July 25, 1961 L. J. MEYER 2,993,657

IMPACT COMMINUTOR

Filed March 16, 1960

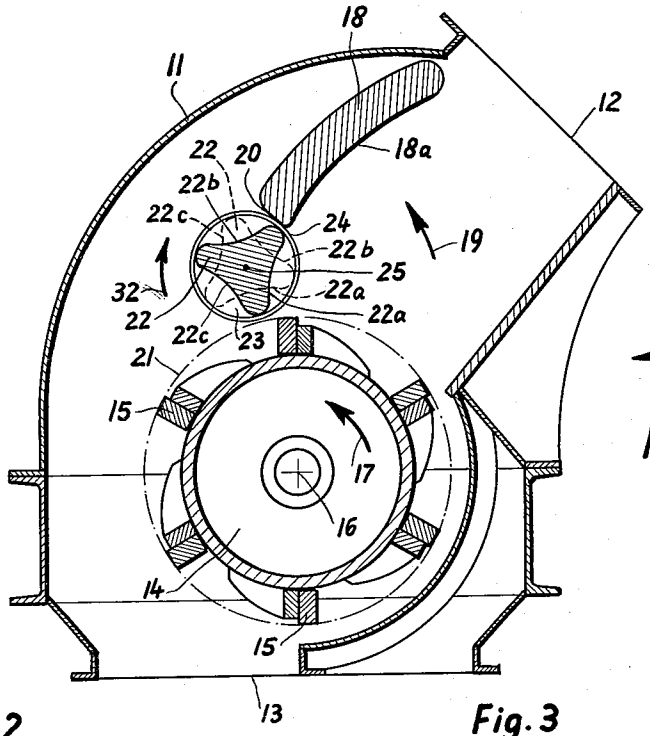


Fig. 1

Fig. 2

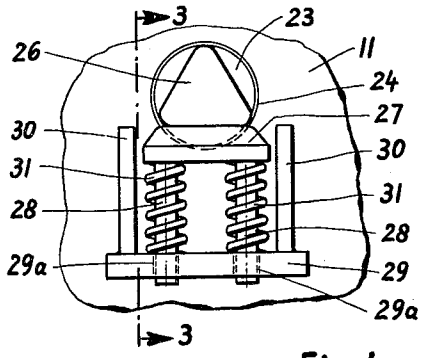


Fig. 3

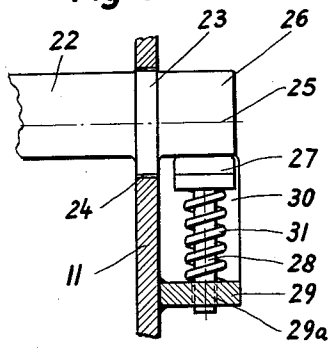


Fig. 4

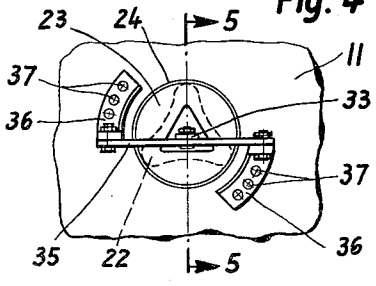
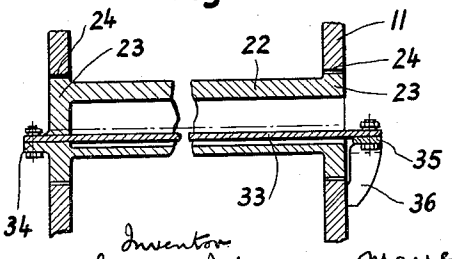


Fig. 5



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IMPACT COMMINUTOR

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The present invention relates to an impact comminutor.

More particularly, the present invention relates to an impact comminutor for crushing or smashing various types of goods, especially rocks, stones, earths, and the like in metallurgical works, smelting plants, ironworks, steel mills, foundries, mining installations, cement-works installations, quarries, and similar industries.

