solidly connected, but they are linked to operate on the same

side of the crusher rotor, which makes it difficult to remove a foreign object as well as to replace a screen mesh.

5 [0007] Publication US 2011259985 A1 discloses a crusher, in which interconnected counterblade and a set of screens may be collapsed down together to a maintenance position, but neither one of these evades an obstacle jointly or separately.

[0008] Publication EP 2113305 A2 describes a crusher, in which a counterblade and a set of screens may both give way separately, but they are mounted on bearings on different sides of the rotor.

10 [0009] Publication DE 102006050051 A1 discloses a crusher, in which counterblades are immovably connected to screen parts, one of which may yield. The counterblades are thus not capable of yielding independently.

15 [0010] In the crusher according to publication US 7222805 B1 there are no separate counterblades, but grinding or crushing is performed against a fixed counterpart preceding a set of screens, and against the actual set of screens, which in turn may yield downwardly.

20 [0011] Publication US 5213273 A discloses a crusher comprising two assemblies of screens/counterblades (i.e. the screen set is simultaneously a “counterblade”), which yield separately around bearing points locating on different sides of the crusher. Because the set of screens itself serves as a counterblade, there is no independently yielding counterblade.

25 [0012] Publication US 4917310 A describes a crusher having a plurality of separate, yielding counterblade configurations (without an actual screens structure) that yield separately about various axes but not as one whole in any circumstances.

30 [0013] Publication EP 0254173 discloses a crusher, in which, below a crusher rotor, there is a structure consisting of two superimposed “screen system sections” where both screen systems may be collapsed together or separately about an axis situating on the opposite side of the rotor with respect to the feeding point of material to be crushed. Said screens structure also forms the actual “counterblade structure” and it does not yield downwardly by itself in any circumstances, because the screens are locked into place with bolts that have to be unlocked before the screens are collapsed down. The presented hydraulic cylinders only assist in moving the screens. The rotation 35 rate of the screens is high and major part of the material to be screened exits through the screens above the rotor.

## Summary of the invention

**[0014]** The object of the invention is to eliminate the drawbacks of the known solutions. This is achieved by a crusher of the invention, which is characterized in that a counterblade structure is linked to the frame of a set of screens and made turnable towards it in a yield situation about a pivoting shaft; and that the set of screens is linked to the crusher frame, on the opposite side of the crusher rotor with respect to the counterblade structure and its pivoting shaft, to be downwardly collapsible about the pivoting shaft of the set of screens.

**[0015]** The invention is based on the idea that the crusher has no separate frame structures for the counterblade structure and for the set of screens, but they are linked together in such a manner that they move in one package, providing, however, a separate evasive movement of protection. The same structure allows a possibility of easily removing foreign objects caught between the crusher rotor and the set of screens and a practical way of replacing a screen mesh. At the same time the structure is lighter, easier to implement and considerably simpler to control.

**[0016]** The basic idea of the invention is that even though the evasive counterblade structure is linked together with the set of screens, the counterblade structure is capable of performing an independent evasive movement. Thanks to the lighter structure and the vicinity of the pivoting point, the operation of an independent counterblade structure enables a considerably faster evasive movement and thus it protects better the blades of the crusher rotor and the counterblade structure itself.

**[0017]** Most preferably, the whole consisting of the set of screens and the counterblade structure is further supported to a common yielding structure, one end of which yielding structure is supported to the crusher frame and the other end to the counterblade structure between its free end and pivoting point.

## 30 List of figures

**[0018]** The invention will now be described in more detail by means of one preferred exemplary embodiment, with reference to the attached drawings, in which

**35** Figure 1 shows a crusher of the invention in a normal crushing situation, seen in the axial direction of its crusher rotor;

Figure 2 shows the crusher of the invention as in Figure 1, but in a situation where the counterblade structure yields and

Figure 3 shows the crusher of the invention as in Figures 1 and 2, but in yielding and opening situations of both the counterblade structure and  
5 the set of screens.

### **Detailed description of the invention**

**[0019]** With reference to the drawings, the crusher of the invention for crushing solid material comprises a frame 1; at least one crusher rotor 2 arranged rotatably about an axis A to the frame 1, including crusher blades 3 secured to the circumference thereof and crushing the material; a yielding counterblade structure 4 arranged for cooperation with the crusher blades 3 of the crusher rotor 2; and a yielding, downwardly openable set of screens 5 that is arranged below the crusher rotor 2 at a selected axial distance from the crusher blades 3 of the crusher rotor 2.

15 **[0020]** The counterblade structure 4 is linked with a pivoting shaft 6 to the frame 7 of the set of screens 5 and made turnable towards it in a yield situation with respect to the pivoting shaft 6, and the set of screens 5, in turn, is linked with a pivoting shaft 8 to the crusher frame 1, on the opposite side of the crusher rotor 2 with respect to the counterblade structure 4 and its pivoting shaft 6 and to be downwardly collapsible about said pivoting shaft 8.

