

Translation:

The invention relates to an impact crusher or detacher, for material of the grain, semolina or flour type, with a rotating centrifuging wheel which comprises at least two axially offset centrifuging ducts and which is surrounded by an impact ring; also with a concentric feed tube and a material discharge duct.

An impact detacher of this kind is known from GB-A-539 883.

Various kinds of impact machines are used in mills, or in grinding for milling purposes. These are known as impact detachers, sterilisers, and in the English-speaking world as entoleters, depending on their use. As regards process technology these concern in part identical and in part very similar operations. The impact force or the impact speed to which the product is subjected is adjusted to the particular case concerned.

The individual particles of material have very considerable strength, whether the cereal grain as a whole or the semolina or flour particles. In contrast, a cereal grain which has been hollowed out e.g. by a grain weevil, is sensitive to fracture. Insects and insect eggs are very vulnerable to impact. This state of affairs is made use of in the case of impact machines, for example the impact machine known as the steriliser shatters hollow grains. Insects and their eggs are killed off.

An important aim in a mill is also the separation of the endosperm layer from the white flour core. The ground material from a roller stand is divided in the respective downstream plansifter into the desired fractions. When using the impact detacher in the mill diagram context between the roller stand and the plansifter the small discs produced in

the grinding are disintegrated, and coherent endosperm particles are loosened up.

In very many uses, the geometric conditions specifically chosen in each case, with an optimal circumferential speed of the centrifuging wheel, allow a very good effect to be achieved for the desired work result. More particularly in recent times it has generally been desirable to maintain values in this way, or prevent the spoiling of the basic food-stuffs, without the use of any disadvantageous thermal processes or the radiation actions the effects of which have never been conclusively clarified. This is deliberate mechanical intervention with the possibility of exclusive mechanical separation of the fractions. Therefore it was one of the main objects of the invention to improve the mechanical solution in this sense.

The main disadvantage of hitherto known solutions is that when the product throughput through the impact machine was increased the desired effect decreased inversely with respect to the throughput increase, combined with the very unpleasant fact that at least in the event of incomplete killing-off of value-reducing minute forms of life, this may not be noticed at once. Likewise it is not easy to establish whether impact separation of endosperm and flour particles is being carried out in the optimal way. This had the result that there was a widespread tendency in the technical world to think that impact machines would bring in "little". Actually it has also been possible to prove this with practical examinations in individual cases. However, mostly it also had to be admitted that the individual impact machines have been loaded to beyond the respective permissible throughput quantities.

The invention has as its object to improve the impact machine so that a genuine increase in throughput is possible, but whilst maintaining work quality or almost 100 % effectiveness whether as regards rendering harmless the value-

reducing insects or detaching the endosperm from the husk.

The aforesaid object is achieved by the subject of claim 1, that is to say in that in the initially mentioned impact detacher of the category specified there is arranged in the centrifuging wheel a guide vane apparatus or distributor which is downstream of the feed tube and which distributes the fed-in material to the centrifuging ducts, and each centrifuging duct has a separate impact ring surface associated with it, the impact surfaces being constructed as truncated cones opening in opposite directions.

Until the invention it has not been recognised that hitherto too little attention has been paid to the product flow or product flows on the one hand and to the situation at the place of impact on the other hand. Too great concentration of product flow has the result that as it were a cushion of product is built up above the impact surfaces with part of the product flow, so that in this way the impact is damped and for example the impact force needed for smashing hollow grains or insect eggs is no longer produced. In the second case the product flow undergoes a trouble-causing deflection, for example too much product flowing through in certain regions and too little in others. The impact detachier is a difficult machine inasmuch as a mixture is being dealt with. The laws of air flow in the sense of a fan apply, but also the physical laws of a product centrifuge. Therefore, for obvious reasons, up to the present day it has been customary to avoid comparing a dense-flow centrifuge directly with a water or air type, since extreme demixing occurs in the centrifuging wheel owing to the considerable deflection and acceleration of the material. The way the product is conducted can be controlled only by the use of more than one centrifuging duct in a machine.

