Oct. 30, 1956 A. K. TATEISHI 2,768,782

ELECTRIC FAN

Filed July 2, 1954 5 Sheets-Sheet 1

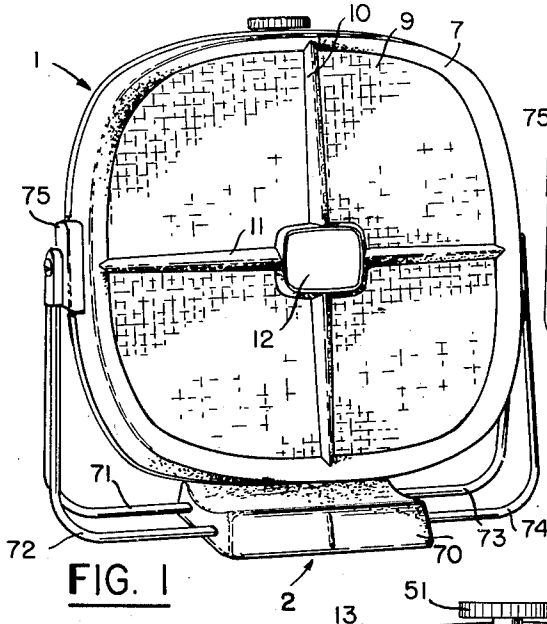


FIG. 1

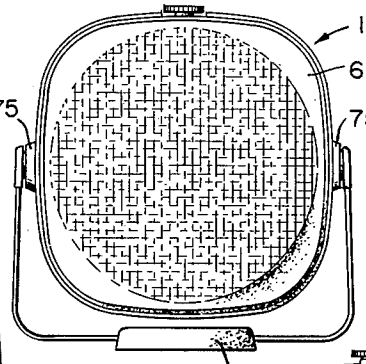


FIG. 2a

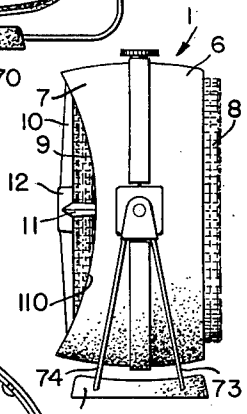


FIG. 2

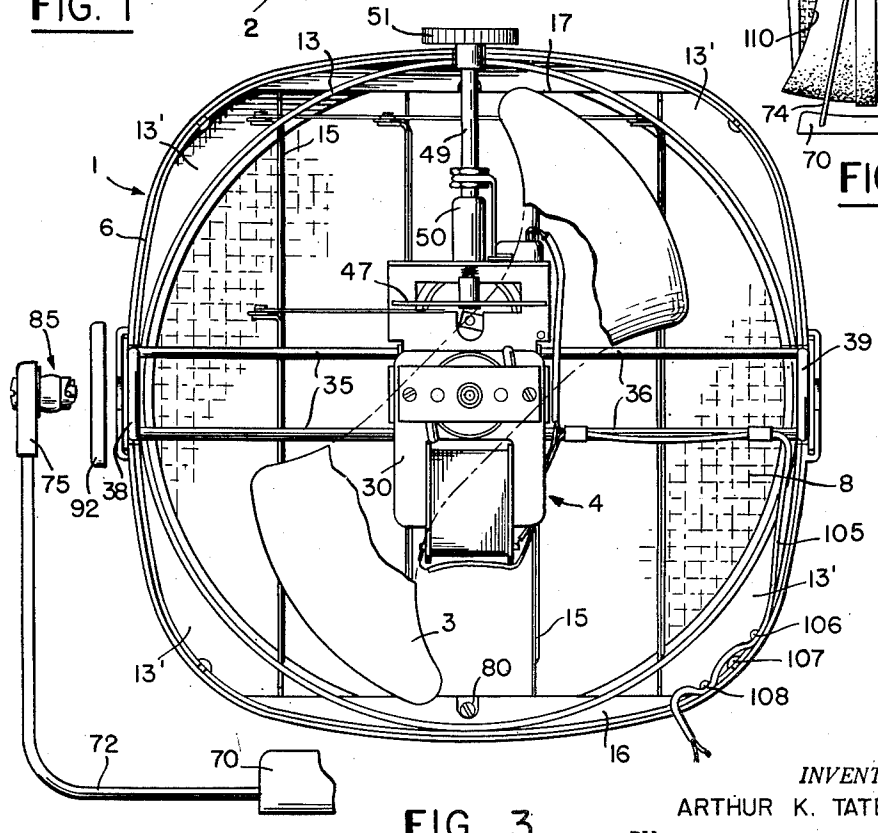


FIG. 3

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ELECTRIC FAN

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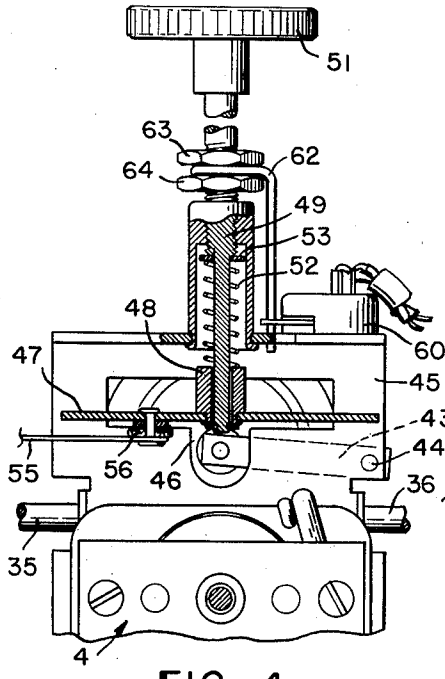


