

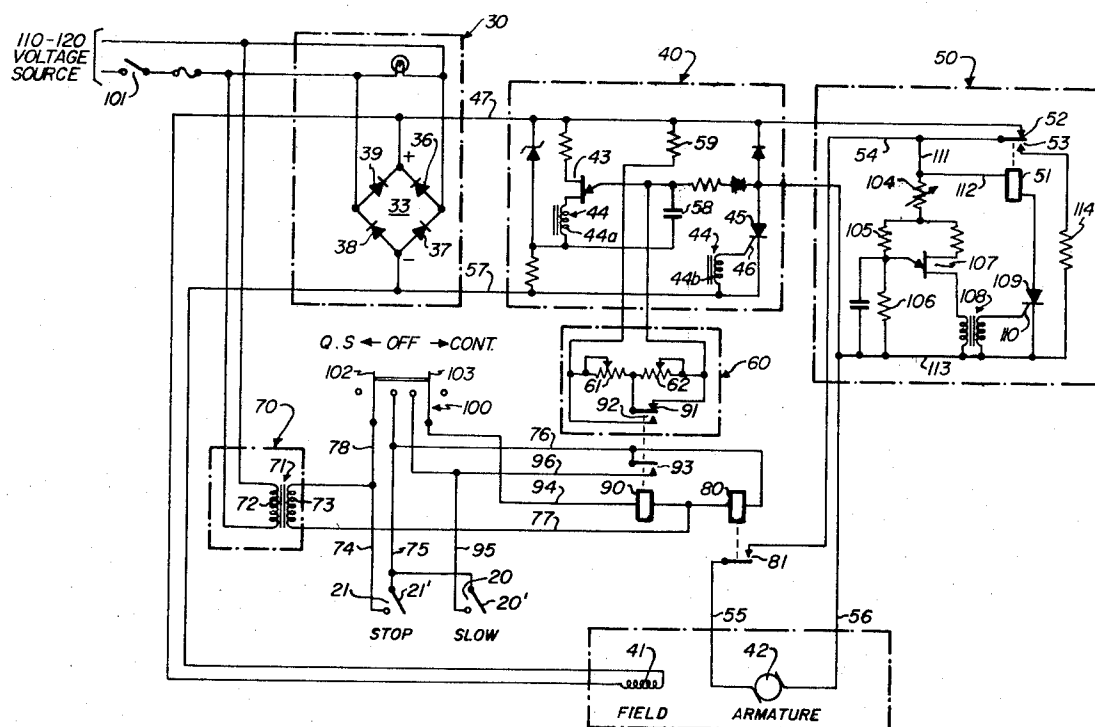
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 [21] Appl. No. **13,951**
 [22] Filed **Feb. 25, 1970**
 [45] Patented **Sept. 7, 1971**
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[56] **References Cited**
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[54] **SPEED CONTROL MECHANISM FOR REVOLVING DOORS**
4 Claims, 3 Drawing Figs.

[52] U.S. Cl. **318/302,**
318/331, 318/380
 [51] Int. Cl. **H02p 5/04**
 [50] Field of Search **318/302,**
258, 269, 331, 380

ABSTRACT: A speed control mechanism for controlling the operation of a motor used to rotate a revolving door, to prevent the latter from being rotated faster than a predetermined maximum speed of rotation. Control is established by sensing the speed of rotation of the door, and, if it exceeds the established predetermined speed, a resistance is connected across the armature of the motor driving the door, which resistance functions as a dynamic-braking means for the motor.