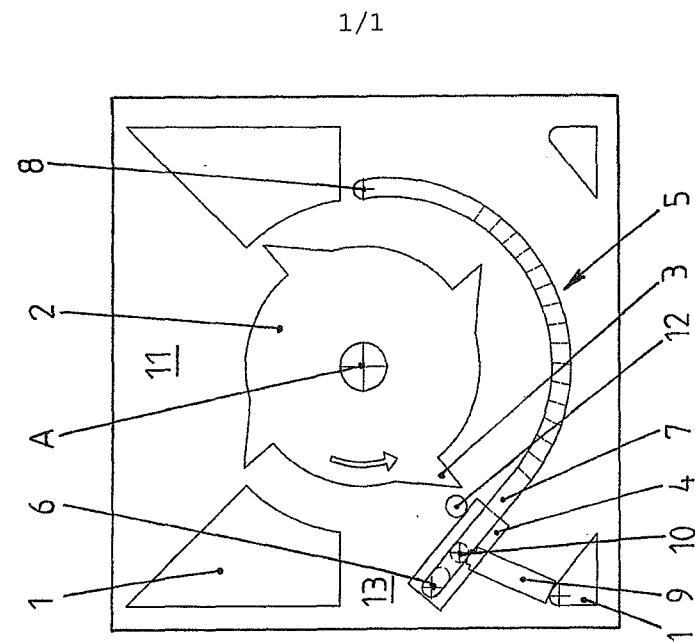
20 **[0021]** In this exemplary implementation the whole consisting of the set of screens 5 and the counterblade structure 4 is further supported to a common yielding structure 9, the lower end of which yielding structure 9 is supported to the crusher frame 1 and the upper end is supported to the counterblade structure 4 between its free end and pivoting shaft 6 with a pivoting shaft 10 of the yielding structure 9. For instance one or more hydraulic cylinders or pneumatic or mechanical springs may serve as the yielding structure 9. If there are several separate yielding members, such as said hydraulic cylinders, they are located with even spacing in the longitudinal direction of the counterblade structure 4 and the set of screens 5 (in the axial direction of the crusher rotor 2). In that case the counterblade structure 4 itself may also be divided into a plurality of portions in the axial direction of the crusher rotor 2. If so desired, it is naturally possible to arrange separate yielding structures for the counterblade structure 4 and for the set of screens 5, but, in practice, a structure common to both is most preferable and its control is easiest to arrange.

**[0022]** When the crusher is used as shown in Figure 1, material to be crushed is conveyed, through an open feeding funnel 11 in the upper part of the crusher, between the crusher blades 3 of the crusher rotor 2 and the counterblade structure 4, which together crush and cut the material to be fed 5 into a desired piece size. As shown in Figure 2, when a hard object 12 (e.g. a large piece of metal) is caught between the crusher blades 3 and the counterblade structure 4 (or a portion thereof), the counterblade structure 4 (or a portion thereof) yields about its pivoting shaft 6 by means of the yielding structure 9 and prevents said cooperating crushing members 3 and 4 from being damaged. In a further situation, as shown in Figure 3, the set of screens 5 integrated 10 in the counterblade structure 4 may start opening about its pivoting shaft 8, and if necessary, it may be controlled to stop the crusher rotor 2, which enables removal of the foreign object 12 caught between the set of screens 5 and the crusher rotor 2 via an open jaw 13 provided.

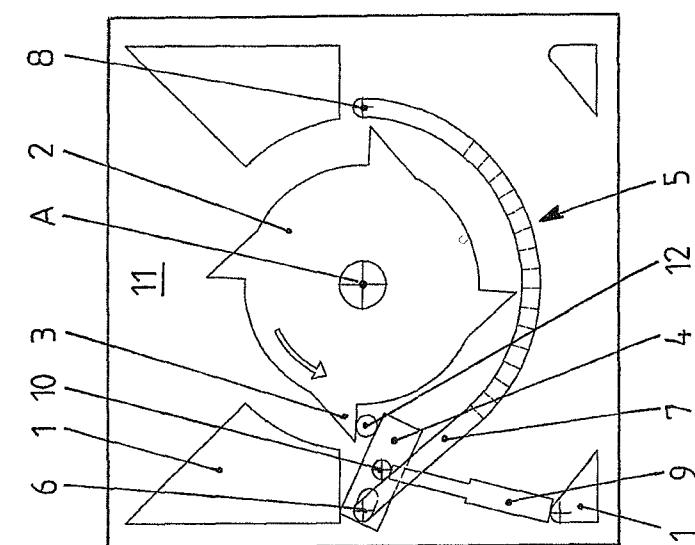
15 **[0023]** The above description of the invention is only intended to illustrate the basic idea of the invention. A person skilled in the art may, however, implement the details of the invention in various ways within the scope of the attached claims.

