

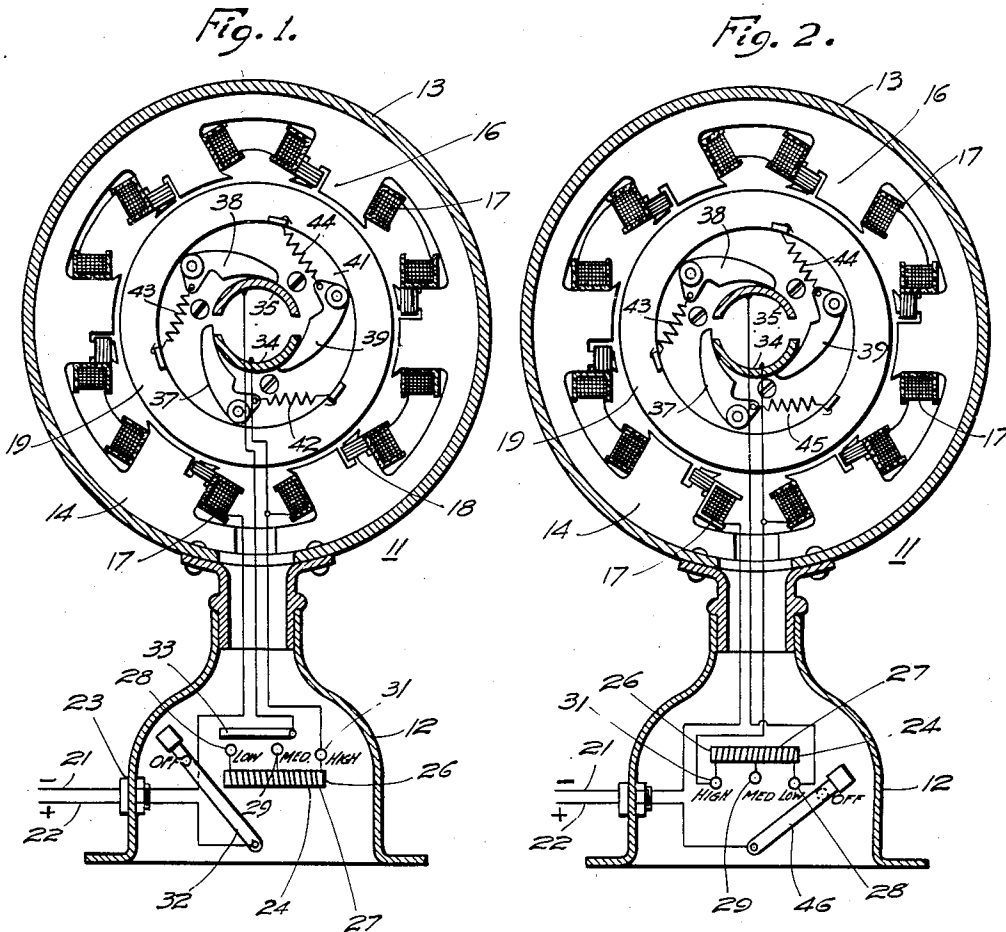
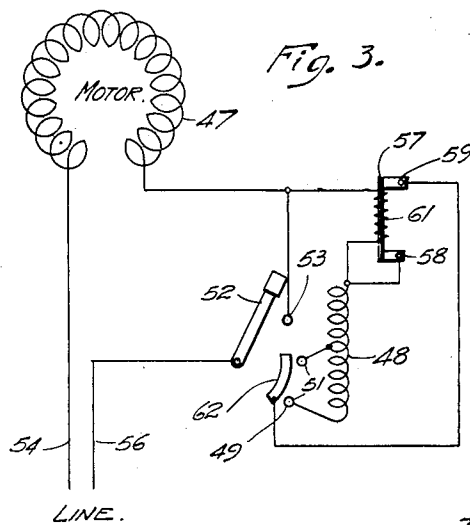
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STARTING DEVICE FOR FAN MOTORS

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STARTING DEVICE FOR FAN MOTORS

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My invention relates to fan motors and particularly to starting means therefor.

It is an object of my invention to provide a relatively simple, inexpensive and efficient means for permitting of starting a fan motor at substantially full-voltage conditions, irrespective of the position of the starting lever cooperating with a speed-reducing means.

