Nov. 22, 1927. 1,650,280

L. R. KOENIG

OSCILLATOR

Filed Dec. 6, 1926 2 Sheets-Sheet 1

Fig. 1.

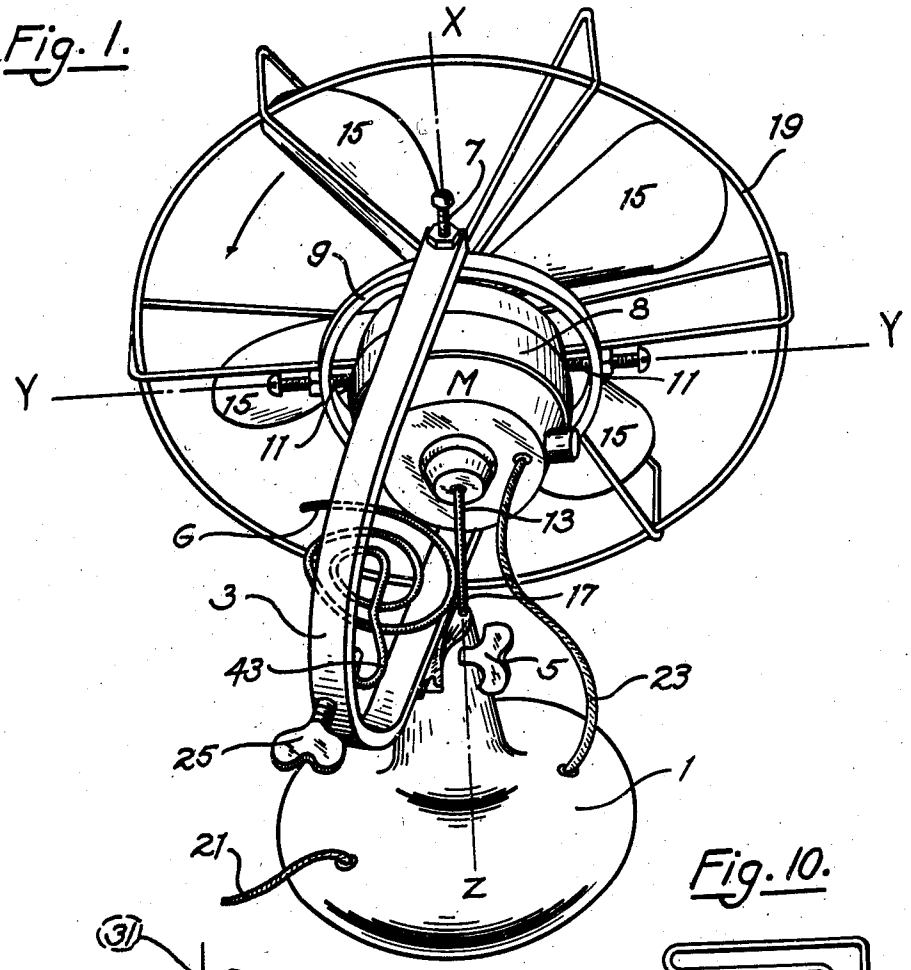
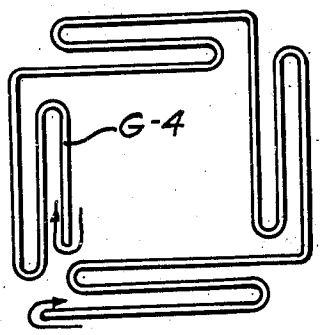


Fig. 10.



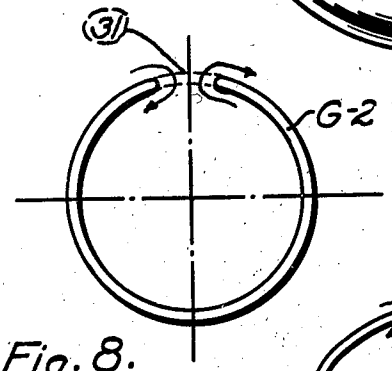


Fig. 9.

