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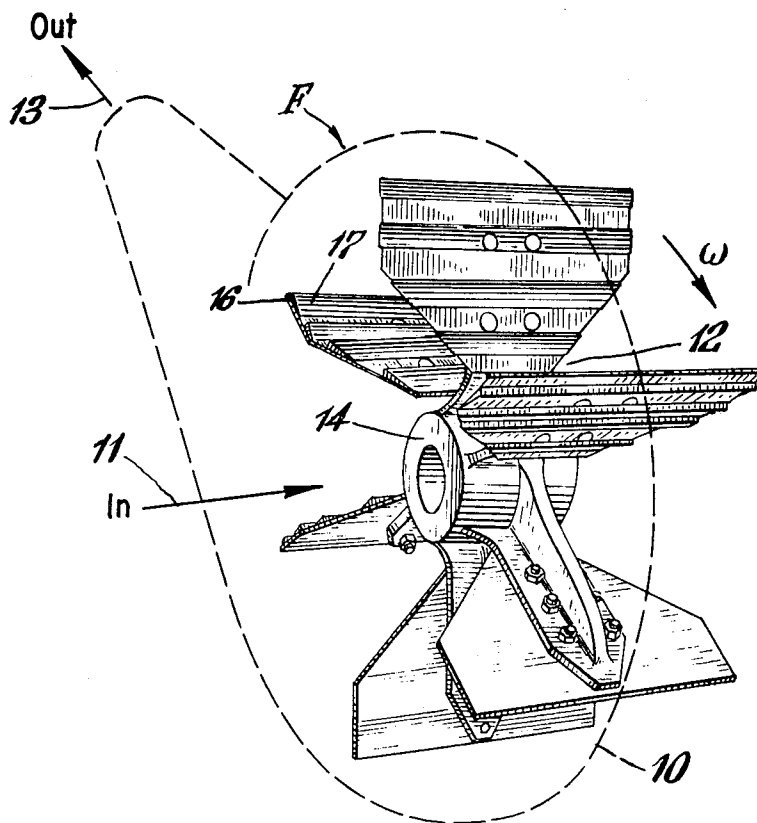
[54] **FAN BLADE HAVING WEAR-RESISTANT RIBS AND FAN INCLUDING A PLURALITY OF SAME**
8 Claims, 2 Drawing Figs.

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415/212, 416/236, 416/229

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[50] Field of Search **415/98,**
212; 416/224, 229, 235, 236; 302/37, 38

ABSTRACT: A fan blade is disclosed having a plurality of wear-resistant ribs extending across the width of its working surface and spaced along the length thereof for contacting solid particles, e.g. pulverized coal, to be propelled thereby. A fan including a plurality of blades as above-described is also disclosed.



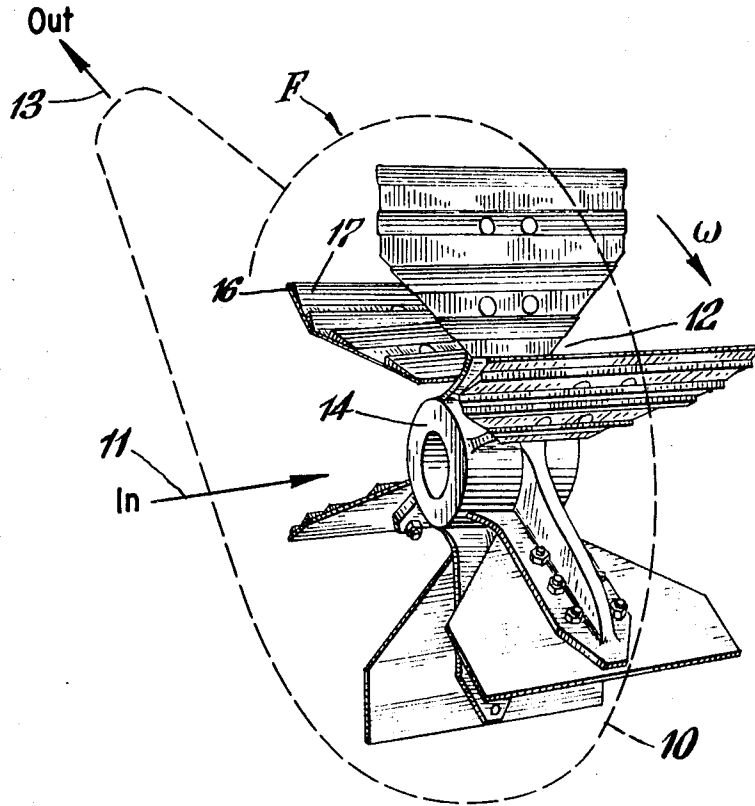


Fig. 1.

