F. R. STILL.

CENTRIFUGAL FAN.

APPLICATION FILED JAN. 14, 1910.

1,020,725.

Patented Mar. 19, 1912.

Fig. 1.

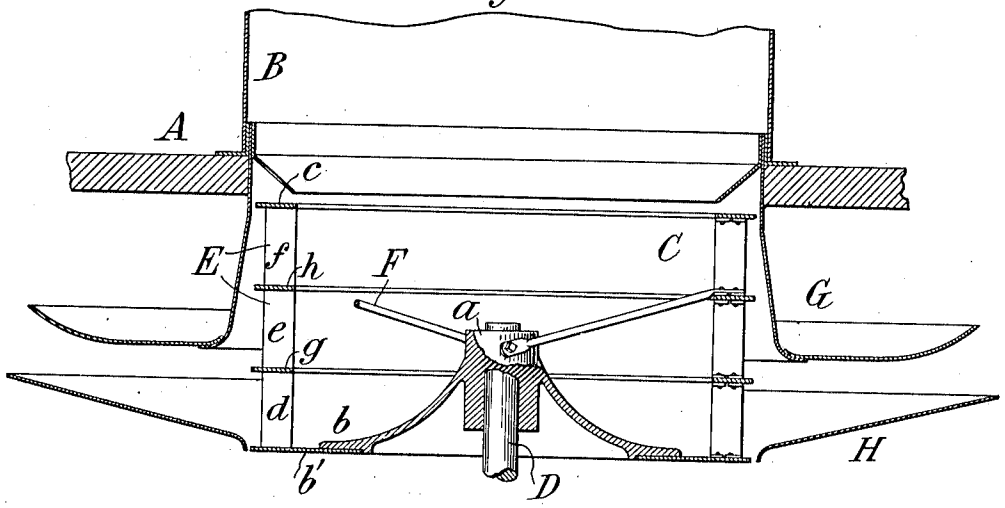


Fig. 3.

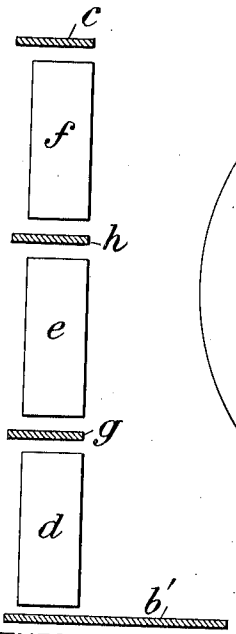


Fig. 2.

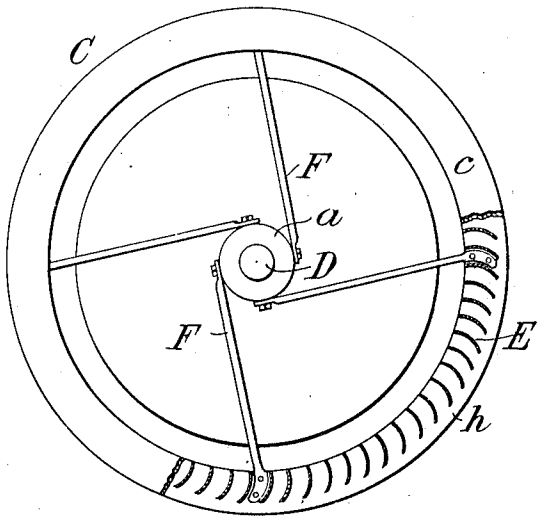


Fig. 4.

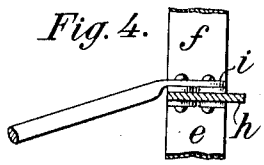
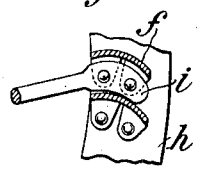


Fig. 5.



WITNESSES:

Fred White

René Bruine

INVENTOR:

Frederick R. Still,

By Attorneys,

Schum & Fraser & Elsing

UNITED STATES PATENT OFFICE.