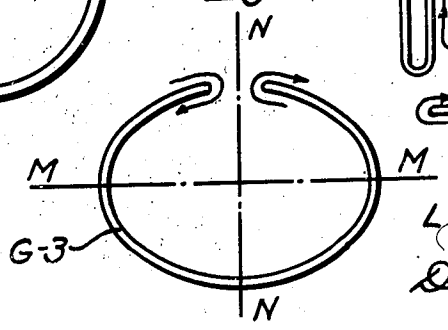


Fig. 8.

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Fig. 2.

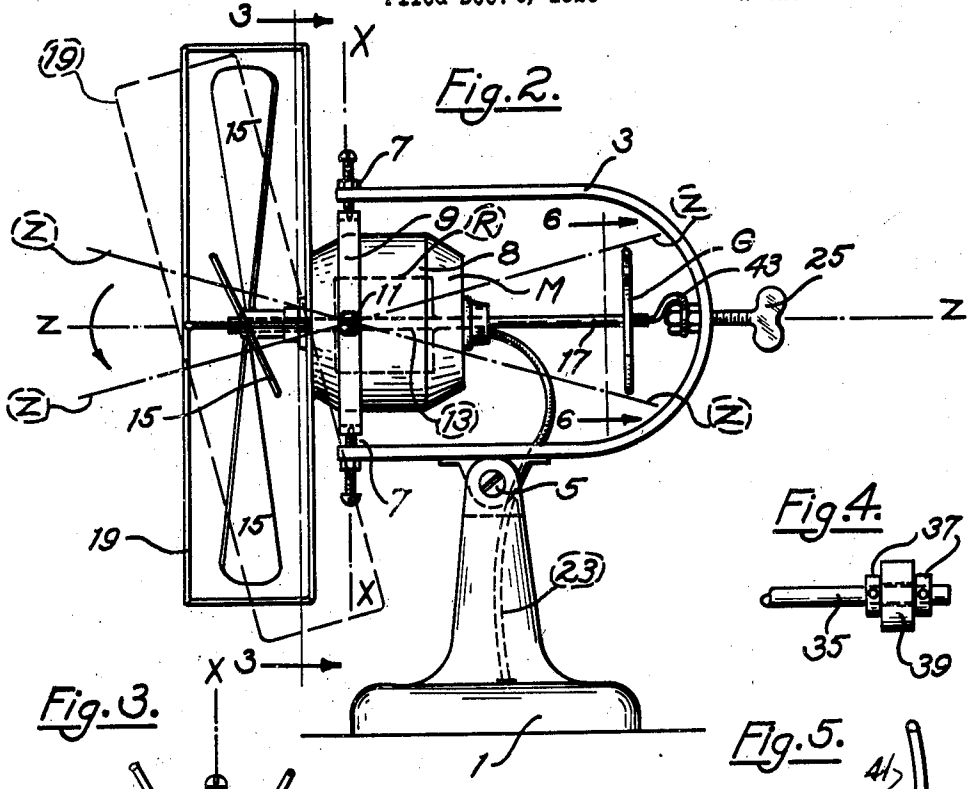


Fig. 4.

Fig. 3.

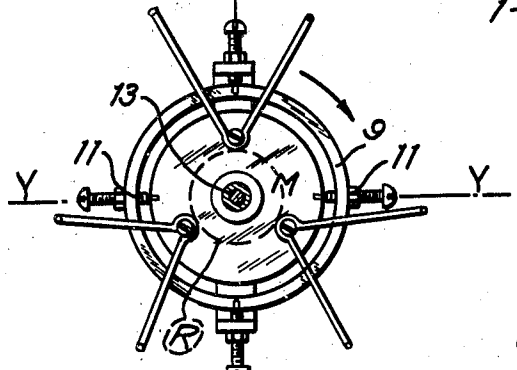


Fig. 5.

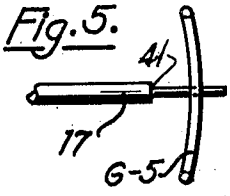
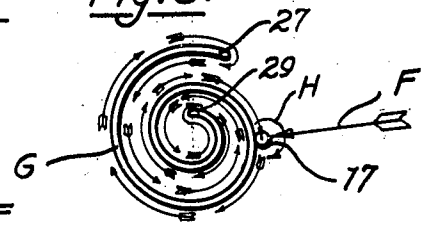


Fig. 6.



