Jan. 3, 1956 K. WANDEL 2,729,146

IMPELLERS FOR PULP DISINTEGRATING MACHINES

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Fig. 1.

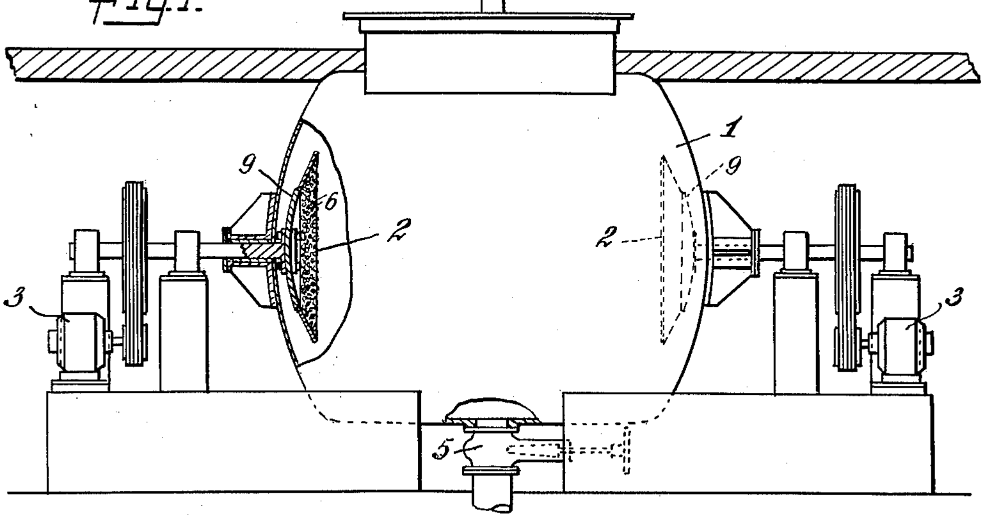


Fig. 5.

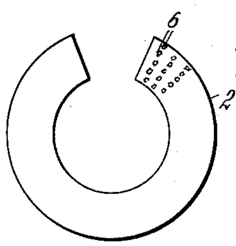


Fig. 2.

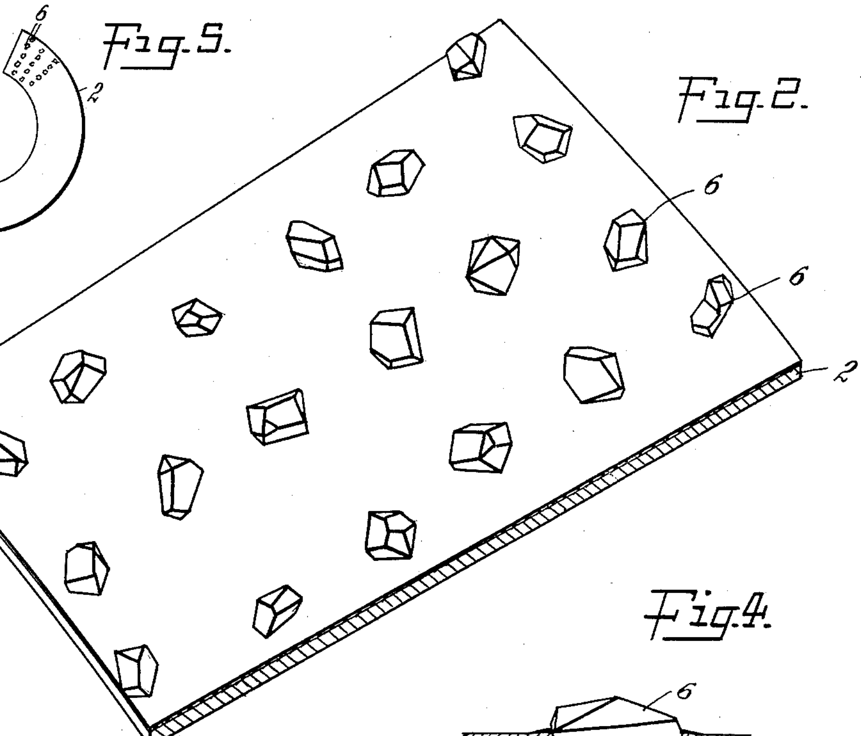


Fig. 4.

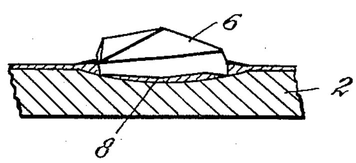
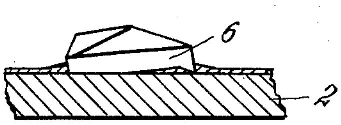


Fig. 3.



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IMPELLERS FOR PULP DISINTEGRATING MACHINES

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4 Claims. (Cl. 92—26)

This invention relates to impellers for pulp disintegrating machines, and constitutes particularly an improvement on the impeller disclosed in Patent No. 2,641,165 granted on my co-pending application Ser. No. 121,270, filed October 14, 1949. In that application I have described a pulp-disintegrating machine comprising rotating disk-like impellers having their surfaces coated in whole or in part with particles of tungsten carbide fused to the surface of the steel disks constituting the impeller. These impellers have been found quite satisfactory in actual practice but are difficult to manufacture and are also subject to clogging with the disintegrated pulp to an extent that their effectiveness is reduced.

One object of the present invention is to provide an improved impeller of the type above referred to whereby the cost of manufacture is greatly cheapened and an improved bond between the tungsten carbide and the impeller is obtained.

A further object of the invention is to provide an impeller of the class described wherein the tendency to clog is substantially eliminated and the disintegrating effect considerably enhanced, thereby increasing the capacity of the machine.

