Jan. 27, 1948. H. A. MEYER 2,435,092

INLET VANE CONTROL APPARATUS WITH VANES SET AT AN ANGLE

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FIG. 1.

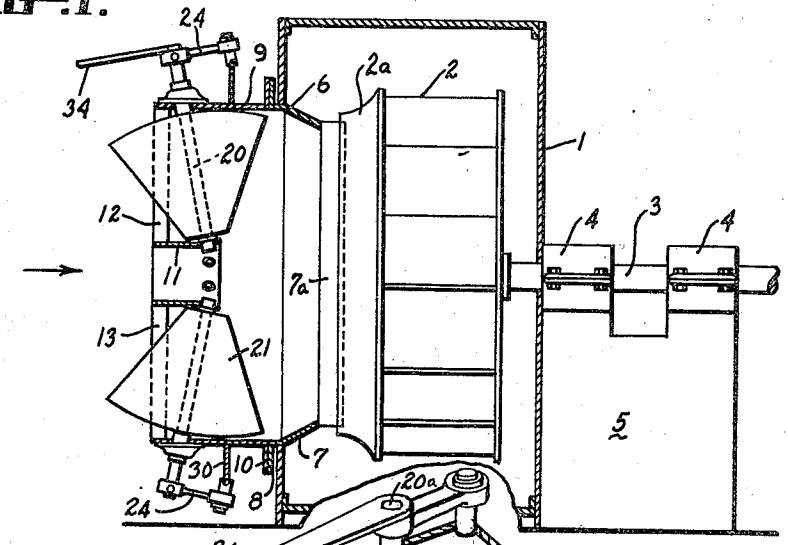
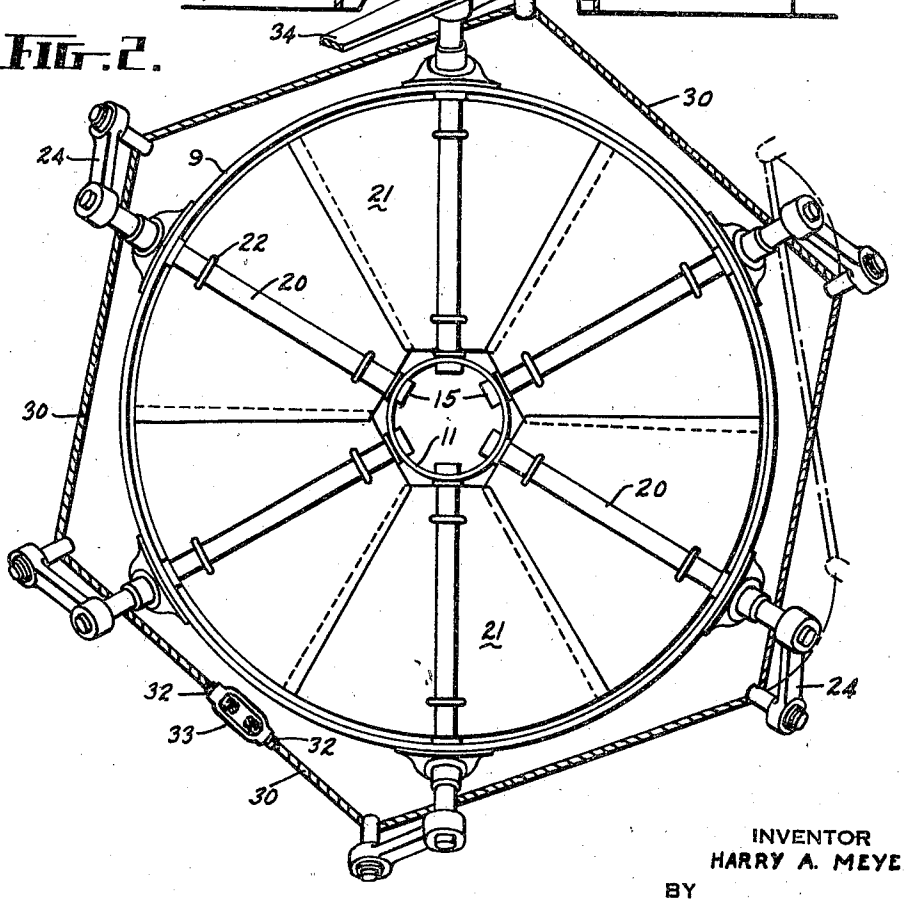


FIG. 2.