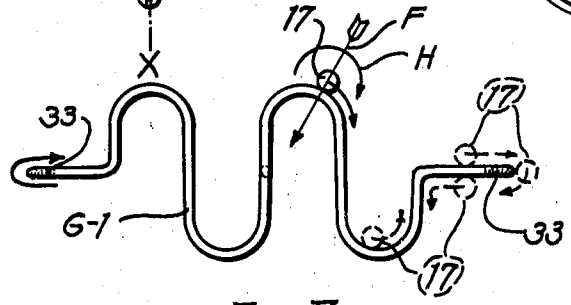


Fig. 7.

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UNITED STATES PATENT OFFICE.

LLOYD R. KOENIG, OF ST. LOUIS, MISSOURI.

OSCILLATOR.

Application filed December 6, 1926. Serial No. 152,778.

This invention relates to oscillators and with regard to certain more specific features, to oscillators for fans and the like.

Among the several objects of the invention may be noted the provision of an oscillator adapted to function on gyroscopic principles, whereby the inherent rotative characteristics of certain devices, such as fans, may be made use of, to cause oscillations of the axes of rotation; the provision of an oscillator adapted to direct an axis of rotation in various conoidal paths, the shapes of which paths may readily be changed, thereby providing means for directing a moving column or other blast of air (in the case of a fan) in various directions and thereby also providing oscillatory movement of said column or blast; and the provision of an oscillator of the class described requiring for its construction a minimum number of simple and rugged elements adapted to wear for long periods without special attention. Other objects will be in part obvious and in part pointed out hereinafter.

The invention accordingly comprises the elements and combination of elements, features of construction, and arrangements of parts which will be exemplified in the structure hereinafter described, and the scope of the application of which will be indicated in the following claims.

In the accompanying drawings, in which are illustrated several of various possible embodiments of the invention,

Fig. 1 is a right-rear perspective view of an electric fan embodying the invention,

Fig. 2 is a left side elevation of the fan shown in Fig. 1;

Fig. 3 is a fragmentary vertical section taken on line 3—3 of Fig. 2;

Figs. 4 and 5 show certain alternative gyroscopic, frictional contactors;

Fig. 6 is a vertical section taken on line 6—6 of Fig. 2 but shows an alternate position for the frictional contactor; and

Figs. 7 to 10 are views similar to Fig. 6, but enlarged, and illustrate certain alternative forms of contact guides.

Corresponding reference characters indicate corresponding parts throughout the several views of the drawings.

Referring now more particularly to Figs. 1 and 2, there is illustrated at numeral 1 a supporting base which pivotally carries a frame 3. A clamping type of thumb screw 5 provides the pivot and at the same time provides locking means at the pivot, whereby relative motion between the frame 3 and supporting base 1 may be prevented at any of the relative positions between the two.

A pair of pivots or bearings 7 are arranged on the frame 3, along a preferably vertical axis X—X, for the purpose of rotatably supporting a gimbal ring 9.

A pair of pivots or bearings 11 are arranged on said gimbal ring, along an axis Y—Y, for the purpose of rotatably supporting an electric motor M, of a type adapted to be used for electric fans. The axis Y—Y is preferably located at substantially 90 degrees with respect to the axis X—X (see Fig. 3). The axis Y—Y is also in the plane of said axis X—X in the present embodiment, although the last-named limitation is not always necessary.

The motor M comprises the ordinary casing 8 which rotatably supports a conventional rotor R. The rotor revolves at the substantially high rates of speed which are usual in fan construction. It comprises any type such as will provide the rotation ordinarily required in fan or like constructions and in the present embodiment uses either direct or alternating current. The field windings are carried by the casing 8. It is clear that an induction or any other suitable type may also be used and that the size may be varied to suit particular conditions. In fact, other forms of motors, not electric, may be used to cause rotation.

