

Nov. 30, 1937.

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2,100,489

FAN

Filed July 31, 1936

3 Sheets-Sheet 1

Fig. 1

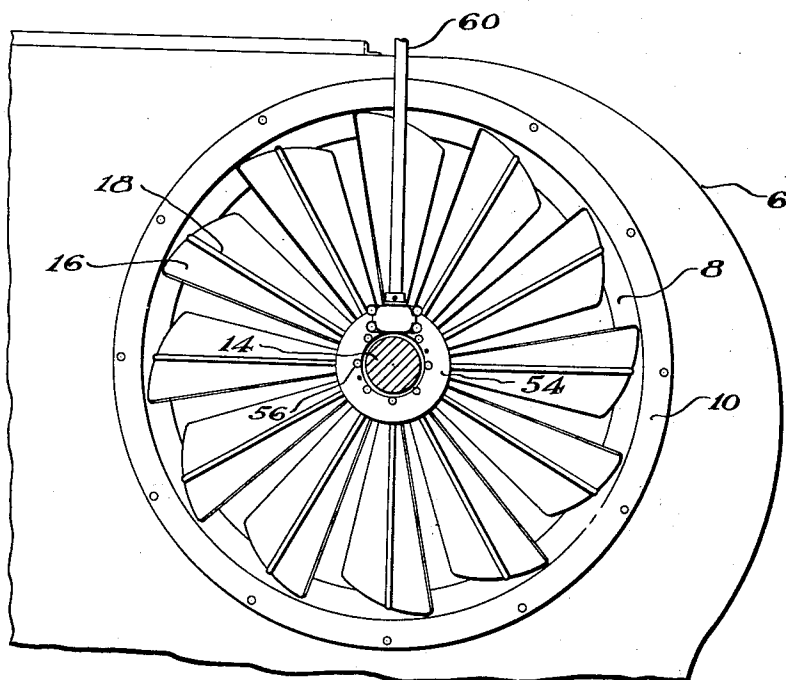
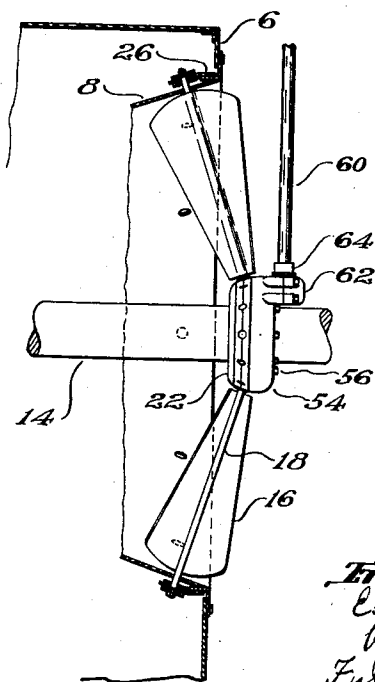