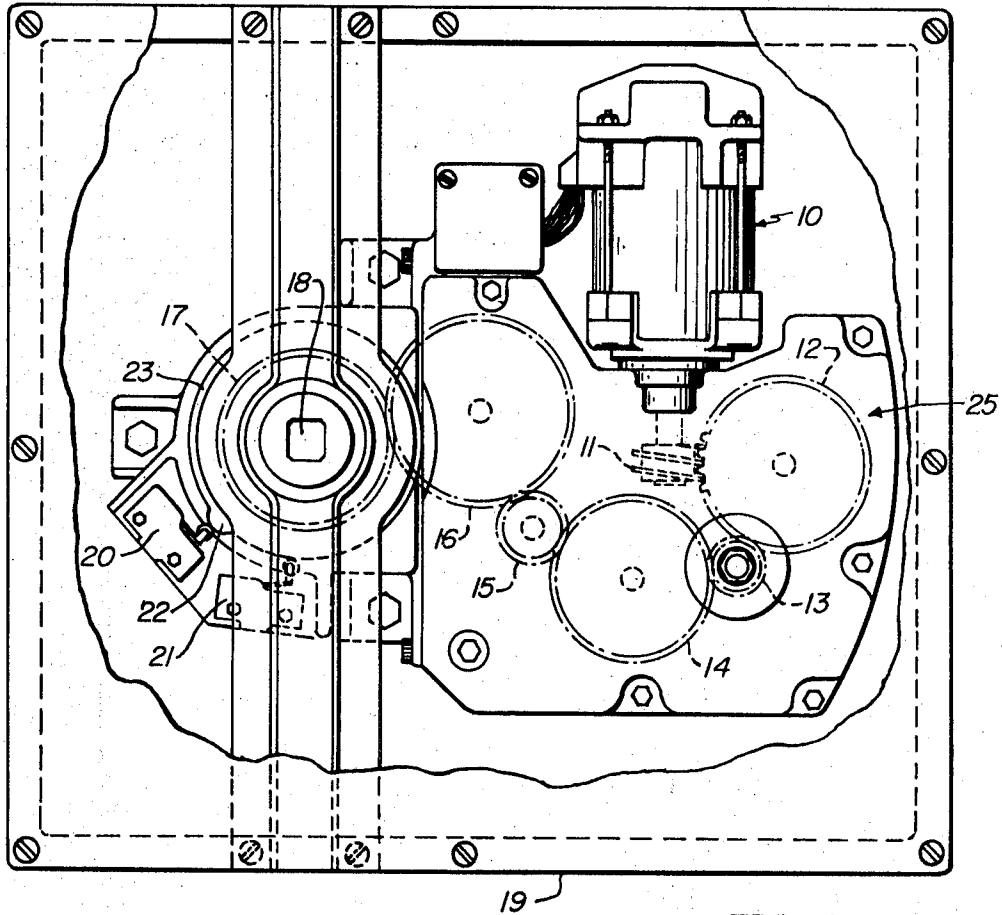


FIG. 1

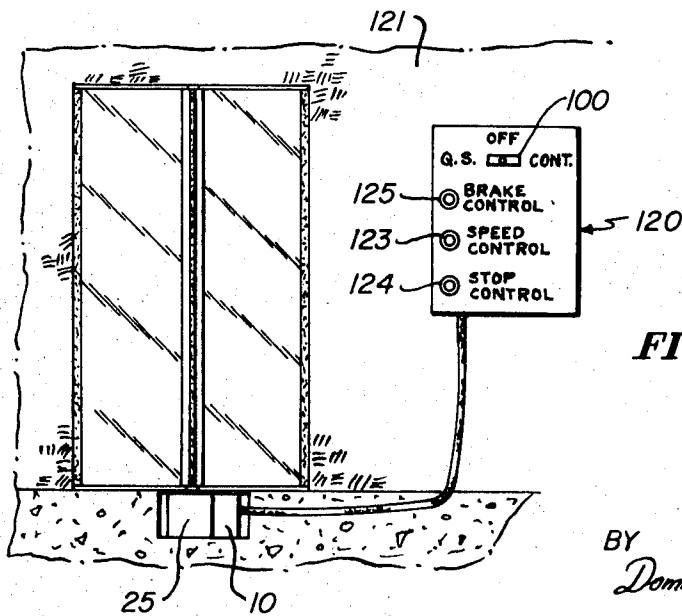
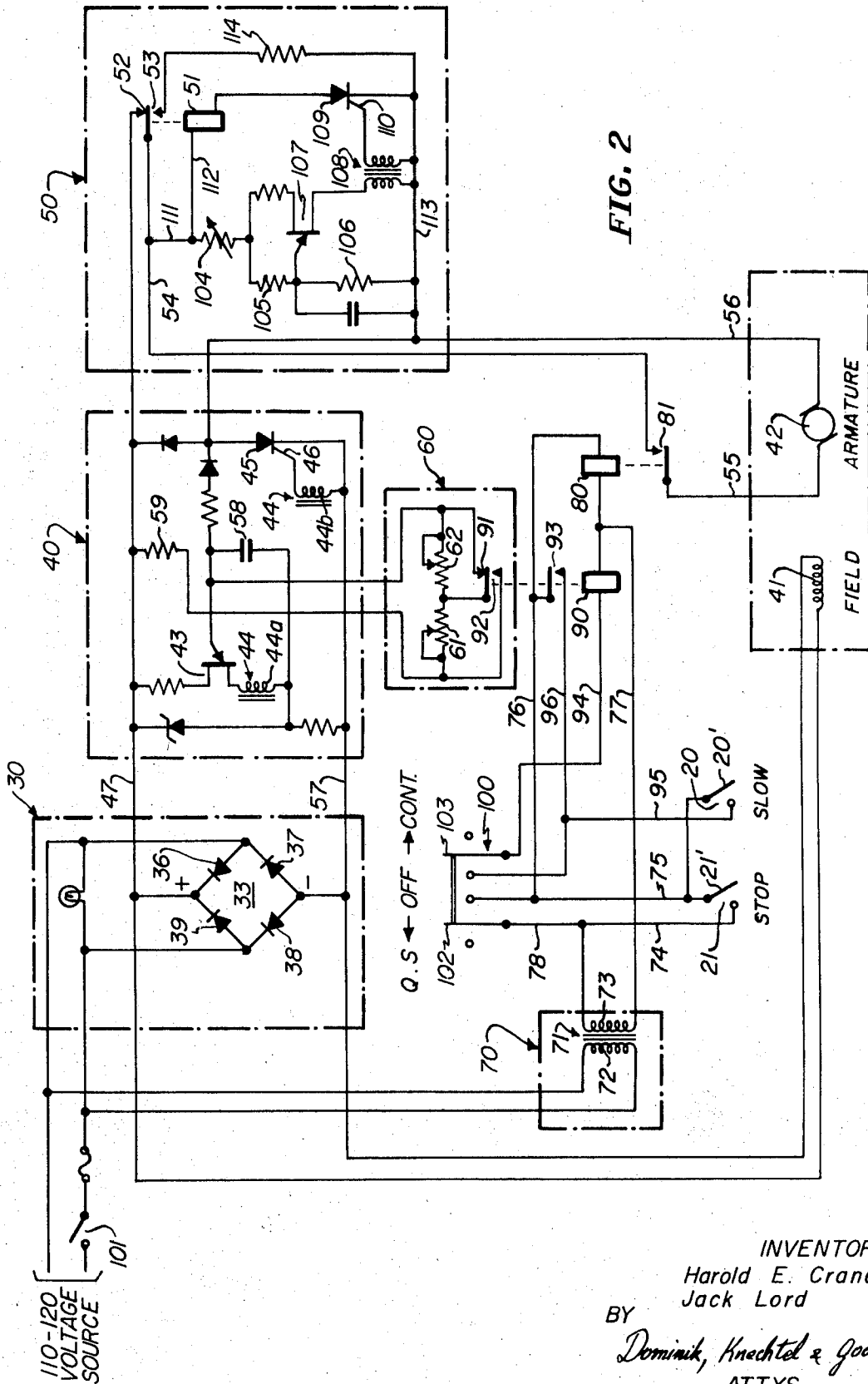


FIG. 3

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SPEED CONTROL MECHANISM FOR REVOLVING DOORS

This invention relates to a speed control mechanism and, more particularly, to a speed control mechanism for revolving doors.

Many types of speed control devices have been devised for limiting the speed of rotation of revolving doors. These devices usually include a gear train operatively connected between the shaft of the revolving door and a centrifugal brake mechanism whereby, upon rotation of the revolving door beyond a certain speed, the centrifugal brake mechanism is actuated.

