Nov. 19, 1957 R. E. SMITH 2,813,673

TILTABLE OSCILLATING FAN

Filed July 9, 1953 3 Sheets-Sheet 1

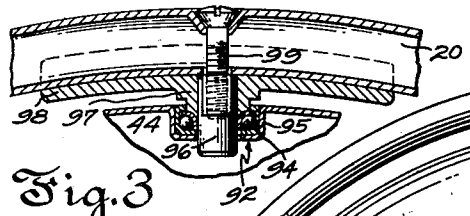

Fig. 3

Fig. 1

Fig. 11

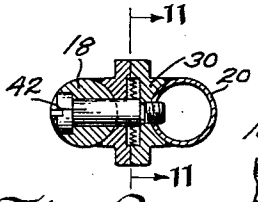

Fig. 2

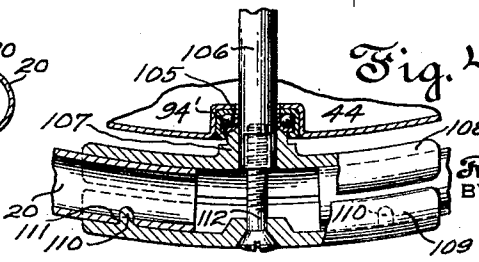

Fig. 4

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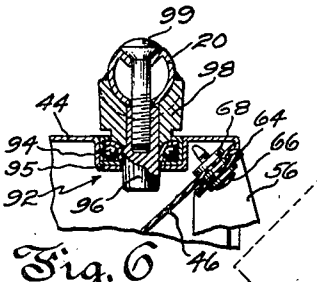