FIG. 4

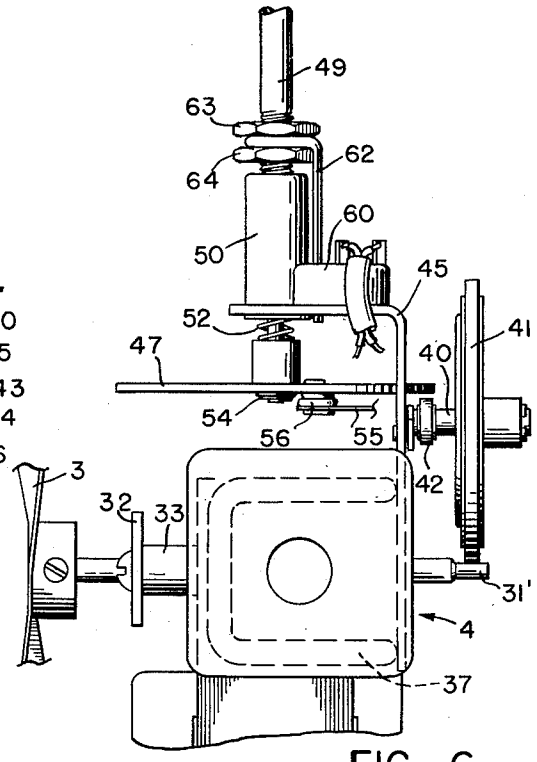


FIG. 6

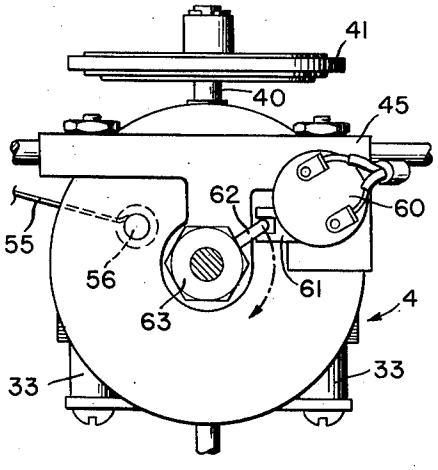


FIG. 5

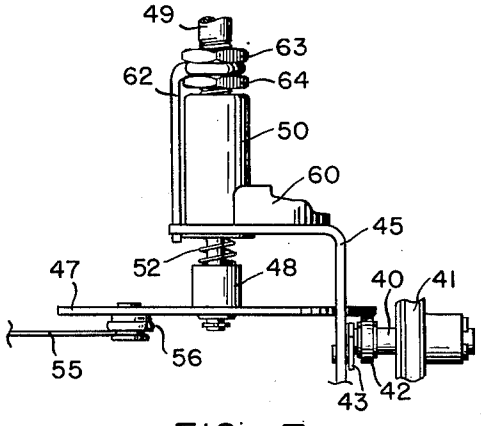


FIG. 7

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ELECTRIC FAN

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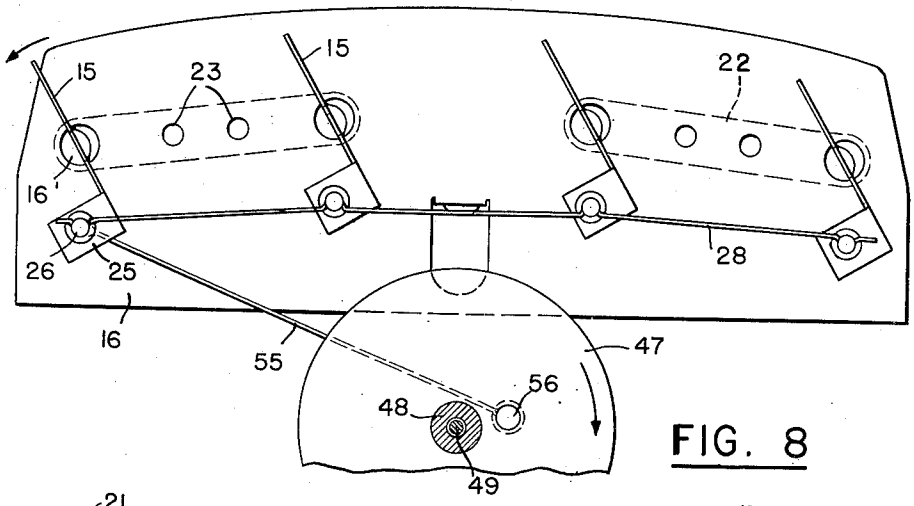


FIG. 8

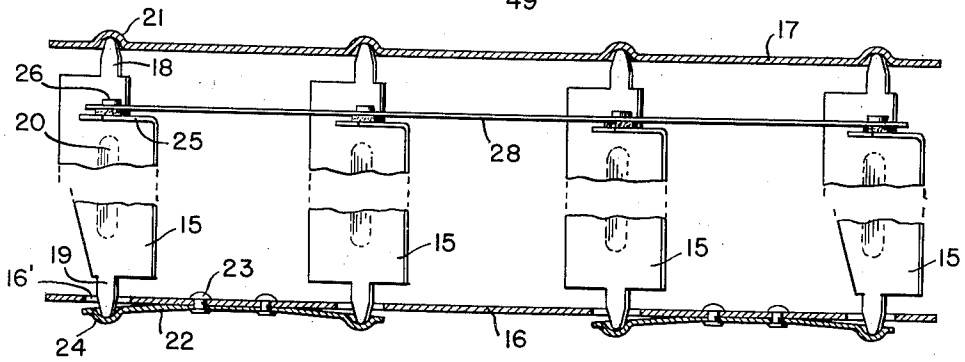


FIG. 9

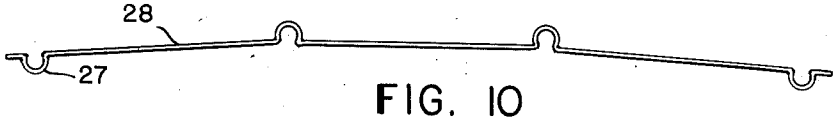


FIG. 10

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ELECTRIC FAN

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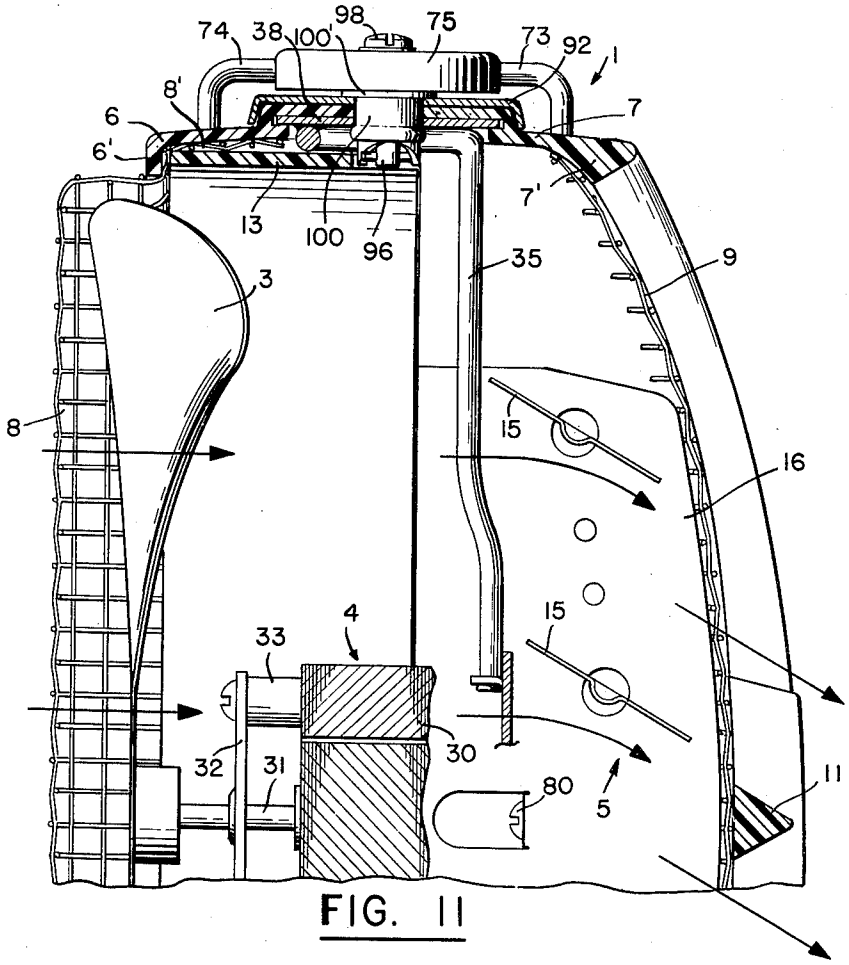