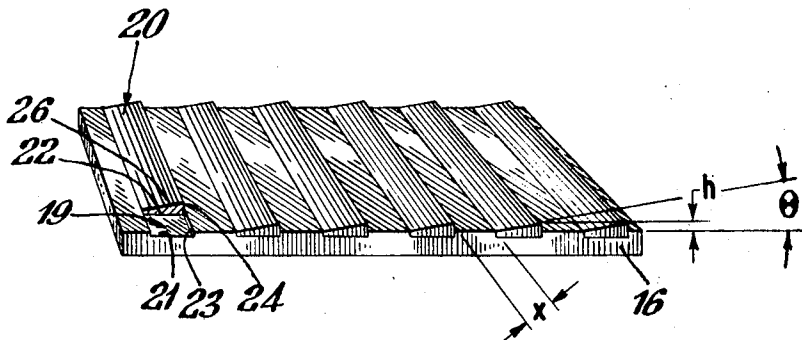


Fig. 2.

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FAN BLADE HAVING WEAR-RESISTANT RIBS AND FAN INCLUDING A PLURALITY OF SAME

This invention relates to fan blades and to fans having a plurality of fan blades as a part thereof. While not limited thereto, the fan and fan blades of the invention are particularly well suited for utilization in applications wherein the fan blades contact solid particles. For example, it is common practice in many power plants utilizing pulverized coal as a fuel, to blow the same into the boilers with a multibladed fan resembling a paddle wheel.

The fans usually include an outer casing or scroll containing a rotor assembly. The rotor assembly generally consists of a rotor having a plurality of blades extending radially outward therefrom toward the wall of the casing. The blades are generally formed from hardened steel plate in order to resist rapid erosion by the pulverized coal. Nevertheless, erosion is severe and accordingly, blade life is relatively short. In many boiler plants, the fan blades are replaced about every 6 months. This is both a time consuming and costly operation.

It is an object of the invention to provide a fan blade which will not erode easily when subjected to contact with solid particles;

Another object is to provide a fan having fan blades which are particularly well suited for propelling solid particles such as pulverized coal and the like into a boiler and which will exhibit a substantially longer service life than those of the prior art.

In the drawings:

FIG. 1 is a perspective view of the fan of the invention with the casing shown in broken lines to illustrate the rotor assembly, and

FIG. 2 is a perspective view of a fan blade of the invention, a portion thereof being shown in section.

According to the invention, a fan blade having a working surface is provided with a plurality of ribs extending across it, the same being spaced along the length of the blade. The ribs have an exposed surface containing a wear-resistant material. Preferably, each rib is substantially in the form of a right triangle in cross section, including a base portion, a sidewall portion and an inclined surface portion. Preferably, the working surface of the blade is provided with a plurality of grooves extending across its width for receiving the wear-resistant ribs.

A fan is provided according to the invention and includes a casing and rotor assembly. The rotor assembly includes a plurality of blades having wear-resistant ribs as briefly described above and as more particularly described hereinafter.

Referring now to the drawings, a fan F is provided and includes a casing or scroll 10 having a rotor assembly 12. The rotor assembly includes a rotor 14 having a plurality of blades 16 connected thereto. The blades 16 extend radially outward from the rotor 14 toward the wall of the casing 10. The fan casing 10 is provided with an intake opening 11 and an exhaust opening 13. The fan also includes a drive means (not shown) connected to the rotor 14 in a conventional manner. Each of the blades 16 has a working surface 17 which contacts solid particles, e.g. pulverized coal, as the rotor 14 is rotated during normal operation. Preferably, each blade has a plurality of substantially rectangular grooves 19 having a base 21 and sidewalls 23. The grooves extend across the width of the working surface and are spaced along the length thereof. A plurality of wear-resistant ribs 20 extend outwardly from the grooves 19 into the path of particles being propelled by the fan.

