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McDonald

[11] **3,877,174**

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[54] **GRAVITY OPERATED ELECTROMAGNETICALLY CONTROLLED GATE**

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[52] **U.S. Cl.** **49/334;** 49/139; 49/280; 49/335; 49/379

[51] **Int. Cl.**..... **E01f 13/00;** E05f 1/00; E05f 15/10

[58] **Field of Search** 49/324, 35, 334, 49, 349, 49/124, 327, 335, 139, 379, 280; 246/125, 128

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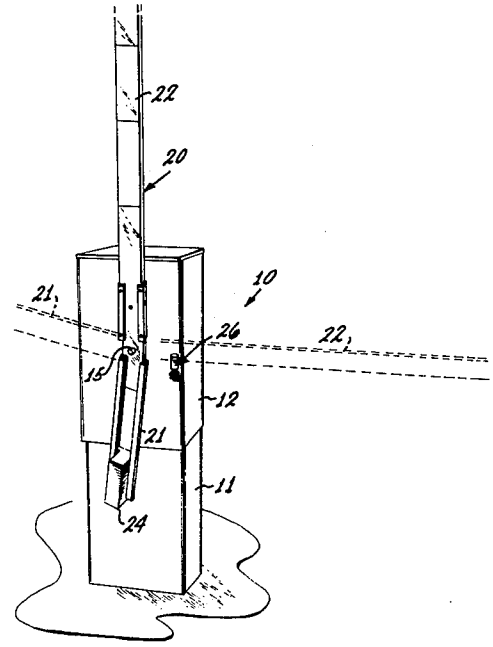
Primary Examiner—Philip C. Kannan

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[57] **ABSTRACT**

An electromagnetically controlled, gravity operated gate of simple construction and of reliable performance includes a housing enclosing the principal functional components of the gate assembly. Extending through a wall of the housing is a drive shaft on which is mounted a gate element, the latter including a counterbalanced channel affixed to be rotated by the drive shaft, the channel having affixed thereto a gate arm. Located within the housing is a motor and clutch assembly connected to drive the gear means to which the drive shaft is affixed. Also cooperating with the drive shaft is a follower arm which cooperates with an electromagnet positioned within the housing to maintain the gate arm in a generally horizontal position. Also located within the housing is a switch engageable by the follower arm to maintain the electromagnet energized while the gate is in the horizontal position. A control circuit is provided which in an energized state activates the motor and clutch assembly for moving the gate arm from a vertical to a horizontal position, the switch means being energized by the follower to de-energize the motor, to maintain the electromagnet energized for maintaining the gate arm in the horizontal position. Movement of the gate from the horizontal to the vertical position is achieved by de-energizing the circuit control means so that the gate arm is moved to the vertical position by gravity.

