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Burney

[11] **3,733,783**

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[54] ELECTROSTATIC PRECIPITATOR

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[52] **U.S. Cl.** **55/104,** 55/138, 55/139, 55/143, 55/145, 55/149, 55/154

[51] **Int. Cl.**.....**B03c 3/66**

[58] **Field of Search**.....55/104, 138, 139, 55/143, 145, 149, 154, 136, 137

[56] **References Cited**

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3,140,935 7/1964 Flagg.....55/139

FOREIGN PATENTS OR APPLICATIONS

1,379,817 10/1964 France 55/124

Primary Examiner—Dennis E. Talbert, Jr.
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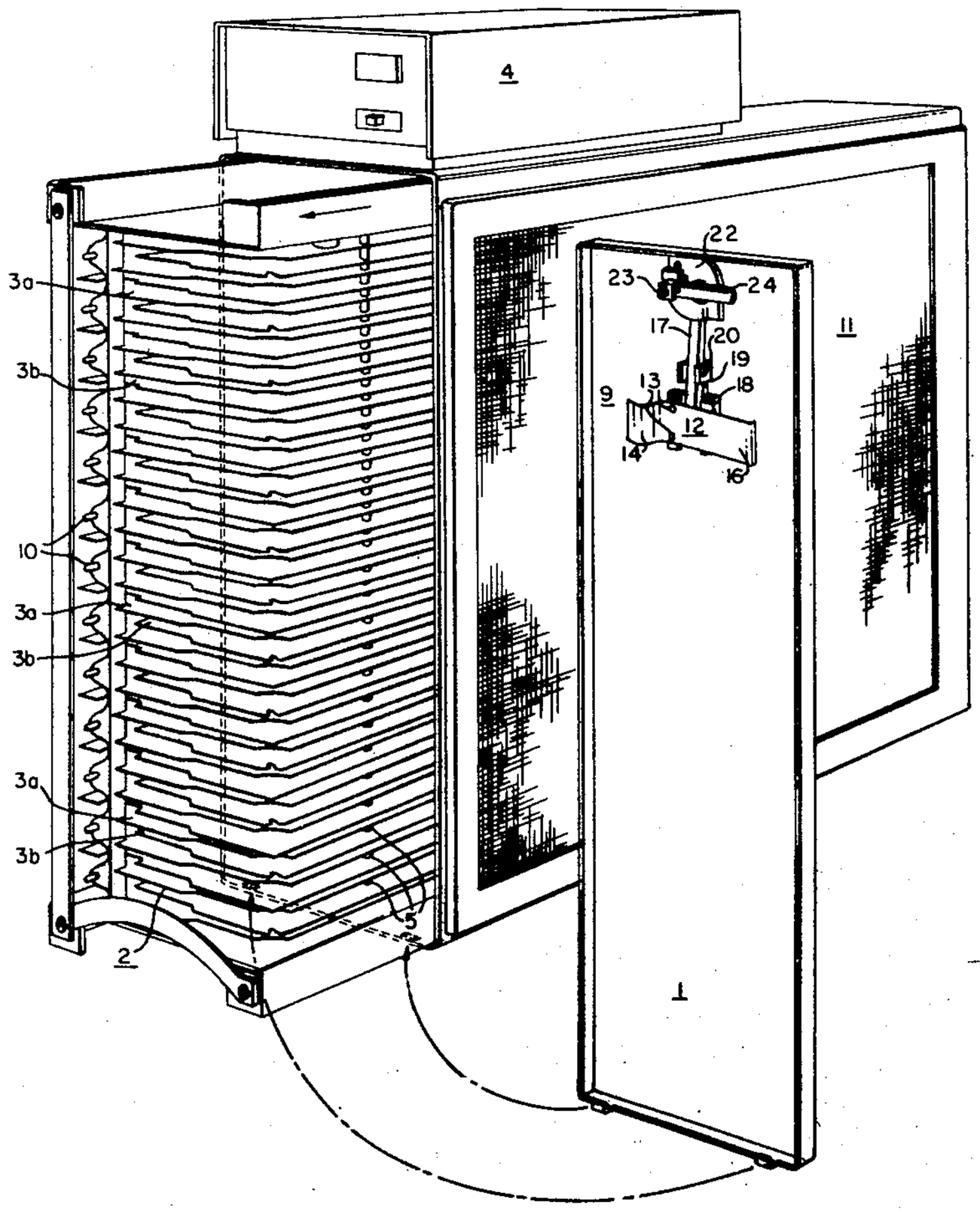
[57] **ABSTRACT**