These speed control mechanisms generally are bulky and, as a result, they have to be designed specifically for installation in either the overhead or floor-type revolving door installation. In addition, these mechanisms generally require constant maintenance to prevent accumulation of moisture, rust, etc., which cause the braking assembly to grab with the resultant chattering of the door when operated. While these speed control mechanisms are open to the above, as well as other, certain objections, probably the most serious objection is the inability to vary the speed of rotation, that is, the maximum speed of rotation, without disassembling the same to gain access to the centrifugal brake mechanism so that the latter can be mechanically adjusted. This not only requires time and the services of a maintenance man, but places the door out of service during the time these mechanical adjustments are being made.

The speed control mechanism of the present invention includes, generally, a constant speed motor which is coupled to and drives a gear train which, in turn, is operatively connected to and drives the shaft of a revolving door. The constant speed motor can be operated to continuously rotate the revolving door or, alternatively, intermittently to provide quarter-point stopping. The speed of rotation, in either case, can be selectively established within a range of, for example, 4 to 12 r.p.m. so as to meet traffic requirements. The most significant feature of the speed control mechanism is that no centrifugal brake assembly is used or required. Instead, the constant speed motor is adapted and is operated to both rotate the revolving door and to function as a brake to prevent the door from being rotated faster than a selected established maximum speed of rotation. The speed of rotation can be varied and the maximum speed of rotation limited, merely by operating control knobs mounted remotely from the revolving door, so that the latter never need be out of service, as in the past, with those speed control mechanisms using a centrifugal brake assembly.

Accordingly, it is an object of the present invention to provide an improved speed control mechanism for revolving doors.

Another object is to provide an improved speed control mechanism for revolving doors wherein the use, or need, or a centrifugal brake assembly is eliminated.

Still another object is to provide an improved speed control mechanism for revolving doors of a construction such that the speed of rotation can be varied and the maximum speed of rotation limited, by operating means remotely located with respect to the revolving door.

A still further object is to provide an improved speed control mechanism of this latter type, wherein said door need not be placed out of service when these speed adjustments are being made.

A still further object is to provide a speed control mechanism including a constant speed motor which functions both to rotatably drive the revolving door and to limit the maximum speed of rotation thereof.

Other objects of the invention will in part be obvious and will in part appear hereinafter.

The invention accordingly comprises the features of construction, combination of elements, and arrangement of parts

which will be exemplified in the construction hereinafter set forth, and the scope of the invention will be indicated in the claims.

For a fuller understanding of the nature and objects of the invention, reference should be had to the following detailed description taken in connection with the accompanying drawings in which:

FIG. 1 is a top plan view generally illustrating the constant speed motor and the gear train of the revolving door control mechanism of the present invention, and the manner in which the motor is coupled to the shaft of a revolving door to rotate the latter;

FIG. 2 is an electrical schematic of the control circuit for controlling the operation of the constant speed motor; and

FIG. 3 is a diagrammatic representation of a typical revolving door installation, using the revolving door control mechanism of the invention.

Similar reference characters refer to similar parts throughout the several views of the drawings.

Referring now to the drawings, in FIG. 1 there is shown the constant speed motor 10 and the gear train 25 including gears 11-17 of the speed control mechanism of the present invention, for rotatably driving the shaft 18 of a revolving door. The motor 10 and the gear train are secured within a housing 19 which is adapted for mounting in either a floor or overhead-type revolving door installation and has cover plates (not shown) for protectively enclosing the motor 10 and gear train therein. The constant speed motor 10 is a DC motor of suitable horsepower rating so that it, in combination with the gear train, is capable of rotating the revolving door at a selected speed within a range of, for example, 4 to 12 r.p.m. The revolving door, the motor 10 and the gear train all can be of standard construction.

Also enclosed within the housing 19 are a pair of microswitches 20 and 21 which are affixed therein in spaced relationship and so as to be operated by a cam 22 on a cam plate 23, in a manner described below. The cam plate 23 is secured to and rotates with the shaft 18 of the revolving door, and further is adjustable with respect to the shaft 18 to operate the microswitches 20 and 21 for quarter-point stopping of the revolving door, that is, with the wings of the latter positioned such that no outside air can directly enter a building through the doorway.