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FIG. 3.

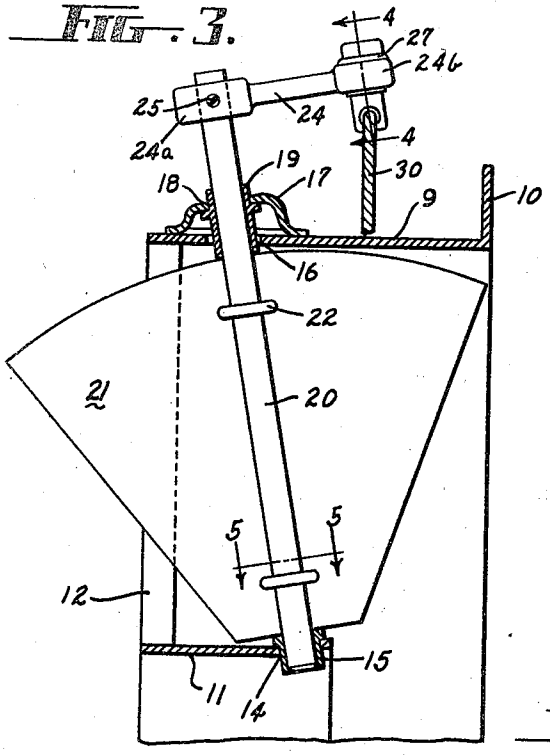


FIG. 4.

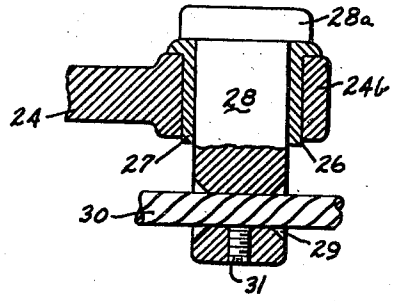


FIG. 5.

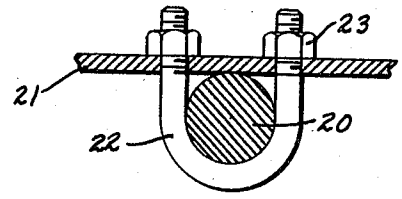


FIG. 6.

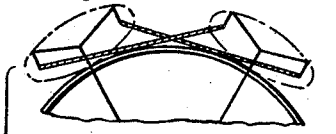
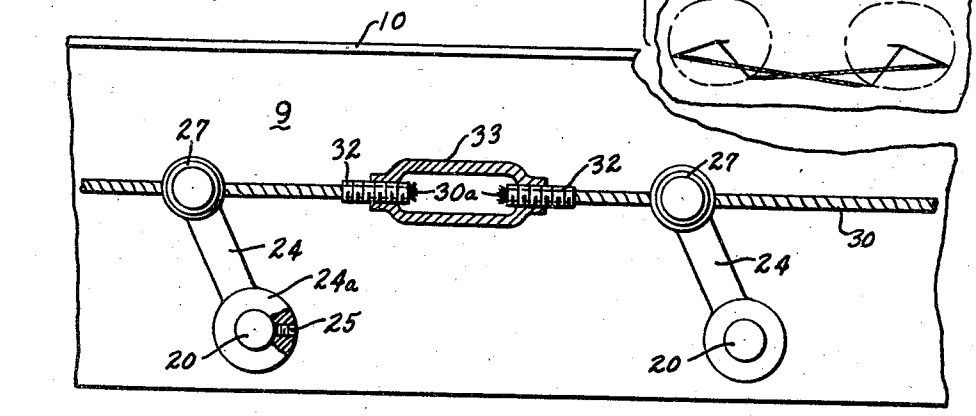


FIG. 7.



