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PROXIMITY CONTROL GUARD PLATE

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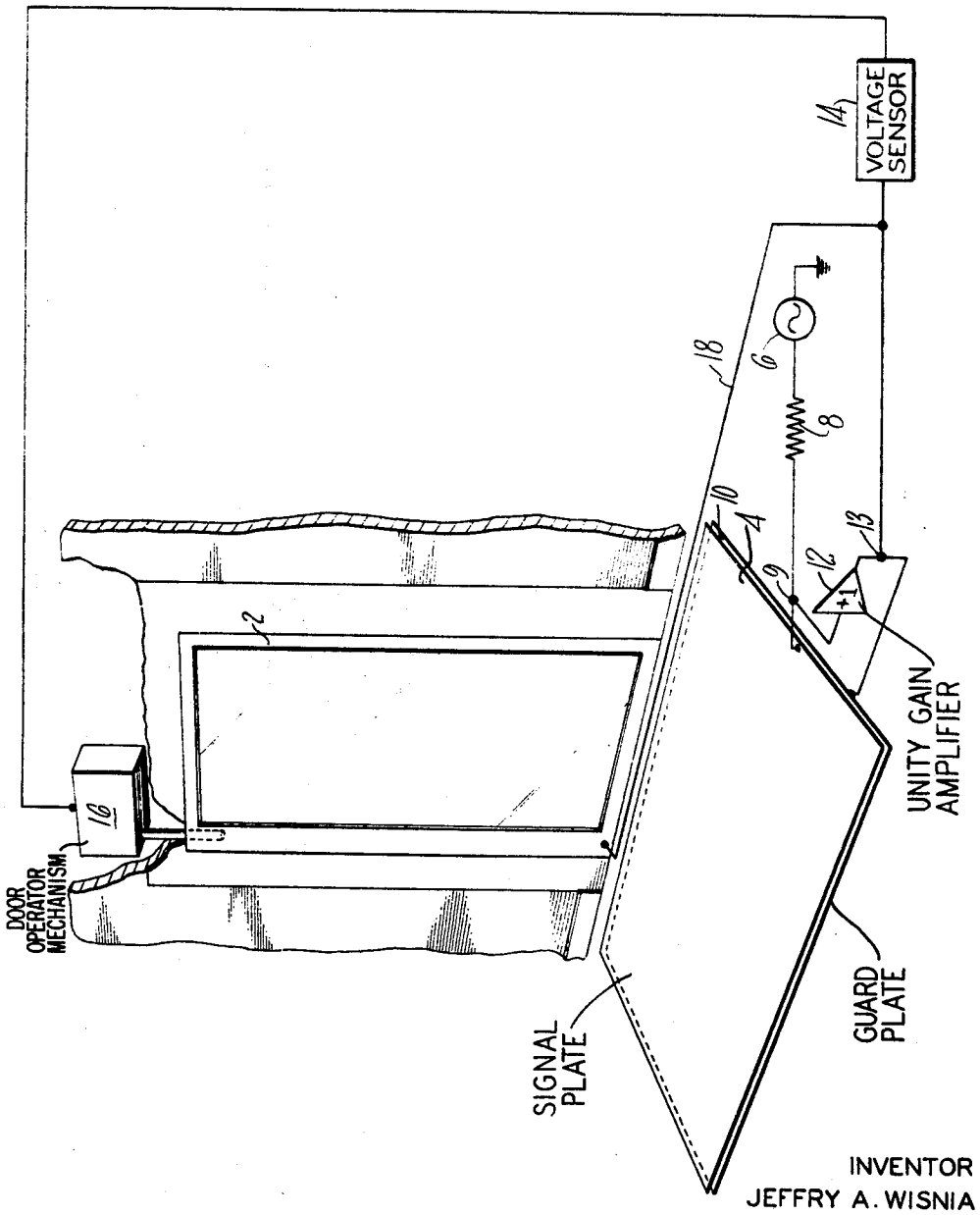

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PROXIMITY CONTROL GUARD PLATE

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ABSTRACT OF THE DISCLOSURE

A capacitance actuated door operator system in which an increase of space capacitance of a signal plate adjacent a door opening due to the presence of an object such as a person or other traffic using the doorway provides a signal which is detected to actuate the door operator mechanism. The signal plate may be a large flat metal sheet mounted on the floor. A guard plate or shield is mounted on the unused side or beneath the signal plate and connected thereto through a high input impedance, low output impedance unity gain voltage amplifier which has its input connected to the signal plate to eliminate the effect on the capacitance of the signal plate of any object, such as the floor, on the unused side of the signal plate as well as increasing the sensitivity of detection of a change of capacitance of the signal plate due to the approach of a person or object.