The operation of the constant speed DC motor 10 is controlled by means of the control circuit shown in FIG. 2, in combination with the microswitches 20 and 21 which are operated by the cam 22 on the cam plate 23. This control circuit includes, generally, a DC power supply 30; a motor power supply 40 which is powered by the DC power supply 30; a braking circuit 50 which is adapted to sense the speed of the motor 10 and to limit the speed of rotation of the revolving door if it reaches or exceeds an established value; a speed control 60 for controlling the output of the motor power supply 40 to the motor 10; and a 24-volt AC source 70 which is used to control a pair of relays 80 and 90 which, in turn, are adapted to couple the motor power source 40 to the motor 10 and to control the operation of the speed control 60, respectively. A switch 100 also is provided for coupling a 110-120-volt AC source to the control circuit, and for switching the mode of operation of the revolving door to either continuous or quarter-point stopping operation.

The operation of the control circuit can be generally described as follows. The switch 100 initially is operated to couple the 110-120-volt AC source to the control circuit, and to establish the mode of operation of the revolving door, as continuous or quarter-point stopping. The switch 100 may be a triple pole, double-throw switch, as illustrated, including the switch contact 101 which is connected to couple the 110-120-volt AC source to the control circuit and the switch contacts 102 and 103 which close various electrical circuits, described more fully below, to establish the desired mode of operation. In the illustrated embodiment, the switch contact 101 is shown separated from the switch contacts 102 and 103, for simplicity.

Assume for the purpose of describing the operation of the control circuit that the switch contacts 102 and 103 are thrown to the left, in which case, as indicated, the quarter-point stopping mode of operation is established. At this time, the DC power supply 30 which comprises a full wave rectifier 33 including diodes 36-39 energizes the motor power supply 40 and the field winding 41 of the motor 10. The 110-120-volt AC source also is coupled to the 24-volt AC source 70 which comprises a low-voltage transformer 71 having windings 72 and 73 which are adapted to reduce the voltage to 24 volts. It may be noted that the output of the motor power supply 40 is not electrically coupled to the armature 42 of the motor 10 at this time, since the contact 81 of the relay 80 is open, hence the motor 10 is not energized to rotate the revolving door or, more particularly, the shaft 18 thereof.

The contact 21' of the microswitch 21, at this time, is held open by the cam 22 on the cam plate 21, but as soon as the revolving door is rotated, the shaft 18 and hence the cam plate 23 affixed to it both rotate and thereby cause the contact 21' to drop off the cam 22 and close the energizing circuit for the relay 80. This is as follows: from the top side of the winding 73 of the transformer 71, conductor 74, contact 21' of the microswitch 21 which is now closed, conductor 75, conductor 76, the winding of relay 80, conductor 77, to the bottom side of the winding 73. Relay 80 in operating closes its contact 81, thereby coupling the output of the motor power supply 40 to the armature 42 of the motor 10.

The motor power supply 40 is a DC pulse generator including a unijunction transistor 43, a pulse transformer 44 including windings 44a and 44b, and a silicon control rectifier 45. The unijunction transistor 43 is triggered by an RC timing circuit, described more fully below, and conducts a pulse through the winding 44a of pulse transformer 44. This pulse is coupled to the gate 46 of the silicon control rectifier 45 by means of the winding 44b of the pulse transformer 44, to thereby trigger the silicon control rectifier 45 conductive. When the latter is rendered conductive, a current pulse is coupled to the armature 42 of the motor 10, from the positive terminal of the full wave rectifier 33, conductor 47, contact 52 of relay 51, conductor 54, contact 81 of the relay 80 which is now closed, conductor 55, armature 42 of the motor 10, conductor 56, silicon control rectifier 45, conductor 57, to the negative terminal of the full wave rectifier 33. Each time the unijunction transistor 43 is triggered, another current pulse is coupled to the armature 42 of the motor 10, to drive the latter which action, in turn, functions to rotate the revolving door, via the gear train 25 coupled between the output shaft of the motor 10 and the shaft 18 of the door.