FIG. 11

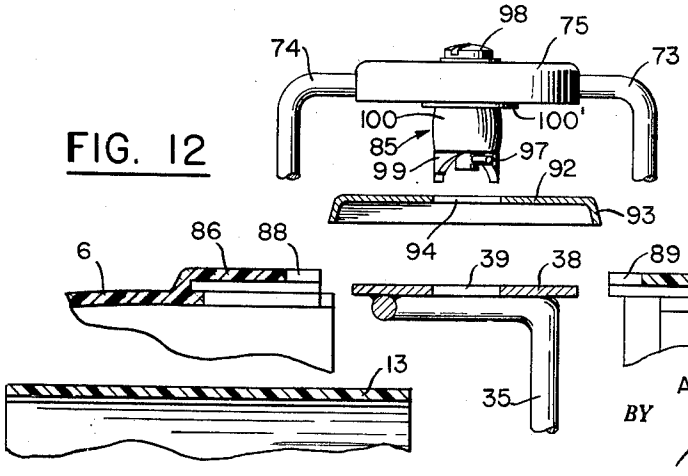


FIG. 12

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ELECTRIC FAN

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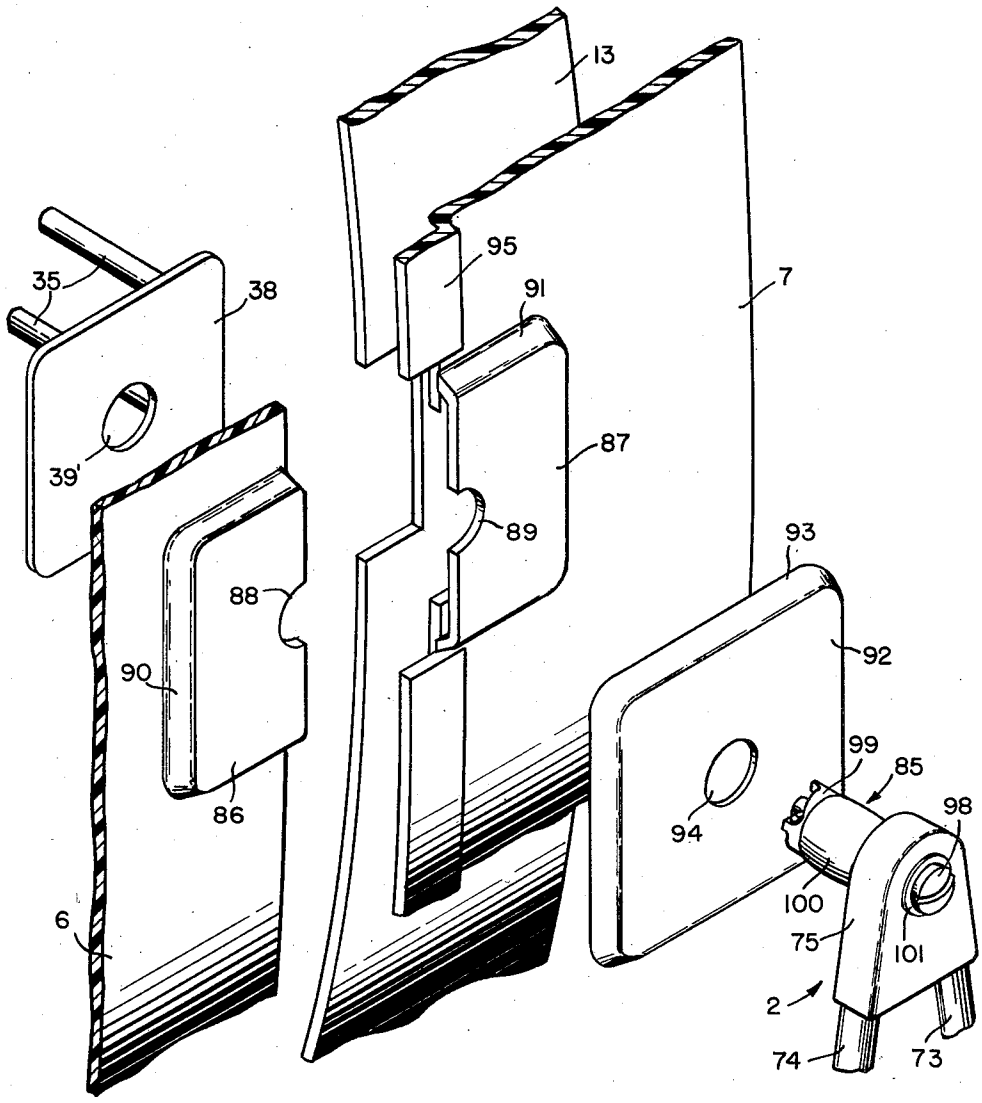


FIG. 13

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United States Patent Office 2,768,782 Patented Oct. 30, 1956

2,768,782

ELECTRIC FAN

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Application July 2, 1954, Serial No. 440,949

23 Claims. (Cl. 230—259)

This invention relates to electric fans of the blower type, more particularly to an electric fan producing an oscillating air flow.

Electric fans of this kind conventionally have an oscillating fan head, the angularly reciprocating movement of which produces an air flow slowly oscillating within a corresponding arc. The oscillating movements of the fan head are generally controlled by a gear and crank mechanism driven by a fan motor.

The invariably exposed gear and crank mechanism and even more the usually rather sharp edged fan blades present a certain danger. The frequently employed blade cage affords scant protection as it leaves the blades easily accessible. The danger caused by the whirling blades and the moving mechanism is the more acute as fans of the kind here involved are frequently used in homes and easily accessible to children.

Furthermore, use of a moving fan head prevents an attractive streamlined design of the fan. It also necessitates a rather heavy weight of the fan, especially of the base thereof, as the centre of gravity of the fan is continuously moving when the fan is in operation and must be balanced by the weight of the base in each position of the head.

It has been proposed to effect oscillation of the air flow by means of reciprocating vanes arranged directly in advance of the fan blades but the low efficiency and the serious problems of turbulence have prevented such fans from being commercially acceptable.

Moreover such proposed fan constructions have still required relatively complicated and expensive gear drives, parts of which are still exposed and again a relatively heavy base is required as the centre of gravity of the fan cannot be located centrally of the fan housing and still maintain a compact unit and therefore on tilting or adjusting the fan housing the centre of gravity will change relative to the base.