There exist impact comminutors in which the goods to be crushed are fed onto an impeller which impels the goods against appropriately positioned impact surfaces. In early impact comminutors, there was but a single impact means which was arranged above the impeller in the path of goods being impelled and usually extended to the periphery of the rotating impeller. As a result, exceptionally hard work pieces which resisted crushing, or certain tools, could and on occasion did become wedged between the impact means and the impeller, thereby causing stoppage of the apparatus. In order to avoid this, more recent impact comminutors incorporate two separate impact means, one of which is a stationary impact means that is spaced from the periphery of the impeller and the other of which is a yielding impact means that is arranged in the space between the stationary impact means and the periphery of the impeller. In existing constructions, these yielding impact means are in the form of a lever-like construction, with one end being formed with the impact surface that occupies the space between the stationary impact surface and the periphery of the impeller and the other end being pivotally mounted for turning movement about an axis that is spaced from the gap a distance equal to the length of the lever. This lever-like construction is either gravity-biased or spring-biased into a normal operating position in which the impact surface forms a continuation of the stationary impact surface, and this allows the yielding impact surface to move out of the space between the stationary impact surface and the periphery of the impeller, against the action of the force which biases the yielding surface into its normal position, whenever a certain rock or stone or perhaps a heavy work tool is wedged between the yielding surface and the impeller.

Installations of the above described type have the inherent disadvantage that the goods being hurled against the yieldably arranged impact surface are not comminuted with the same degree of efficiency as the goods which are impelled against a non-yielding impact surface. This could be avoided by eliminating the yieldable impact means altogether, but then a relatively large gap would have to be left free between the stationary impact means and the periphery of the impeller, lest the aforementioned wedging action stop the machine entirely. This gap would then permit a certain percentage of the goods fed to the comminutor to avoid the crushing action altogether, thereby reducing the overall efficacy of the machine.

It is therefore an object of the present invention to provide an impact comminutor or crushing apparatus which overcomes the above-described disadvantages.

It is another object of the present invention to provide an impart comminutor which is of simple construction so that it may be built at low cost.

The objects of the present invention also include the provision of an impact comminutor which operates at high efficiency.

It is a still further object of the present invention to provide an impact comminutor which is of rugged construction and will give long periods of trouble-free service.

With the above objects in view, the present invention mainly resides in an impact comminutor which comprises a housing, a rotatable impeller arranged in the housing for impelling goods to be comminuted, first impact means fixedly mounted in the housing above the impeller in the path of goods being impelled thereby, the lower edge of the first impact means being spaced from the periphery of the impeller, second impact means arranged in the space formed between the lower edge of the first impact means and the periphery of the impeller, these second impact means having at least one impact face and being turnable about an axis which is generally parallel to that of the impeller and which passes through the aforesaid space, into and out of a normal operating position wherein the impact face forms a continuation of the first impact means and extends between the lower edge of the first impact means and the periphery of the impeller, and means for resiliently urging the second impact means into its normal operating position.

The novel features which are considered as characteristic for the invention are set forth in particular in the appended claims. The invention itself, however, both as to its construction and its method of operation, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection with the accompanying drawings, in which:

FIG. 1 is a sectional elevational view of an impact comminutor according to the present invention;

FIG. 2 is a fragmentary side elevational view showing a detail of the present invention;

FIG. 3 is a sectional view taken on line 3—3 of FIG. 2;

FIG. 4 is a fragmentary side elevational view showing a modified embodiment of the same detail; and

FIG. 5 is a sectional view taken on line 5—5 of FIG. 4.

Referring now to the drawing and to FIG. 1 thereof in particular, there is shown an impact comminutor indicated generally at **10**. The comminutor comprises a housing **11** having an inlet **12** through which goods to be comminuted are fed and an outlet **13** through which the crushed goods pass out. Intermediate the inlet **12** and outlet **13** there is arranged an impeller **14** having a plurality of beating arms **15** and mounted for rotation about an axis **16**. The impeller is rotated in the direction of the arrow **17** by a suitable driving motor (not shown).

The comminutor further comprises two impact means, one of which is a stationary impact plate **18** which is arranged above the impeller **14** in the path of goods being impelled thereby in the direction of the arrow **19**. This impact plate, which may, if desired, be fashioned as a grill work, has an impact face **18***a* and a lower edge **20** which is spaced from the periphery **21** of the impeller, shown in dotted lines, so that a gap is formed. Within this gap there is arranged the other impact means, and the same is in the form of a member **22** of polygonal cross-section and having a plurality of slightly concave impact faces **22***a*, **22***b* and **22***c*. The ends of this member are formed with circular bearing portions **23** which are rotatably arranged in circular cutouts **24** of the housing **11** so that the member **22** is turnable about an axis **25** which is generally paralled to the axis of rotation **16** about which the impeller **14** turns. It will be noted that this axis **25** passes through the gap between

the lower edge 20 of the first impact means 18 and the periphery 21 of the impeller 14.