The firing or triggering point of the unijunction transistor 43, and hence the speed of rotation of the motor 10 and the revolving door, is variably controlled by the RC timing circuit including the capacitor 58, the resistor 59 and one or the other of the two potentiometers 61 and 62 included in the speed control 60. Normally, the potentiometer 61 is connected in series with the resistor 59 through the contact 91 of the relay 90, and the potentiometer 62 is bridged or shorted-out. The potentiometer 61 functions as a speed control and is adjusted so that its resistance and that of the resistor 59 will cause capacitor 58 to charge at an established rate, to reach the conduction point of the unijunction transistor 43. By varying the charge time of capacitor 58, the unijunction transistor 43 is triggered at a point such that current pulses are coupled to the armature 42 of the motor 10 to drive the latter at a selected speed of rotation, within a range of, for example, 4 to 12 r.p.m.

As the revolving door rotates, its shaft 18 and the cam plate 23 affixed to it likewise rotate. When the cam 22 on the cam plate 23 engages and operates the contact 20' of the microswitch 20, the relay 90 is energized and closes a holding circuit for holding it energized, through its own contact 93. This is as follows: from the top side of winding 73 of the low voltage transformer 71, conductor 74, contact 21' of the microswitch 21 which is still closed, contact 20' of the microswitch 20 which is now closed, conductor 95, contact

103 of the switch 100, conductor 94, the winding of relay 90, conductor 77, to the lower side of winding 73. When relay 90 operates to close its contact 93, a holding circuit is closed for the relay 90 from the top side of winding 73, conductor 74, contact 21', conductors 75 and 76, contact 93, conductors 96 and 95, contact 103, conductor 94, the winding of relay 90, conductor 77, to the lower side of winding 73.

The contact 20' of the microswitch 20 is only closed momentarily by the cam 22 on the cam plate 23 as the latter rotates, however, the relay 90 is energized and held, in the manner described above. The relay 90, at its contact 91 and 92, switches the potentiometer 62 in series with the resistor 59 and bridges or shorts-out the potentiometer 61. The potentiometer 62 functions as a stopping control, and it normally is adjusted to establish a longer charge time for the capacitor 58. The triggering point of the unijunction transistor 43 is thereby varied, so that fewer current pulses are coupled to the armature 42 of the motor 10. The rotational speed of the latter therefore is reduced, so that the revolving door is rotatably driven at a much slower speed.

When the cam 22 on the cam plate 23 engages and operates the contact 21' of the microswitch 21 to open it, the energizing circuit for both the relays 80 and 90 is opened, so that both of these relays restore. The relay 80 at its contact 81, opens the coupling circuit between the motor power supply 40 and the armature 42 of the motor 10, so that the motor 10 is deenergized and no longer drives the revolving door. The relay 90, at its contacts 91 and 92, again switches potentiometer 61 in series with the capacitor 58 and cuts out the potentiometer 62 and, at its contact 93, opens its holding circuit. The revolving door normally will stop in its quarter-point stopping position at this time. If it is rotating too fast or traffic is still flowing through the door so that the contact 21' of the microswitch 21 drops off the cam 22 on the cam plate 23, the above-described cycle of operation is repeated.

The braking circuit 50 functions to prevent the revolving door from being pushed or rotated too fast, that is, faster than the established maximum speed of rotation desired. The resistors 105 and 107 form a voltage divider across the unijunction transistor 107, and this voltage divider is connected in series with the potentiometer 104. This series network is connected in parallel with the armature 42 of the motor 10, and functions to sense the speed of the motor 10 by measuring the voltage across the armature 42. The potentiometer 104 is adjusted so that the voltage across the resistors 105 and 106 forming the voltage divider reaches the conduction or triggering point of the unijunction transistor 107 at the desired maximum speed of rotation of the motor 10. If the revolving door is rotated too fast, the motor 10 becomes a generator and, when this happens, the current flow from the positive terminal of the full wave rectifier 33 ceases. The motor 10 which is now functioning as a generator triggers the unijunction transistor 107 conductive which, in turn, then couples a pulse through the pulse transformer 108. The latter couples this pulse to the gate 110 of the silicon-controlled rectifier 109, to trigger the latter conductive. When the silicon-controlled rectifier 109 is triggered conductive, the current generated by the motor 10 flows from conductor 55, contact 81 of relay 80, conductors 111 and 112, the winding of relay 51, the silicon-controlled rectifier 109, conductors 113 and 56, to the motor 10 and thereby energizes and operates the relay 51. The latter in operating opens its contact 52 to disconnect the motor power supply 40 from the armature 42 of the motor 10, and closes its contact 53 to connect a dynamic braking resistor 114 across the armature 42, thus preventing the revolving door from being pushed or rotated too fast.

