

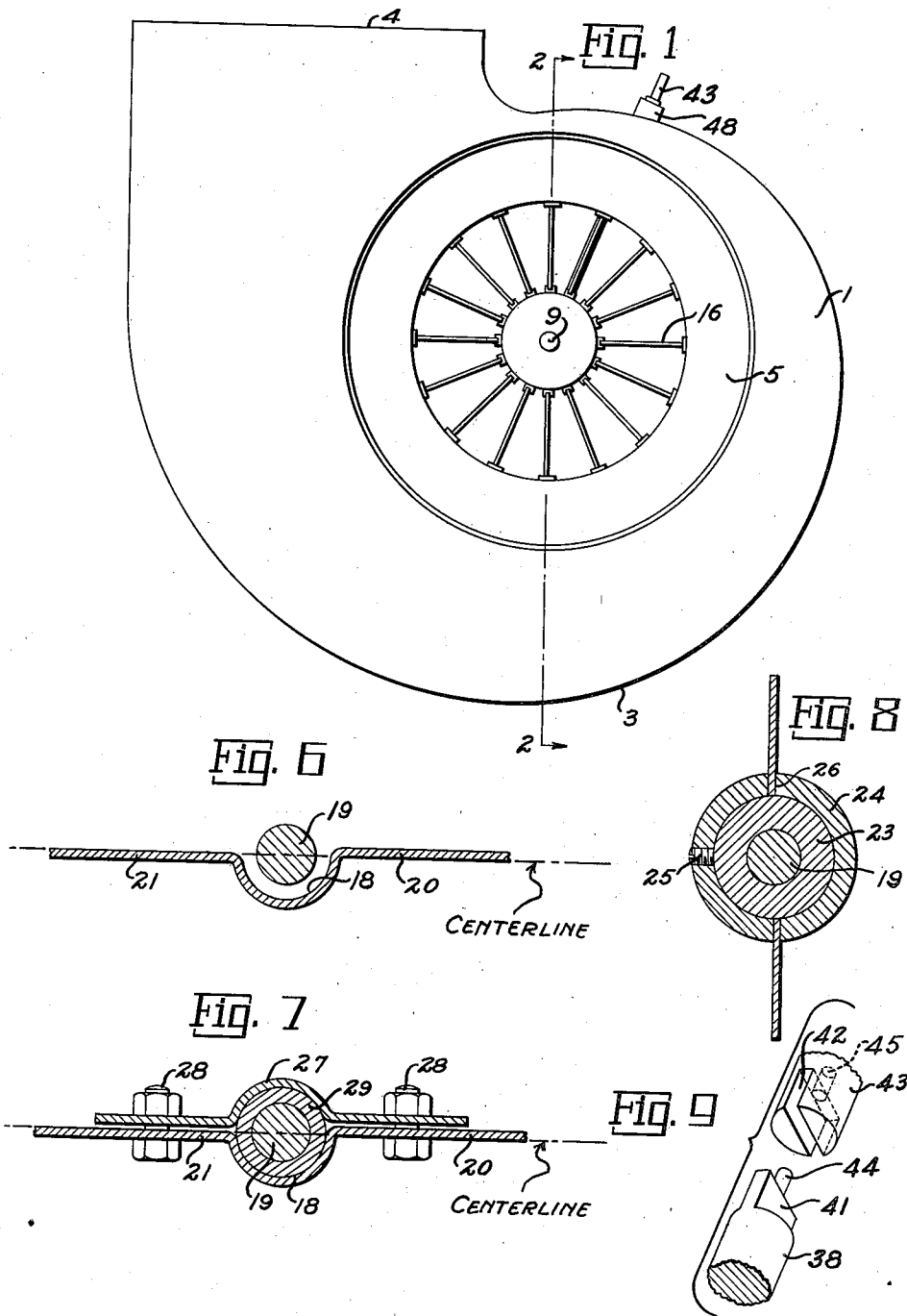
March 18, 1941.