A door latch and safety arrangement for an electrostatic precipitator is comprised of a spring contact to engage at least one of the plates of one polarity to thereby connect those plates to a first grounded terminal of a high voltage power supply when the door is in place and the latch is in the locked position. A test button is arranged so that when it is momentarily depressed and while the latch is locked, the spring contact is also moved towards the plates that are connected to the second terminal of the power supply and charged with the other polarity to thus produce an audible spark indicating the charged condition of the plates. When the latch is moved to the unlocked position, switch means connected therewith de-energizes the power supply. Moving the latch to the unlocked position also moves the spring means to simultaneously connect together precipitator plates of opposite charges and thus short circuit the collector cell and eliminate any residual charge therein.

6 Claims, 5 Drawing Figures



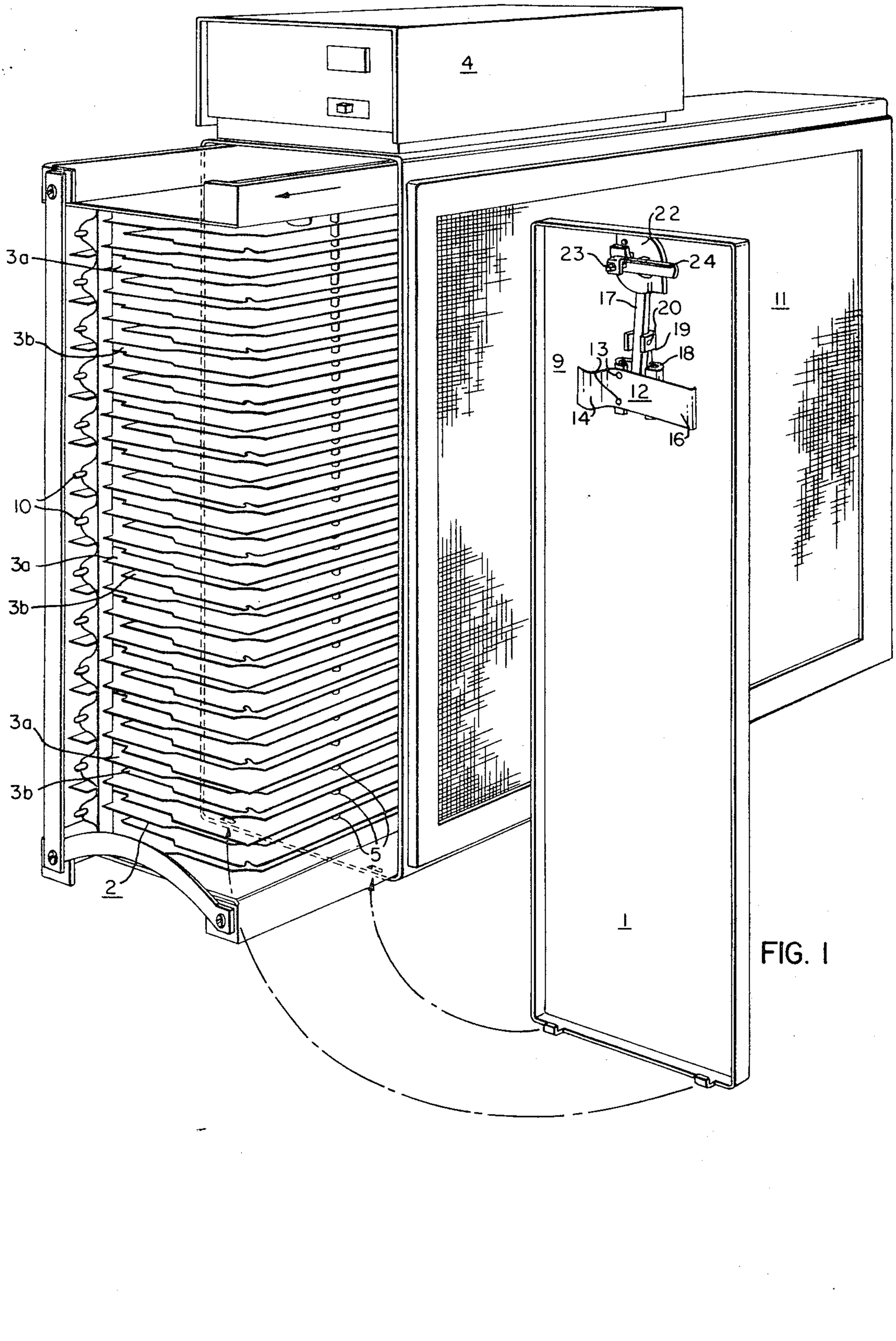


FIG. 1

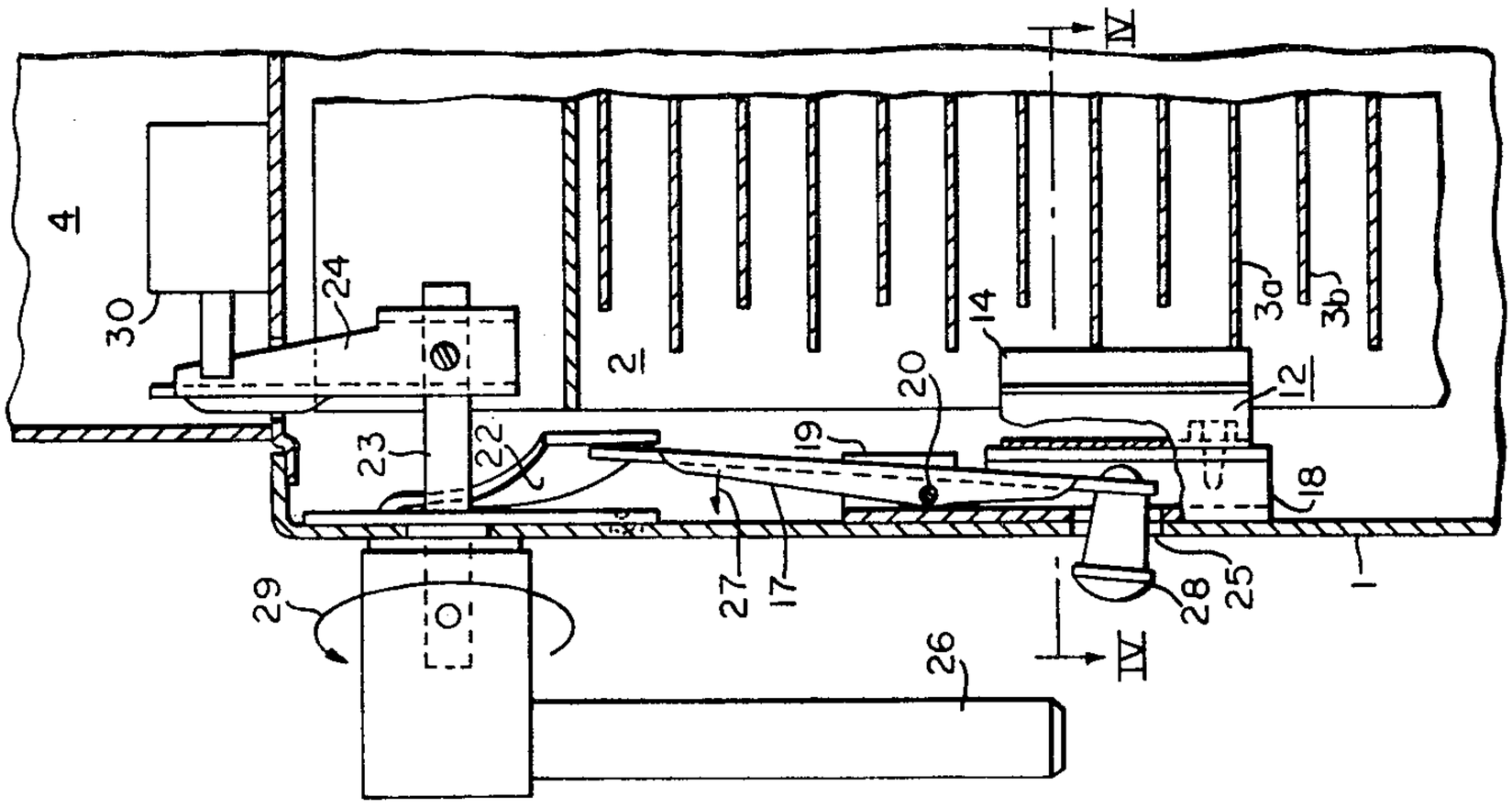
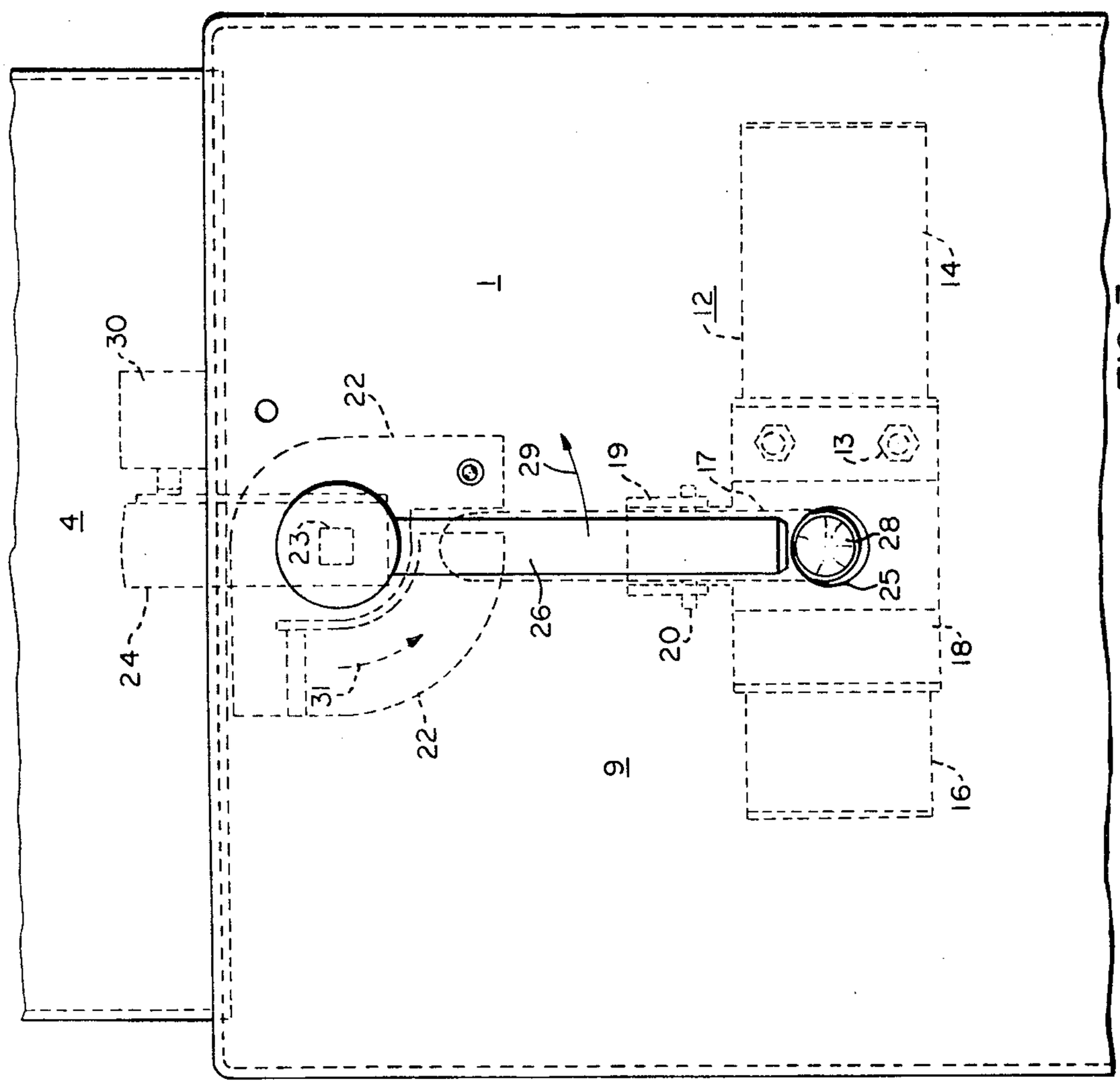