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INLET VANE CONTROL APPARATUS WITH VANES SET AT AN ANGLE

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Application November 1, 1944, Serial No. 561,408

6 Claims. (Cl. 230—114)

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The invention relates to vane control systems of the type wherein a plurality of vanes are mounted within an opening and are pivoted on axes extending generally radially of a central axis of said opening, together with means interconnecting said vanes for pivoting in unison between one position in which said vanes coact to substantially close the opening, and a second position in which they are moved into planes through the central axis, to leave the opening substantially unobstructed.

It is an object of my invention to provide a vane control system as described in the foregoing paragraph wherein the vanes are connected by a smoothly-operating efficient construction that is easy and inexpensive to build while at the same time having a minimum of moving parts whereby wear is reduced and the life of the control greatly increased.

It is a further object to provide a control as aforesaid wherein the vanes are interconnected by a single elongated cable element so that, when a torque is applied to adjust one vane, all others are simultaneously and equally adjusted.

A further object is to provide a vane control system as in the preceding paragraph, wherein the vanes are pivoted on concurrent, angularly-related axes, lying in the surface of a right circular cone with obtuse apex angle and having its axis substantially coincident with the central axis of the opening.

A still further object is to provide a vane control in which the vanes are pivoted on tilted concurrent axes and are attached to a tensioned cable element in such a manner that distance between successive connections remains substantially constant throughout the desired range of vane adjustment whereby the cable element is under tension throughout said range.

Another object is to provide connections between the vanes and cable element that are smooth and highly efficient in operation and that give precise control of the vanes in all positions of adjustment.

Other objects and advantages of my invention will become apparent as the description proceeds.

In the drawing:

Figure 1 is an elevation of the invention as applied to a centrifugal fan showing the fan casing and vane ring in cross section, and with the vanes in fully open position,

Figure 2 is a view looking along the central axis of the vane ring from the left of Figure 1, showing the vanes in closed position,

Figure 3 is an enlarged detailed view of one of

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the vanes, in open position as in Figure 1, with the vane ring and hub in cross section,

Figure 4 is a cross section substantially on the line 4—4, Figure 3, showing one cable pin, the manner of mounting it on a vane arm and the way in which the cable is secured thereto,

Figure 5 is a cross section taken on the line 5—5, Figure 3, showing the preferred manner of securing the vanes to their pivot rods,

Figure 6 is a diagrammatic view showing the cable connections between two adjacent vane arms in two limiting positions, of adjustment, and

Figure 7 is a view looking down upon a development of the vane ring and showing two adjacent vane arms and the turnbuckle connection between the ends of the operating cable.

Referring in detail to the drawing wherein like reference characters indicate corresponding parts throughout, and particularly to Figure 1, numeral 1 indicates the casing of a centrifugal fan of conventional type, having a bladed rotor 2, a shaft 3 supported in bearings 4 carried by a block 5. One side of the casing has an opening 6 within which is secured a shroud ring 7 having a flange 8 exterior of the casing. The ring 7 has a portion 7a extending within and closely spaced with respect to a ring 2a of rotor 2 whereby air entering the casing through the vaned opening is conducted to the interior of rotor 2.

A vane ring has a flange 10 mating with flange 8 of shroud ring 7, the two flanges being secured together in any desired manner, as by bolts. A hub 11 is located within and concentrically of vane ring 9 by a pair of diametrically arranged spokes 12 and 13. Hub 11 may consist of a section of pipe, and as shown at Figures 1 and 3, is preferably flared at its inner end. The flared portion of the hub is drilled at circumferentially spaced points to form holes 14 of the proper size to receive bushings 15, preferably in the form of "Oilite" bearings. These may have a press fit in the respective holes or may be secured therein in any other desired manner.