One of the main objects of the present invention is to provide a novel improved and greatly simplified electric fan which will efficiently produce a slowly oscillating air flow by means of reciprocating louvers without movement of the fan head with a minimum of turbulence and noise.

Another object of the invention is to provide a novel streamlined fan design, all the moving parts of which are completely enclosed and inaccessible for all practical purposes.

Still another object of the invention is to provide a novel compact fan design the overall width of which is considerably less than that of conventional oscillating and stationary fans of comparative size.

A further important object of the invention is to provide a novel and improved fan in which the centre of gravity of the fan is located centrally of the fan casing or housing while maintaining the fan design to its most compact form whereby a relatively small and light base is sufficient to support the fan casing or housing for vertical tilting about an axis through its centre of gravity as the centre of gravity will not alter from its position relative to the base under either tilting movement of the fan or reciprocation of the louvers.

A still further object of the invention is to provide novel and improved friction drive means for imparting to the louvers the aforementioned reciprocatory movements. These means afford the advantage of great simplicity and inexpensiveness as they do not require gears and an involved linkage system. While the said friction drive means are particularly advantageous for use as drive means for a fan according to the invention, they also are useful for fans in general.

A more specific object of the invention, allied with the preceding one, is to provide joint control means for controlling the circuit of the fan motor and actuating the drive means, the joint control means ensuring that the load of the louvers is not coupled to the fan motor until the motor has picked up speed. This affords the advantage that louver reciprocation can be obtained with a smaller capacity motor than would be permissible if the louvers could be connected, even accidentally, to load the motor at starting requiring an increased starting torque.

Yet another object of the invention is to provide novel and improved mounting means for said louvers which prevent rattling of the same and greatly facilitate the reciprocatory movement of the louvers.

A more specific object of the invention, allied with the preceding one, is to provide simple and inexpensive means coupling the louvers for joint movement so as to permit a rapid and convenient coupling and uncoupling of the louver assembly.

Again it is an object to mount the louvers so that they are dynamically balanced in operation to reduce their load on the motor through the friction drive means, and to enable them to be halted in any direction for steady air flow in such direction.

It is a particular object of the invention to achieve a substantial reduction of the overall weight of the fan from previous fan constructions of comparative size by virtue of the reduction of the base size and weight as aforesaid and by the ability to employ a minimum capacity motor for a given air flow delivery due to the positive disconnecting of the louvers from the motor load at starting and the efficient air flow deflection of the dynamically balanced louvers as aforesaid.

It is another object to provide a louver mounting and casing construction to enable a wide angle sweep of the oscillating air flow to be obtained without loss of efficiency of air delivery or obstruction by the casing.

Another important object of the invention is to provide a novel and improved design of a housing and a fan mechanism which permits a rapid and simple assembly or disassembly of the housing parts and the mechanism parts supported by the housing without the use of tools and without requiring special mechanical skill. This design not only reduces the labour costs of the original assembly but also facilitates subsequent cleaning and repair of the fan.

Other and further objects, features and advantages of the invention will be pointed out hereinafter and set forth in the appended claims forming part of the application.

In the accompanying drawing a now preferred embodiment of the invention is shown by way of illustration and not by way of limitation.

In the drawings:

Fig. 1 is an isometric front view of a fan according to the invention.

Fig. 2 is a side elevational view.

Fig. 2*a* is a rear elevational view of the fan.

Fig. 3 is a rear view with the rear part of the fan housing removed to show the fan mechanism.

Fig. 4 is a fragmentary sectional view of the control means of the drive means for the louver assembly of the

fan and of the control means for the drive means and the fan motor.

Fig. 5 is a plan view of Fig. 4 partly in section.

Fig. 6 is a view of the components of Fig. 4 turned through to 90° and showing the drive means and control means in one operational position.

Fig. 7 is a fragmentary view of Fig. 6 showing the drive means and the control means in another operational position.

Fig. 8 is a plan view of the louver assembly and part of the drive means therefor.

Fig. 9 is an elevational view of the louver assembly partly in section.

Fig. 10 is a detail view of one of the components of the louver assembly.

Fig. 11 is a fragmentary sectional plan view taken on the horizontal mid-axis of the fan.

Fig. 12 is a sectional exploded view of the means for joining the parts of the fan housing, the fan mechanism and the base of the fan, and

Fig. 13 is an isometric exploded view of the joining means of Fig. 12.

Referring now to the figures in detail, the exemplification of the fan according to the invention comprises a housing generally designated by **1** which may be described as being of approximately ring shape. The housing may be made of a light gauge sheet metal or of plastic since the housing proper does not have to carry the weight of the fan mechanism as will appear from the subsequent description. The housing is preferably mounted on a base or standard generally designated by **2** pivotal about a horizontal axis.

As seen in the direction of the air flow through the housing, the fan mechanism comprises impeller blades **3**, a fan motor generally designated by **4** and a louver assembly generally designated by **5**, reference being made to Fig. 11. By the disposition of the motor between the fan blades and the louver assembly a compact design is attained the width of which in the direction of the axis of the housing is much narrower than that of conventional fans of comparable size.

It is important further to note that by so disposing the blades and louvers the blades are displaced an appreciable distance from the louvers so that the blades will not be operating in the field or against the resistance of any air mass momentarily slowed or deflected by the louvers.

Further, such disposition of the louvers and the blades enables the centre of gravity of the motor and its driven elements to be located precisely at the centre of the fan housing **1** as will hereinafter be seen while achieving the aforementioned compact design.

The housing is composed of two generally ring shaped shells **6** and **7** which complement each other to form the housing. The two shells are closed by grill or wire mesh guards **8** and **9** respectively which serve both, to prevent injury to persons by the whirling fan blades and to protect the fan mechanism against damage. The wire mesh **9** at the front of the fan is preferably reinforced by crossing bars **10** and **11** which may support a name plate **12**. The inner wall of the housing is made cylindrical by either giving the inner peripheral wall of shells **6** and **7** a corresponding configuration or by providing, as shown, a cylinder **13** made of thin metal gauge or plastic material. As is apparent from the previous description the interior of the fan constitutes in effect a wind tunnel through which a straight flow of air relatively free of turbulence is forced by impeller blades **3**.

Surrounding the cylinder **13**, as best shown in Fig. 3, are pockets **13'** which constitute air pressure pockets in which an air pressure build-up, to at least a certain degree, occurs due to the inherent barrier effect of the louver assembly.

By providing these pockets the air pressure build-up is maintained away from the blades **3** further to reduce

turbulence in the wind tunnel constituted by the cylinder **13**.

Cylinder **13** also serves to anchor wire mesh **8** within shell **6**. To this end mesh **8** has an extension **8'** held between the cylinder and a corresponding wall portion of shell **6** and is bent to form a shoulder resting upon a corresponding shoulder **6'** of shell **6** as can best be seen in Fig. 11. Wire mesh **9** is anchored by resting with its rim upon the reinforced rim **7'** of shell **7**. This reinforced rim is outwardly slanted to direct and confine the air flow deflected by the louver assembly as will be more fully explained hereinafter.