IV
4
30
24
2
20
14
12
30
3b
23
22
19
18
29
27
17
28
25
1
26
IV

FIG. 2


1
4
30
22
29
19
17
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12
23
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31
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9
16

FIG. 3

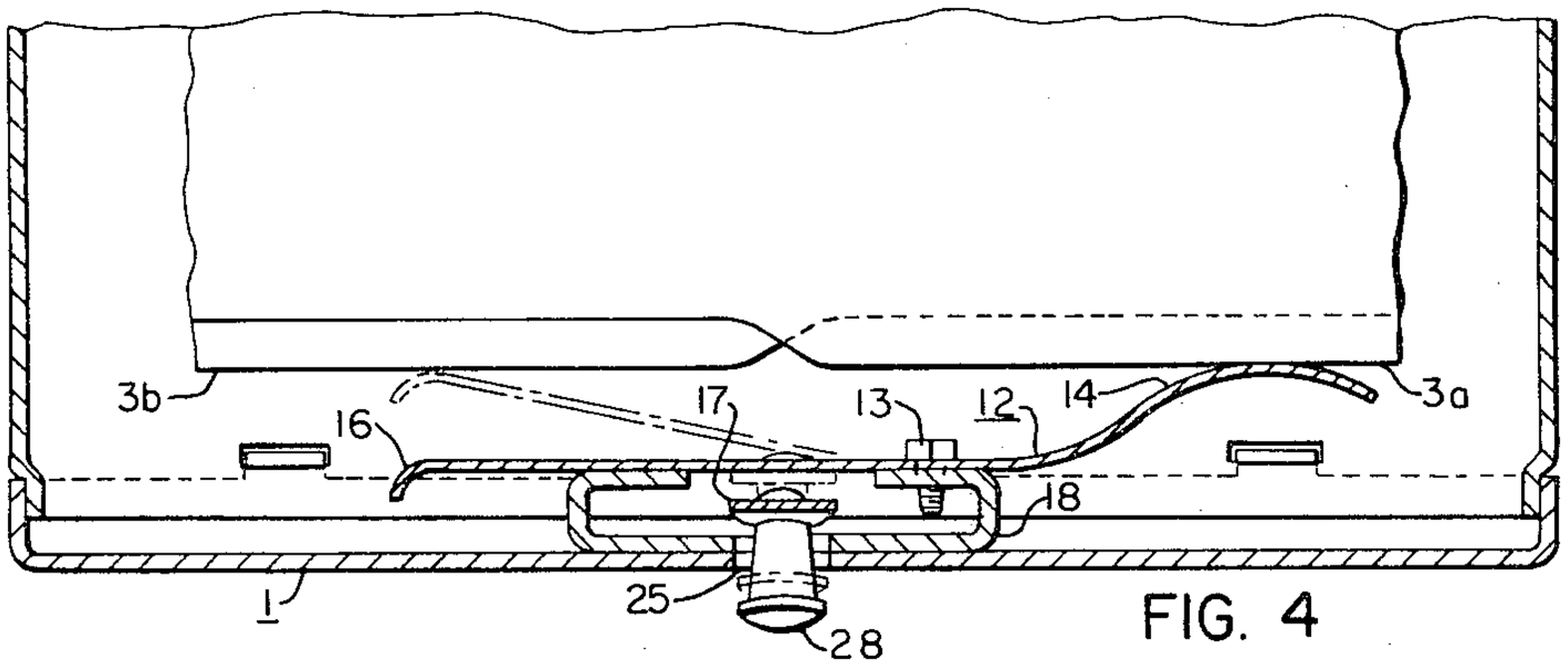

FIG. 4

FIG. 5

ELECTROSTATIC PRECIPITATOR

BACKGROUND OF THE INVENTION

Electrostatic precipitators have long been known in the art of air purification to provide a much improved means for cleaning the air. Dust, smoke and other microscopic contaminants from the atmosphere may be eliminated by first passing both the air and the impurities through a highly charged ionized field which is created by a plurality of ionizer wires in the air intake of the precipitator. Alternate parallel precipitator collector plates are given respective charges alternate to and the same as that of the ionized impurities by means of a power supply. Particles passing through the collector plates will be electrically attracted and held to the oppositely charged plates where they remain until they are removed by a cleaning process. The air leaving the precipitator will be substantially free of such impurities.