FREDERICK R. STILL, OF DETROIT, MICHIGAN, ASSIGNOR TO AMERICAN BLOWER COMPANY, OF GREEN ISLAND, NEW YORK, A CORPORATION OF NEW YORK.

CENTRIFUGAL FAN.

1,020,725. Specification of Letters Patent. **Patented Mar. 19, 1912.**

Application filed January 14, 1910. Serial No. 537,987.

To all whom it may concern:

Be it known that I, FREDERICK R. STILL, a citizen of the United States, residing at Detroit, in the county of Wayne and State of Michigan, have invented certain new and useful Improvements in Centrifugal Fans, of which the following is a specification.

This invention relates to centrifugal fans of the well-known Sirocco type having numerous blades elongated in axial direction, and arranged in drum form to inclose within them a relatively large intake chamber.

The object of the invention is to strengthen such fans against centrifugal stresses when driven at exceptionally high speeds.

It has been customary in constructing such multi-blade fans to make the blades in one piece the length of the fan or drum, and to support them at opposite ends by riveting them to rings or a ring and disk. In some instances the blades have been strengthened by applying a ring or rings exteriorly to the drum. It has been customary to employ radial or slightly tangential stays or tie rods for centering the fan or drum and for resisting centrifugal stresses. In some instances the blades have been divided longitudinally into two or more sections with a flat ring between the sections to which they are riveted. According to the present invention the blade is divided into such sections, preferably three in number, and preferably of equal length, and flat rings are fastened between the respective sections, and instead of connecting the usual stays or tie-rods to the outer or end ring, they are connected to one of the intermediate rings in such manner that the centrifugal stress of the sections on opposite sides of such ring is approximately balanced, and is transmitted through the ring and stays to the hub.

Referring to the accompanying drawing,—Figure 1 illustrates a high speed fan embodying my invention applied upon a vertical axis as a ventilating fan; Fig. 2 is a plan thereof partly in horizontal section; Fig. 3 shows the three sections of one blade and their connected rings and disk slightly separated; Fig. 4 is a fragmentary section, being an enlargement of a portion of Fig. 1; Fig. 5 is a horizontal section, being an enlargement of a portion of Fig. 2.

In the particular construction shown in Fig. 1, the fan is applied for drawing air down through a deck, roof, or floor A through a tubular conduit or throat B. The fan wheel C is mounted on a vertical shaft D, the bearings for which are not shown. The fan wheel comprises a hub *a* carrying a disk *b*, the numerous blades E E which are disposed cylindrically or in drum form around the axis, and the customary end ring *c*. Ordinarily the blades E E extend from the disk *b* to the ring *c*. According to the present invention the blades are divided preferably into three sections, lettered *d e* and *f* respectively, and which are preferably of equal length, so that in practice the same blade punchings can be used for each of the three sections. Between these sections flat rings *g* and *h* are introduced, and the blade sections are fastened to them in any suitable manner, usually by riveting through ears struck up from the blade sections. The disk *b* is customarily formed partly as a flange cast upon the hub and partly as a flat disk or ring *b'*. Thus the blade sections *d* are riveted between the disk ring *b'* and the ring *g*; the sections *e* are riveted between the rings *g* and *h*; and the sections *f* are riveted between the rings *h* and *c*. Stays or tie rods F F are connected between the hub D and the ring *h*. These stays are connected tangentially to the hub (as in Davidson Patent No. 691,609), so that they carry tensionally a considerable part of the driving stress or torque. Their principal function, however, is to center the fan wheel or drum and resist centrifugal stresses. Heretofore it has been customary to connect these stays F F to the outer or end ring *c*, so that the blades are supported only at their opposite ends. In fans driven at exceptionally high speed, it results that the middle portions of the blades, being unsupported, tend to bow outward. Subdividing the blades into sections and interposing the flat rings *g* and *h* which are shaped to resist centrifugal stresses, results in strengthening the blades, but with the old arrangement of stays the middle sections *e* are supported only through the terminal sections and intervening rings. By connecting the stays to the intermediate ring *h*, this ring is strongly supported and centered. The centrifugal stresses communicated from the sections *e* and *f* on opposite sides of this ring, substantially balance one another, so that there is no unequal stress upon the ring, and

the balanced stresses are transmitted in the plane of the ring to the points at which the stays are attached. Thus each blade section is connected at one end to a strong and rigidly centered support, namely, to the disk *b* or ring *h*, the opposite ends of the blade sections being connected to the rings *g* and *c* which are supported and centered from *b* and *h* through the intermediation of the blade sections.