Fig. 6

Fig. 5

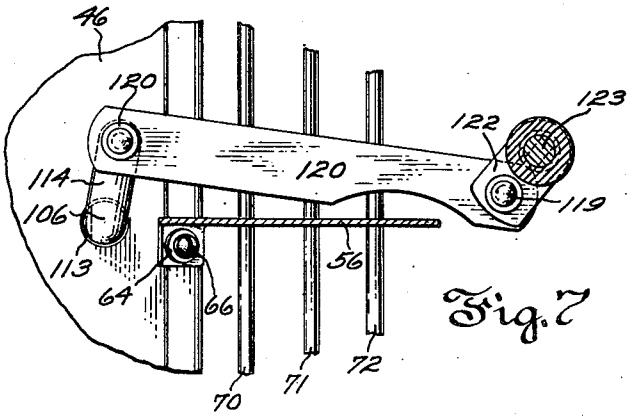

Fig. 7

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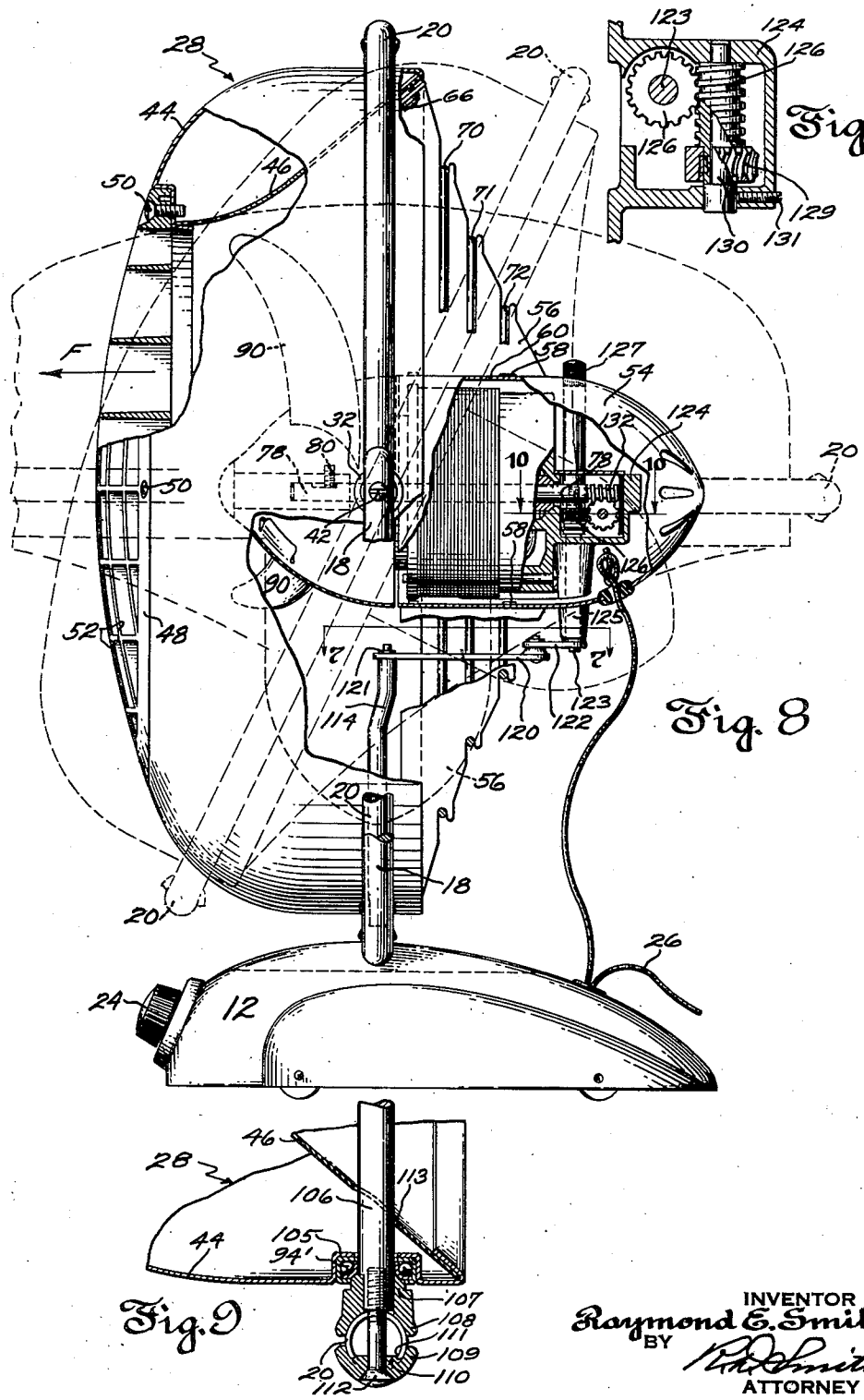

Fig. 8

Fig. 10

Fig. 9

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TILTABLE OSCILLATING FAN

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7 Claims. (Cl. 230—256)

This invention relates to fans that combine an ability to swivel independently about two perpendicularly related axes both of which preferably intersect the axis of rotation of the air impeller of the fan.

Further, the present improvements make possible automatic oscillation of a funnel type of tiltable fan unit the organization of whose air displacing parts is disclosed and claimed in Patents Nos. 2,709,035 issued May 24, 1955, 2,672,280 issued March 16, 1954, and 2,660,368 issued November 24, 1953.

One object of the invention is to retain as fully as possible the advantageous features of construction and air displacing efficiency of the fan disclosed in said copending applications while enabling it to oscillate automatically at any of the various angles to which it may be tilted relatively to its stationary base, pedestal, or other means of support.

A particular object is to provide a fan capable of tilting adjustment and automatic oscillation which in all of its tilting and oscillating movement shall remain confined to the compass of a globe approximating its overall size such as a circular opening in a fan supporting panel designed to fill part of a window space for room ventilating purposes.

These and other objects of the invention will appear in greater particular from the following description of a successful embodiment of the invention having reference to the accompanying drawings wherein all sectional views are to be regarded as looking in the directions of the arrows designating planes on which the sections are taken.

Fig. 1 is a front view in reduced size of a fan embodying the invention showing parts broken away.

Fig. 2 is a view taken in section on the plane 2—2 in Fig. 1 drawn on a preferable full size scale.

Fig. 3 is a fragmentary view drawn on the same scale as Fig. 2 taken in section through the top oscillating bearing on the plane 3—3 in Fig. 5.

Fig. 4 is a corresponding sectional view through the bottom oscillating bearing taken on the same plane 3—3 in Fig. 5.

Fig. 5 is a plan view of the fan shown in Fig. 1 in part broken away.

Fig. 6 is a view taken in section on the plane 6—6 in Fig. 5 drawn on the same scale as in Figs. 2, 3 and 4.

Fig. 7 is a plan view of the oscillating linkage taken on the plane 7—7 in Fig. 8 drawn on an enlarged scale.

Fig. 8 is a side elevation of the fan shown in Fig. 1 with the motor casing and other parts partially broken away to expose the oscillating mechanism and linkage.