In practicing my invention, I provide a fan motor having associated means for reducing the voltage applied to the energizing winding to permit of lowering the speed of the same and a time-delay device for initially short-circuiting the voltage-reducing means.

In the single sheet of drawings,

Figure 1 is a view, mainly in vertical section, of a fan motor having the device embodying my invention associated therewith,

Fig. 2 is a view, mainly in vertical section, of a modified form of device embodying my invention, and

Fig. 3 is a schematic diagram of connections illustrating a still further modification of the device embodying my invention.

One of the well-known and frequently used methods of operating a fan motor of the desk, wall or ceiling type is to provide a resistance or choke coil having a manually operable control lever associated therewith.

In order to operate the fan at reduced speed, it may happen that all or a part of the resistance or inductance is initially connected, thus reducing the voltage at the energizing winding. Under these conditions, it may happen that the voltage actually applied to the energizing winding is not large enough to cause a sufficiently large current to traverse the energizing winding to cause the motor to start. This is particularly the case in certain forms of energizing windings well known in the art.

Referring more particularly to Fig. 1 of the drawing, I have there illustrated a fan motor 11 comprising a suitable base 12, a casing 13 having located therein a laminated stator 14, here shown as provided with a plurality of salient poles 16, on which are located a plurality of field coils or windings 17 to be traversed by an electric current. The pole pieces 16 are of special construction to

permit of locating, on a portion thereof, shading coils 18 of a type generally used for the purpose of cooperating with the main field coils 17 to produce a torque on the rotor which is indicated schematically or generally only and designated by the numeral 19.

Neither fan blades nor other standard elements of a motor or of a fan are illustrated, since the construction and use of such elements is well known and it is, therefore, believed that no illustration or specific description thereof is necessary or desirable.

The base 12 is preferably made hollow in order to lighten the fan and also to permit of locating therein, on a suitable base, (not shown) a voltage-reducing means.

Lead wires 21 and 22 extend into the base 12, a suitable bushing 23 of electric-insulating material being provided, in a manner well known in the art. An inductance coil 24, of any suitable or desired construction, may embody a core member 26 and a winding 27, the size of the wire and the number of turns being suitably proportioned to obtain the desired reduction of the voltage at the energizing winding 17 of the motor, to thereby obtain the desired speed reduction of the fan.

The winding 27 is provided with a plurality of taps that are connected to contact members 28, 29 and 31, respectively. A manually operable contact lever 32 is so located and mounted that it may be moved to successively engage the contact members 28, 29 and 31.

A contact bar 33 is so located that the contact lever 32 will engage it when in engagement with either contact member 28 or contact member 29.

Conductor 22 is connected to the fixed end of lever 32, while conductor 21 is connected to one terminal of the set of coils 17. The other terminal of the set of coils 17 is connected to contact terminal 31, as well as to one (34) of a pair of fixed contact members 34 and 35, each of substantially semi-annular shape, as shown in the drawing. The two contact members 34 and 35 are mounted on suitable electric-insulating material supported by and in the casing 13. The arcuate con-

tact member 35 is connected, by a suitable conductor, to the contact bar 33.

The two arcuate contact members 34 and 35 are parts of a centrifugal short-circuiting switch embodying, in addition to them, three pivotally mounted contact arms 37, 38 and 39, the inner ends of which normally engage the contact members 34 and 35, while the outer ends thereof are pivotally mounted on a metallic plate 41 which is suitably mounted on the rotor structure 19. Springs 42, 43 and 44 are associated with the respective arms 37, 38 and 39 to yieldingly hold them normally in the positions shown in the drawings.

It is obvious that, when the speed of the rotor of the motor 11 has reached a predetermined value, the levers 37, 38 and 39 will fly outwardly, being disengaged from the contact members 34 and 35 to thereby remove the short circuiting connection existing up to that time.

Referring more particularly to Fig. 2 of the drawings, I have there illustrated a similar fan motor structure, the modification consisting particularly in the means for connecting the voltage-reducing means.

A choke coil or inductance 24 embodies a core 26 and a winding 27 having taps connected to contact members 28, 29 and 31, respectively, and a manually operable contact lever 46 to permit of making selective engagement with these contact members.