To obtain maximum efficiency, blades **3** are so mounted that they protrude with about two thirds of the blade area from rear shell **6**. Wire mesh **8** also extends correspondingly beyond shell **6** to accommodate the protruding portion of blades **3**.

To provide for wide angle air flow oscillation the shell **7** is formed with its forward side edges recessed or concaved as at **110**, as best shown in Fig. 2, whereby housing interference of air deflected at a substantial angle to the sides by the louver assembly **5** as hereinafter explained is eliminated.

The louver assembly

The louver assembly which is shown in detail in Figs. 8 to 10 inclusive comprises several identical louver slats or vanes made of thin sheet metal gauge or plastic, four louver slats **15** being shown. The slats are mounted within shell **7** perpendicular to the fan axis and are arranged to have their forward portions project forwardly beyond the recessed sides **110** of the shell **7**. To this end, flat metal or plastic strips **16** and **17** are secured by any suitable means on diametrically opposite sides of shell **7**. These strips constitute mounting bases in which bearings for the louver slats are formed.

The slats are mounted to pivot about their longitudinal centre axis which at the centre of the slat is approximately in line with the recessed sides **110** of shell **7**, as illustrated particularly in Fig. 11, and each slat is provided for this purpose with centre pins **18** and **19**. As the material of the slats is light, stiffening ribs **20** are preferably provided. The bearings for the four slats in base strip **17** are shown to be formed by depressions or cups **21** which are engaged by the preferably pointed pins **18**. The opposite pins **19** may be pivotally held in similar bearing cups but preferably the louver slats are spring loaded in axial direction to prevent rattling of the slats during operation. There are shown, as suitable spring loaded bearings for the slats, leaf springs **22**, one spring being provided for each two slats. The springs are secured to base strip **16** by any suitable means such as one or several rivets **23** and each free end of the spring is formed with a bearing cup **24** engaged by the preferably pointed end of a pin **19** extending through a hole **16'** in strip **16**. As is apparent, the pressure of springs **22** urges the slats into tight engagement with their upper bearings **21**. It is of course also possible to provide spring loaded bearings for both pivot pins of the slats or to provide the spring loaded bearings in strip **17**.

The width of the slats is such that the same do not overlap in any pivotal position, or in other words, slots for the passage of a straight air flow between adjacent slats remain in each pivotal position of the slats.

To obtain joint reciprocatory pivotal movement of the slats, the same are coupled by joining means. These joining means are shown as a tongue **25** laterally extending from each slat. Each tongue supports a headed pin **26** or similar member which serves to receive and releasably to retain a loop **27** formed in a wire **28**. The mouth of each loop of the preferably somewhat springy wire **28** is slightly less than the diameter of the shank of headed pin **26** so that the wire is safely retained by the pins, and further snugly fits the pins to eliminate rattle or noise and

dispenses with relying on close tolerances. As is evident, pins 26 can rotate within loops 27 so that reciprocatory movements imparted to wire 28 in generally axial direction, allowing of course for the arc described by tongues 25, will result in corresponding reciprocatory movements of the slats about their longitudinal centre axes. Preferably the pins 26 are wrapped in a lubricant socket felt washer to reduce friction to a minimum under the snug fit of the spring wire loops 27.

By having the slats reciprocating about their longitudinal centre axes a dynamic balance is achieved in operation of the slats with the air impinging on one side of centre balancing the air impinging on the other side so that the force required to reciprocate the slats from the motor 4, as hereinafter described, is simply the force necessary to overcome the friction of the louver system which is reduced to a minimum through the slat mountings above described.

The fan motor

While an electric motor of any suitable size and power may be used, it has been found advantageous to employ a two-pole motor with a generally U-shaped field core 30. The plane base branch of such core permits conveniently to mount thereon the drive means and the control means of the fan as will be more fully explained hereinafter. The drive shaft of the motor which protrudes from both sides of the rotor has its axis lying coincident with the axis of the cylinder 13 and intersecting the axis of pivot of the fan housing 1 which pivots about the axes of fasteners 85, as hereinafter more particularly described. The shaft end 31 mounts blades 3 and is guided by a bearing formed in a plate 32 secured to the motor by any suitable means such as posts 33. The other shaft end serves to actuate the drive means and is preferably set off for this purpose at 31'. The motor and the components supported thereon are mounted in the fan housing by two laterally extending brackets. Each bracket is formed by two parallel bars 35 and 36 respectively which are secured to the motor by any suitable means such as the U-shaped portions 37 shown in Fig. 6. The bars may either be secured to the motor directly or to a plate fastened to the motor for this purpose. The free ends of bars 35 and 36 respectively are secured to a mounting plate 38 and 39 respectively having a hole 39' therethrough. By locating the motor centrally between the plates 38 and 39 and by having the blades at one end of the motor and the louver assembly at the other end the centre of gravity of the unit is disposed so that it lies substantially at the centre of housing 1 and on the axis of the holes 39' so that it will not shift relative to the base 2 when the casing is tilted about the axis of the holes 39' as hereinafter described. The motor is connected with a suitable source of current by a connecting cord 105. To avoid an undue strain on this cord, the same is preferably meandered by means of guide pins 106, 107 and 108 extending from the inner wall of shell 7, as can best be seen in Fig. 3, thereby providing a strain relief for the connecting cord.

The drive means for the louver assembly and the control means of the fan

The drive means serve to transmit the rotation of the motor shaft to the louver assembly for imparting the required reciprocatory movements to the louver slats and the control means serve to control the motor circuit and the drive means, independently one from the other.

The drive means comprise a shaft 40 on which is seated a large wheel 41 and a small wheel 42 to obtain the required ratio of transmission. Wheel 41 coacts with shaft end 31' by frictional engagement. To obtain a satisfactory power transmitting frictional engagement between wheel 31 and shaft 31' both the wheel and the shaft end are preferably peripherally lined with a high friction material such as a rubber or a rubber composition. Shaft 40 is supported by an arm 43 pivoted at 44 to a right angle bracket 45. This bracket is secured to the motor as can best be seen in Figs. 4 and 6. The perpendicular part of the bracket (as shown in Figs. 4 and 6) is formed with a cut-out 46 to permit a free up and down movement of the end of arm 43 supporting shaft 40. As a result, wheel 41 constitutes a floater wheel which is not in power transmitting frictional engagement with shaft end 31' unless it is pressed against the shaft end.

The small wheel 42 coacts with a horizontally mounted wheel 47 by frictionally engaging the peripheral rim of wheel 47 when the two wheels are moved toward each other. Wheel 47 is rotatably mounted on a rod 49 by any suitable means such as a bushing 48. Rod 49 has a threaded portion 49' which is screwed in a bracket 50 fixedly secured to the horizontal branch of bracket 45. As is apparent, rotation of rod 49 for instance, by means of a knurled or milled control knob 51 results in an axial up and down movement of rod 49 and hence of wheel 47. A loaded spring 52 abutting at one end against a shoulder of rod 49 or a washer 53 and at the other end against bushing 48 serves to bias wheel 47 into its lowermost position on rod 49 in which it is retained by a cotter pin 54.