This invention relates in general to a capacitance actuated door operator, and an object of this invention is to provide a capacitance sensitive door operator system of increased responsiveness to traffic using the doorway.

Another object of this invention is to provide means for eliminating the effect on the space capacitance of a signal plate of a capacitance sensitive door operator system of an object on the unused side thereof. Included in this object is a means for preventing any change in tht dielectric value of a permanent body, such as a floor, on the unused side of the plate from effecting the level of the capacitance of the signal plate.

A further object is to provide means for enhancing detectability of a capacitance change caused by traffic using a doorway for improved reliability in a capacitance actuated door operator.

Other objects will be in part obvious and in part pointed out more in detail hereinafter.

The invention accordingly consists in the features of construction, combination of elements and arrangements of parts which is exemplified in the construction hereafter set forth, and the scope of the invention is indicated in the appended claims.

In the drawing, the single figure shows a perspective view partly in section, of an illustrative door operator system embodying the teachings of this invention, including a schematic diagram of the electronic components.

The drawing shows an illustrative embodiment of a power operated door embodying the present invention. In the illustrated embodiment, a power operated door **2** (shown as being a swinging door) is provided with a power operator mechanism **16** for opening and closing the door automatically in response to the traffic therethrough. The door **2** is shown as being provided with a large flat signal plate **4** mounted by the floor at the approach to the doorway for producing a signal to initiate the automatic operation of the door. It will be understood, however, that the signal plate **4** may be positioned at any convenient location.

The illustrative embodiment includes an oscillator **6** which produces an output signal having a preselected frequency of, say, 10 kilocycles and 25 volts for charging the signal plate **4**. As shown, the oscillator **6** is connected to the signal plate **4** through a resistor **8** which may have an impedance approximately that of signal plate **4** at the frequency impressed on plate **4**.

In accordance with this invention, means are provided for eliminating the effect of any object on the unused side of the signal plate **4** on the capacitance of signal plate **4**. Where, as in the illustrated embodiment, the signal plate **4** must be large in order to provide for the timely opening of the door **2** to meet the demands of approaching traffic, the capacitance between the signal plate **4** and the floor or other permanent body on which the signal plate **4** is positioned may be large enough to obscure the reliable detection of an increase in the capacitance of signal plate **4** due to the presence of traffic. This is overcome by providing a guard plate or shield **10** positioned below, or on the unused side of signal plate **4** and having a cross section substantially the same as that of signal plate **4** and connecting signal plate **4** to the guard plate **10** by a unity gain voltage amplifier **12**. The unity gain voltage amplifier **12** may be of any suitable type having a high input impedance and a low output impedance with its input connected to signal plate **4** and its output connected to the guard plate **10**. So connected, the guard plate **10** will follow the voltage excursions of the signal plate **4** and, as a result, there will be no voltage difference between signal plate **4** and guard plate **10** so that the effective capacitance of the unused or bottom side of signal plate **4** is eliminated and the only change in capacitance of plate **4** is an increase in its space capacitance with ground due to the approach of a body (such as a person approaching the door **2**), near the side of the signal plate **4** opposite guard plate **10**.