The grooves and ribs are so aligned with respect to the blade that when the blades are assembled onto the rotor 14, they will be in a direction substantially parallel with the axis of the rotor.

The ribs 20 are substantially in the form of a right triangle in cross section, having a base portion 22, a sidewall portion 24 and an inclined surface portion 26. Preferably, the base portion 22 of each rib is bonded to the base 21 of each groove 19, either by brazing or with an adhesive cement. The advantage gained by the use of a groove which is adapted in shape to receive each rib is that the forces set up during rotation of the

blades act to push the ribs tightly against the base and sidewalls of the groove. This prevents the ribs from breaking away from the blades which would be more prevalent if they were bonded directly to a nongrooved working surface. The outer surface of ribs 20 contain a wear-resistant material such as tungsten carbide or other material known to be highly wear-resistant. The ribs 20 may be fabricated entirely of wear-resistant material by known forming techniques, e.g. by a sintering process with or without some machining. The ribs may also be fabricated of a base metal having a wear-resistant coating applied to the outer surface thereof by a plasma-spraying process in a conventional manner. It is important that the height h and angle of inclination θ of the ribs as well as their spacing x along the length of the blades be constructed within certain limits. In order to substantially improve the service life of the blades, the angle of inclination θ should be between 50° and 30° and the spacing x between ribs should be one-half to 2 times the length of the base portion 22 of the ribs 20. In practice, the spacing x between ribs may be varied because of both hole locations. In this case, because the angle of the inclination will remain within close limits, the height h of the sidewall portions 24 of the rib will be the variable which will probably be adjusted substantially, depending upon the particular fan construction utilized. The substantially triangular ribs should point in the direction of rotation of the fan blades so that the solid particles contact the inclined surface portion 26 of the wear-resistant ribs instead of the working surface of the blades.

Steel fan blades having wear-resistant ribs with exposed surfaces containing tungsten carbide have exhibited substantially increased service life as compared with steel blades formed without ribs according to the prior art.

While the invention has been described in connection with the specific fan and fan blades shown in the drawings, it should be understood that various modifications and changes may be made without departing from the spirit and scope of the invention. For example, while the term fan blade has been utilized throughout the specification and claims, the term should also be interpreted to include an impeller blade. Substantially the same construction may be utilized in turbines and pumps as well as in fans.

What is claimed is:

1. In a fan blade designed for mounting in an outwardly extending radial fashion from a rotor so that the working surface of said blade is substantially forwardly aligned with respect to the direction of rotation of said rotor, the improvement comprising a plurality of ribs extending across said working surface and being spaced apart along the length thereof with the exposed surface of each rib containing a wear-resistant material and being shaped in the form of an inclined plane which rises in the outwardly extending direction.

2. Apparatus as claimed in claim 1, wherein each rib is substantially in the form of a right triangle in cross section including a base portion, a sidewall portion and an inclined surface portion, said base portion being bonded to the base of a mating groove in the working surface of the blade.

3. Apparatus as claimed in claim 2, wherein the angle of inclination formed between the inclined surface portion of the rib and the base of the rib is between 5° and 30° and wherein the spacing between ribs is one-half to 2 times the length of the base portion of the rib.

4. In a fan including a casing and rotor assembly wherein the rotor has a plurality of blades connected thereto and extending radially outward therefrom toward the wall of the casing with the working surface of each blade being substantially parallel with the axis of said rotor, the improvement comprising a plurality of ribs extending across said working surface and spaced apart along the length thereof with the exposed surface of each rib containing a wear-resistant material and being shaped in the form of an inclined plane the apex of which is at the edge away from said rotor.

5. A fan as claimed in claim 4, wherein the ribs have a coating of tungsten carbide on their exposed surfaces in order to make the same wear resistant.

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6. A fan as claimed in claim 4, wherein the working surface of each blade has a plurality of grooves extending across its width, each groove having a base and sidewalls, said ribs being bonded to the blades in the grooves thereof.

7. A fan as claimed in claim 6, wherein each rib is substantially in the form of a right triangle in cross section including a base portion, a sidewall portion and an inclined surface portion, said base portion being bonded to the base of the groove

in the working surface of the blade.

8. A fan as claimed in claim 7, wherein the angle of inclination formed between the inclined surface portion of each rib and the base of each rib is between 5° and 30° and wherein the spacing between ribs is one-half to 2 times the length of the base portion of each rib.

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