FIG. 1 shows, in solid lines, one of three normal operative positions of the member 22 in which one of the impact faces—here the faces 22*a*—forms a continuation of the impact face 18*a* and extends between the lower edge 20 and the periphery 21 of the impeller 14. However, thanks to the turnable mounting afforded by the bearing portion 23 and the circular cutouts 24, the member 22 may rotate into an abnormal position, shown in dotted lines, in which a free space is formed between the member and the periphery 14 of the impeller. This turning will occur when a piece or item incapable of being smashed is wedged between the member 22 and the impeller 14.

Suitable indexing or positioning means are provided for continuously urging the member 22 into its normal operating position, i.e., a position in which one of the impact faces forms a continuating of the impact face 18*a* and extends between the lower edge 20 and the periphery of the impeller. In the embodiment shown in FIGS. 2 and 3, the means for carrying out this function comprise an indexing cam 26 which is rotatable with the member 22 and extends exteriorly of the housing 11, and a cam-follower having a head 27 and two stems 28 slidably received in holes 29*a* of a ledge 29 attached to the housing 11, suitable reinforcing brackets 30 being provided if desired. The cam-follower is pressed into engagement with the indexing cam 26 by two coil springs 31 which encompass the stems 28 and bear at one end against the undersurface of the head 27 and at their other end against the ledge 29. The angular position of the indexing cam 26 with respect to the impact faces 22*a*, 22b and 22c of the member 22 and the orientation of the ledge 29 are so selected that the member 22 will always be urged into the operative position shown in FIG. 1, i.e., a position in which one of the three impact faces occupies the positions which the face 22*a* occupies in FIG. 1.

It will be seen from the above that when a piece incapable of being crushed is wedged between the impeller 14 and the member 22, the latter will rotate in the direction of the arrow 32 into the abnormal position shown in dotted lines. The indexing means will then return the member 22 into its normal operating position, in this case, a position in which it will be the face 22*b* that forms the continuation of the impact face 18*a*. A subsequent wedged piece will advance the face 22c into this position, and so on. In this way, no one impact face is continuously exposed to the material being impelled by the impeller, thereby increasing the useful life of the member 22.

Thanks to the above-described arrangement, goods hurled against the yielding impact means will for all intents and purposes encounter an unyielding impact surface. This is so inasmuch as the member 22 in its entirety cannot yield backwardly, i.e., it cannot yield in the direction in which the goods are being hurled at it by the impeller, such backward movement being prevented by the mounting which allows the member to rotate in case of jamming. Therefore, the crushable goods being impelled against the member 22 will encounter what is for them a virtually unyielding impact surface, while goods incapable of being crushed and thus finding themselves wedged between the member 22 and the impeller 14 will be freed thanks to the rotatability of the member 22.

In order to improve the above-described non-yieldability of the member 22 for crushable goods, the impact faces are formed concave, as mentioned above. As a result, the goods being hurled against the member 22 will exert forces that will pass more nearly through the center of the member, i.e., through the axis 25, so that they will not exert a turning moment on the member 22. Consequently, the goods impinging on the member 22 will be comminuted with virtually the same degree of efficiency as if they were being hurled against a completely immobile surface.

It will also be noted that in the illustrated embodiment the member 22 is shown as having a triangular cross-section. This configuration is selected in preference to polygonal cross-sections having a greater number of faces so that when the member is turned into an abnormal position as shown in dotted lines, the gap formed between the member 22 and the periphery of the impeller is greater than could be obtained with a member having more than three faces.

FIGS. 4 and 5 show an indexing mechanism incorporating a twistable torsion spring 33 one end of which is attached to a ledge 34 of the member 22 and the other end of which is attached to a leaf spring 35 which is supported by two brackets 36. The latter are secured to the housing 11 by screws 37. In order to expose each impact face of the member 22 to the goods being hurled by the impeller, the orientation of the leaf spring 35 may periodically be changed by 120° by loosening the screws 37 and thereafter re-locating and fastening the brackets 36 in the appropriate place.

It will be understood that each of the elements described above, or two or more together, may also find a useful application in other types of impact comminutors differing from the types described above.

While the invention has been illustrated and described as embodied in an impact comminutor adapted for rocks, stones and earth, it is not intended to be limited to the details shown, since various modifications and structural changes may be made without departing in any way from the spirit of the present invention.

Without further analysis, the foregoing will so fully reveal the gist of the present invention that others can by applying current knowledge readily adapt it for various applications without omitting features that, from the standpoint of prior art, fairly constitute essential characteristics of the generic or specific aspects of this invention and, therefore, such adaptations should and are intended to be comprehended within the meaning and range of equivalence of the following claims.