Tests have shown that in this way the product throughput can actually be doubled, with only slight additional

constructional outlay and with the same impact effectiveness. Surprisingly the new invention also allows a large number of especially advantageous embodiments.

Thus it is particularly preferable to connect the distributor to the centrifuging wheel to co-rotate integrally therewith. Here the distributor comprises a plurality of entry ducts which extend to into the annular-disc-shaped centrifuging ducts.

If the centrifuging ducts are axially offset, varying forms of entry ducts are necessarily obtained. Here again relatively long series of tests have shown that in the case of two axially offset centrifuging ducts a plurality of entry ducts is advantageous, it being recommended to associate twice the number of entry ducts with that centrifuging duct which is distant from the feed tube relatively to the number of entry ducts for the centrifuging duct near the feed tube, or a corresponding surface ratio should be observed for the entry. Thus there is precise product halving for the two centrifuging ducts, or the two centrifuging ducts give identical centrifuging conditions for the material.

It is also advantageous if the entry ducts opening into the centrifuging duct distant from the feed tube comprise at the outer periphery an insert which narrows the cross-section. The insert is constructed as a ring segment with a narrowing form to the axis of rotation.

Respectively identical entry ducts are symmetrically arranged. In a further feature each centrifuging duct has a separate annular impact surface associated with it.

Optimal impact operation is obtained if the centrifuging wheel is constructed as a double wheel, and with the double wheel or the two impact surfaces there is associated a common material discharge duct which opens into a tangential material discharge duct.

In this preferred embodiment also the impact surfaces

are constructed in relation to the double wheel as two truncated cones opening in opposite directions. Both for self-cleaning and also for the impact effect the distributor has flat guide vanes.

Continuing the idea of the invention further it is also possible to construct a centrifuging wheel with three or four axially offset centrifuging ducts wherein, looking from the entry, the more distant a centrifuging duct is the larger the number of entry ducts are to open into it, or the corresponding entry surface is to be matched. Here also a separate impact ring is always associated with each centrifuging duct.

Constructional outlay can be kept very low if an electric drive motor is flange-mounted directly on the housing of the impact detacher. The centrifuging wheel then has the same number of revolutions per minute as the electric motor e.g. 3,000 r.p.m.

The material discharge duct can be formed of two halves which are substantially alike in form and which are dividable in a perpendicular plane to the axis of rotation of the shaft of the centrifuging wheel.

Very advantageously the impact detacher is constructed in the manner of a fan, so that it is possible to select product feed and product discharge in all spatial directions within a vertical plane and also in a horizontal plane.

This allows almost complete freedom as regards fitting into a processing plant, and facilitates the appropriate planning of an installation.

The invention will now be explained with further details with reference to a constructional example. In the drawings:

Fig. 1 is a section in the axial direction through an impact detacher,

Fig. 2 is a section taken on II-II of Fig. 1,

Fig. 3 shows the distributor of a double wheel,

Fig. 4 shows a plan view of Fig. 3,

Figs. 5 to 8 show various installation possibilities for the impact detacher,

Fig. 9 shows a further constructional example with a triple centrifuging rotor, and

Fig. 10 shows a further constructional example, wherein the centrifuging rotor is constructed as a quadruple rotor.