**Claims**

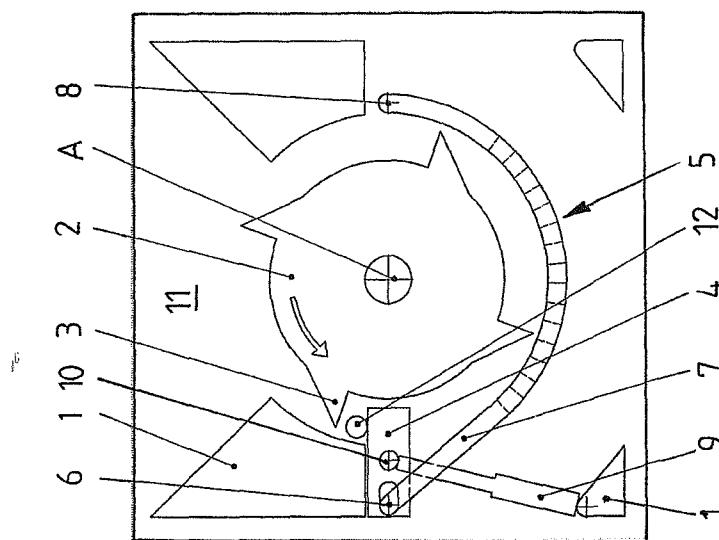
1. A crusher for crushing solid material, the crusher comprising a frame (1);  
5 at least one crusher rotor (2) arranged rotatably to the frame (1), including crusher blades (3) secured to the circumference thereof and crushing the material;  
10 a yielding counterblade structure (4) arranged for co-operation with the crusher blades (3) of the crusher rotor (2) to concurrently crush and cut said material, the counterblade structure (4) being arranged to yield when encountering non-crushable material (12) and when overloaded; and  
15 and a yielding, downwardly openable set of screens (5) that is arranged below the crusher rotor (2) at a selected axial distance from the crusher blades (3) of the crusher rotor (2),  
characterized in that  
the counterblade structure (4) is linked to the frame (7) of the set of screens (5) and made turnable towards it in a yield situation with respect to the pivoting shaft (6); and that  
20 the set of screens (5) is linked to the crusher frame (1) on the opposite side of the crusher rotor (2) with respect to the counterblade structure (4) and its pivoting shaft (6) and to be downwardly collapsible about the pivoting shaft (8) of the set of screens (5).  
25 2. The crusher of claim 1, characterized in that the whole consisting of the set of screens (5) and the counterblade structure (4) is supported to a common yielding structure (9), one end of the yielding structure being supported to the crusher frame (1) and the other end to the counterblade structure (4) between its free end and pivoting shaft (6).  
30 3. The crusher of claim 1 or 2, characterized in that the yielding structure (9) comprises at least one hydraulic cylinder.  
4. The crusher of claim 1 or 2, characterized in that the yielding structure (9) comprises at least one pneumatic or mechanical spring.  
35 5. The crusher of any one of the preceding claims, characterized in that the counterblade structure (4) is divided into a plurality of portions in the axial direction of the crusher rotor (2).



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## INTERNATIONAL SEARCH REPORT

International application No.

PCT/FI2013/050075

## A. CLASSIFICATION OF SUBJECT MATTER

See extra sheet

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC: B02C

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

FI, SE, NO, DK

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

EPO-Internal, WPI

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 2113305 A2 (UNTERWURZACHER PATENTVERWERTUNGSGESELLSCHAFT [AT]) 04 November 2009 (04.11.2009) the whole document, especially figures 2a-2c cited in the application	1-5
A	DE 102006050051 A1 (FINBARK OY [FI]) 31 May 2007 (31.05.2007) the whole document, especially figures 1 and 2 cited in the application	1-5
A	US 2010252670 A1 (KITAGUCHI ATSUSHI [JP]) 07 October 2010 (07.10.2010) the whole document, especially figures 3-5, 8, 10-12, 15-19, 23 and 24	1-5

 Further documents are listed in the continuation of Box C. See patent family annex.

\* Special categories of cited documents:

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

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Patent document cited in search report	Publication date	Patent family members(s)	Publication date
EP 2113305 A2	04/11/2009	AT 10892 U1	15/12/2009
DE 102006050051 A1	31/05/2007	FI 20051069 A FI 122710 B1 SE 531766 C2 SE 0602244 A	25/04/2007 31/05/2012 28/07/2009 25/04/2007
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