Aug. 2, 1932. J. D. BEEBE 1,869,655

IMPELLER BLADE

Filed Aug. 29, 1930

Fig-1

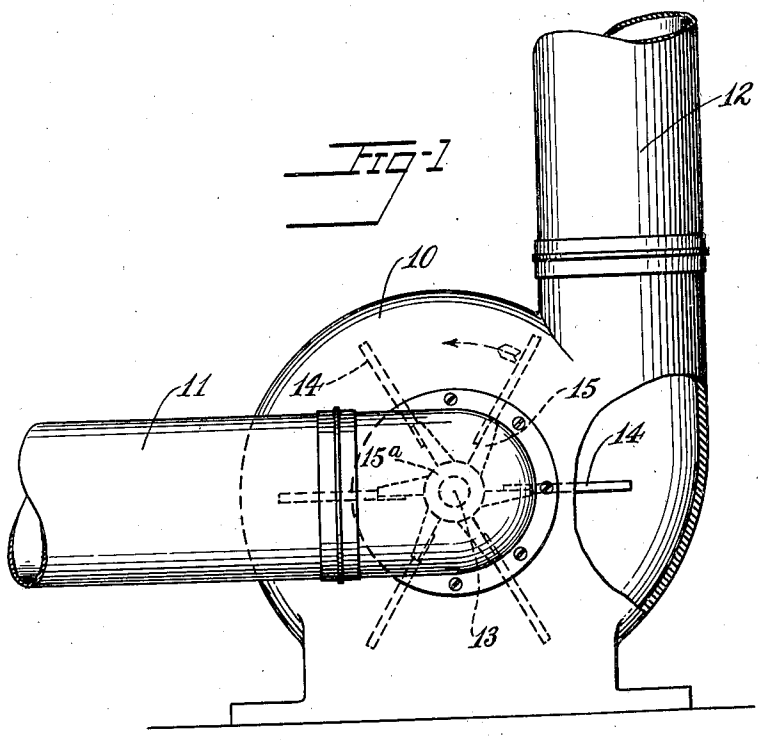


Fig-3

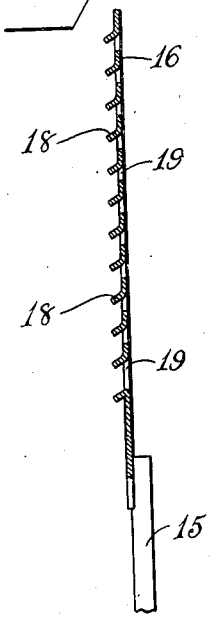


Fig-2

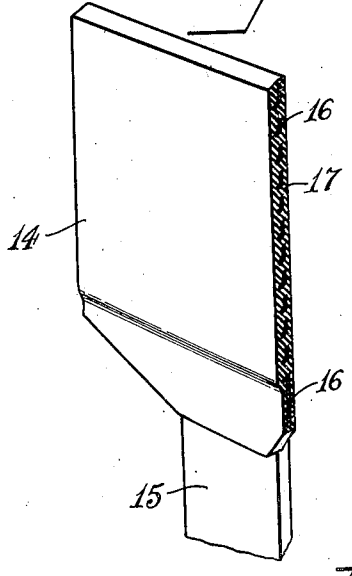
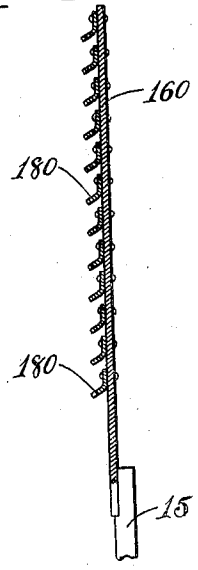


Fig-4



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UNITED STATES PATENT OFFICE

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IMPELLER BLADE

Application filed August 29, 1930. Serial No. 478,623.

This inventon relates to an impeller blade for use in fluid circulating appliances such as centrifugal fan blowers, fluid pumps, and the like, and especially for use in such appliances wherein fluids laden with particles of abrasive material are circulated or agitated.

An object of the invention is to provide an impeller blade highly resistant to the abrasive wear caused by the impact and frictional rubbing contact of abrasive particles in the fluid against the surface of the blade.

Other objects include the embodiment of these features in a blade of simple and durable construction, which may be economically manufactured.

Impeller blades protected on their exposed faces by rubber composition have been found to possess a resistance to the wear of abrasive materials carried by fluids distinctly superior to that of metals and other harder materials.

In the use of a layer of rubber on the face of an impeller blade, however, it has been found that in some instances the rubber is placed in a state of tension due to the centrifugal force set up by the speed of rotation, the peripheral speed and consequently the centrifugal force being greater near the outer end than near the inner end of the blade, and because the exposed surface of this rubber under tension is susceptible to a more rapid rate of wear from the abrasive action of materials in the fluid than if the rubber were not in such state of tension, the benefits available in this use of rubber have not always been fully obtained.

According to the present invention the blade is so constructed that, as to one phase of the invention, the rubber on its impact surface is prevented from going into a state of tension under the influence of centrifugal force, and in fact is caused by the centrifugal force to be put in a state of compression, the invention thereby not only countering the objectionable effects of centrifugal force on the rubber, but, in addition, utilizing the centrifugal force to render the rubber better able to withstand the impacts and abrasive action of materials carried by the fluid.