M. S. KICE, JR
HIGH SPEED INLET VANE

2,235,260

Filed Sept. 27, 1938

6 Sheets-Sheet 1



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FIG. 2

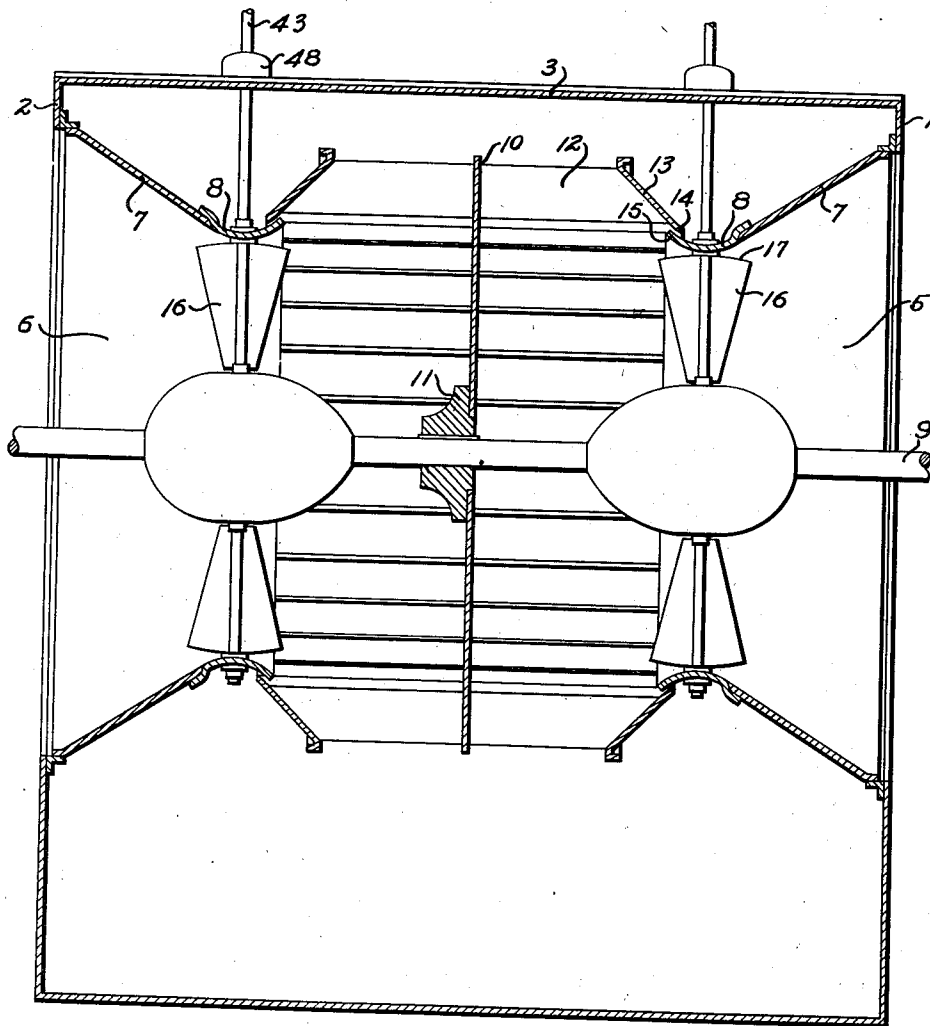
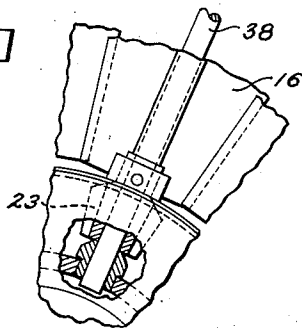