It therefore becomes necessary to remove the precipitator collector cell to obtain access to the collector plates which have a build up of impurities and a need for cleaning. The requirement arises that a precipitator should have a built in safety feature which will insure that any remnant of the 7,000 volt charge maintained in the collector cell will be dissipated before the user is able to open the precipitator cabinet door to remove the cell for cleaning.

DESCRIPTION OF THE PRIOR ART

Prior art schemes such as that found in U.S. Pat. No. 3,438,180 to Klouda may not be completely adequate in providing a totally safe precipitator cleaning operation. Although in Klouda the cabinet door must be in a closed position in order that spring contact means on the door may contact the precipitator plates to electrically connect the power supply to the collector cell, no provisions are made for dissipating any residual charge which might be remaining in the cell after electrical contact between the power supply and the precipitator cabinet has been broken.

It would be more desirable that with the power supply de-energized and before removing the cabinet door, the residual charge remaining in the cabinet could be eliminated. In the instant invention, rotating the cabinet door handle to the unlocked position, forces a spring contact into contact with collector plates of opposite polarities, one of which is held at a ground potential, thus having the effect of shorting the plates and grounding out any residual charge which might remain in the precipitator cell. The cell could then be safely removed and the plates cleaned.

SUMMARY OF THE INVENTION

A door latch and safety arrangement for an electrostatic precipitator cabinet that encloses a stack of oppositely charged precipitator plates is disclosed. The latching and safety arrangement comprises a door panel, a latching door handle which is mounted on the door panel and is capable of being moved from a latching to a non-latching position, a power supply for charging the precipitator plates, and switch means for electrically energizing the power supply while the door handle is in the latching position and the door is secured to the cabinet. Spring contact means are attached to the door panel and are adapted to be moved into contact with at least one of the precipitator plates

which is to be held at ground potential and is to be charged with the same polarity as that of the first or grounded terminal of the power supply while the door handle is in the latching position and the door is secured to the cabinet. Push button means are provided on the cabinet door which, when actuated, will move a portion of the spring contact means also toward the plates to be charged with the opposite polarity to that of the first terminal of the power supply while the door handle is in the latching position and the door is still secured to the cabinet. Since in the latching position, the spring contact means is also contacting at least one plate that is to be held at ground potential and is charged with the same polarity as that of the first power supply terminal, sparking will occur whenever actuating the push button to move the spring toward a plate of the opposite charge. This sparking provides an audible indication that sufficient electrical potential is being supplied to the plates to enable proper operation of the precipitator.

When the door handle is moved to the unlatching position but while the door is still secured to the cabinet, a latching cam mounted on the door handle shaft will rotate and force the spring contact means into contact with at least one of the precipitator plates that is to be charged with an opposite and ungrounded polarity to that of the first terminal of the power supply. This shorting of the plates of opposite polarities eliminates the danger of electric shock by removing any residual charge remaining within the collector cell, thus making the cabinet electrically safe for opening.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is an isometric view of the electrostatic precipitator with the cabinet door removed and the collector cell slid forward exposing the collector plates;

FIG. **2** is a fragmentary sectional view of the door latch and safety arrangement of this invention with the door handle in the latching position and the door secured to the cabinet;

FIG. **3** is a fragmentary front elevation of FIG. **2**;

FIG. **4** is a sectional view taken along line IV—IV of FIG. **2**; and

FIG. **5** is a view similar to FIG. **3** but taken from the rear of the cabinet door and showing the door handle and door latch as they would appear in the non-latching position.

DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIG. **1**, an electrostatic precipitator, such as those used in the commercial and residential purification of air, is shown with the cabinet door removed and the collector cell **2** slid forward to expose the groups of collector plates, shown generally by **3***a* and **3***b*. The respective groups of collector plates **3***a* and **3***b* are electrically connected together in a well known manner, (shown for example at **5**) and are respectively to be oppositely charged by a power supply **4** which is capable of maintaining a potential in the order of 7,000 volts DC with collector cell **2** in place. As air enters the precipitator through an inlet screen (not shown), the contaminants within the air are charged by ionizer wires **10**. As the charged particles pass between the groups of charged plates **3***a* and **3***b*, they will be attracted to and adhere to the plates having an opposite polarity to that of the charged particles.