Reference will now be made to Fig. 1 in what follows. The upper portion of the Figure shows an impact detacher 1 in the form of a section in the axial direction. An electric motor 2 of for example 3,000 r.p.m. type is securely fixed with bolts 3 and a connecting flange 4 to a lower stationary housing part 5 of the impact detacher 1. The connecting flange 4 is so constructed that it accommodates the sealing elements for sealing the impact detacher 1 with respect to the outside. An upper housing part 6 is so connected to the lower housing part 5 that a baffle or impact ring 7 is securely held therebetween. Concentrically with the two housing parts 5 and 6 there is mounted on the upper housing part 6 a feed tube 8 through which the material for treatment is introduced into the impact detacher 1. A centrifuging wheel 9 is arranged in the housing parts 5 and 6. This wheel is mounted by means of a supporting sleeve 10 and a securing screw 12 on the shaft 11 of the electric motor 2. The centrifuging wheel or rotor 9 is formed, by the use of an inner rotary disc 13, an outer rotary disc 14 and a separating ring 15 arranged centrally between the two rotary discs 13, 14, all held together by bolts 16, as a double wheel or double rotor 17. With this arrangement there are formed an inner centrifuging duct 18 near the feed tube 8, and an outer centrifuging duct 19 distant from the feed tube 8. The impact ring 7 comprises two oppositely directed impact surfaces 20, 21, which represent two truncated cones

opening in opposite directions, the inner impact surface 20 being associated with the inner centrifuging duct 18 and the outer impact surface 21 being associated with the outer centrifuging duct 19.

In the circumferential direction with respect to the centrifuging wheel 9 or double wheel 17 there is arranged a material discharge duct 23, 24 widening in the manner of a fan in the direction towards a material discharge duct 22 (Fig. 2).

The distributor 30 is shown by itself in Figs. 3 and 4. The distributor 30 has two kinds of flat guide vanes: short metal guide vanes 31 which conduct the product and air flow into the inner (nearer the feed tube 8) centrifuging duct 18, and long metal guide vanes 32 which conduct the product and air flow into the outer (more distant from the feed tube 8) centrifuging duct 19. The short metal guide vane 31 is given vertical hatching and the long metal guide vane horizontal hatching in Fig. 3.

As can be seen from Fig. 3, the distributor 30 can be made in one piece e.g. in the form of a casting, and the centrifuging ducts 18 and 19 can be made from sheet steel, and the two parts joined to form one unit.

The centrifuging duct 19 is also completely self-cleaning if in the said duct or ducts an insert 33 in the form of a ring segment is arranged in the entry region of the centrifuging duct 19 (shaded with circular rings in Fig. 4). In the case of the double rotor 17 a ratio of 2:4 as regards the number of inner entry ducts 34 to outer entry ducts 35 has been found satisfactory. Tests have been able to demonstrate that almost identical product flows are set up with this arrangement, which likewise is confirmation for the positive effect of the new invention. The mixture of material and air which is to be processed enters through the feed tube 8 directly into the entry ducts 34, 35 of the distributor 30 and is given rotational movement. The mixture is accelerated in the entry ducts 34, 35, and experi-

ences a first impact on the bolts 16. By the use of two sets of bolts 16 arranged annularly, this impact effect is even doubled. The large number of bolts 16, however, also has the advantage of uniform distribution of mixture in the circumferential direction. They also produce a blade effect to a certain extent. The product-air mixture is then centrifuged ^{separately} from the two centrifuging ducts 18, 19 to their own respective impact surfaces 20, 21 respectively. It will be readily apparent that due to the 90° deflection of the two flows, each in an opposite direction, an immediate separation of the mixture takes place. The heavy material impinges on the respective impact surface provided, and the air flows past thereover. Because of the annular and substantially symmetrical arrangement of the two material discharge ducts 23, 24, a stable air flow forms plus a stable product flow, even after impact. The water-turbine-type material discharge duct 22, widening in the circumferential direction, assists uniform impingement on the baffle surfaces 20, 21, and assists a re-uniting of air and material, which can be transported further as a mixture after the material discharge duct 22 with a pneumatic conveying system.

Figs. 5 to 8 show various mounting or fitting arrangements. An intention here is to bring out the fact that the work effect of the impact detacher 1 is always ensured independently of the position in which it is fitted.