FIG. 10



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Fig. 4

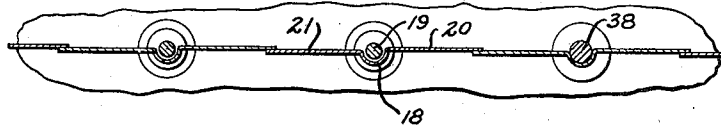
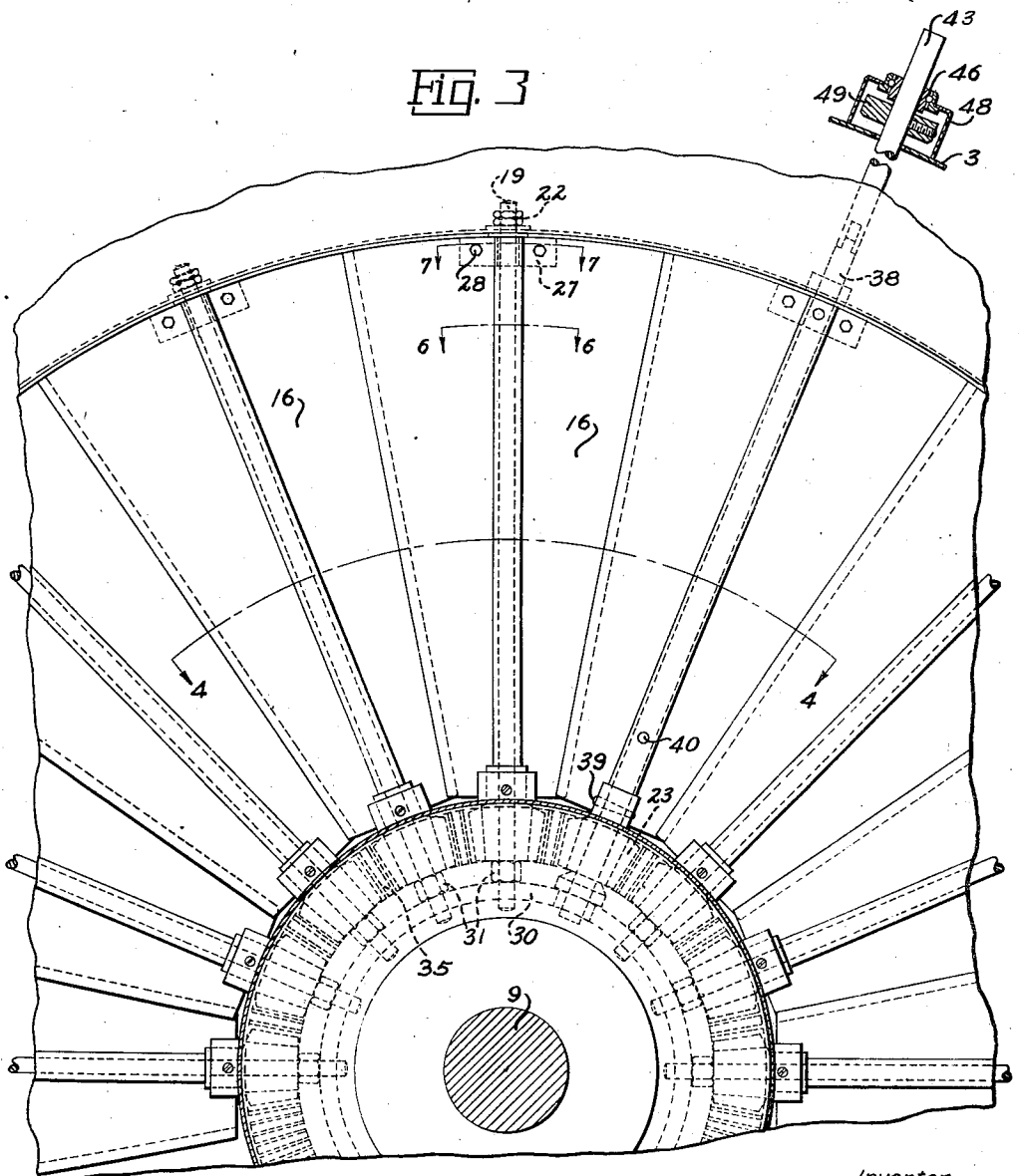