Wheel 47 is coupled with the louver assembly by a bar or wire member 55 eccentrically secured at one end to wheel 47 and to its other end to one of the tongues 25 on the louvre slats, preferably as shown in Fig. 8 to one of the outermost tongues. Wire 55 may be secured to wheel 47 by any suitable means. There is shown a headed pin 56 upon which is fitted a closed loop formed at the respective end of wire 55. The other end of the wire is preferably hooked upon the respective headed pin 26 by an open springy loop such as loop 27 of wire 28 so that wire 55 can be conveniently attached to and detached from the louver assembly.

As is apparent, rotation of wheel 47 will impart a reciprocatory pivotal movement to all the louver slats, the same being joined by wire 28. The arc performed by the louver slats can be conveniently set by appropriately selecting the eccentricity of headed pin 56 and the lengths of wire 55 and the associated components relative one to another. In practice it has been found that pivotal movements of the slats through an arc of 45° will give satisfactory results.

The control means further comprise a switch 60 for controlling the motor circuit mounted on the horizontal branch of bracket 45. While this switch may be of any suitable type, a toggle switch as shown is preferred. The switch has a bifurcated actuating member 61 which coacts with an arm 62 extending from rod 49. This arm may be fixedly secured to the rod, or as shown be held by two clamping nuts 63 and 64 to permit axial adjustment of the arm and to assure rotation thereof in unison with the rod.

The drive means and the control means just described, function as follows:

Let it be assumed that the drive means and the control means are in the positions shown in Figs. 4, 5 and 6. The switch 60 is then in its open position disconnecting the motor circuit. Wheel 42 is out of engagement with the wheel 37 and wheel 41 abuts against shaft end 31' only with the pressure of its own weight. When knob 51 is now turned through a rather small angle in the direction of the arrow shown in Fig. 5, arm 62 snaps switch 60 onto its "on" position thereby starting the motor which will turn blades 3 with its full force and speed. Although rod 49 is slightly lowered by the initial rotation of knob 51, wheel 47 remains out of engagement with wheel 42. During this stage of the operation, wheel 41 may be rotated by shaft end 31' or may more or less slip relative thereto depending upon the friction between the wheel and shaft end. In any event the engagement between the wheel and the shaft end is only slight and

not capable of transmitting power. This affords the advantage that the wear and tear upon the peripheral surfaces of wheel **41** and shaft end **31'** are negligible when the blades only of the fan are operated.

It will be understood that while rod **49** is positively advanced by screw or cam action, the wheel **47** is free to travel axially of the rod and is biased under action of the spring **52** to contact the wheel **42** with the correct pressure for drive of the wheel **47** without requiring critical control of the movement of rod **49**. Further, this spring **52** will automatically compensate for any wear in rubber or metal parts.

This control arrangement ensures that the load constituted by the louvers and their driving disc **47** cannot even accidentally be imposed on the motor **4** when starting the motor. By eliminating any need for a high starting torque a minimum capacity motor capable of delivering a given air flow is required, affording again a saving in cost and weight. Further, when the fan is shut off the above arrangement ensures that pressure is automatically removed from all rubber surfaces thereby lengthening the life of rubber parts and eliminating deformation in set of the rubber parts.

When it is now desired to start the louver assembly, the rotation of knob **51** is continued until wheel **47** engages wheel **42** with a pressure sufficient to force the floating wheel **41** into power transmitting engagement with shaft end **31'**. As a result, the rotation of the shaft end is transmitted to wheel **47** which rotates about rod **49** and imparts through eccentric pin **56** and wire **55** the aforedescribed pivotal movements to all the louver slats.

To stop first the louver assembly and then the fan blades, knob **51** is rotated in opposite direction. Such opposite rotation of knob **51** first moves wheel **47** out of engagement with wheel **42** and then switch **60** into its "off" position. As appears from the previous description, a single common control means permits selectively to operate either the fan blades only or the fan blades and the louver assembly, operation of the fan blades only producing an air flow in a fixed direction and operation of the louver assembly an oscillating air flow by the effect of the reciprocating louver slats.

Standard of the fan

The standard comprises a base plate **70** from which extends two pairs of bent arms **71**, **72** and **73**, **74** respectively, the opposing pairs of arm portions **73** and **74** being spring urged inwardly to grip the casing **1** therebetween. These arms are joined at their free ends by caps **75** which form a base for fastening means enabling the shells of the housing and the components supported therein to be fastened by a single operation. The fastening means also serve as a horizontal axle about which the entire fan assembly may be tilted, as hereinafter more fully described. It suffices to state at this point of the description that they are capable of frictionally retaining the fan housing in any selected position of tilt.

As appears from the previous description, the motor assembly and all parts supported thereon remain in their same positions relative to the base **2** during the operation of the fan.

The reciprocation of louvers which are of course extremely light and which further are moved about central axes will not alter the disposition of the centre of gravity. Further, since the axis of tilt of the fan is essentially coincident with the centre of gravity its location will not alter appreciably during tilting.

This fact, together with the compactness of the unit, provides the advantage as pointed out above of enabling a small light base to be employed in contrast to previous oscillating fans.

The assembly of the fan housing and the parts supported therein

As has been previously described, the fan according to the invention comprises a shell **6** in which is fitted wire mesh **8**; a shell **7** in which is fitted wire mesh **9** and which supports with the louver assembly secured thereto by a screw **80** or other suitable means, the motor assembly including the drive means, the control means and the fan blades, cylinder **13**, and base or standard **2**. All these components are so designed that they can be assembled or disassembled by tightening or unlocking two fastening means generally designated by **85**. The assembly and disassembly of the aforesaid fan components can best be seen in Figs. 11, 12 and 13.

As appears from these figures, wall members **86** and **87** with depending flanges are secured to or integral with the coacting edges of housing shells **6** and **7** respectively to form two narrow pockets. The shells are provided with these pockets at opposite sides and at each side the pockets complement each other to accommodate at one side plate **38** and at the other side plate **39** secured to motor brackets **35** and **36** respectively. The abutting edges of the wall members **86** and **87** have each a semicircular recess **88** and **89** respectively which form a circular hole equal in diameter to hole **39'** and in alignment therewith when the respective edges of wall members **86** and **87** abut against each other as is shown in Fig. 11. The outside walls **90** and **91** of the pocket forming members are preferably outwardly slanted. Wall members **86** and **87** and the side walls **90** and **91** thereof are engageable by a shell **92**. The side walls **93** of this shell are also preferably outwardly slanted though slightly less than side walls **90** and **91**. Shell **92** is formed with a circular hole **94** of equal diameter as the circular holes **39'** and **88**, **89**. Housing shell **7** is preferably shouldered at **95** to accommodate the rim of housing shell **6**.