In Fig. 5 the material to be processed is fed vertically from below into the impact detacher 1, and discharged horizontally, and in Fig. 6 the product is fed-in vertically from above. In contrast, in Figs. 7 and 8 the raw material enters the impact detacher 1 horizontally. In Fig. 7, product transfer is in the vertically downward direction, and in Fig. 8 vertically upwards.

Fig. 9 shows a further constructional example with a

triple centrifuging rotor 9, each centrifuging duct 51, 52, 53 respectively having its own impact surface 54, 55, 56 in each case. The product flow is deflected downwards by the two impact surfaces 55 and 56, and upwards by the impact surface 54. It is important here again that the distributor 30 is constructed in accordance with the same rules as in Figs. 1 to 4, and a uniform product distribution is ensured for all ducts.

In Fig. 10 the centrifuging rotor 70 is constructed as a quadruple rotor, similarly to Figs. 1 to 4, with product guiding in two opposite directions by means of 4 separate impact surfaces.



C L A I M S :

1. Impact detacher (1) for material of the grain, semolina or flour type, with
 - a) a rotating centrifuging wheel (9; 17; 50; 60; 70) which comprises at least two axially offset centrifuging ducts(18, 19; 51, 52, 53) and which is surrounded by an impact ring (7),
 - b) a concentric feed tube (8) and
 - c) a material discharge duct (22), characterised in that
 - d) in the centrifuging wheel (9; 17; 50, 60; 70) there is arranged a guide vane apparatus or distributor (30) which is situated following the feed tube (8) and which distributes the fed-in material to the centrifuging ducts (18, 19; 51, 52, 53), and
 - e) a separate impact ring surface (20, 21; 54, 55, 56) is associated with each centrifuging duct (18, 19; 51, 52, 53) , the impact surfaces (20, 21, 54, 55, 56) being constructed as truncated cones opening in opposite directions.
2. Impact detacher according to claim 1, characterised in that the material discharge duct (22) surrounds the centrifuging wheel (9;17;50;60;70) annularly.
3. Impact detacher according to claim 1 or 2, characterised in that the impact ring surfaces (20, 21; 54, 55, 56) are connectable to constitute a common material discharge duct (22) with a tangential product exit.
4. Impact detacher according to one of the preceding claims, characterised in that the centrifuging wheel (9) is constructed as a double wheel (17) and the impact ring (9) comprises two oppositely directed impact surfaces (20, 21).



5. Impact detacher according to one of the preceding claims, characterised in that the distributor (30) is connected to the rotating centrifuging wheel (9).

6. Impact detacher according to one of the preceding claims, characterised in that the distributor (30) comprises a plurality of entry ducts (34, 35) which extend to into the centrifuging ducts (18, 19), these latter being in the form of annular discs.

7. Impact detacher according to one of the preceding claims, characterised in that the distributor (30) comprises flat guide vanes.

8. Impact detacher according to claim 6 or 7, characterised in that the entry ducts (35) which open into that centrifuging duct (19) which is distant from the feed tube (8) comprise at the outer periphery a crosssection-narrowing insert (33).

9. Impact detacher according to claim 8, characterised in that the insert is arranged in the entry of the distributor (30), and is constructed as a ring segment with a tapering form towards the axis of rotation.

10. Impact detacher according to one of claims 6 to 9, characterised in that like entry ducts (34, 35) are arranged symmetrically.

11. Impact detacher according to one of the preceding claims, characterised in that an electric motor (2) is flange-mounted directly on the housing (5, 6) of the impact detacher (1).



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12. Impact detacher according to one of the preceding claims, characterised in that the material discharge duct (23, 24) is formed of two halves which are substantially alike in form and which are dividable in a perpendicular plane to the axis of rotation of the shaft (11) of the centrifuging wheel (9).

13. Impact detacher according to one of the preceding claims, characterised in that it is so constructed in the manner of a fan that the product feed (40) and the product discharge (41) can be chosen in all spatial directions within a vertical plane and also in a horizontal plane.