Fig. 9 is a fragmentary view taken in section on the plane 9—9 in Fig. 1 drawn on the same scale as in Fig. 4.

Fig. 10 is a fragmentary view taken in section on the plane 10—10 in Fig. 8 enlarged to preferred actual size.

Fig. 11 is a view taken in section on the plane 11—11 in Fig. 2.

As described in the aforesaid co-pending patents the standard of the presently improved fan comprises a hollow base 12 incorporating an invertedly dished top span 14 against the under surface of which is fixedly fastened, as by welding, the middle portion of a half circle of curved tubing whose ends upstand to form the supporting frame arms 18. 24 is the operating handle of a four position snap switch (not herein shown) contained within the inverted concavity of base 12. The switch handle 24 is accessible at the exterior of the front of the base for switching current to different circuits feeding the fan motor 54 thereby to stop, start, or vary the speed of running of the fan. The current is derived through a flexible attachment cord 26.

Fan motor 54, its air impeller 55, and a funnel shell structure 28 comprises an assembled air flow generating unit which is pivotally mounted, not directly on the stationary frame arms 18 as in the aforesaid copending application, but on a carrier ring 20 and can oscillate with respect thereto about a diametral axis which, in the full line position of the carrier ring shown in Fig. 8, is disposed vertically. Oscillation of the fan about this vertical axis can range in both angular directions from the front facing position of the flow generating unit shown in full lines in Fig. 5 to broken line positions thereof shown in Fig. 5. Independently thereof the aforesaid vertical axis of oscillation can itself be shifted to selective settings by tilting the carrier ring 20 to various positions represented by broken lines in Fig. 8.

The shell structure 28 of the air streaming unit is composite and forms a hollow funnel consisting for lightness and manufacturing convenience of two drawn, sheet-metal parts. The circumferentially inner part of air conduit shell 46 in conjunction with the shape of impeller hub 82 forms an axially short annular Venturi passageway for the air traveling through the fan in the direction of arrows F in Figs. 5 and 8 which tapers to a minimum girth of passageway at about the tip of the fan blades 90. The circumferentially outer part of the funnel shell structure is a casing shell 44. This casing shell and conduit shell 46 slightly overlap at circular meeting margins in a manner to bind the funnel shell parts permanently and fixedly together.

The front opening of funnel shell 28 is spanned by a grid 48. The border rim of grid 48 is removably secured by screws 50 in an annular rabbet formed in the front face of casing shell 44. Screws 50 have threaded engagement with casing 44. The shape in which grid 48 is formed produces intersecting thin cross vanes 52 of sufficient depth to guide air in the single direction F desired as the air passes through the grid. The thickness of vanes 52 tapers according to principles of airfoil contour so that the grid divides the discharge opening for the impeller driven air into cubicles of honeycomb nature. One function of these cubicles is to counteract vortex or whirling motion of the outstreaming beam of air.

The torpedo shaped body of the fan motor is designated 54. It is coaxial with conduit 46 and derives its support solely from the funnel shell structure 28 through the medium of four stiff spider fins 56 each of triangular shape. This places a substantial portion of the length of the motor body in outboard or rearwardly offset relation to funnel shell 28. Fins 56 are spaced at equal angles about the motor body and are fixed to the case 60 of the latter by lugs 58 welded thereto as is more fully disclosed in the copending Patent 2,672,280. The strengthening assistance of three hoops 70, 72, 74 of round wire is employed. These hoops are nested in notches in the edges of the spider fins. Fins 56 are fixed to conduit shell 46 by holding screw 66 engaging nuts 68 and surrounded by vibration deadening washers 64 of distortable resilient material.

Impeller 55 is removably fixed on the motor shaft 78

by set screw **80** which is accessible through a hole in the hub wall of the impeller. In the present improvement shaft **78** also drives gearing described hereinafter to cause automatic oscillation of the fan.

One construction by which a fan shell such as **28** might be pivotally supported upon the carrier ring **20** is shown and claimed in the Patent 2,660,368. The particular construction of the spider fins **56** and their combination with funnel shell **46** and motor **54** are the subject of claims in Patent 2,672,280 aforesaid.