What is claimed as new and desired to be secured by Letters Patent is:

1. In an impact comminutor, the combination which comprises: a housing; a rotatable impeller arranged in said housing for impelling goods to be comminuted; first impact means fixedly mounted in said housing above said impeller in the path of goods being impelled thereby, the lower edge of said first impact means being spaced from the periphery of said impeller; second impact means arranged in the space formed between said lower edge of said first impact means and the periphery of said impeller, said second impact means having at least one impact face and being turnable about an axis which is generally parallel to that of said impeller and which passes through said space, into and out of a normal operating position wherein said impact face forms a continuation of said first impact means and extends between said lower edge of said first impact means and the periphery of said impeller; and means for resiliently urging said second impact means into its normal operating position.

2. In an impact comminutor, the combination which comprises: a housing; a rotatable impeller arranged in said housing for impelling goods to be comminuted; first impact means fixedly mounted in said housing above said impeller in the path of goods being impelled thereby, the lower edge of said first impact means being spaced from the periphery of said impeller; second impact means arranged in the space formed between said lower edge of said first impact means and the periphery of said impeller, said second impact means having at least one impact face and being turnable about an axis which is generally parallel to that of said impeller and which passes through said space, between a normal operating position wherein said impact face forms a continuation of said

first impact means and extends between said lower edge of said first impact means and the periphery of said impeller and an abnormal position in which a free space is formed between said second impact means and the periphery of said impeller; and means for resiliently urging said second impact means into its normal operating position.

3. In an impact comminutor, the combination which comprises: a housing; a rotatable impeller arranged in said housing for impelling goods to be comminuted; first impact means fixedly mounted in said housing above said impeller in the path of goods being impelled thereby, the lower edge of said first impact means being spaced from the periphery of said impeller; second impact means arranged in the space formed between said lower edge of siad first impact means and the periphery of said impeller, said second impact means having a polygonal cross-section so as to have a plurality of impact faces and being turnable about an axis which is generally parallel to that of said impeller and which passes through said space, between a normal operating position wherein one of said impact faces forms a continuation of said first impact means and extends between said lower edge of said first impact means and the periphery of said impeller and an abnormal position in which a free space is formed between said second impact means and the periphery of said impeller; and means for resiliently urging said second impact means into its normal operating position.

4. In an impact comminutor, the combination which comprises: a housing, a rotatable impeller arranged in said housing for impelling goods to be comminuted; first impact means fixedly mounted in said housing above said impeller in the path of goods being impelled thereby, the lower edge of said first impact means being spaced from the periphery of said impeller; second impact means arranged in the space formed between the lower edge of said first impact means and the periphery of said impeller, said second impact means having at least one concave impact face and being turnable about an axis which is generally parallel to that of said impeller and which passes through said space, into and out of a normal operating position wherein said impact face forms a continuation of said first impact means and extends between said lower edge of said first impact means and the periphery of said impeller; and means for resiliently urging said second impact means into its normal operating position.

5. In an impact comminutor, the combination which comprises: a housing; a rotatable impeller arranged in said housing for impelling goods to be comminuted; first impact means fixedly mounted in said housing above said impeller in the path of goods being impelled thereby, the lower edge of said first impact means being spaced from the periphery of said impeller; second impact means arranged in the space formed between said lower edge of said first impact means and the periphery of said impeller, said second impact means having a polygonal cross-section so as to have a plurality of impact faces, each of said impact faces being arched concavely, and said second impact means being turnable about an axis which is generally parallel to that of said impeller and which passes through said space, between a normal operating position wherein one of said impact faces forms a continuation of said first impact means and extends between said lower edge of said first impact means and the periphery of said impeller and an abnormal position in which a free space is formed between said second impact means and the periphery of said impeller; and means for resiliently urging said second impact means into its normal operating position.

6. In an impact comminutor, the combination which comprises: a housing; a rotatable impeller arranged in said housing for impelling goods to be comminuted; first impact means fixedly mounted in said housing above said impeller in the path of goods being impelled thereby, the lower edge of said first impact means being spaced from the periphery of said impeller; second impact means arranged in the space formed between said lower edge of said first impact means and the periphery of said impeller, said second impact means having a triangular cross-section so as to have three impact faces and being turnable about an axis which is generally parallel to that of said impeller and which passes through said space, between a normal operating position wherein one of the three impact faces forms a continuation of said first impact means and extends between said lower edge of said first impact means and the periphery of said impeller and an abnormal position in which a free space is formed between said second impact means and the periphery of said impeller; and means for resiliently urging said second impact means into its normal operating position.