Fig. 3



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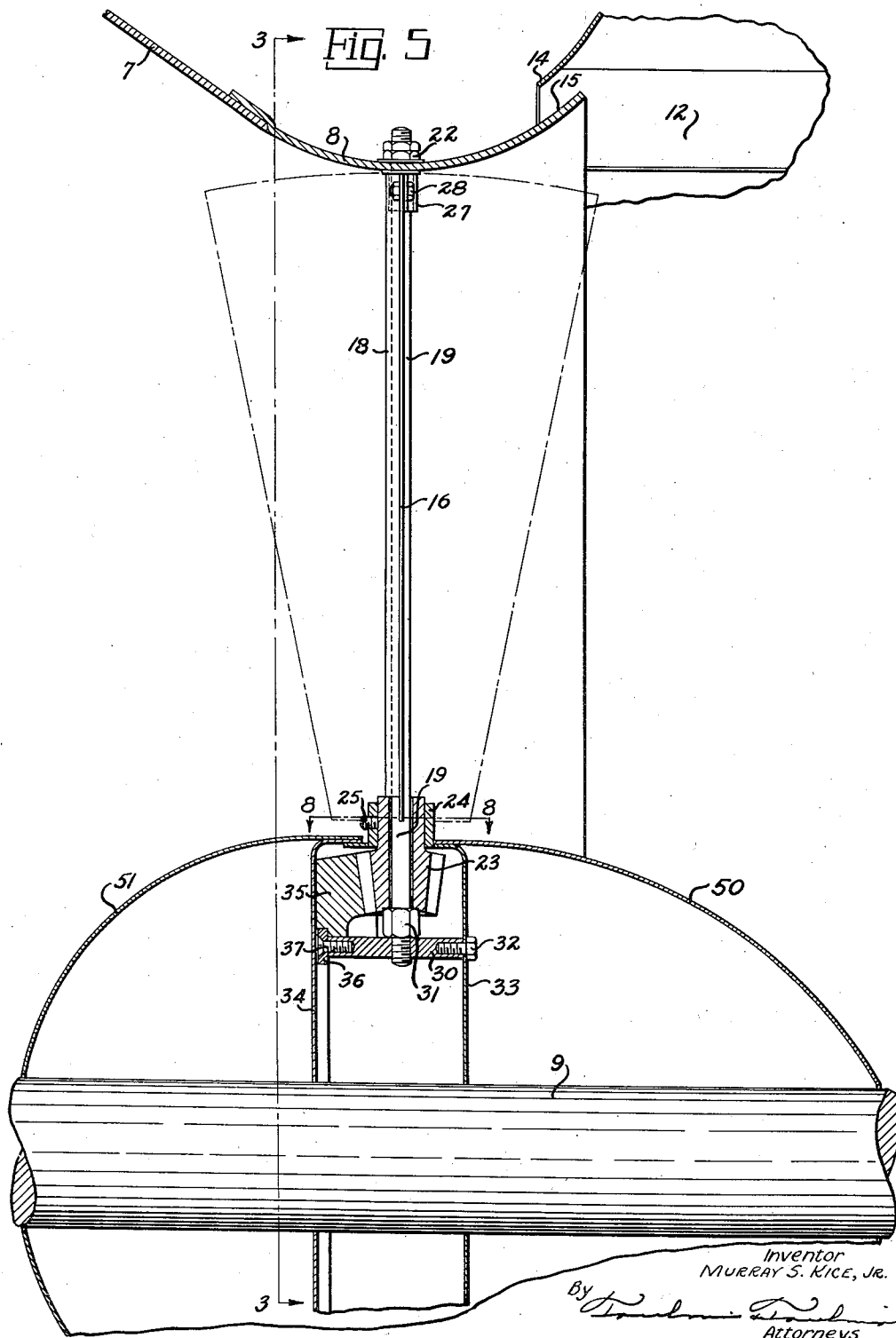
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FIG. 11