In the present construction it is preferred to equip opposite sides of the carrier ring **20** respectively with two diametrically aligned trunnions **30** fixed on the outer surface of the ring by welding or otherwise. The outer end face of each of trunnions **30** is radially notched to receive mating radially directed ridges on the meeting face of a hinge post **32** welded or otherwise secured fixedly to each of the support arms **18**. Each of trunnions **30** contains a tapped hole which receives the threaded end of a hinge screw **42** that extends through each arm **18** and hinge post **32** near the top end of the former which end may be plugged with a finishing cap. The head of screw **42** sets flush with the outer surface of arm **18**. The engaging faces of the trunnion and post hold the fan tilting adjustment where set whenever screw **42** is sufficiently tightened.

For oscillating motion in relation to ring **20** about an axis diametrically of the latter, shell **28** and its coaxial carried motor body **54** and air impeller **55** are pivotally supported by and concentrically within ring **20** by top and bottom antifrictional bearings **92** and **93**, respectively. Top bearing **92** as shown in Figs. 3 and 6 includes a ball bearing unit **94** having its outer ball race nested in a cupped recess or indentation **95** in the sheet metal of casing shell **44** and having its inner ball race sleeved on a pivot stud **96** that is flatted and thus lodged fixedly against rotation in a corresponding flatted socket formed by a boss **97** projecting inward of ring **20** from the arcuately curved saddle piece **98** welded or otherwise made fast to ring **20**. Stud **96** is maintained in place in the socket of boss **97** by the holding screw **99** that threads into the stud and penetrates the walls of ring **20** and has its head nested flush within a countersunk depression in the outer wall of the ring.

Bottom bearing **93** as shown in Figs. 4 and 9 includes a similar ball bearing unit **94'** coaxial with the ball bearing unit **94** and having its outer ball race nested in a cupped recess or indentation **105** in casing shell **44** and having its inner ball race sleeved on a pivot post **106** whose bottom end is flattened and thus lodged fixedly against rotation in a correspondingly flatted socket formed by a boss **107** projecting inward of ring **20** from an arcuately curved saddle piece **108** that is welded or otherwise made fast to and bridges a gap between spaced ends of ring **20**. These ring ends are further firmly locked together by an inverted saddle piece **109** having cross ribs **110** that seat in transverse notches **111** cut in tubular walls of ring **20**. Pivot post **106** is maintained rigidly in the socket of boss **107** by a holding screw **112** that threads into the post and extends through both saddle pieces **108** and **109** and whose head is nested flush within a countersunk depression in the latter. Pivot post **106** extends with clearance freely through an aperture **113** in the inner air conduit shell **46** as shown in Fig. 9. It is provided with a jog **114** that offsets its top end laterally from axial alignment with its bottom mounted end thereby to serve operatively as anchorage for a moving part of the oscillating mechanism of the fan.

Such oscillating mechanism includes a rigid pitman link **120** that pivotally swings in a horizontal path from the reduced top offset end of post **106** and is retained thereon by a thrust washer **121**. The opposite end of link **120** pivotally engages at **119** a crank arm **122** that is rotatably fixed on the exposed bottom end of a vertical drive shaft **123** journaled in a bearing **125** on the speed reduction case **124** carried by the stator of the motor within the rear end of the motor housing **60**.

Clutchable to rotate in unison with shaft **123** by axial pressure of a thumb screw **127**, whose clutch operating mechanism may be constructed as in U. S. Patent No. 2,341,220, there is a driven worm gear **126** in mesh with a transmission worm **128** which rotates in unison with a transmission worm gear **129** upon the counter shaft **130** removably fastened in the transmission case by the set screw **131**. Transmission worm gear **129** is driven by a driving worm thread **132** cut on the rear end portion of motor shaft **78**.

In operation the slow rotation of crank arm **122** by the motor shaft **78** through the medium of the transmission gears **132, 129, 128** and **126** will alternately push and pull on post **106** through the medium of the freely swingable link **120** while the fan impeller **55** is generating an air stream projected away from itself in direction of the arrow F forwardly through the grid vanes **52**. This will swing the entire airstream generating unit, including the fan motor and its supporting funnel shell structure, back and forth between, say, the positions thereof shown in broken lines in Fig. 5. During this oscillating performance of the fan the carrier ring **20** will remain stationary.

At any time whether or not such oscillation is taking place the carrier ring **20** may be shifted to different angles of inclination relatively to its support arms **18** and base **12**, for setting it in various selected positions such as indicated in broken lines in Fig. 8. The ring will be movable to and fastened in any such position by sufficiently loosening and then retightening the screws **42** permitting the mating ridges and grooves on the engaging faces of trunnions **30** and hinge posts **32** temporarily to slip to effect the tilting adjustment.