The rotor R is mounted to turn on and with an axle or shaft 13 carried in suitable bearings associated with the motor casing 8. This shaft 13 has its axis of rotation Z—Z located preferably in a plane at 90 degrees to the axis Y—Y. The shaft 13 carries forwardly therewith a set of conventional fan blades 15 for inducing a draft of air when the motor M is operated. The shaft 13 is provided with a rearward extension 17, referred to hereinafter as a contactor 17, for purposes to be described.

Fastened to the motor casing is a suitable blade guard 19 which is movable with said casing. The casing may carry other accessories therewith (not shown).

From the above, it is evident that the rotating elements of, and connected with the motor M have three degrees of freedom,

namely about the axes X—X, Y—Y and Z—Z and that the motor M is universally coupled to the frame 3. For the best operation of the device, the motor M, including all parts and accessories associated therewith, such as the rotor R, blades 15, shaft 17 and guard 19, should be substantially balanced about that axis which is to be ordinarily located at right angles to the force of gravity, namely axis Y—Y. This balance need not be a refined one and it is not necessary that the axis Y—Y always remain in said location, that is, at right angles to the force of gravity. This is because the said balance around axis Y—Y provides substantial balance of the said elements about the other axis X—X, said axis Y—Y being in the plane of axis X—X. Hence said motor elements are in substantial static balance, regardless of how the device is tilted. It is to be understood that the rotor and parts turning therewith are given enough dynamic balance for smooth rotative action.

Electric current is brought to the device over a suitable wire lead 21 (Fig.1) which may lead to a speed-varying switch (not shown) in the base 1. A flexible wire lead 23 leads from said base or other suitable point to the casing of the motor M to deliver electrical energy to said motor.

The frame 3 is provided rearwardly with a longitudinally and rotatably adjustable supporting piece or screw 25, comprising a thumb screw, which carries a contact guide G. This guide G may have various forms and in Figs. 1, 2 and 6, comprises a length of spirally formed wire. The rotating extension or frictional contactor 17 of the motor shaft 13 is adapted to engage this guide G at any lateral point, because of the described universal swiveling action of the motor M. If contact is made while said motor M is rotating (the motor rotates the contactor 17), then (see Fig. 6) the first contact results in a tendency of the contactor 17 to be driven in a direction tangential to the curved or other surface of the guide G. Clockwise rotation of the contactor 17 around its own axis is assumed for the present (see arrow H, Fig. 6).

This tendency of the contactor 17 to be driven tangentially by the frictional effect between it and the guide, results in a gyroscopic couple being set up (due to the rotating masses associated with the rotating contactor 17 such as the blades and rotor). This gyroscopic couple tends to force the contactor 17 in a direction substantially at 90 degrees to the said tangential movement which caused the couple. The result, in the present application, is that there is a continual gyroscopic force F which presses the rotating contactor 17 against the guide G, regardless of the curvature or angularity of the outline of said guide. The fact that this force F is resisted by the guide G results in the contactor 17 advancing to a new position (due to said frictional driving effect).

The process proceeds indefinitely as long as the motor M provides rotation, that is, the frictional contact between the contactor 17 and the guide G moves the contactor 17 ahead on the guide, while the gyroscopic couple F engendered by said movement, forces the contactor against the guide to maintain the frictional contact. The slight amount of energy required to carry on the process is derived from the motor by way of the gyroscopic reactions involved.

It is to be understood that, although the contactor 17 is directly driven to rotate in the present embodiment, thereby simplifying the construction, nevertheless, it may be driven to rotate indirectly and at a reduced speed, without changing the broader novel features of the invention as claimed. However, if it is driven indirectly, the direction of rotation of the contactor of the reducer should be such as to produce a frictional driving effect in the same relative direction with respect to the rotating elements as at present, because if the rotating inertial parts rotate oppositely to the frictional driving piece, the tendency will be to lift the contactor from the guide instead of to press it to it. This is due to the properties of gyroscopic structures in general.

It is evident that the driving contact may be purely frictional as described or of other classes without departing from the scope of the invention as claimed herein.

In Fig. 6 the arrow F represents the gyroscopic reaction at right angles to the surface of the guide G, the arrow H the direction of contactor rotation and the arrows parallel to the guide surfaces indicate the direction of travel of said contactor on the guide G. It may be noted that when the end 27 of the guide G is reached that the contactor rolls over the end as in following other curved portions of the guide and then moves along the inside of the spiral until another reversal is made at the inner end 29.