Fig. 2



Witness

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Fig. 3

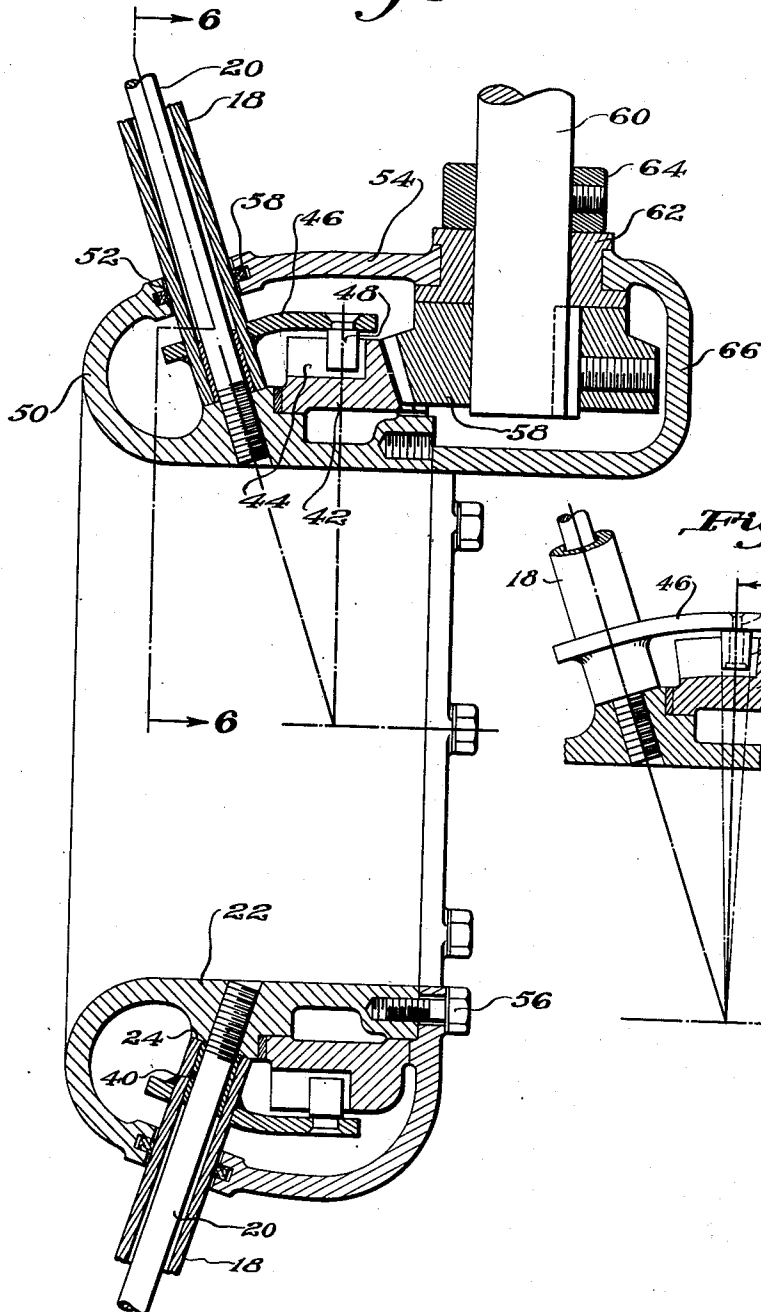
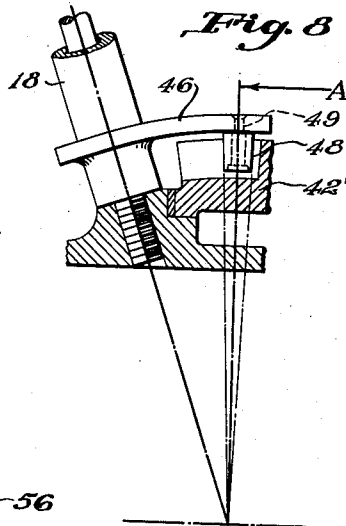