Fastener **85** is of the type available in the market under the trademark Vibrex Fastener. A fastener of this type comprises a shank **96** from which a pin **97** laterally extends on both sides. Shank **96** is headed by a slotted head **98**. The fastener further comprises a cam **99** forming two cam surfaces, one for each of the pin ends and an axially deformable elastic sleeve such as a rubber sleeve **100**. The fastener is pre-assembled on its base **75** by extending its shank **96** through a hole provided for this purpose in the base with head **98** seated against the outside of the base. A washer **101** may be interposed between head **98** and base **75**. Sleeve **100** and cam **99** are then slipped upon the shank and finally pin **97** is inserted to engage its cam surfaces as can best be seen in Fig. 12. The axial length of sleeve **100** is such that it is slightly pre-compressed when the ends of pin **97** engage the part of the cam surfaces closest to head **98**, said position being shown in Fig. 12. The pre-compression of sleeve **100** is indicated by the slight bulging of the sleeve. The purpose of the precompression is to ensure a sufficient initial starting friction between the engaging surfaces of the fastener. When it is now desired to assemble the fan, plates **38** are fitted in the respective pockets, housing shells **6** and **7** are pressed against each other, cylinder **13** is inserted thereby holding wire mesh **8** or more specifically the extension **8'** thereof in position. All the aforementioned parts then occupy the positions relative to each other shown in Fig. 11. Plates **92** are now fitted upon wall members **86** and **87**. Finally cam **99** and sleeve **100** of the fasteners **85** are inserted in holes **94**, **88**, **99** and **39** then in alignment. When now fasteners **85** are tightened by turning heads **98** for instance by means of a screw driver or an appropriate coin the ends of pin **97** ride upon the respective cam surfaces thereby shortening the axial distance between the cam member and the side of base **75** against which sleeve **100** abuts. As a result, the sleeve portion protruding from plate **38** becomes strongly bulged as is shown in Fig. 11. The bulging portion of the

sleeve clamps tightly together all the components engaged by the fastener. Furthermore, the difference in slant between the side walls **90**, **91** and **93** respectively forces wall members **86** and **87** and hence housing shells **6** and **7** closely toward each other. It will now be evident that by the simple and single operation of tightening the fasteners the assembly of the entire fan is completed, the entire weight of the motor assembly being supported by blades **38** and **39**. It is important to note that the plates **38** and **39** are actually carried by the resilient sleeves **100** of the fasteners and the fasteners therefor form resilient mounts for these plates and as well the motor and other structure carried by the transverse frame constituted by these plates and the wires **35** and **36**. Further, shock mounting is provided by the resilient cushion member **100'** arranged between the cap **75** and the shell **92**. Similarly the fan can be disassembled for cleaning or repair purposes by unlocking fasteners **85**. The fasteners are unlocked by returning the pins **97** from the position of Fig. 11 into the position of Fig. 12 and the fasteners can be withdrawn from the fan housing.

It is further apparent that sleeves **100** constitute an axle about which the housing can be pivoted. Due to the frictional properties of the rubber sleeves, the fan housing will remain in any position of tilt in which it is placed

The operation of the fan

Let it be assumed that the fan is assembled as described and that it is desired to operate the fan for producing a stationarily directed air flow. Knob **51** is then rotated just sufficiently to move switch **60** into its "on" position. The rotating impeller blades will draw an air current through the wind tunnel formed by cylinder **13**. The direction in which this air current is delivered depends upon the position of the louver slats. If these slats happen to be in positions parallel to the axis of cylinder **13** the air flow will be delivered straight in the direction of the axis of the cylinder otherwise it will be deflected by the slats corresponding to the angle which the slats form with the cylinder axis. In any event the direction of the air flow will be stationary.

When it is now desired to produce an oscillating air flow, rotation of knob **51** in the same direction is continued until wheel **47** engages wheel **42** and the louver slats are reciprocated as previously described.

The strata of the air flow impinging upon the louver slats or vanes will be directly deflected by the same through changing angles corresponding to the angular movements of the slats. As previously described, the louver slats are so arranged that air slots remain between adjacent slats in any pivotal position thereof. In other words, certain strata of the air flow do not impinge upon slats but pass straight and directly between the slats. Immediately after passing through the slats, these air strata impinge upon the air strata which have been directly deflected by the slats and as a result the air strata passing between the slats are deflected at the same angle as the air strata impinging upon the slats. While the aerodynamics phenomena causing such a deflection of the entire air flow are not yet entirely clear, it appears that the air strata deflected by the slats form curtains or pressure areas which cannot be penetrated by the straight air strata whereby the latter are deflected. In any event, extensive tests have shown that the louver slats do not produce a shutter effect but that a true deflection of the entire air flow is attained. In other wards, the air delivery is substantially one hundred per cent of the air intake.

The slanted surface **7'** of the reinforced rim of shell **7** has been found to be helpful in directing the oscillated air flow when it reaches its limit positions.

Moreover by having the sides of the shell **7** recessed or concaved as at **110** as explained in connection with Fig. 2 and by extending the lower slats **15** forwardly of these concaved sides, the air flow can be oscillated through a wide angle without impedance by the shell.

While the invention has been described in detail with respect to a certain now preferred example and embodiment of the invention it will be understood by those skilled in the art after understanding the invention, that various changes and modifications may be made without departing from the spirit and scope of the invention, and it is intended, therefore, to cover all such changes and modifications in the appended claims.

What I claim as my invention is:

1. A portable electric fan comprising a ring shaped casing forming a wind tunnel, one end of said tunnel formation constituting the intake side and the other the delivery side of the tunnel, fan support means pivotally supporting the casing to pivot about a horizontal axis disposed substantially midway between the intake end and the delivery end of said tunnel, impeller blades rotatably mounted at the intake side of said tunnel for producing an air flow therethrough, louver means disposed at the delivery side of the tunnel, the said louver means including several parallel louver slats each pivotal about a longitudinal axis, the axes of said slats extending transversely to the axis of said tunnel, motor means for rotating said blade means within said tunnel between the blade means and the louver means, a horizontal support structure for the motor means disposed within the casing substantially coincident with said horizontal axis and suspended by the means pivotally supporting the casing, drive means supported on the motor and arranged to be coupled with said motor means for actuation thereby and with said louver means for imparting to the slats thereof reciprocatory pivotal movement through a predetermined arc for deflecting said air flow corresponding to the pivotal movements of the slats, the spacing of said slats being such that the slats do not overlap in any pivotal position thereof as seen in the flow direction of the air through the tunnel whereby slots are formed between adjacent slats providing for the passage of straight air streams between adjacent slats, the said straight air streams being deflected by impinging upon the air streams deflected by impinging upon the slats, and joint control means for controlling the motor means and the coupling of the drive means with the motor means and the louver means respectively for the purpose aforesaid.

2. An electric fan according to claim 1, wherein the said casing is divided in two generally ring shaped portions of substantially equal axial length, and further comprising joining means for joining the respective rims of said portions to each other and said motor support means for the assembly in the casing.