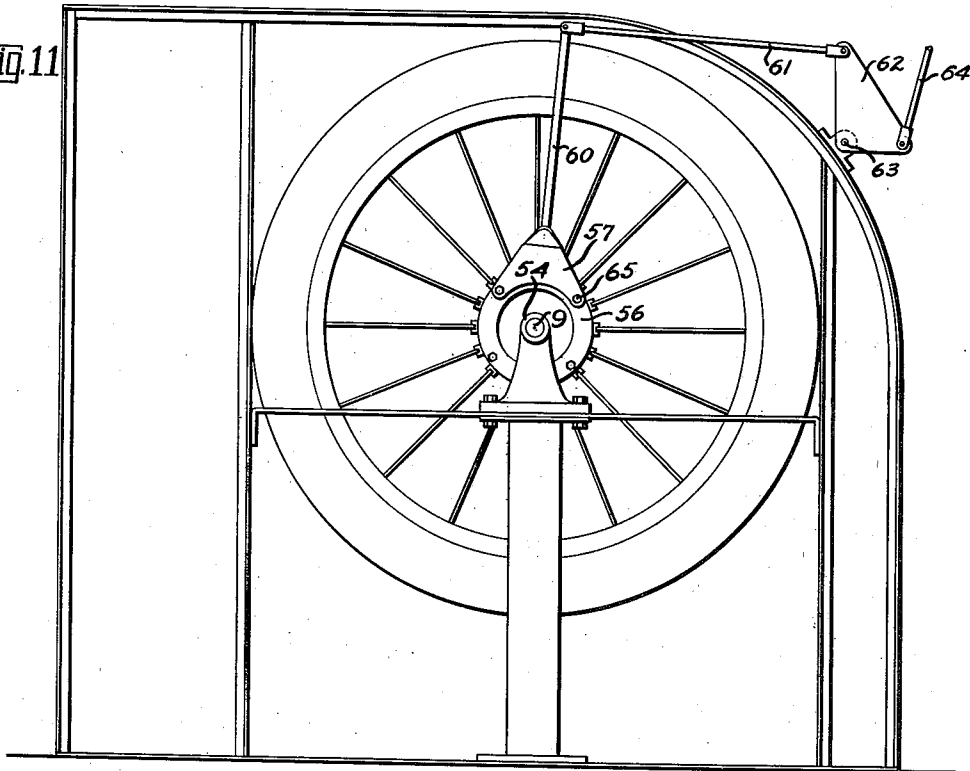
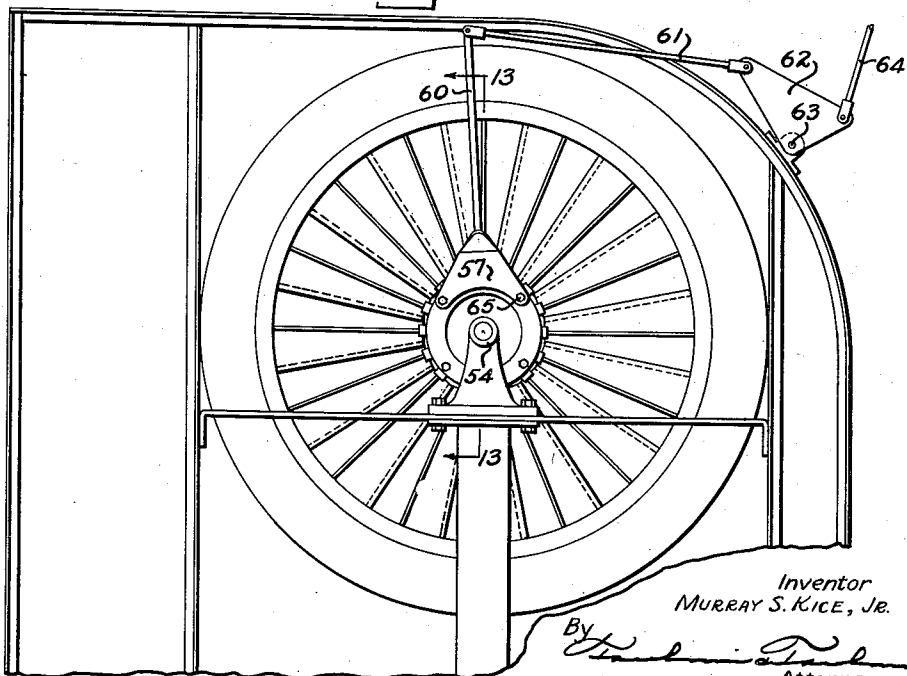


FIG. 12



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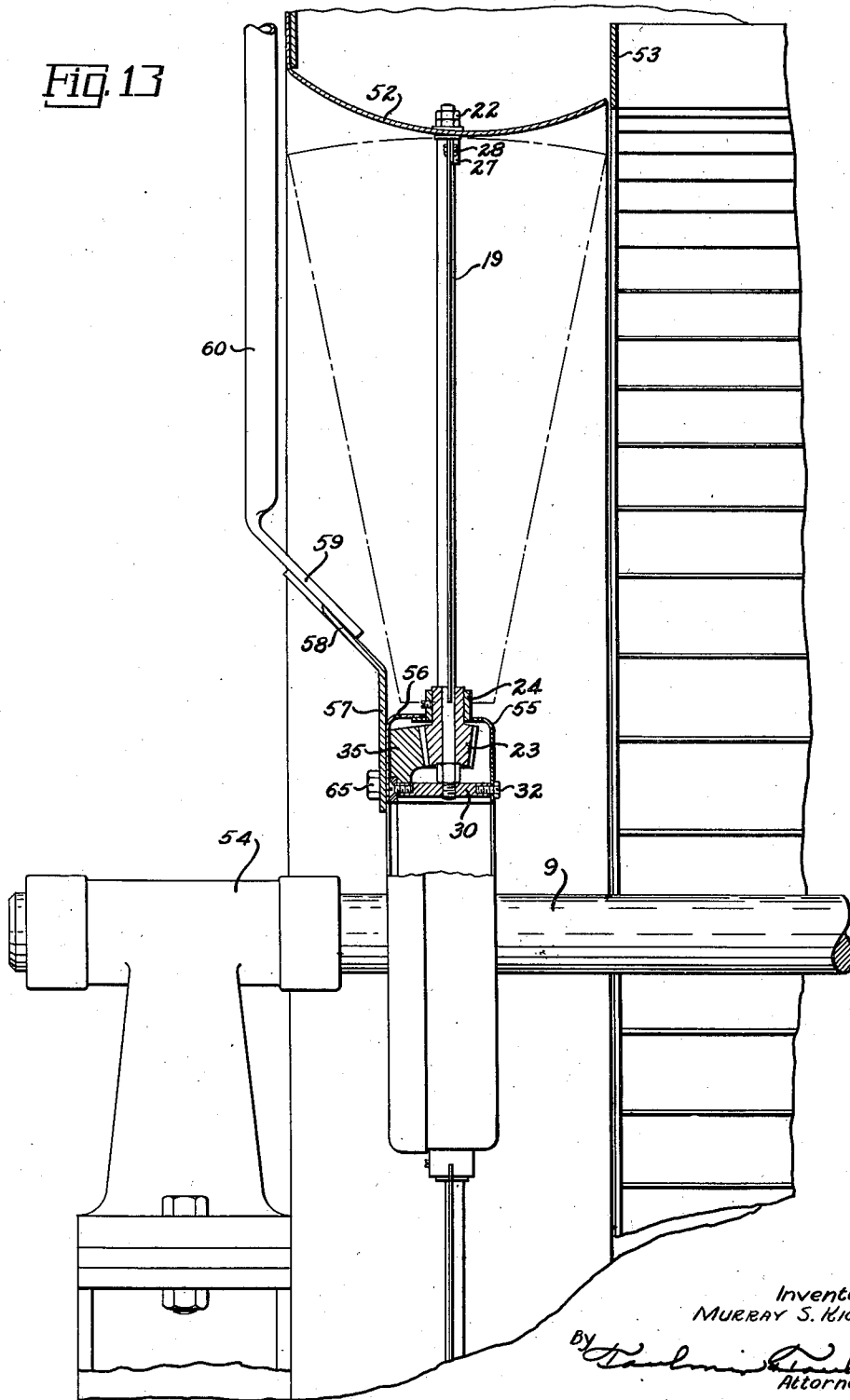
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Fig. 13