Fig. 7 shows an enlarged view of a wave form of guide G—1 wherein the other reference characters correspond to those shown in Fig. 6. The dotted lines show certain alternate positions of the contactor 17.

Fig. 8 shows a circular form of guide G—2 and the arrows indicate the direction of contactor travel at the guide ends. The dotted lines 31 indicate how the open gap in the guide G—2 may be bridged so that the contactor will have a continuous external or internal movement, depending upon its initial position within or without the ring.

Fig. 9 illustrates an ovate form of guide G—3 with directional arrows.

Fig. 10 represents a form of guide G—4

which will give the contactor a plurality of wave motions, each located angularly with respect to the other. The arrows again indicate the movement of the contactor at the guide ends.

Any one of the above described guides or any other desired shape may be fastened to the member 25. Hence a user may be supplied with one or more shapes so that he may employ the one best suited to his particular needs. If only one shape is used, such as the ovate one, several effects may be had, merely by interchanging or otherwise shifting its major and minor axes M—M and N—N, respectively. This may be done from the member 25.

From the above description, it is evident that the motor shaft 13 is directed to sweep out a conoidal form, the exact shape depending upon the configuration of the guide. The result is that the fan blows a draft of air which sweeps out in space a curved shape, rather than the conventional uni-planar sector shape. The advantages are manifold, as for instance, where it is desired to cool an object without blowing a draft directly thereon, the present fan may be set to blow all about it, by using such a guide as one of those shown in Figs. 8 to 10. The simplicity of the device is apparent.

For a slow oscillating effect, it is desirable to have the contactor 17 and the guide G rather smooth. To ensure reversal at the guide ends under these conditions it is sometimes desirable to have a more roughened portion at said ends, as indicated at numerals 33 in Fig. 7. This feature is not necessary with all designs made under the principles of this invention. Its desirability depends upon the mechanical constants involved, such as the speed of rotation and the value of the moment of inertia and radius of gyration of the rotating masses. Since the gyroscopic couple depends in part upon the moment of inertia of the rotating elements, it is evident that the rate of oscillation may be controlled by varying said moment of inertia because this varies the frictional effect between the contactor and guide. Likewise variations in the radius of gyration of the rotating masses will accomplish a similar effect. The rate of oscillation may also be varied by increasing or decreasing the diameter of the contactor 17. An increase will increase the rate of oscillation and a decrease will decrease it. It is evident that reversal of motor rotation results in the gyroscopic couple being effective to press the contactor to the guide, as before, but the direction of oscillation is reversed, that is, movement of the contactor along the guide is reversed.

Fig. 4 illustrates a modified form of contactor 35 having two collars 37 fastened thereto for the purpose of retaining a rotatable bearing collar 39 therebetween on the shaft. The collar 39 is adapted to engage the guide G. By this means the frictional effect between the guide and contactor is varied, whereby the period of oscillation of the system is changed.

Fig. 5 illustrates a shoulder 41 cut on the contactor 17, thereby providing other means for varying said oscillation constant, that is, by decreasing the contactor diameter. Fig. 5 also illustrates a form of guide G—5 built on a spherical surface whose center is at the center of the described universal swivel system for the motor M. By this means contact on the contactor is limited to a restricted length. This form of guide is especially useful where the form of collar 39 is used, such as is shown in Fig. 4.

It is to be understood that each of the alternative forms of guides may be fastened to the member 25 as the guide G is fastened, that is by an offset portion 43 (Figs. 1 and 2) or other suitable means. Furthermore, plate forms of guides may be used from which the guide path is cut as an opening, rather than formed as a solid piece as illustrated. A suitable casing (not shown) may be formed around the oscillating elements.

In starting this oscillator, the current is merely turned on. Ordinarily the contactor is resting against same portion of the guide and if it is not it may be manually pushed into such a position. In any case it will start itself oscillating, for if the contactor and guide are separated, the ordinary creep of the system sooner or later causes them to make the initial contact and thereafter the oscillations are continuously automatic as long as the motor rotates.