Fig. 8



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Fig. 4

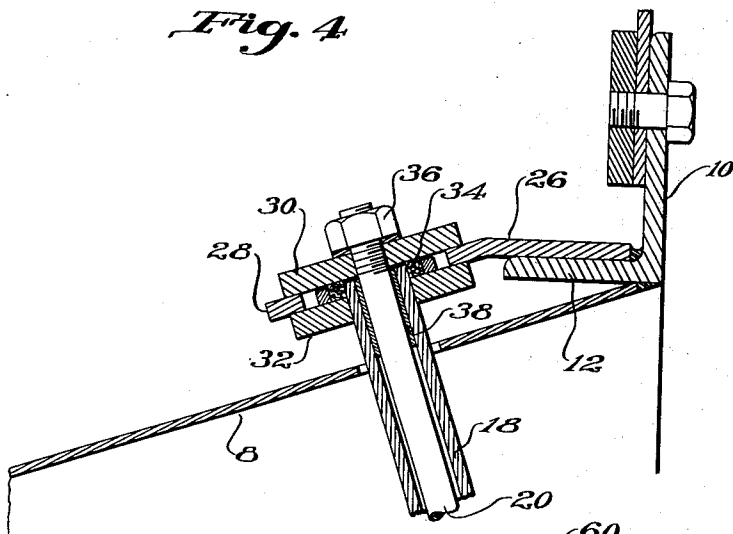


Fig. 5

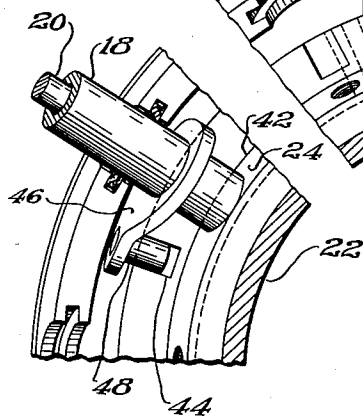


Fig. 6

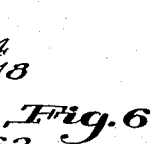
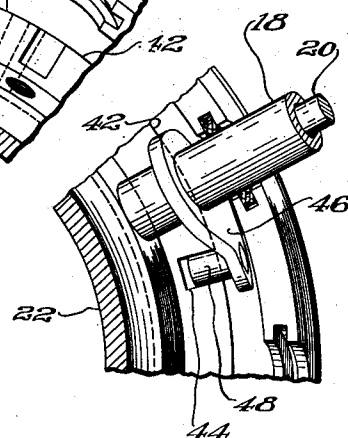


Fig. 7



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UNITED STATES PATENT OFFICE

2,100,489

FAN

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Application July 31, 1936, Serial No. 93,550

11 Claims. (Cl. 230—114)

The present invention relates to centrifugal fans and more particularly to fans of the vane control type disclosed in the patent to Hagen No. 1,989,413.

The principal object of the present invention is to provide a simple and reliable mechanism for operating the vanes with a particular view to smooth operation without cramping.

Another object of the invention is to provide a vane control mechanism in which the operating parts are protected against the entrance of dust and dirt.

With these and other objects in view as will hereinafter appear, the present invention comprises the fan hereinafter described and particularly defined in the claims.

In the accompanying drawings, Fig. 1 is an end elevation of a fan embodying the features of the present invention; Fig. 2 is a sectional view showing the vane assembly; Fig. 3 is an enlarged sectional elevation of the hub and associated parts; Fig. 4 is an enlarged sectional detail view showing the mounting of the supports; Figs. 5, 6 and 7 are detail views showing the vane operating members in different positions, Fig. 6 being a section on line 6—6 of Fig. 3; and Fig. 8 is a view of a modified arrangement.

The fan illustrated in the drawings comprises a forced draft centrifugal fan having a casing 6 and a converging or cone inlet 8. Secured to the housing is an inlet support 10 having an inwardly directed cylindrical flange 12 to which the inlet 8 is welded. The fan is provided with a shaft 14 on which is mounted a wheel or rotor 16 of any suitable form.

Located within the inlet on pivots perpendicular to the wall thereof is a series of adjustable vanes 16 which, as described in the Hagen patent, are for the purpose of regulating the flow of air to the fan. Each vane is secured to a tubular sleeve 18 which is adapted to rotate on an internal pivot or supporting rod 20.

The inner end of each rod 20 is threaded into a central hub 22 which surrounds the shaft but is free thereof. The several sleeves 18 rest at their inner ends on a conical surface 24 formed on the hub. The outer end of each rod 20 is supported on a bracket 26 which is secured to the flange 12 and has a portion 28 parallel to the elements of the conical inlet 8. Securing plates 30 and 32 are bolted together on opposite sides of the bracket plate 28. The sleeve 18 passes through the lower plate 32 and is positioned within the opening in the bracket plate 28 by packing 34. The rod and sleeve assembly is held

in place by a nut 36 on the end of the rod 20. The sleeve 18 is spaced from the rod 20 by bushings 38 and 40 at opposite ends. The arrangement thus far described permits accurate location of the pivot rods by virtue of the adjustable relation between the plates 30 and 32 and the bracket plate 28.

Journalled on the hub 22 is a rotary actuating member or ring 42 having a cylindrical portion provided with axial parallel wall grooves 44. Secured to each sleeve 18 is an operating crank 46 having at its end a cylindrical pin 48 received tightly within the groove 44. As shown in Fig. 3 the cranks are bent to permit attachment to their corresponding sleeves and cause the pins 48 to be received in the grooves 44. The arrangement is such that rotary movement of the member 42 rocks the cranks 44 and turns the sleeves 18 and effects simultaneous adjustment of the vanes.