When the motor 10 slows down to the point where the armature voltage is less than the dropout voltage of relay 51, the relay 51 will restore. When relay 51 restores, the motor power supply 40 again is connected to the armature 42 of the motor 10, through contact 52, and the dynamic braking resistor 114 is disconnected, at the contact 53. The maximum speed of rotation of the revolving door can be varied to any desired

value within, for example, a 4 to 12 r.p.m. range, simply by adjusting the potentiometer 104 so that the voltage across the resistors 105 and 106 will render the unijunction transistor 107 conductive to cut in the dynamic braking resistor 114 and to disconnect the motor power supply 40, when the speed of rotation reaches or exceeds this point. Accordingly, it can be seen that the rotational speed of the revolving door is controlled, without the use of a centrifugal brake, as it normally is controlled in prior revolving-door control mechanisms.

As indicated above, the control circuit can be operated to continuously rotate the revolving door. In this case, the switch 100 is operated to the "Continuous" position which, in the illustrated embodiment, moves the contacts 102 and 103 to the right. In this position, it can be seen that the microswitches 20 and 21 are bypassed, and the relay 80 is held energized to couple the motor power supply 40 to the armature 42 of the motor 10. This is as follows: from the top side of the winding 73 of the low-voltage transformer 71, conductor 78, contact 102, conductors 75 and 76, the winding of relay 80, conductor 77, to the lower side of the winding 73. Accordingly, the microswitches 20 and 21 have no control over the operation of the control circuit, and the motor 10 is continuously energized by the motor power supply 40.

Of course, if the rotational speed of the door reaches or exceeds the maximum established value, the braking circuit 50 again is operated to disconnect the motor power supply 40 and to connect the dynamic-braking resistor 114 across the armature 42 to slow the same, in the manner described above. The speed at which the door continuously rotates is controlled and established in the manner described above, by adjusting the potentiometer 61.

In FIG. 3, there is generally represented a typical revolving door installation, the motor 10 and the gear train, in this case, being a floor-type installation, although they could as well be an overhead-type installation. As indicated above, one important feature of the revolving door control mechanism of the present invention is the fact that the centrifugal brake assembly, as well as the problems associated with the same, normally used to control the speed of rotation of a revolving door is eliminated, and the door is controlled instead by means of the same motor which is used to rotate it. The diagrammatic representation of FIG. 3 illustrates another very important and exceedingly advantageous feature of the revolving door control mechanism. In particular, it may be noted that the control circuit of FIG. 2 for controlling the operation of the motor 10 which drives and brakes the revolving door can be remotely located in a control panel or box 120 affixed within or to a wall 121 of the structure including the revolving door installation. The electrical coupling 122 between the two units can be provided in any suitable fashion. The control panel 120 includes the switch 100 for energizing the control circuit, and three knobs 123, 124 and 125 for adjusting the potentiometers 61, 62 and 104, respectively. These potentiometers 61, 62 and 104, as described above, function as the speed control, the stopping control, and the braking control for the revolving door, respectively. Accordingly, the speed of rotation of the revolving door can be varied within, for example, a range of 4 to 12 r.p.m. simply by adjusting the knob 123 which, in turn, adjusts the potentiometer 61. Similarly, the maximum speed of rotation of the door can be controlled, simply by adjusting the knob 125 which, in turn, adjusts the potentiometer 104. The significant feature of this is that both adjustments can be easily and quickly made at a location remote from the revolving door installation and, most importantly, without the necessity of placing the revolving door out of service or disassembling the same to make any mechanical adjustments to, for example, a centrifugal brake assembly, as in the past.