Thus a fan embodying these improvements can be tilted to various positions about a diametral axis for blowing air upward or downward and in each of those various tilted positions can oscillate automatically from side to side about a diametral axis that is perpendicularly related to the axis of tilting adjustment, and coplanar therewith, and as shown these axes may intersect each other.

The support for the hinge posts **32** may comprise brackets at diametrically opposite sides of an aperture in a fan supporting panel designed to fill part of a window space for room ventilating purposes as in U. S. Patent No. 1,306,845.

The appended claims are directed to and intended to cover variations of the precise construction and relationship of parts herein disclosed in which the invention defined by the claims may be incorporated within the teaching of this disclosure.

1. I claim:

1. An oscillating fan comprising, stationary supports spaced apart along an axis of tilting adjustment, a carrier ring spanning the space between said supports and swingably coupled thereto for tilting adjustment about said axis, an annular funnel shell encompassed by said carrier ring and so pivotally mounted thereon that the axis of said shell can be oscillated in a plane perpendicular to a plane containing said axis of tilting adjustment, an air stream generating unit including an electric fan motor having a magnetic field structure supported by said funnel shell in fixed relation thereto and an air impeller rotatable by said motor about said axis of said shell, an anchorage post rigid with said carrier ring extending therefrom to an anchorage terminal located intermediate the combined axial length of said motor field structure and said air impeller, a crank carried on and rotated by said motor, and a pitman link operatively coupling said crank to said anchorage terminal, the said funnel shell being hollow comprising a unified inner air conduit shell and an outer casing shell, and the said anchorage post extending through both said outer shell and said inner shell.

2. A fan as defined in claim 1, in which the said anchorage post affords rotary bearing for the said funnel shell.

3. A fan as defined in claim 2, in which the said anchorage post has a jog on the opposite side of the said rotary bearing from the said carrier ring laterally offsetting its said terminal engaged by the said pitman link.

4. An oscillating fan comprising, stationary supports spaced apart along an axis of tilting adjustment, a carrier ring spanning the space between said supports and swingably coupled thereto for tilting adjustment about said axis, an annular funnel shell encompassed by said carrier ring pivotally mounted thereon to swing relatively thereto about an axis of oscillation so disposed that the axis of said shell can be oscillated in a plane perpendicular to a plane containing said axis of tilting adjustment, an air stream generating unit including an electric fan mtor having a field structure of substantially smaller compass than said funnel shell supported thereby mainly at the rear of said axis of oscillation and an air impeller rotatable by said motor about said axis of said shell located mainly in front of said axis of oscillation, an anchorage post rigid with said carrier ring extending therefrom past said funnel shell and having an anchorage terminal located radially intermediate said unit and said shell within the combined axial length of said motor field structure and said air impeller, a crank carried on and rotated by said motor, and a pitman link operatively coupling said crank to said anchorage terminal.

5. An oscillating fan as defined in claim 4, together with a ball bearing having its inner race sleeved on the said anchorage post and having its outer race fixedly lodged in the said funnel shell.

6. An oscillating fan comprising, stationary supports spaced apart along an axis of tilting adjustment, a carrier ring spanning the space between said supports and swingably coupled thereto for tilting adjustment about said axis, an annular funnel shell encompassed by said carrier ring and so pivotally mounted thereon that the axis of said shell can be oscillated in a plane perpendicular to a plane containing said axis of tilting adjustment, an air stream generating unit including an electric fan motor having a magnetic field structure supported by said funnel shell in fixed relation thereto and an air impeller rotatable by said motor about said axis of said shell, an anchorage post rigid with said carrier ring extending therefrom to an anchorage terminal located intermediate the combined axial length of said motor field structure and said air impeller, a crank carried on and rotated by said motor, and a pitman link operatively coupling said crank to said anchorage terminal, together with means holding the said anchorage post in rigid relation to the said carrier ring comprising, a radially inward directed socket on the carrier ring occupied by one end of the latter and a screw fastener extending crosswise of said carrier ring having threaded engagement with said end of the anchorage post to maintain the latter rigidly in said socket.

7. An oscillating fan as defined in claim 6, together with a split clamp at least in part encompassing the said carrier ring, said clamp incorporating the said socket and being tightened against said ring by the said screw fastener.

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