The conductor 22 has its inner end connected to the contact lever 46. Conductor 21 is connected to one terminal of the set of coils 17, while the other terminal of said set of coils is connected to contact terminal 31, as well as to the arcuate contact member 34. Arcuate contact member 35 is connected to contact member 28.

Referring to Fig. 3 of the drawings, I have there illustrated a somewhat different form of time-delay device, operative for the same purpose as the devices illustrated in Figs. 1 and 2 of the drawing but depending upon a different principle for its operation.

An energizing winding 47 is to be considered as schematically illustrating both the energizing winding proper and the motor structure, including a rotor.

A voltage-reducing means 48 is shown schematically and may comprise either a resistor or a choke coil. A plurality of taps are connected to contact members 49 and 51, respectively. A manually operable contact lever 52 may make selective engagement with either of the contact members 49 and 51 or with another contact member 53, which is connected to one terminal of the energizing winding 47, the other terminal of which is connected to one conductor 54 of a supply circuit comprising conductors 54 and 56.

A thermally operable time-delay device, operatively associated more particularly with the choke coil or inductance 48, comprises a

bimetallic strip 57, one end of which is supported by member 58 and a fixed contact member 59 which may be engaged by, or disengaged from, the movable end of the strip 57. A low resistance heating element 61 is operatively associated with the strip 57 to heat the same when traversed by an electric current.

The contact member 53 is connected to one terminal of the winding 47 and also to one terminal of the winding 61. One terminal of the choke coil 48 is connected to contact member 49, while its other terminal is connected to the other terminal of the heating element 61, as well as to the member 58.

A contact strip 62, which may be of arcuate shape, is located adjacent to contact members 49 and 51, which latter contact member is connected to substantially the midpoint of the winding 48. The arcuate contact member 62 is connected, by a suitable conductor, to the terminal 59.

Referring more particularly to Fig. 1 of the drawings, the parts are there shown in their inactive positions, that is, with the rotor at rest. If the conductors 21 and 22 are connected to a suitable source of electric energy and if the lever 32 is moved into engagement with the contact terminal 28 and the bar 33, current may flow, through the conductor 22, contact lever 32 and bar 33, to the contact member 35 and into arm 38; from there, through the support 41, to either or both contact arms 37 and 39, through arcuate contact member 34 and energizing winding 17 and, from there, back to the supply circuit through conductor 21. This effectively short circuits the choke coil 24, whereby substantially the full voltage of the supply circuit is made available at the terminals of the energizing winding, to cause a sufficiently large current to traverse the energizing winding to start the motor. Obviously, the same conditions will hold if the contact lever 32 is moved over far enough to engage contact member 29.

If the bar 33 were not present, and the contact lever 32 were moved over into engagement with contact member 28, all of the inductance of the choke coil 24 would be in circuit, and the starting current would be relatively small. However, with the construction and device hereinbefore described, the choke coil is initially short circuited by the time-delay device, comprising the centrifugally actuated structure, until such time as the motor has reached a predetermined speed, after which the short circuit is removed and the motor will then slow down to a speed determined by the amount of inductance in the circuit.

It is, of course, obvious that, if the lever 32 be moved over into immediate engagement with the contact member 31, the short-circuiting device will not be connected in cir-

cuit except for a very short interval of time necessary to move the lever 32 over the contacts 28 and 29.

Referring more particularly to Fig. 2 of the drawings, if the lever 46 be moved into engagement with the contact terminal 28, a circuit is established through the motor, beginning at conductor 22 and including arm 46, and from contact member 28, through the short-circuiting device, including the arcuate contact members 34 and 35 and the levers 37, 38 and 39, energizing winding 17 and from there to conductor 21. This, therefore, provides substantially full line voltage on the energizing winding 17, and the motor will start.

If, however, the lever is moved to engage contact member 29, current may flow through two parallel paths substantially as follows: from contact member 29 through one part of the winding 27 to contact member 31 and to one terminal of energizing winding 17. The other path is through the other part of winding 27 to contact member 28 and, from there, through the short-circuiting device and then to the same terminal of winding 17. If the current flow through the respective parts of the winding 27 is in such direction as to generate fluxes in the core 26 which are opposed to each other, it is evident that the inductance or choking effect of the choke coil will be relatively small, particularly so if the tap connected to terminal 29 is at substantially the midpoint of the winding 27.