The impeller blade shown and described in the present illustrative embodiment of the invention is of a form adapted for use with a fan blower rotor of the paddle wheel type. It will be understood, however, that the invention has application to impeller blades of various forms, and that the invention is not limited to the particular form herein shown and described, except as it is defined in the appended claims.

In the drawing:

Fig. 1 is a view in elevation, partially fragmentary, of a centrifugal fan blower of the paddle wheel type.

Fig. 2 is a perspective view, partly in section, of an impeller blade constructed in accordance with the present invention.

Fig. 3 is a view in vertical cross section illustrating the skeleton of the blade of Fig. 2, with the rubber removed.

Fig. 4 is a view similar to that of Fig. 3 but showing a modified form of blade skeleton.

Fig. 1 shows a centrifugal fan blower embodying a casing 10, having an intake 11, discharge 12, and a rotor which is rotatable about a horizontal axis designated at 13 in a direction indicated by the arrow. The rotor is provided with a plurality of radially extending blades 14 secured by means of spokes 15 to a hub or drum 15ª, driven by any suitable power means.

Each of the blades 14 comprises a rigid skeleton plate 16, preferably of metal, which as shown is wholly enclosed in rubber composition 17, although the rubber may be applied to a portion only of the blade, such as the pressure face alone, if desired.

In order to avoid excessive tension in the rubber, the invention contemplates the provision of baffles or fins arranged to extend in a direction generally transverse to the radial direction of the blade. Such baffles may be formed, as indicated at 18 in Figs. 2 and 3, by stamping from the material of the plate 16 leaving apertures 19 therein; or the baffles may be in the form of separately constructed strips 180 attached by any suitable means to a skeleton plate 160, as shown in the modification in Fig. 4. The baffles are arranged to project from the pressure face of the blade in the general direction of blade movement

and are embedded in the rubber composition. Under the influence of centrifugal force set up during rotation, each portion of the rubber between adjacent baffles will be prevented from outward creeping by the obstructing outer baffle, and with the baffles sufficiently closely spaced the rubber as a whole as well as the units thereof between baffles will be restrained from developing an undesirable state of tension, the surface layer or zone of rubber beyond the baffles being comparatively thin.

When the baffles, as shown, do not extend all of the way to the impact surface of the rubber, the rubber adjacent the impact surface may be put under some slight tension by the relatively great centrifugal force of the rubber adjacent the outer end of the blade, but the differential of centrifugal force between parts of the rubber at different distances from the axis of rotation, and consequently the tension set up in the surface rubber, is very small when the zone of rubber beyond the baffles is very thin, as shown, not only because of the relative lightness of that thin, surface zone of rubber, but also because centrifugal force in the rubber does not act with a long arm of leverage to displace it with relation to its support, which consists of the skeleton plate 16, including the baffles, and the rubber between the baffles. The rubber between the baffles being interlocked therewith against outward movement and the surface zone of rubber being integral therewith, the surface rubber is well secured against displacing forces.

Moreover, when the rubber of the impact face has worn down to the baffles, the compacting of the rubber against the baffles by centrifugal force produces a state of compression instead of tension in the rubber at the impact surface, the surface rubber now consisting wholly of individual inter-baffle units each of such small dimension radially of the blade as not to have any substantial difference of centrifugal force in its inner and outer regions and the thickness of the unit being such as to permit all of the rubber at the impact face of the unit to have part of its centrifugal force sustained by the baffle on its outer side. The surface compression enables the rubber to better withstand the abrasive action of materials suspended in the contacting fluid.

The exposed edges of the baffles may wear away somewhat in advance of the wearing of the intervening rubber units, but the latter consequently retard the wear of the baffles.

Although the baffles may be arranged to project substantially normal with relation to the blade face, it is preferred to arrange the baffles to project somewhat inwardly toward the rotor axis, as illustrated, in order that the compacting effect of the rubber may be increased by a wedging action of the rubber beneath the baffles, causing an increased pressure of the rubber against the baffles and skeleton plate, and increasing compression in the rubber. Further, instead of extending straight across the blade face, as illustrated, the baffles may be curved or angularly bent as desired, without departing from the spirit of the invention.

What I claim is:

1. An impeller blade comprising a rigid backing, a blade face of resilient rubber composition, and means coacting with said rigid backing and extending toward the face of the blade into said rubber composition for restraining the latter at the blade face from stretching under the action of centrifugal force.

2. An impeller blade comprising a backing plate, a blade face of resilient rubber composition, and means comprising a plurality of baffles attached to said plate and embedded in said rubber composition for restraining the latter from stretching under the action of centrifugal force.

3. An impeller comprising a hub, a blade comprising a rigid backing secured to the hub and having a plurality of radially spaced baffles projecting outwardly from its face, each of said baffles having radially spaced faces extending from the backing in a radially inward direction, and a blade facing of resilient rubber composition extending between said baffles.

4. An impeller comprising a hub, a blade comprising a backing plate secured to the hub, said plate having a plurality of radially spaced baffles struck out from the plate and projecting outwardly from its face, and a blade facing of resilient rubber composition extending between said baffles and filling the plate apertures left by the struck-out baffles.

In witness whereof I have hereunto set my hand this 21st day of August, 1930.

JOHN D. BEEBE.