To enclose the operating assembly and prevent entrance of dust and cinders the hub 22 is curved outwardly around the adjusting mechanism, as indicated at 50, and is provided with a series of semi-circular recesses 52 which register with correspondingly shaped recesses on a cover member 54 secured to the hub by bolts 56. The recesses are grooved to receive packing 58 which surrounds the sleeve.

To operate the vanes, the rotary member 42 is provided over a portion of its circumference with bevel gear teeth which mesh with teeth on a bevel gear segment 58. The segment 58 is keyed to a shaft 60 which is journalled in a bushing 62 and held in place by a collar 64. The bushing 62 is held between the cover member 54 and a cap 66 which is bolted thereto. All of the vanes are simultaneously adjusted to the same angular position by rotating the shaft 60.

A feature of importance is the relative arrangement of the pivots and the operating pins 48. The axis of each pivot sleeve 18 intersects with the axis of each pin 48 at the center line of the shaft which is also the axis of the rotary member 42. Regardless of the position of the rotary member the axis of each pin 48 intersects the pivot axis at the same point. In other words, rotation of the member 42 maintains one side of the cylindrical pin 48 always in line contact with one wall of the groove 44. This is illustrated in Figs. 5, 6 and 7. In Fig. 5, the sleeve 18 is shown in the position for the fully closed vanes, in Fig. 6 the sleeve is midway between the positions for open and closed vanes, and in Fig. 7 the sleeve is in position for full opening of the vanes. It will be understood that the pins 48 move in and

out axially of the grooves as the ring 42 is rotated but there is no cramping between the pins and the side walls of the grooves.

A modified form of the invention is shown in Fig. 8. The ring 42' is formed as a portion of a sphere with its center in the axis of the shaft, and the groove 44' is milled on a spherical curve. The pin 48' is a roller which is mounted on a stud 49 on the arm 46. The pin 48' is conical with its elements at such an angle that they would, if extended, intersect in the axis of the shaft. The walls of the groove are inclined to conform to the pin, that is, a section taken on line A of Fig. 8 or on any other radius of the sphere would show the same inclination of the walls. The axis of the pivot sleeve 18 passes through the center of the sphere. It will be seen that upon movement of the ring 42', the pin 48' moves on a small circle of the sphere, and that the axis and all elements of the pin always point toward the common center. The contact between the pin and either wall of the groove is therefore an anti-friction rolling contact.

The construction of Fig. 8, although entirely practical, is rather expensive to manufacture, and therefore may be considered as an idealized form of the construction previously described, in which the pins 48 are cylindrical and are fixed on the arms 46. Rolling or anti-friction contact is not obtained, but a substantial line contact is obtained, so that the apparatus operates satisfactorily with a minimum of wear. In either form of the invention, the substantial contact obtainable is to be distinguished from the point contact which would result from the use of a ball member, as would be necessary if the proper relation of the operating ring and the pivot sleeves were not maintained.

A further feature is the enclosure of the operating parts by the hub 22, the cover 54 and the cap 66. This is particularly necessary for induced draft fans which handle dust and cinders. For induced draft operation, an inlet box is connected to the inlet support 10, and the vane operating shaft is run through the wall of the inlet box.

Although one specific embodiment of the invention has been described, it will be understood that the invention is not limited to the particular arrangement shown and described but may be modified, except as limited by the appended claims.

The invention having been thus described, what is claimed is:

1. A fan having a shaft, an inlet, a plurality of simultaneously adjustable vanes, a hub, a support for each vane to permit pivotal movement of the vane about an axis substantially perpendicular to the inlet wall and oblique to the axis of the shaft, a rotary actuating member having a plurality of grooves, a crank on each vane support, and a member on each crank received in a corresponding groove of the actuating member and conforming to the walls of the groove in line contact therewith, all of said members and vane supports having axes intersecting in the axis of the rotary member to permit adjustment of the vanes by the rotary member without cramping of said members in the grooves.

2. A fan having a shaft, a converging inlet, a plurality of simultaneously adjustable vanes, a hub, a support for each vane to permit pivotal movement of the vane about an axis substantially perpendicular to the inlet wall and oblique to the axis of the shaft, a rotary actuating member hav-

ing a plurality of grooves, a crank on each vane support, and a member on each crank received in a corresponding groove of the actuating member and conforming to the walls of the groove in line contact therewith, all of said members and vane supports having axes intersecting in the axis of the rotary member to permit adjustment of the vanes by the rotary member without cramping of said members in the grooves.