3. An electric fan according to claim 2, wherein the said joining means comprise clamping means engageable with both said casing portions for clamping the same together, and releasable locking means including a locking member extending through corresponding openings in the clamping means and the support means for locking together the said two means and the casing by actuation of said locking means.

4. An electric fan according to claim 3 and further comprising a standard for the casing, said standard including a base and a frame rising therefrom, the said frame being also engageable by said locking member for releasably securing the standard to the casing by actuation of said locking means.

5. An electric fan according to claim 1, wherein the tubular member, the blade means, the louver means, the motor means and the drive means are mounted in the casing, the said motor means including a connecting cord, and wherein strain relief means for said cord are provided on an inside wall of said casing.

6. An electric fan according to claim 1, wherein each of the said louver slats is pivotal about its longitudinal centre axis, and coupling means interconnect said slats for joint reciprocatory movement by said drive means, said

coupling means comprising a wire member extending across said slats, and fastening means on the slats and the wire member for detachably fastening the latter to each of said slats.

7. An electric fan according to claim 6, wherein the said fastening means comprise an open loop formed in the wire member for each of the slats and a headed pin surrounded by a lubricant-soaked compressible member on each slat for receiving a respective one of said loops.

8. An electric fan according to claim 1, wherein each of said louver slats is pivotal about pivot pins extending from each end of the slat co-axially with the longitudinal centre axis thereof, and wherein the said slats are mounted in spring loaded bearing means exerting a yielding axial pressure upon the slats to prevent rattling of the slats during the reciprocatory movements thereof.

9. An electric fan according to claim 1, wherein the said drive means comprise an input wheel frictionally engageable with the drive shaft of said motor means, an intermediate wheel mounted for rotation in unison with the input wheel, an output wheel frictionally engageable with said intermediate wheel, coupling means eccentrically connecting said output wheel with said louver means for imparting said reciprocatory movements to the louver slats upon rotation of said output wheel, said control means being arranged to move the said wheels into and out of rotation transmitting frictional engagement with each other and said motor drive shaft.

10. An electric fan according to claim 9, wherein the said output wheel is spring biased and mounted axially displaceable for movement into and out of yielding spring pressure engagement with said intermediate wheel, and the said control means coact with said output wheel to effect axial displacement thereof for the purpose aforesaid.

11. An electric fan according to claim 10, wherein the said input wheel and the said intermediate wheel are supported by a floating mounting causing idling of the input wheel when the output wheel is disengaged from the intermediate wheel.

12. An electric fan according to claim 11, wherein the said input wheel and the said intermediate wheel are seated on a common shaft which is supported by said floating mounting displaceable parallel to the drive shaft of the motor means, and the said output wheel is seated on a shaft disposed perpendicularly to the aforesaid shafts and axially displaceable by said control means whereby displacement of the output wheel shaft in the respective direction moves the output wheel into frictional pressure engagement with the intermediate wheel and the input wheel into frictional pressure engagement with the motor drive shaft.

13. An electric fan according to claim 12, wherein the said eccentrically connected coupling means comprise a wire member joined with one end to said output wheel and with the other end to said louver means for effecting said joined reciprocatory movements of the louver slats.

14. An elastic fan according to claim 1, wherein the said control means comprise switch means controlling an energizing circuit for said motor means and a movable actuating member, the said actuating member being successively movable into a first position effecting closure of said switch means and a second position effecting coupling of the drive means with the motor means and the louver means while maintaining said switch means closed.

15. An electric fan according to claim 14, wherein the said actuating member comprises an axially displaceable rod, axial displacement of said rod through a predetermined distance moving the rod into said first position and axial displacement of the rod through an additional distance moving the same into said second position.

16. An electric fan according to claim 15, wherein the said switch means is a toggle switch, and wherein the said rod is threaded in a threaded mounting and comprises an extension engageable with the toggle member of said switch whereby a predetermined rotation of said rod effects actuation of said toggle switch and continued rotation of said rod effects said coupling of the drive means.

17. An electric fan according to claim 1, wherein the said drive means comprise an input wheel frictionally engageable with the drive shaft of said motor means, an intermediate wheel mounted for rotation in unison with the input wheel, an output wheel frictionally engageable with said intermediate wheel, coupling means eccentrically connecting said output wheel with said louver means for imparting said reciprocatory movements to the louver slats upon rotation of said output wheel, and wherein the said control means comprise switch means controlling an energizing circuit for said motor means and an axially displaceable rotary rod controlling the switch means and supporting said output wheel for axial displacement thereof, the said rod being selectively movable into a first position in which said switch means is in its "off" position and said output wheel is disengaged from said intermediate wheel, a second position in which said switch means is in its "on" position and said output wheel is disengaged from said input wheel or a third position in which said switch means is in its "on" position and said output wheel and said other wheels of the drive means are in rotation transmitting frictional engagement with each other and the drive shaft of the motor means.

18. An electric fan according to claim 1, wherein the said motor means comprise a motor having a generally U-shaped field core, the said drive means and the said control means being supported on and secured to the base branch of said field core.

19. In an electric fan according to claim 1, a fan support means comprising a base, a pair of spaced arms extending upwardly from said base, the motor support structure being removably mounted between said spaced arms to rotate about said horizontal axis, the motor means being mounted on said support structure centrally between said spaced arms and having a rotor shaft extending transversely of said support structure, the casing surrounding said motor support structure and motor means and having its axis substantially coincident with the axis of said rotor shaft and having a horizontal diameter substantially coincident with the axis of rotation of said motor support structure and intersecting the horizontal axis of rotation of said support structure, the blades being mounted on said rotor shaft on one side of said support structure at one end of said rotor, the louver means being supported by said casing at the opposite side of said support structure at the other end of said rotor, the blades, the motor means, the louver means and the drive means therefor providing a balanced structure having a centre of gravity substantially coincident with the axis of rotation of said support structure.

20. A fan as claimed in claim 1 in which said blade means comprises at least two blade members having a substantial area thereof disposed outside of said wind tunnel formation and the remaining area disposed inside said wind tunnel formation.

21. A fan as claimed in claim 20 in which two-thirds of the area of said blade members are located outside said wind tunnel formation.

22. A fan as claimed in claim 1 in which said casing has the sides thereof at the front of a concaved formation smoothly receding rearwardly of the casing from the casing top and bottom and said louver slats are mounted between the casing top and bottom on said longitudinal central axes with said axes disposed towards the front of said casing approximately to the point of maximum rearward recession of said casing sides.

23. An electric fan as claimed in claim 1 in which said drive means for said louver means comprises a friction drive having a spring-biased friction member movable into and out of frictional engagement with motor-driven means, and said means controlling said drive means comprise a member operable to move said friction member into and out of engagement with said motor-driven means, said motor having a switch therefor, and means actuating said switch from said controlling means to effect energization of said motor prior to engagement of said friction member with said motor-driven means.

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