Other objects of the invention will appear from the following specification wherein—

Fig. 1 shows one form of disintegrating apparatus with my improved impellers installed therein:

Fig. 2 is a perspective view of a section on the impeller constructed in accordance with my invention;

Fig. 3 is a detail sectional view showing in full scale a typical tungsten carbide crystal attached to the underlying portion of the impeller;

Fig. 4 is a view similar to Fig. 3 showing a modification; and

Fig. 5 is a detail view of a portion of the impeller disk.

Referring to the drawings, 1 indicates the usual tank or shell in which the charge of fibrous material such as waste paper and water is placed for disintegration by means of the impellers 2 mounted at each end of the shell. The impellers are continuously rotated at high speed by their driving motors 3 for a sufficient period for the impellers to fully disintegrate the waste paper or other material to a homogeneous pulp which is withdrawn through the discharge valve 5 at the bottom of the tank. The rotation of the impellers maintains the mass in which they are submerged in circulation outwardly across the face of the impellers by reason of the centrifugal force imparted to the mass, thereby drawing the material toward the center of the disks whence it moves outwardly across the faces of the disks and over the disintegrating projections on the face of the disk which serve to tear the pulp apart until the whole charge is reduced to a homogeneous mass.

In my prior application above referred to the impellers are formed of concave steel disks and the tungsten carbide particles are fused directly to the face of the disk. The steel is coated with a flux and softened by heating. The tungsten carbide particles are then sprinkled at random upon the surface of the disk and pressed into the

softened metal to a sufficient extent to be partially embedded in the surface when the steel cools. The impellers so made have proved quite satisfactory in practice but are expensive to manufacture and subject to clogging as stated above.

In my improved impeller forming the subject-matter of this application the tungsten carbide particles are of substantially uniform size. For example, the size which I have found most effective are of a range from ¼" mesh to ½" mesh. That is to say, the crushed tungsten carbide is screened on screens of ½" mesh; those particles which pass the screen are again screened on ¼" mesh and only those particles which pass the ½" mesh and are retained on the ¼" mesh are used in the manufacture of the impellers.

Instead of being distributed at random through the area over the face of the impeller to which they are applied the particles, indicated at 6 in the drawings, are arranged on the face of the impeller so that each particle is spaced from the adjacent particles by a distance at least several times the dimensions of the particles. Preferably the particles are arranged in circumferential rows and are placed on the face of the steel impeller with their sharpest corners uppermost. After the particles are thus arranged on the face of the impeller, molten copper is poured over the face of the impeller to form a layer of a thickness in the order of $\frac{1}{32}$ inch. The copper is heated above its melting point so that it is highly fluid and the steel disk is also heated above the melting point of copper so that the copper will not be chilled and solidify when it reaches contact with the disk. By preheating the disk the fluidity of the copper is maintained for a long enough period for it to flow fully into the irregular spaces between the crystals and the face of the disk so that when the copper solidifies as the disk and copper cool, the crystalline particles of tungsten carbide will be embedded in the copper layer and will be firmly attached to the face of the disk.

The disk may be of uniform thickness throughout, as shown in Fig. 3, or if desired the impeller disk, in process of manufacture, may be provided with spaced depressions 8 such as shown in Figs. 4 and 5, for receiving the tungsten carbide crystals so that they will be embedded in a greater depth of copper than when placed on the flat surface of the disk, as shown in Fig. 3. Also, the depressions facilitate the placing of the crystals in properly spaced relation on the face of the disk and serve to prevent displacement of the crystals when the coating of melted copper is poured over the face of the disk.

To carry out the process as above described it is essential that the entire surface to which the tungsten carbide crystals are attached be maintained in a horizontal plane when the molten copper is poured on the surface so that the copper will form a layer of uniform thickness. To this end the portion of the impeller bearing the tungsten carbide crystals is formed of a flat sheet of the shape shown in Fig. 5. After the crystals are attached in the manner above described, the sheet is bent to concave form and welded to the perimeter of a central disk 9, all as described in my above mentioned co-pending application.

I have found in practice that the efficiency of the impellers in disintegrating waste paper is materially enhanced by selecting the crystals of tungsten carbide within a fairly uniform range and mounting them in spaced relation on the face of the impeller. I have found that about six rows of crystals spaced around the outer margin of the face of the impeller disk, as illustrated, provides the maximum disintegration of the pulp per unit of power consumed. The arrangement of the crystals in rows is particularly effective in preventing the clogging up of the impellers which occurs by virtue of the fibers catching on the crystals. When spaced in the manner illustrated the streams of pulp flowing over the face of the impellers due to centrifugal action apparently attain a greater velocity than when the impellers have the crystals arranged in random relation, and are thereby more effective. But whatever may be the actual action on the material the reduction of the mass to the desired homogeneous pulp mixture is materially enhanced by the arrangement disclosed. Also the cost of manufacture of the impellers is considerably reduced by embedding the crystals in a copper coating instead of directly into the steel of the impeller. Also a much stronger bond between the crystals and the impeller is obtained.

I claim:

1. In an apparatus of the class described an impeller comprising a disk having attached to a portion of its face a plurality of hard mineral crystals arranged in predetermined spaced relation.

2. In an apparatus of the class described an impeller comprising a disk having attached to a portion of its face a plurality of hard mineral crystals arranged in spaced relation in radial rows.

3. In a machine of the class described an impeller comprising a concave disk of steel having a layer of copper on its concave surface and a series of hard mineral crystals arranged in radial rows embedded in the copper layer.

4. In a machine of the class described an impeller comprising a concave disk of steel having a plurality of spaced depressions in its concave face and a surface layer of copper thereon and a series of hard mineral crystals positioned in said depressions and embedded in the copper layer.

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