3. A fan having a shaft, an inlet, a plurality of simultaneously adjustable vanes, a hub, a support for each vane to permit pivotal movement of the vane about an axis substantially perpendicular to the inlet wall and oblique to the axis of the shaft, a rotary actuating member having a plurality of parallel wall grooves, a crank on each vane support, and a cylindrical pin on each crank received in a corresponding groove of the actuating member, all of the pins and vane supports having axes intersecting in the axis of the rotary member to permit adjustment of the vanes by the rotary member without cramping of the pins in the grooves.

4. A fan having a shaft, a converging inlet, a plurality of simultaneously adjustable vanes, a hub, a support for each vane to permit pivotal movement of the vane about an axis substantially perpendicular to the inlet wall and oblique to the axis of the shaft, a rotary actuating member having a plurality of parallel wall grooves, a crank on each vane support, and a cylindrical pin on each crank received in a corresponding groove of the actuating member, all of the pins and vane supports having axes intersecting in the axis of the rotary member to permit adjustment of the vanes by the rotary member without cramping of the pins in the grooves.

5. A fan having a shaft, an inlet, a plurality of simultaneously adjustable vanes, a hub, a support for each vane to permit pivotal movement of the vane about an axis substantially perpendicular to the inlet wall and oblique to the axis of the shaft, a rotary actuating member having a plurality of longitudinal grooves formed on a sphere with its center in the axis of the rotary member, a crank on each vane support, and a roller on each crank, each roller being conical with elements which if extended would intersect at the center of the sphere, the walls of the grooves of the actuating member being inclined to conform to the conical rollers, and the vane supports having axes intersecting at the center of the sphere.

6. A fan having a shaft, a converging inlet, a plurality of simultaneously adjustable vanes, a hub, a support for each vane to permit pivotal movement of the vane about an axis substantially perpendicular to the inlet wall, a rotary actuating member having a plurality of longitudinal grooves formed on a sphere with its center in the axis of the rotary member, a crank on each vane support, and a roller on each crank, each roller being conical with elements which if extended would intersect at the center of the sphere, the walls of the grooves of the actuating member being inclined to conform to the conical rollers, and the vane supports having axes intersecting at the center of the sphere.

7. A fan having a shaft, a converging inlet, a plurality of simultaneously adjustable vanes, a hub, a plurality of rods for supporting the hub, sleeves on the rods to support the vanes, the axes of the rods and sleeves being substantially perpendicular to the inlet wall, and means for simultaneously adjusting the sleeves.

8. A fan having a shaft, a converging inlet, a plurality of simultaneously adjustable vanes, a hub, a plurality of rods for supporting the hub, sleeves on the rods to support the vanes, the axes of the rods and sleeves being substantially perpendicular to the inlet wall, and means for simultaneously adjusting the sleeves including a ring journaled on the hub and having a plurality of longitudinal grooves, a crank on each sleeve, and a cylindrical pin on each crank received in a corresponding groove of the actuating member, all of the pins and vane supports having axes intersecting in the axis of the rotary member to permit adjustment of the vanes by the rotary member without cramping of the pins in the grooves.
9. A fan having a shaft, a converging inlet, a plurality of simultaneously adjustable vanes, a hub, a support for each vane to permit pivotal movement of the vane, a cover, the hub and cover having complementary portions to sur-

round the vane supports, and operating means for the vanes enclosed within the hub and cover.

10. A fan having a shaft, a converging inlet, a plurality of simultaneously adjustable vanes, a hub, brackets outside the inlet, a plurality of rods attached at one end to the hub and at the other end to the brackets to support the hub, sleeves journaled on the rods and supporting the vanes, and means for rotating the sleeves simultaneously to adjust the vanes.

11. A fan having a shaft, a converging inlet, a plurality of simultaneously adjustable vanes, a hub, a plurality of rods for supporting the hub, sleeves on the rods to support the vanes, the axes of the rods and sleeves being substantially perpendicular to the inlet wall, a cover, the hub and cover being formed with recesses to engage the sleeves and to enclose the inner ends thereof, and operating devices enclosed within the hub and cover.

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