UNITED STATES PATENT OFFICE

2,235,260

HIGH SPEED INLET VANE

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Application September 27, 1938, Serial No. 231,981

2 Claims. (Cl. 230—114)

My invention relates to a means for controlling incoming air into a fan inlet and, in particular, into a high speed fan.

It is an object to provide a fan having an air inlet apparatus which will permit of a gas-tight operation.

It is an object to provide inlet vanes comprising a single sheet, which sheet is adapted to overlap at its edges with adjacent single sheet vanes.

It is a further object to provide means for mounting such vanes with their axes at right angles to the axis of the fan rotor and to provide means for actuating all of the blades uniformly and simultaneously.

It is a further object to provide means for streamlining the interconnecting actuating means and support for the inlet vanes.

In particular, it is an object to provide a novel means for actuating inlet vanes where there is or is not an overlap between the fan rotor and the inlet passageway.

It is an object to provide means for actuating inlet vanes with the actuating connection and rod or lever parallel to the axis of the vanes.

It is an object to provide a right angle rod control in such a combination.

It is an object to provide an apparatus for controlling the inlet of air to standard fans which have inlets that have not been normally equipped with inlet vanes so that it can be converted into a fan with inlet vanes by merely unbolting the bearings and bearing supports, removing the standard inlet, and inserting a duplicate inlet equipped with vanes so that it is not necessary to alter the design of the standard fan.

It is an object to provide a control that permits the inlet vanes to be moved about at the same time the control is arranged generally parallel to the axis of such movement.

In the drawings:

Figure 1 is a side elevation of a fan casing, showing the inlet vanes in the inlet passageway in their open position. In this form the control for the vanes extends through the fan casing scroll.

Figure 2 is a section on the line 2—2, looking in the direction of the arrows, on Figure 1, showing the vanes in their open position and arranged to be actuated as described in connection with Figure 1.

Figure 3 is a detailed elevation with the streamline housing and rotor shaft, the fan in section, and with the bearing support for the fan actuating shaft in section. In this view, the vanes are

shown closed. The view is taken on the section line 3—3 of Figure 5.

Figure 4 is a section on the line 4—4, looking in the direction of the arrows, on Figure 3.

Figure 5 is a detail vertical section through a portion of the inlet passageway, a fan shroud, the streamlined housing and support for the vane-actuating mechanism. The vane is shown in full lines in its closed position, and in the dotted lines in open position.

Figure 6 is a section on the line 6—6 of Figure 3, looking in the direction of the arrows.

Figure 7 is a section on the line 7—7, looking in the direction of the arrows, on Figure 3.

Figure 8 is a section on the line 8—8 of Figure 5, looking in the direction of the arrows.