The vane ring 9 has formed therein, a series of openings 16, equal in number to the holes 14 in hub 11. Caps 17 are secured to ring 9, over each opening 16 and each has a hole 18 in which is secured, as by a press fit, a bushing or "Oilite" bearing 19. Each bushing 19 forms a pair with a respective bushing 15 in hub 11 and the respective pairs have their central axes aligned to form vanes axes which, as shown at Figures 1 and 3, lie in angularly related planes through the common central axis of ring 9 and hub 11, but which are equally tilted through an acute

angle with respect to a plane normal to said central axis.

Each pair of bushings 14 and 19 coact to pivotally mount a vane rod 20. While I have shown six rods in the particular installation selected for illustration, it will be understood that the number may be varied within reasonable limits, without departing from the principles of the invention. Each rod 20 has a vane 21 secured thereto, as by means of U-bolts 22 and nuts 23. These vanes are generally sector-shaped and dimensioned so that, in closed position the adjacent edges of sequential vanes overlap slightly to substantially close the opening through ring 9 and conjointly form a surface generally in the form of a truncated pyramid.

Each rod 20 projects exteriorly of ring 9 and has a radial arm 24 secured thereto, as by means of a set screw 25 within an apertured hub portion 24*a*. The outer or free end of each arm is enlarged to form a hub 24*b* having a hole 26 (Figure 4) within which is secured a bushing or "Oilite" bearing 27. A cable pin 28 having a head 28*a* is rotatably positioned within each bearing 27 and has a shank portion projecting from each arm and formed at its inward end with a transverse hole 29 having counterbored ends. A flexible element 30 which may be a metallic cable, cord, or chain, passes through the holes 29 and is secured within each hole as by means of set screws 31.

As shown at Figure 7, the ends of cable 30 are connected between an adjacent pair of arms 24. This connection may be conveniently effected by passing each end thru a nipple 32, then brooming and soldering the projecting end, as at 30*a*. A turnbuckle 33 is then turned onto the oppositely-threaded nipples to draw the cable taut. At least one of the rods 20 is formed with a non-circular end 20*a*, Figure 2, to receive a wrench or lever 34 having a correspondingly shaped aperture whereby, through the connection effected by cable 30, all vanes 21 may be simultaneously turned.

Figure 2 shows the vanes in closed position, and it will be noted that, in the preferred arrangement, each arm 24 is positioned at approximately 45° to the plane of its vane. When it is desired to move the vanes to open position, lever 34 is applied to the end of a rod and swung counter-clockwise to move all interconnected arms 24, the rods 20 and vanes 21 counter-clockwise to the dotted line position shown for one adjacent pair of arms. Due to the sloping of the vane rods 20 and the symmetrical position of the arms in their limiting positions, with respect to a plane normal to the central axis of the vane ring, the distance between adjacent cable pins is the same in both limiting positions and, in fact, is substantially the same throughout the entire range of adjustment of the vanes. By my invention, therefore, the cable or other connecting element remains taut throughout the range of vane adjustment and the vanes are thus under precise control at all times.

In assembling the vane control, the vanes are mounted in position and moved to proper closed position, with each arm 24 in the same angular relation with respect to its vane, the cable is threaded through holes 29 and nipples 32 soldered to the adjacent cable ends. Turnbuckle 33 is then applied and turned to place the cable under the desired tension, whereupon set screws 31 are turned down to clamp the cable to each arm in the proper position.

