Feb. 15, 1938. H. F. HAGEN 2,108,435

FAN

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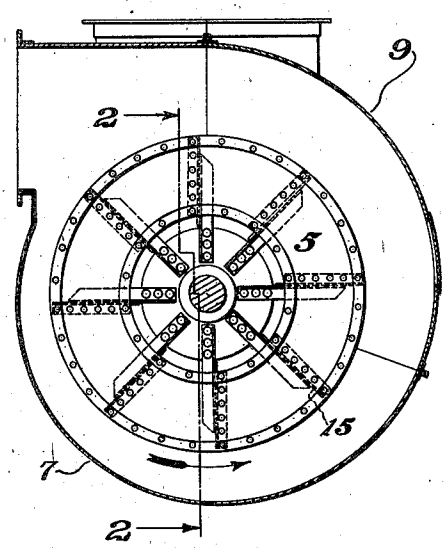


Fig. 1

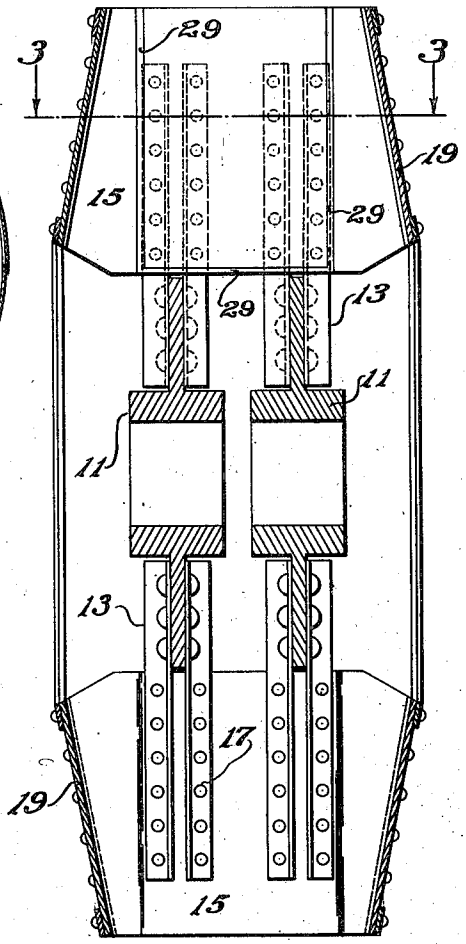


Fig. 2

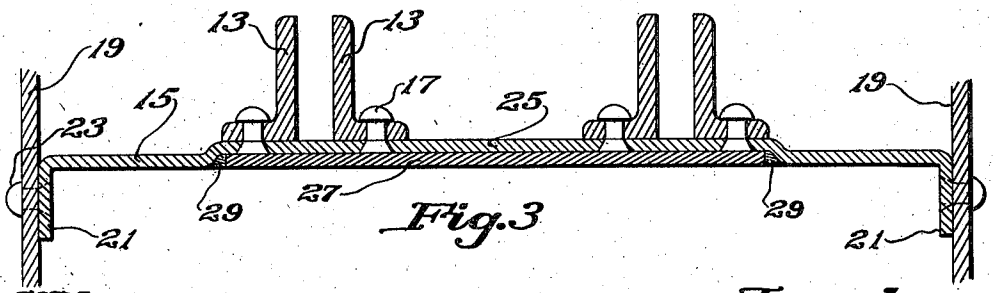


Fig. 3

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FAN

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4 Claims. (Cl. 230—132)

This invention relates to fans, and more particularly to fans which are required to handle air or gases in which abrasive material is suspended. The object of the invention is to provide a fan which will permit operation with a minimum of erosion from such abrasive material, in which none of the main structural parts of the rotor will be subjected to the erosive action of the suspended material, and in which those portions of the rotor subject to erosion may be quickly and cheaply replaced.

It has been found that fans which handle air or gases in which particles of abrasive matter are suspended are subject to erosion from the scouring action of such particles on the blades of the rotor. The problem of erosion has become particularly serious in connection with induced draft fans of power plants, the ashes and cinders present in the hot flue gases producing rapid and destructive erosion of the fan blades at the high rotational speeds now commonly used. In certain cases the erosion has been so rapid that after a comparatively short period of operation the blades have been cut completely through in places and the rivets sheared off, so that the whole rotor structure is so weakened and damaged that repair or replacement is required.

In the present invention the portions of the blades subject to erosion are covered on their advancing faces by removable or replaceable plates which serve as a supplementary driving face which protects from destructive erosion the main blades and the rivets holding them to the supporting arms. Not only may these plates be formed of a material particularly resistant to the erosive action of the abrasive material, thus prolonging the period of use before replacement is required, but when these supplementary driving faces do become worn from erosion, they may be removed and new ones inserted, the replacement being simple, rapid, and inexpensive, and in marked contrast to the repair of a conventional type of fan rotor weakened by erosion.