Figure 9 is a perspective of the respective ends, separated, showing the connection between the actuating rod and the actuated rod which supports one of the inlet vanes.

Figure 10 is a detail showing the nature of the overlapping of the inlet vanes adjacent the rotor shaft, and a modification of the means for driving the gears.

Figure 11 is a side elevation of a fan casing showing an inlet opening with the vanes partially open, and with the modified form of actuating mechanism with its actuating rods. Such mechanism is characterized by the fact that it is on the exterior of the fan casing and moves in a plane parallel to the axis of rotation of the inlet vanes.

Figure 12 is a similar view showing the vanes closed.

Figure 13 is a section on the line 13—13 of Figure 12, looking in the direction of the arrows.

Referring to the drawings in detail, 1 and 2 designate the side walls of a volute casing having a volute wall 3. This casing has a discharge opening 4 and side inlet openings 5 and 6. Each of these openings is formed by a conical inlet passageway wall 7 and an internally disposed flaring mouth 8, so that a Venturi-shaped passageway is formed.

Within the fan casing, there is mounted upon the rotor shaft 9 a fan rotor consisting of a center plate 10 that is mounted on the shaft 9 by the hub 11. This center plate or spider supports the fan blades 12 and the shrouds 13 which overlap, at 14, the ends 15 of the inlet passageway members 8. These overlapping ends are substantially parallel and are slightly spaced from one another.

In order to control the volume and direction of the incoming air, there is provided a plurality

of substantially flat segmental inlet vanes 16. The outer ends of these vanes are arcuate, as at 17. The vanes consist of single sheets which are formed as follows. The center of each vane 5 has a semi-circular depression or trough 18 so as to clear the rod 19. The wing portions of the vane 16, designated 20 and 21, are offset with respect to one another so as to permit of parallel overlapping with adjacent vanes of similar construction. Thus, when all of the vanes are in closed position, they overlap through their entire length and completely shut off the air inlet passageway 5 or 6 radially.

The rods 19 are mounted at right angles to the axis of the rotor shaft 9 and are, therefore, at right angles to the air inlet passageways 5 and 6. The axis of rotation of the vanes 16 are consequently also at right angles to the axis of the rotor 9. The rods 19 are mounted at their outer ends in the inlet casing 8 and are retained in position as by the nuts 22. The inner ends of these rods have mounted thereon beveled pinions 23. These pinions are rotatably mounted upon the rods 19. Each pinion carries a slotted collar 24 which is affixed thereto by the set screw 25. The slot in the collar 24 is designated 26. The bottom portions of the vane 16 fit in this slot in the collar so that, as the bevel pinion 23 turns with its collar 24, so turns the vane 16. Thus, the vane is rotatably mounted upon the rod 19. It is mounted on the rod 19 at the top by a clamp 27.

This clamp 27 consists of an arcuate portion with wings which are secured as by the bolts 28 to the wings 20 and 21 of the vane 16. A bearing sleeve 29 may be provided between the two arcuate portions of the vane 16 at 18 and the opposing arcuate portion of the clamp 27. Between the extreme ends of the vane, the arcuate portion 18 is separated from the rod 19 by an appreciable space, as will be seen in Figures 4 and 6.

The rods 19 are mounted in a supporting ring 30 at their inner ends. Nuts 31 on the rods 19, at their inner ends, serve to position and retain these rods in the supporting ring 30. The ring 30, in turn, is attached by the bolts 32 to the supporting housing 33. The shaft 9 passes through the center of this housing and through the complementary opposing half of the housing 34. The ring 30 supports the ring gear 35 which meshes with each one of the tapered pinions 23. In this manner, when any one of the pinions is actuated, all of them will be equally actuated. The ring 36 retained by the bolt 37 on the ring 30 serves to maintain this ring gear in position.

When the vanes are to be actuated, the following means is employed for this purpose. The rod 38 which is similar to the rods 19 is pinned by the pin 39 to the collar of the pinion 23. The vane 16 on this rod is preferably also attached to it by the stud or rivet 40. The outer end of the rod 38 is formed, as shown in Figure 9, with a male member 41 insertable in a corresponding female slot 42 of an actuating rod 43. The projecting male member 41 has a pin 44 that is inserted in a corresponding hole 45 in the base of the slot 42 of the rod 43.