By the foregoing construction I have provided a vane control that is simple, and inexpensive to construct, yet positive and efficient in operation, and that gives smooth action and precise control of the vanes at all times. While I have shown my vane control as applied to the inlet of a centrifugal fan, I desire to have it understood that this is but one of many possible uses of the invention and that it is adaptive to any installation where it is desired to alter the effective size of an opening to precisely control the flow therethrough of fluids or granular or pulverous substances. Furthermore, numerous substitutions and modifications will be obvious to those skilled in the art. It is my intention to reserve all such substitutions and modifications as fall within the scope of the subjoined claims.

Having now fully described my invention what I claim is:

1. In a vane control system, an open frame defining a plane and having a central axis normal to said plane, a plurality of vanes, means pivotally mounting said vanes in said frame on angularly-related axes each lying in a plane through said central axis, each vane axis being inclined at the same acute angle to the plane of said frame, said vanes in one position of pivotal adjustment coacting substantially to close the opening in said frame, an arm fixed to each vane radially of its axis, and flexible cable means connecting the free ends of said arms whereby to connect the vanes for movement in unison throughout their range of adjustment.

2. In a vane control system, a ring having a central axis normal to the plane of said ring, a plurality of rods, means pivotally mounting said rods within said ring with their longitudinal axes lying in respective angularly-related planes through said central axis, each rod axis being inclined at equal acute angles with respect to the plane of said ring, a plurality of vanes, each secured to a respective rod and coacting in one position of pivotal adjustment, to substantially close said ring, an arm radially secured to each rod externally of said ring, a pin pivoted in each arm, and cable means sequentially connecting said pins, whereby all vanes may be synchronously adjusted.

3. A vane control comprising means having a generally circular opening therein said opening having a central axis normal to the plane of said opening, a plurality of sector-shaped vanes, means pivoting each vane within said opening upon the central radial axis of said vane, the said vane axes lying in respective angularly-related planes through said central axis and inclined at equal acute angles to said central axis, an arm rigidly connected with each vane radially of its axis, and flexible cable means sequentially connecting the ends of said arms whereby said vanes may be pivoted in unison conjointly to obturate said opening.

4. In combination with a vane ring having a central axis normal to the plane of said ring, a hub mounted centrally of and within said ring, a plurality of rods pivoted on and between said ring and hub on axes lying in respective, equally-spaced planes through said central axis, each said axis being inclined to the plane of said ring, a sector-shaped vane secured to each rod along its central radial axis, a radial arm secured to each rod exteriorly of said ring, a pin pivoted in the end of each arm upon an axis parallel to the axis of said rod, a single flexible element sequentially connected to said pins, and turnbuckle means

connecting the ends of said element between an adjacent pair of pins whereby said vanes may be moved in unison between one position wherein they conjointly close said ring and a second position wherein said ring is substantially unobstructed.

5. A vane control system including a ring, a hub centrally located within said ring, a plurality of rods pivotally mounted between said ring and hub on axes each lying in respective angularly-related planes passing substantially through the axis of said ring and inclined to the plane of said ring, a sector-shaped vane connected to each rod, said vanes coacting in one pivotal position substantially to close said ring, a lever means secured to each rod exteriorly of said ring, a pin pivoted in each lever on an axis parallel to and spaced from the axis of its rod, the effective axis of each lever being inclined at substantially 45° to the plane of its vane, there being a hole transversely through each pin, and a single elongated flexible element sequentially passing through and fixed within each said hole whereby on turning of one rod, all vanes are pivoted in unison.

6. In a vane control, a ring having a central axis normal to the plane of said ring, a plurality of vanes of generally sector shape, means pivoting said vanes within said ring on axes lying in respective angularly-related planes through said

central axis, each said axis being inclined at an acute angle to the plane of said ring, said vanes when in one pivotal position coacting to substantially close the opening through said ring, and in a second position to leave said opening substantially unobstructed, a lever connected to pivot with each vane, and flexible cable means sequentially connecting the ends of said levers, the effective axes of said levers being inclined at substantially 45° to the plane of said ring when said vanes are in said one position, and at substantially 90° to said first position on the same side of the plane of said ring, when in said second position.

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