Where the impedance of resistor **8** equals the impedance of the effective space capacitance between signal plate **4** and ground, the voltage drop across resistor **8** will equal one-half the output voltage of oscillator **6** when no extraneous object is near the plate **4**. The approach of a body near signal plate **4**, as for example the approach of a pedestrian toward door **2**, increases the capacitance of the signal plate because the impedance thereof decreases. Since the resistance of resistor **8** remains the same, the resistance across resistor **8** becomes a greater proportion of the total resistance through the series circuit comprising the resistor **8** and the signal plate **4**. Accordingly, the voltage drop across resistor **8** increases to reduce the voltage level at junction **9** between the resistor **8** and the signal plate **4**. This reduces the input (and output) voltage of the unity gain amplifier **12**. This voltage drop can be sensed by any voltage sensor **14**, such as a voltage sensitive relay, which is connected to initiate the operation of door operator mechanism **16** to actuate the door through any desired opening and closing cycle. By connecting the voltage sensor **14** to the output of the amplifier **12** at junction **13**, the illustrated system takes advantage of the increased power of the amplifier **12** and eliminates the need for any impedance circuits in the voltage sensor **14**.

Where the door **2** is metal and is powered through its opening and closing cycle so that it sweeps across the signal plate **4**, it is desirable to provide some means such as a circuit connection through conductor **18** which connects the door to the output of the unity gain amplifier **12** so that the door follows the voltage excursions of the signal plate **4** to prevent the swinging door from having a self-sustaining coupling effect with signal plate **4** to prevent the door from closing after the traffic has passed through the doorway.

From the foregoing, it will be apparent that this invention, by elinmiating the effective capacitance between

the signal plate **4** and the floor or any other object on the unused, or bottom, side of signal plate **4**, makes it possible to use a large capacitance plate for a capacitance actuated door operator system. Without the guard plate, the capacitance between such a signal plate and the floor or other adjacent objects is so large, as compared with the increase in the space capacitance on the useful side of the plate due to the approach of traffic using the doorway, that the change in the capacitance of the signal plate **4** due to traffic is, a practical matter, difficult to detect on a reliable basis.

Moreover, the elimination of the effective capacitance between the signal plate **4** and the guard plate **10** causes the capacitance of the signal plate **4** to appear to be only one-half of its free space capacity, thus enhancing capacitance changes due to an object such as a person approaching the door thereby providing increased capability in the system for detecting traffic approaching the doorway.

As will be apparent to persons skilled in the art, various modifications and adaptations of the structure above-described will become readily apparent without departure from the spirit and scope of the invention, the scope of which is defined in the appended claims.

I claim:

1. A traffic responsive door having a powered operator automatically actuated by traffic using the doorway, said powered operator having a control system including a floor mounted flat signal plate with its upper side exposed to the traffic adjacent the doorway, a source of electrical energy for establishing a charge on the signal plate, a sensor responsive to a change in the capacitance of the signal plate to initiate the operation of the door, and means including a guard disposed below the signal plate to eliminate the effective capacitance between the signal plate and bodies disposed below the same.

2. The device recited in claim **1** wherein the guard plate has substantially the same size and shape as the signal plate.

3. The device of claim **2** wherein said means is a unity gain voltage amplifier having its input connected to the signal plate and its output connected to the guard plate.

4. The device recited in claim **3** wherein the amplifier has a high input impedance and a low output impedance.

5. A traffic responsive door having a powered operator automatically actuated by traffic using the doorway, said operator having a capacitive type control system including a floor mounted signal plate disposed along the traffic path through the doorway, a source of electrical energy connected to said signal plate for establishing a high frequency electric field across said traffic path so that the capacitance of said signal plate increases with the entry of an object into said electric field, a sensor responsive to an increase in the capacitance of said signal plate for initiating the operation of the powered operator, a guard plate below said signal plate, and means to eliminate the electric field between said guard plate and said signal plate.

6. The device recited in claim **5** wherein said means comprises a substantially unity gain voltage amplifier having its input connected to the signal plate and its output connected to the guard plate.

7. The device recited in claim **6** wherein a resistor is connected in series between the source of electric energy and the signal plate and the sensor is responsive to a decrease in the voltage imposed on said signal plate for initiating the operation of the operator.

8. The device recited in claim **7** wherein the amplifier has a high input impedance and a low output impedance and the sensor is a voltage sensitive relay.

References Cited

UNITED STATES PATENTS

2,031,226	2/1936	Parvin	49—25
2,149,177	2/1939	Miller	49—25
2,802,178	8/1957	Shafer et al.	340—200 X
2,848,659	8/1958	Cutler.	
3,406,802	10/1968	Needham et al.	307—116 X

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