Thus, the two rods are aligned by the pin 44 and cylindrical opening 45 and are caused to turn together by the male and female joint, just described. The outer end of the rod 43 is mounted within a bearing 46 in a housing 48 on the exterior of the fan casing on the outside of the wall 3. There is also mounted upon this rod 43 a collar 49. Collar 49 is adapted to be locked as by a set

screw or other suitable locking means to rod 43 so as to prevent separation of rod 43 from rod 38 at the aligning and locking juncture between rods 38 and 43.

The particular feature or advantage of this arrangement is that inlet vanes of one piece simple construction may be employed. They can be attached and detached without disturbing the rod construction. The rods are stationary and do not have to be rotated, as they merely act as pivotal supports. It will be understood that, instead of having continuous rods extending from the inner portion of the inlet passageway to the outer portion, other equivalent pivotal means may be substituted.

In order to facilitate the entry of air, without turbulence, into the fan, I provide streamline casings 50 and 51. The casing 51 on the inlet incoming side is of blunter section than that on the outgoing side. The contour of this streamline inlet is generally that of an airfoil section.

Turning to the modified form of actuating mechanism in Figures 11, 12 and 13, in this case the arcuate inlet passageway 52 does not overlap with the vertical end ring 53 of the fan rotor which is mounted upon the shaft 9. This shaft is supported by bearings 54. The construction of the vane and the method of its mounting is the same as heretofore described. The ring 30, however, has mounted upon it, on either side, the enclosing casings 55 and 56 which serve to position the several associated parts.

There is mounted upon the enclosing ring 56 a connection 57 which is diagonally disposed at 58. This portion of the connection is, in turn, connected to a diagonally disposed end 59 of a generally radially disposed actuating lever 60 which is parallel to the rods 19. This rod 60 is connected by a pitman 61 to a bell crank 62 pivoted at 63 on the outside of the fan casing. The bell crank is actuated by another pitman 64.

In this way, the vanes are moved by the lever and rod system actuating the ring gear 35 through the housing 56. The exact means for attaching the connection 57 to this ring gear are the bolts 65. If desired, this connection 57 may be connected directly to the ring gear 35 instead of having the housing 56 associated therewith. By utilizing this form of adjusting mechanism, it is unnecessary to actuate the vanes from the inside of the casing. All of the actuating mechanism is on the outside. It is located parallel to the axes of rotation of the inlet vanes.

Certain features shown and described but not claimed in this application are disclosed and claimed in my copending application Serial No. 220,634, filed July 22, 1938. The present application is directed to a structural apparatus for transmitting a rotary motion applied outside a fan casing to within a fan casing, the apparatus being arranged in such a manner that the rotary motion transmitted to within the casing simultaneously rotates a plurality of vanes positioned in the inlet of the fan casing for controlling the quantity of air passing into the casing. It will be understood that I desire to comprehend within my invention such modifications as come within the scope of the claims and the invention.

Having thus fully described my invention, what I claim as new and desire to secure by Letters Patent is:

1. In combination, a fan, a fan casing and rotor, an inlet passageway mounted in said fan casing, a plurality of stationary rods radially disposed at

right angles to the axis of said rotor, a plurality of inlet vanes of segmental shape having arcuate outer ends and longitudinally disposed central grooves to accommodate said rods, a bevel pinion 5 on each of said rods at their inlet ends and so mounted as to be rotatable relative thereto except for one rod to which the pinion is fixedly secured, said one rod being extended and terminating in a projecting portion, an extension rod cooperating 10 therewith and having a slot for receiving said projecting portion whereby rotary effort may be applied to the extension rod external of the casing in order to rotate said bevel pinion, a common ring gear for all of said bevel pinions, and me- 15 chanical connections between said gear and said vanes whereby the latter are moved about their rods when the extension rod is rotated.

2. In combination, a fan, a fan casing and rotor, an inlet passageway mounted in said fan casing, 20 a plurality of stationary rods radially disposed at

right angles to the axis of said rotor, a plurality of inlet vanes of segmental shape having arcuate outer ends and longitudinally disposed central grooves to accommodate said rods, a bevel pinion 5 on each of said rods at their inner ends and so mounted as to be rotatable relative thereto except for one rod to which the pinion is fixedly secured, said one rod being extended and terminating in a projecting portion provided with a locating pin, an extension rod cooperating therewith and hav- 10 ing a slot for receiving said projecting portion and an opening for receiving said pin whereby the said one rod is caused to be rotated when the extension rod is rotated, means for supporting the inner ends of said rods, a common ring gear 15 for all of said bevel pinions, and mechanical connections between said ring gear and said vanes whereby as the extension rod is rotated all of the vanes are simultaneously rotated.

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