Referring to the accompanying drawing illustrating the preferred embodiment of the invention, Fig. 1 is a side elevation of the rotor of a centrifugal fan, with the housing shown in section; Fig. 2 is an axial section on line 2—2 of Fig. 1 on an enlarged scale; and Fig. 3 is a section along the line 3—3 of Fig. 2 transversely of one of the blades and on a still larger scale.

In the drawing, a double inlet fan rotor, indicated generally at 5, is mounted in a scroll casing 7 having a removable section 9 to give free access to the rotor or for removal of the same if desired. Flanked hubs 11 carry radial angle iron arms 13 riveted at their inner ends to the hub flanges and carrying at their outer portions the blades 15 secured thereto by means of rivets 17. The ends of the blades are attached to the side plates or shrouds 19 by forwardly-bent riveting flanges 21 and rivets 23.

Centrifugal fans of the double inlet type above described are commonly employed as induced draft fans in boiler plants, and in the central portions of the driving faces of the blades have been found to be subject to the most serious erosion. This is due to the fact that the cinders and ashes present in the flue gases tend to concentrate at these places, as a result of the converging of the two streams of flue gases entering the rotor axially from opposite directions and commingling to form a radial discharge in a single stream. The blades, moving at high velocity, contact the concentrated stream of cinders with considerable force or pressure, resulting in a violent scouring action by the abrasive material which gives rise to the destructive erosion.

According to the present invention replaceable erosion plates are provided to form a protective driving face for the blades in the zone of substantial erosion and upon which the scouring action of the cinders may be expended without injury to the structure of the rotor. Since these plates are not essential to the support or rigidity of the rotor, they may be made of some soft metal which is more resistant to erosion than the harder steel necessary for the conventional type of blade.

In order to provide for the mounting of these erosion plates on the advancing face of the blade and flush with adjacent portions thereof, a plate-receiving recess is formed in the face of the blade by offsetting rearwardly a portion thereof. Preferably this recess extends radially outward from the inner to the outer edges or margins of the blades and is of a depth equal to the thickness of the erosion plate.

Thus, in the drawing, the middle portions 25 of each blade is offset rearwardly to form a recess in which is received the plate 27, the front or advancing face of which is flush with the front face of the adjacent portions of the blades. The plate is secured by forming a continuous weld 29 along the sides and the inner edge of the plate, thereby providing a smooth and unbroken surface across the entire front face of the blade from end to end as well as from the inner to the outer edges.

The recess in the blade, it will be noted, is formed by a bending or shaping of the sheet metal of which the blade is constructed, the full thickness of the metal being retained. Furthermore, the two double bends extending radially from the inner to the outer edges of the blade increase very materially the strength and stiffness of the blade.

When the erosion plates become worn and new ones are to be substituted, it is necessary only to remove a section of the rotor housing, leaving the rotor in place. The retaining weld holding the plate in position is fused out, the worn plate removed and a new one positioned and welded in place. By turning the rotor to bring successive blades before the opening, made by the removal of the section of the casing, the same operation may be performed on all the blades in rapid succession. The section of the housing is then replaced, and operation of the fan is resumed.

While the present invention has been illustrated and described in connection with a particular type and construction of fan rotor, it is to be understood that it is not limited thereto except where so specifically defined in the claims, and that except as so limited, may be embodied in other forms and arrangements within the language and scope of such claims.

Having thus described the invention, what is claimed is:

1. A fan rotor having blades and supporting means therefor, the blades being offset rearwardly with respect to the direction of rotation to strengthen the blades and to form a recess extending the radial depth of the blades and occupying a substantial portion of the axial length thereof, and plates affixed in said recess by welding along the inner and side edges to afford an uninterrupted driving face, said plates forming replaceable driving faces in the zones of the blades subject to substantial erosion.

2. A fan rotor having blades, the blades being offset to form a recess in the advancing face of the blade intermediate its ends, supporting means for the blades including radial angle iron arms secured by rivets to the recessed portion of the blades, and plates affixed in said recesses and overlying the rivets to protect the rivets and to form replaceable driving faces in the zone of the blades subject to substantial erosion.

3. A fan rotor having blades with a portion of their driving faces offset rearwardly with respect to the direction of rotation to strengthen the blades and to form a recess, erosion plates removably affixed in the recesses to provide replaceable driving faces in zones subject to erosion, and supporting and driving arms secured to the offset portions of the blades directly beneath the erosion plates whereby the weight and thrust of the plates are transmitted directly to the arms.

4. A fan rotor having sheet metal blades, the blades being formed with two sets of reverse bends extending radially of the blades, one of the bends of each set being turned rearwardly with respect to the direction of rotation, and the others of the bends being turned axially towards each other to form a shallow recess in the face of the blade with rearwardly offset bottom extending from the inner to the outer edge of the blade, erosion plates extending the length and width of the recess and of a thickness equal to the depth of the recess mounted in the recess, means substantially flush with the advancing face of the blades and plates for securing the plates in the recess, and means secured to the offset bottoms of the recesses for supporting and rotating the blades.

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