Clean air, substantially free from dirt and other contaminants will exit through outlet screen **11.**

To clean the groups of precipitator plates **3***a* and **3***b* which is necessary to maintain proper operation of the precipitator, the collector cell **2** must be removed. According to the invention, a safety feature is built into the precipitator door latch mechanism to insure that before the removal of cabinet door **1,** all residual charge existing in collector cell **2** will be eliminated. This is accomplished by a door latch and safety arrangement **9** that is attached to the inside of cabinet door **1** and which will now be described.

Contact spring means **12,** which is preferably a strip of spring temper steel, is attached to the lower door mounted bracket **18** by screws **13.** Contact spring **12** is double ended, being provided with a short curved end **14** and a longer straight end **16.** A shorting lever **17** is attached to the upper door mounted bracket **19** at pivot **20.** Shorting lever **17** is adapted to be moved about its pivot **20** and into contact with spring contact means **12** when cam member **22** is rotated. Cam **22** is secured to the door handle shaft **23** and is adapted to rotate when the precipitator cabinet door handle (not shown) is rotated from a latching to a non-latching position. Attached to handle shaft **23** is a door latch **24** which is also capable of being moved from a latching to a non-latching position when the cabinet door handle is rotated in order that cabinet door **1** may be opened and removed. The operation of the door latch and safety arrangement will be explained hereinafter.

FIG. **2** shows cabinet door **1** as it is secured to the precipitator cabinet with door latch **24** in the locked position. Rotating cabinet door handle **26** to the latching position causes door latch **24,** which is secured to door handle shaft **23,** to rotate and thereby close interlocking switch **30** to electrically energize power supply **4.** When door **1** is secured to the precipitator cabinet and door handle **26** is in the latched position, curved end **14** of spring contact means **12** is adapted to press against at least one of the precipitator plates **3***a* that is to be held at ground potential and charged with the same polarity as the grounded negative terminal of the power supply. Curved end **14** of spring contact means **12** serves a dual purpose of pressing against the collector plates to hold collector cell **2** in position while completing the electrical circuit between power supply **4** and cabinet door **1.**

It may be desirable to test the precipitator to ascertain whether or not the proper high voltage is being applied to collector cell **2** and that the cell is charged. As shown in FIG. **4,** with power supply **4** energized and with cabinet door **1** latched, the curved portion **14** of spring contact means **12** presses against the group of precipitator plates **3***a* to be grounded. When it is desired to test the precipitator, push button means **28** is depressed. Push button **28** extends through hole **25** in door **1** and is attached to the lower end of shorting lever **17** such that pressing push button **28** (shown dotted in the depressed position) has the effect of causing shorting lever **17** to pivot and force straight end **16** of spring contact means **12** outward toward a precipitator plate **3***b* having the high voltage applied thereto which is of an opposite polarity to that of plate **3***a*. When approximate contact has been made between spring member **16,** as shown dotted in FIG. **4,** the plate **3***b*, arcing will occur to result in a short circuit that will be formed between plates **3***a* and **3***b* of opposite polarities. The sparking that will occur provides an audible indication, whenever push button **28** is pressed, to confirm that sufficient high voltage is being supplied to the collector cell **2** and that the precipitator plates are sufficiently charged to enable proper operation of the precipitator.