As compared with the old construction, the improvement provided by this invention renders the fan wheel or drum from 8 to 16 times as strong in its resistance to the centrifugal stresses developed at high speeds.

Heretofore the outer ends of the stays F have been fastened to the exterior of the fan wheel, that is to say, to the outer side of the terminal ring *c*. Thus the stays have passed through the series of blades, which necessitated perforating or notching the blades. Another construction is to rivet bosses to the ring having inward projections to which the stays are attached; but this has been found to diminish the volume of air as much as 15 per cent. The present invention introduces the outer ends of the stays into the ports or spaces between the blades. As these spaces are somewhat narrow and with the usual curved blades are necessarily curved, it is preferable to make the flattened terminal portion *i* of the stay nearly as wide as will fill this space, and to curve it to conform to the space or approximately so, as best shown in Fig. 5. The blade sections *f* are customarily constructed with ears turned up from them through which the attaching rivets are passed. It is preferable to place the flattened portion *i* so as to overlie these ears, as shown in Fig. 4, and to form holes through it coinciding with those through the ears, and to utilize the same rivets which fasten the ears of both sections *f* and *e* as the fastening also for the stay. This affords a very strong construction which lends itself to the use of the ordinary punchings for the blade sections and the ordinary attachment therefor, and avoids perforating the blades to admit the passage of the stay rods. By avoiding any obstruction to the inflow of air it also conserves the maximum volumetric capacity of the fan.

The drawing shows a fixed hood or casing G, and a hood or cone H for directing the blast of air from the fan.

I claim as my invention:—

1. A centrifugal fan having a hub or disk and numerous elongated blades arranged in drum form to inclose within them a relatively large intake chamber, said blades attached at one end to said disk, and a ring to which their opposite ends are attached, said blades subdivided into sections with intervening rings to which they are fastened, and stays connecting said hub to the inner portion of an intervening ring, said stays having their outer ends entering the spaces between successive blades and riveted to the ring.

2. In a centrifugal fan of the multi-blade drum type wherein the blades are divided into sections with an intervening ring, the blades having ears riveted to said ring, the combination therewith of stays for resisting centrifugal stress, having their outer ends entering the spaces between adjacent blades, overlying the ears of a blade, having holes coinciding therewith, and rivets passing through said holes for fastening both the blade and stay.

3. In a centrifugal fan of the multi-blade drum type wherein the blades are curved forwardly and are divided into sections with an intervening ring, the combination therewith of stays for resisting centrifugal stress, having their outer ends flattened and entering the spaces between adjacent blades, and curved to approximately conform to such spaces, and rivets fastening said flattened ends to said ring.

4. In a centrifugal fan of the multi-blade drum type wherein the blades are curved forwardly and are fastened to a ring at one end and a ring or disk at the other, the combination therewith of stays for resisting centrifugal stress, having their outer ends flattened and entering the spaces between adjacent blades, and rivets fastening such flattened ends to the ring.

5. In a centrifugal fan of the multi-blade drum type wherein the blades are curved forwardly and are fastened to a ring at one end and a ring or disk at the other, the blades having ears riveted to said ring, the combination therewith of stays for resisting centrifugal stress, having their outer ends entering the spaces between adjacent blades, overlying the ears of a blade, having holes coinciding therewith, and rivets passing through said holes for fastening both the blade and stay.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

FREDERICK R. STILL.

Witnesses:
T. CHESTER,
C. H. TREAT.