It will thus be seen that the objects set forth above, among those made apparent from the preceding description, are efficiently attained and certain changes may be made in the above construction. Accordingly, 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.

Now that the invention has been described, what is claimed as new and desired to be secured by Letters Patent is:

1. A speed control mechanism for a revolving door comprising, in combination: a motor having a field winding and an armature, said motor being coupled to and rotating said revolving door at a speed proportional to the rotational speed of said armature; and a control circuit electrically coupled to said motor for controlling the operation thereof including field-energizing means coupled to and energizing said field winding thereof, armature-energizing means coupled to and energizing said armature to thereby rotate said revolving door, and a braking circuit included in said coupling between said armature and said armature energizing means including sensing means comprising a pair of resistors forming a voltage divider connected across said armature for sensing the speed of rotation of said armature by measuring the voltage across said armature, dynamic-braking means comprising resistance means, and a relay for disconnecting said armature from said armature-energizing means and for connecting thereto said dynamic-braking means, variable resistance means connected in series with said voltage divider for varying the established maximum speed of rotation of said revolving door, said relay being operated when the voltage across said voltage divider reaches a predetermined value to connect said dynamic-braking means to said armature and being held operated by the voltage across said armature until the rotational speed of said armature slows to the point where the voltage across said armature is less than the relay dropout voltage.

2. The speed control mechanism of claim 1, further including a unijunction transistor, a pulse transformer and a silicon control rectifier having a gate electrode, said unijunction transistor being rendered conductive when the voltage across said voltage divider reaches a predetermined value and conducting a pulse through said pulse transformer, said pulse being coupled by said pulse transformer to said gate electrode of said silicon control rectifier to trigger said silicon control rectifier conductive, said silicon control rectifier upon being rendered conductive permitting current flow through said relay to operate said relay.

3. The speed control mechanism of claim 2, wherein said variable resistance means is adjusted so that the voltage across said voltage divider reaches the conduction point of said unijunction transistor at the desired maximum speed of rotation of said revolving door.

4. A speed control mechanism for a revolving door comprising, in combination: a motor having a field winding and an armature, said motor being coupled to and rotating said revolving door at a speed proportional to the rotational speed of said armature; a cam plate having a cam thereon, said cam plate being secured to and rotated by a shaft of said revolving door as the latter rotates, and a control circuit electrically coupled to said motor for controlling the operation thereof including field-energizing means coupled to and energizing said field winding thereof, armature-energizing means coupled to and energizing said armature thereof to rotate said armature to thereby rotate said revolving door, and a braking circuit included in said coupling between said armature and said armature energizing means including sensing means for sensing the speed of rotation of said armature, dynamic-braking means, and switching means operated by said sensing means to disconnect said armature from said armature-energizing means and to connect thereto said dynamic-braking means to thereby prevent said revolving door from being rotated faster than a preestablished maximum rotational speed, said control circuit further including speed control means and stopping means for controlling the output of said armature-energizing means to thereby control the rotational speed of said armature, a first and second relay means, a first and a second switch means operated by said cam as said cam plate rotates, said first switch means having a normally open contact which is closed by said cam when said revolving door is initially rotated to couple said source of power to said first relay means, said first relay means upon being energized coupling said armature-energizing means to said armature to energize said arma-

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ture to rotate said revolving door, said second switch means having a normally open contact which is momentarily closed by said cam when said revolving door rotates to couple said source of power to said second relay means, said second relay means upon being energized closing a holding circuit therefor through said first switch means and disconnecting said speed control means and connecting said stopping means to said armature-energizing means, said stopping means causing said ar-

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mature-energizing means to slow the rotation of said armature whereby said revolving door will stop when said cam on said cam plate operates said first switch means to open said normally open contact to disconnect said armature-energizing means from said armature, said normally open contact upon being opened opening said holding circuit for said second relay means.

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