Fig. 2 illustrates certain alternate maximum conical positions of the axis Z—Z and it is evident that these may be changed by varying the longitudinal position of the guide G. Such longitudinal variation in the guide position may be made to vary the rate of oscillation, if the contactor 17 is tapered or stepped as in Fig. 5 to give varying contactor radii on the guide.

It is evident that the fan may be used as a non-oscillator at any time by providing a suitable clip to hold the contactor in a stationary position at any predetermined point.

It is evident that the gimbal ring need not comprise a complete ring supported by two bearings as any equivalent will suffice, such as a cradle member having the bearing 11, but having only a long single supporting and swiveling bearing corresponding to the lower bearing 7.

It is now evident that the degree of static balance described and required about the axes X—X and Y—Y depends upon the speed of rotation and weight of rotating parts, as well as their conformation, that is to say, upon the gyroscopic effect of these

rotating parts. The gyroscopic effect controls the magnitude of the reaction F and if this is small it will not require much unbalance to pull the contactor from the contact guide, thereby destroying the action at some particular stage. If the gyroscopic effect is caused to be great enough (and it need not be excessive) a considerable amount of static unbalance can be had about the axes X—X and Y—Y, yet perfect operation can be maintained.

In view of the above, it will be seen that the several objects of the invention are achieved and other advantageous results attained.

As many changes could be made in carrying out the above constructions without departing from the scope of the invention, it is intended that all matter contained in the above description or shown in the accompanying drawings shall be interpreted as illustrative and not in a limiting sense.

I claim:

1. An oscillator for fans comprising rotating elements, means for mounting said elements with three degrees of freedom including the freedom of rotation, a guide adapted to be engaged by at least one of said elements to provide driving contact, whereby a gyroscopic couple is engendered to maintain engagement between said element and said guide and whereby said elements oscillate themselves and are controlled by the guide, said gyroscopic couple being the only force tending to continuously maintain contact between said element and said guide.

2. An oscillator for a fan comprising rotating elements, including fan blades and contact means, means for mounting said elements with three degrees of freedom including the freedom of rotation, a guide adapted to be engaged by said contact means to provide frictional driving contact whereby a gyroscopic couple is engendered to maintain engagement and whereby said elements move themselves and are controlled by the guide, the mounting of said rotating elements being accomplished with such balance that said driving contact will be maintained in any of the positions that the fan as a whole may be caused to assume.

3. An oscillator for fans comprising a frame, a motor having rotating elements, means for mounting said motor on said frame so as to have a universal movement, a guide on the frame and a rotating contactor driven directly by the motor at motor speed adapted to engage said guide, whereby the motor is oscillated and a gyroscopic reaction engendered against said guide, said gyroscopic reaction being the only force tending to engage the contactor with the guide.

4. An oscillator comprising a frame, a motor having rotating elements, means for mounting said motor on said frame so as to have a universal movement, a guide on the frame and a rotating contactor driven by the motor adapted to engage said guide, the resulting gyroscopic couple being the primary force causing continuous contact between said contactor and guide 7.

5. An oscillator comprising a frame, a motor casing mounted universally thereon, a rotor in said casing, fan blades driven by said rotor adapted to induce an air current and increase the moment of inertia of said rotor, a contactor driven by the rotor, and a guide on said frame adapted to be engaged by said contactor whereby the casing is moved and a substantial gyroscopic reaction is engendered, said reaction being of a magnitude that, if unaided, is adapted to hold the contactor against the guide at all positions that both the contactor or guide may assume.

6. An oscillating fan comprising a frame, a rotatable member mounted on said frame and a motor rotatably mounted on said rotatable member, rotating elements associated with the motor adapted to directly drive fan blades and a contactor, and a guide on said frame with which said contactor frictionally engages to drive itself and control the motor oscillation and engender a gyroscopic reaction to maintain said engagement in any position of said contactor or said guide, irrespective of other holding means.