7. In an impact comminutor, the combination which comprises: a housing; a rotatable impeller arranged in said housing for impelling goods to be comminuted; first impact means fixedly mounted in said housing above said impeller in the path of goods being impelled thereby, the lower edge of said first impact means being spaced from the periphery of said impeller; second impact means arranged in the space formed between said lower edge of said first impact means and the periphery of said impeller, said second impact means having a polygonal cross-section so as to have a plurality of impact faces and being turnable about an axis which is generally parallel to that of said impeller and which passes through said space, between a normal operating position wherein one of said impact faces forms a continuation of said first impact means and extends between said lower edge of said first impact means and the periphery of said impeller and an abnormal position in which a free space is formed between said second impact means and the periphery of said impeller; and indexing means for resiliently urging said second impact means into its normal operating position, said indexing means comprising an index cam rotatable with said second impact means and spring-pressed cam-follower means cooperating with said index cam.

8. In an impact comminutor, the combination which comprises: a housing; a rotatable impeller arranged in said housing for impelling goods to be comminuted; first impact means fixedly mounted in said housing above said impeller in the path of goods being impelled thereby, the lower edge of said first impact means being spaced from the periphery of said impeller; second impact means arranged in the space formed between said lower edge of said first impact means and the periphery of said impeller, said second impact means having at least one impact face and being turnable about an axis which is generally parallel to that of said impeller and which passes through said space, into and out of a normal operating position wherein said impact face forms a continuation of said first impact means and extends between said lower edge of said first impact means and the periphery of said impeller; and indexing means for resiliently urging said second impact means into its normal operating position, said indexing means comprising a torsion spring interposed between said second impact means and said housing.

9. In an impact comminutor, the combination which comprises: a housing; a rotatable impeller arranged in said housing for impelling goods to be comminuted; first impact means fixedly mounted in said housing above said impeller in the path of goods being impelled thereby, the lower edge of said first impact means being spaced from the periphery of said impeller; second impact means arranged in the space formed between said lower edge of said first impact means and the periphery of said impeller, said second impact means having a polygonal cross-section so as to have a plurality of impact faces and being turnable about an axis which is generally parallel to that of said impeller and which passes through said space, between a normal operating position wherein one of said impact faces forms a continuation of said first impact means and extends between said lower edge of said first

impact means and the periphery of said impeller and an abnormal position in which a free space is formed between said second impact means and the periphery of said impeller; and indexing means for resiliently urging said second impact means into its normal operating position, said indexing means comprising a torsion spring one end of which is connected to said second impact means and the opposite end of which is connected to said housing.

10. In an impact communitor, the combination which comprises: a housing; a rotatable impeller arranged in said housing for impelling goods to be comminuted; first impact means fixedly mounted in said housing above said impeller in the path of goods being impelled thereby, the lower edge of said first impact means being spaced from the periphery of said impeller; second impact means arranged in the space formed between said lower edge of said first impact means and the periphery of said impeller, said second impact means having a polygonal cross-section so as to have a plurality of impact faces and being turnable about an axis which is generally parallel to that of said impeller and which passes through said space, between a normal operating position wherein one of said impact faces forms a continuation of said first impact means and extends between said lower edge of said first impact means and the periphery of said impeller and an abnormal position in which a free space is formed between said second impact means and the periphery of said impeller; and indexing means for resiliently urging said second impact means into its normal operating position, said indexing means comprising a torsion spring one end of which is connected to said second impact means and the opposite end of which is connected to said housing in any

one of a plurality of different positions which correspond to different normal operating positions of said second impact means wherein different ones of said impact faces form said continuation.

11. In an impact comminutor, the combination which comprises: a housing; a rotatable impeller arranged in said housing for impelling goods to be comminuted; first impact means fixedly mounted in said housing above said impeller in the path of goods being impelled thereby, the lower edge of said first impact means being spaced from the periphery of said impeller; second impact means arranged in the space formed between said lower edge of said first impact means and the periphery of said impeller, said second impact means being in the form of a member of polygonal cross-section which is mounted for rotation about its own axis which extends in the same general direction as that of said impeller between different normal operating positions wherein different ones of the faces of said member form a continuation of said first impact means and extend between said lower edge of said first means and the periphery of said impeller; and means for resiliently urging said member into any one of its normal operating positions.

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