When it becomes necessary to open and remove cabinet door **1** to obtain access to collector cell **2** for cleaning, cabinet door handle **26** must be rotated to the non-latching position as shown in FIGS. **2** and **3** in the counterclockwise direction shown by arrow **29.** The rotating of handle **26** will also cause door latch **24** to rotate and disengage from interlocking switch **30.** Switch **30** which also serves as the on-off switch for the precipitator, will open and thereby electrically de-energize power supply **4.** However, before door **1** can be removed, any residual high voltage charge should be removed from collector cell **2** to insure the safety of a user handling the cell. With door **1** still secured to the cabinet, door handle **26,** when fully rotated to the non-latching position as shown by FIG. **5,** will cause cam **22,** which is attached to door handle shaft **23,** to also rotate in the same counterclockwise direction **31** as that of handle **26.** Cam **22,** when rotated, engages shorting lever **17** and forces it to pivot (in a direction shown by arrow **27** of FIG. **2**) about pivot point **20** thereby bending straight end **16** of spring contact means **12** outwardly until straight end **16** is brought into contact with the edges of the collector cell high voltage plates **3***b*. Thus, when the cabinet door **1** is closed and handle **24** is moved to the non-latching position of FIG. **5,** curved end **14** of spring contact means **12** will be in contact with the collector plates **3***a* at ground potential while, at the same time, the straight end **16** of spring contact **12** is in contact with the collector cell plates of the opposite potential. Therefore, the spring contact means **12** will form a short circuit between plates of opposite polarities and act as a high voltage discharge to ground for any residual charge remaining in the collector cell whenever door handle **26** is rotated to the unlatched position but while the door **1** is still closed. Cabinet door **1** may now be opened and removed, as the collector cell **2** has been conditioned for an electrically safe removal.

It should be understood that with door handle **26** and door latch **24** in the unlatched position, the straight end **16** of spring contact means **12** will be in the same position for contacting the high voltage collector plates **3***b* (in FIG. **4**) as if push button **28** were pressed. Push button **28** is designed to be pressed with handle **26** and door latch **24** in the latched position and with power supply **4** being energized and in the completed circuit to cabinet door **1.** Consequently, since curved spring end **14** is also contacting the plates **3***a* held at ground potential, arcing will occur each time push button **28** is depressed. When handle **26** and door latch **24** are moved fully to the non-latching position, but before cabinet door **1** is removed, power supply **4** will be de-energized and spring contact means **12** will provide a high voltage discharge to ground by the short formed between plates **3***a* and **3***b* of opposite polarities. The handle **26** and the door latch **24** may be provided with detent means at an intermediate position where the on-off switch **30** will be in the off position. Thus the handle may also function as the on-off control for the precipitator.

The door latch and safety arrangement of this invention can therefore be made to provide an electrically safe means for removing and cleaning the collector cell or can provide an audible indication to the user that sufficient charge is being applied to the collector plates to enable the precipitator to properly function in cleaning the air.

Various modifications will occur to those skilled in the art. For example, the push button is shown in FIG. 4 to be attached to the shorting lever, but it obvously could be arranged in different manners to engage the spring contact for the purpose intended.

I claim as my invention:

1. A door latch and safety arrangement for an electrostatic precipitator cabinet enclosing a stack of precipitator plates alternate ones of which are oppositely charged, said arrangement comprising, a door panel, a latching door handle mounted on said door and movable from a latching to a non-latching position, a power supply for charging said plates, means to connect said door panel to one terminal of said power supply when said door is in the latching position on said cabinet, spring contact means on said door adapted to contact at least one of said plates that is to be charged with the same polarity as the one terminal of said supply when said door is secured to the cabinet in the latching position, and means to move said spring contact means also into contact with at least one of the plates to be charged with the other polarity when said handle is moved out of the latching position while said door is still in place on the cabinet and in its latching position.

2. The invention of claim **1,** wherein said spring contact means on said door is adapted to contact at least one terminal of said power supply when the door is secured to the cabinet in a latching position, and additional means being also provided to be operable to move said spring contact means toward at least one of the plates to be charged with the other polarity while said door and door handle are still in place on the cabinet and in the latching position, said additional means, when operated, providing an audible indication that said precipitator plates are electrically charged.

3. The invention of claim **2,** wherein the additional means to move said spring contact means toward at least one of the plates that is to be charged with the other polarity is a push button which engages said spring to move the spring toward said plates as the push button is depressed to thus cause an audible spark to occur.

4. The invention of claim **1,** wherein switch means are provided for de-energizing said power supply when said door handle is first moved from the latching position towards the non-latching position.

5. The invention of claim **2** wherein switch means are provided for de-energizing said power supply when said door handle is first moved from the latching position towards the non-latching position.

6. The invention of claim **2** wherein switch means are provided for de-energizing said power supply when said door handle is first moved from the latching position towards the non-latching position.

* * * * *