7. An oscillating fan comprising a frame, a member mounted thereon to rotate about an axis, a motor casing rotatably mounted on said member on an axis at right angles to said first-named axis and in the plane thereof, rotating elements carried by said casing rotatable about an axis located in a plane at right angles to said second named axis, a contactor driven by said rotating elements and a guide with which said contactor is adapted to engage to cause movement of said casing, said casing including the rotating elements therewith having a substantial static balance about said second named axis and said rotating elements having a substantial dynamic balance about said third named axis.

8. An oscillating fan comprising a frame, a motor universally mounted in said frame and rotating a contactor, a guide on the frame adapted to be engaged by said contactor, whereby the motor is oscillated on its universal mounting and a gyroscopic couple is engendered to maintain continuous engagement and means for adjusting the position of said guide.

9. An oscillating fan comprising a frame, a motor universally mounted in said frame and rotating a contactor, a guide on the frame adapted to be engaged by said contactor, whereby the motor is oscillated on its universal mounting and a gyroscopic couple

is engendered to maintain continuous engagement and means for changing guides without dismantling.

10. An oscillating fan comprising a frame, a motor universally mounted in said frame and rotating a contactor, a guide on the frame adapted to be engaged by said contactor, whereby the motor is oscillated on its universal mounting and a gyroscopic couple is engendered to maintain continuous engagement and means for moving said guide in respect to said frame.

11. An oscillating fan comprising a frame, a motor universally mounted in said frame and rotating a contactor at motor speed, a guide on the frame adapted to be engaged by said contactor, whereby the motor is oscillated on its universal mounting and a gyroscopic couple is engendered to maintain continuous engagement and means for adjusting the position of said guide.

12. A fan comprising a frame, a motor having a universal mounting on said frame and adapted to have its axis of rotation pass through horizontal positions, a contactor moving with and driven by the motor, a guide on the frame adapted to be engaged by said contactor; whereby the contactor drives the motor to oscillate and a gyroscopic couple is engendered maintaining driving contact between said guide and said contactor.

13. A fan comprising a frame, a motor having a universal mounting on said frame and adapted to have its axis of rotation pass through horizontal positions, a contactor moving with and driven by the motor, a guide on the frame adapted to be engaged by said contactor; whereby the contactor drives the motor to oscillate and a gyroscopic couple is engendered maintaining driving contact between said guide and said contactor, the balance of the motor being such that said gyroscopic couple will not be overcome at any point of oscillation.

14. An oscillating fan comprising a frame, rotating elements including fan blades and a motor mounted for universal movement with respect to said frame, a contactor driven to rotate by said rotating elements, a guide adapted to be engaged by said contactor, whereby a driving couple and a resulting gyroscopic reaction against the guide are engendered, said rotating elements being so mounted as not to overcome said gyroscopic reaction.

15. An oscillator comprising a frame, rotating elements having a free universal mounting thereon, a contactor adapted to be driven from said rotating elements and in the same rotative direction, a guide adapted to be engaged by said contactor, whereby the contactor drives on the guide causing the rotating elements to be oscillated and whereby a gyroscopic couple is engendered for maintaining driving contact between said guide and said contactor.

16. An oscillator comprising a frame, rotating elements having a universal mounting thereon, said elements having a predetermined degree of gyroscopic effect and being mounted with a predetermined degree of balance, a contactor adapted to be driven from said rotating elements, a guide adapted to be engaged by said contactor, whereby the contactor drives on the guide causing the rotating elements to be oscillated and whereby a gyroscopic couple is engendered for maintaining driving contact between said guide and said contactor, the relation between said gyroscopic effect and balance being such that the gyroscopic effect will maintain said driving contact in any position of said guide.

17. An oscillator comprising a frame, rotating elements having a universal mounting thereon, said elements having a predetermined degree of gyroscopic effect and being mounted with a predetermined balance, a contactor adapted to be driven from said rotating elements and in the same rotative direction, a guide adapted to be engaged by said contactor, whereby the contactor drives on the guide causing the rotating elements to be oscillated and whereby a gyroscopic couple is engendered for maintaining driving contact between said guide and said contactor, the relation between said gyroscopic effect and balance being such that the gyroscopic effect will maintain said driving contact in any position of said guide.

In testimony whereof, I have signed my name to this specification this 4th day of December, 1926.

LLOYD R. KOENIG.