In any case, whenever the motor is started, with the starting lever connected to either terminal 28 or terminal 29, substantially full line voltage will be applied to the winding 17 because of the action of the centrifugally actuable time-delay device until the motor has reached a predetermined speed, after which all or a part of the choke coil will be connected in circuit, according to whether the control lever is connected to the low or to the medium contact terminal.

Referring to Fig. 3 of the drawings, if the lever 52 is moved to engage terminal 49, so that all of the inductance of choke coil 48 is in circuit, if not provided with a time-delay device, it may be noted that the time-delay device will initially short circuit the choke coil. A circuit through the motor may be considered as beginning with conductor 54, extending through winding 47, and from there through heating element 61 to terminal 58, through the strip 57 to terminal 59, and from there to the strip 62 and through contact lever 52 to the other conductor 56. This effectively short circuits the choke coil 48.

The heating element 61 is designed, as to size of wire and number of turns, to heat the strip 57, within a predetermined time limit, to cause it to be disengaged from its contact member 59 and thereby move the initially ex-

isting short circuit of the choke coil 48. It is desirable that the short circuit be removed within substantially the same time as is required by the rotor of the motor to reach substantially the same speed as would effect actuation of the levers 37, 38 and 39 shown in Figs. 1 and 2 to disengage the contact members 34 and 35. As soon as the short circuit has been removed, all or part of the choke coil 48 will be in circuit and it may be noted also that the heating element 61 remains connected in circuit in order to insure that the strip 57 will remain in its actuated position.

If the contact arm or lever 52 is moved far enough, in the starting of the motor, to engage contact member 53, it is, of course, obvious that none of the inductance of the choke coil 48 will be connected in circuit, and the motor will, therefore, start at full line voltage applied to the energizing winding.

The device embodying my invention thus provides a time-delay device operatively associated with a voltage-reducing means for initially short circuiting the same. While I may use either the centrifugally-actuated time-delay device or the thermally-actuable time-delay device, tests so far made on devices of the two types indicate that the centrifugally-actuated device is slightly better in its repeated operation than is the thermally actuable device, and that it is more easily designed and adjusted. However, I have obtained good results with devices of both types.

Various modifications may be made in the device embodying my invention without departing from the spirit and scope thereof, and I desire, therefore, that only such limitations shall be placed thereon as are imposed by the prior art or are set forth in the appended claims.

I claim as my invention:

1. In a power motor, the combination with an energizing winding and a voltage-reducing winding having a plurality of taps, electrically connected in series circuit with the energizing winding, and a switch lever for selectively engaging the taps, of centrifugally-actuable means operatively associated with the voltage-reducing winding for initially short circuiting it when the switch lever is caused to engage predetermined taps for starting the motor.

2. In a power motor having an energizing winding, a multiple-tap variable-voltage means, and spaced contact members for the outer ends of said taps, in combination, a manually-adjustable contact arm for electrically connecting the energizing winding in series-circuit relation with the respective taps of the variable-voltage means, and means for initially short circuiting the variable-voltage means when starting the motor,

said means including a contact bar spaced from the contact members and engageable by the contact arm, a time-delay device, and electrical connections between the contact bar, the contact arm, the variable-voltage means and the time-delay device for short circuiting the variable-voltage means at lower speeds of the motor and for removing said short circuit at a predetermined motor speed.

3. In a power motor having an energizing winding, a multiple-tap variable-voltage means, and spaced contact members for the outer ends of said taps, in combination, a manually-adjustable contact arm for electrically connecting the energizing winding in series-circuit relation with the respective taps of the variable-voltage means, and means for initially short circuiting the variable-voltage means when starting the motor, said means including a contact bar spaced from the contact members and engageable by the contact arm, a centrifugally-actuable switch, and electrical connections between the contact bar, the contact arm, the variable-voltage means and the centrifugally-actuable switch for short circuiting the variable-voltage means at lower speeds of the motor and for removing said short circuit at a predetermined motor speed.

In testimony whereof, I have hereunto subscribed by name this 5th day of September, 1928.

RICHARD H. JORDAN.

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