10 Claims, 5 Drawing Figures



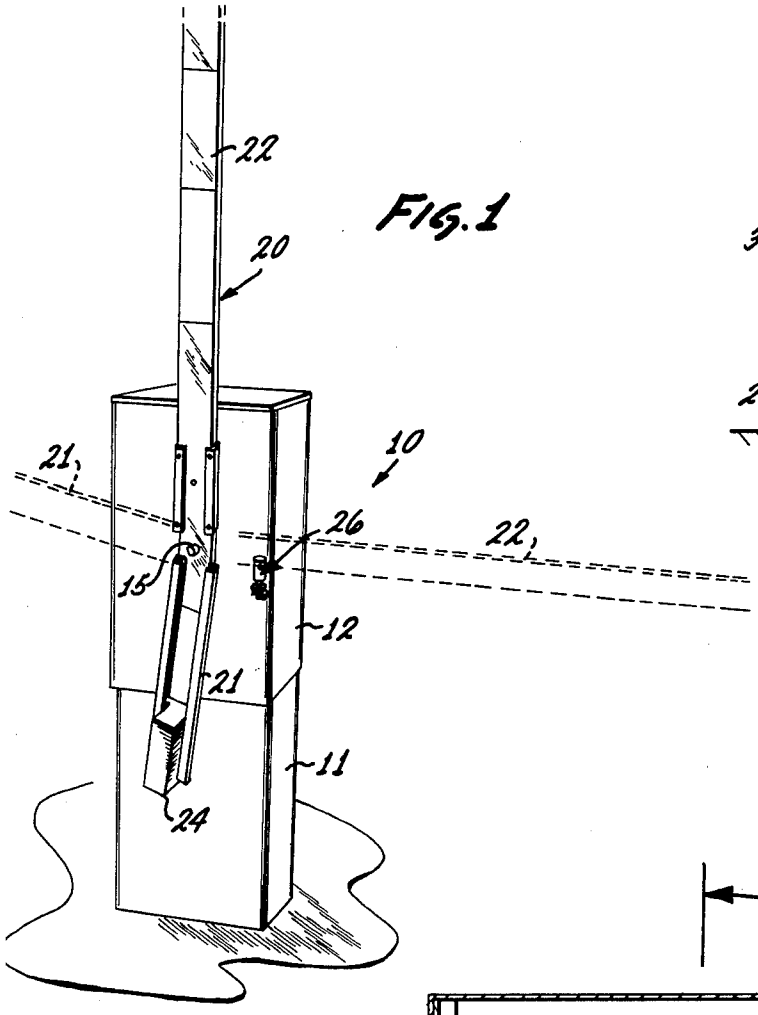


FIG. 1

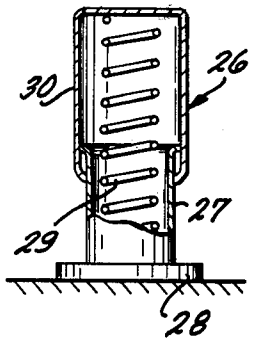


FIG. 3

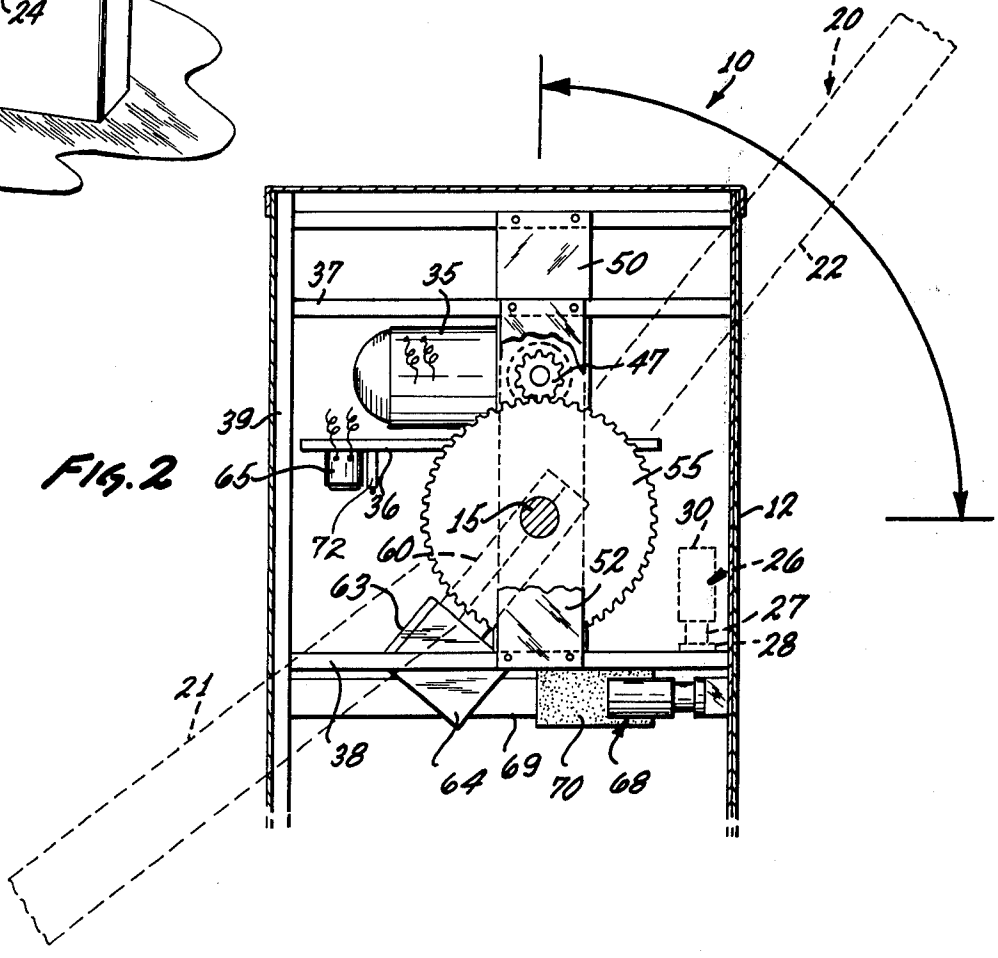


FIG. 2

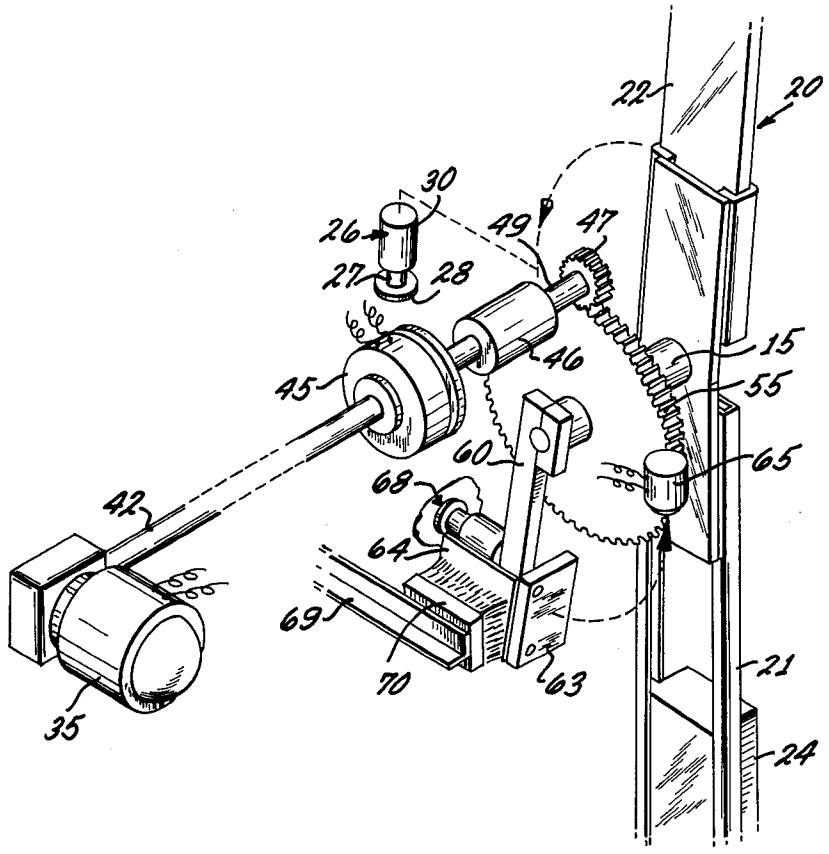

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FIG. 4

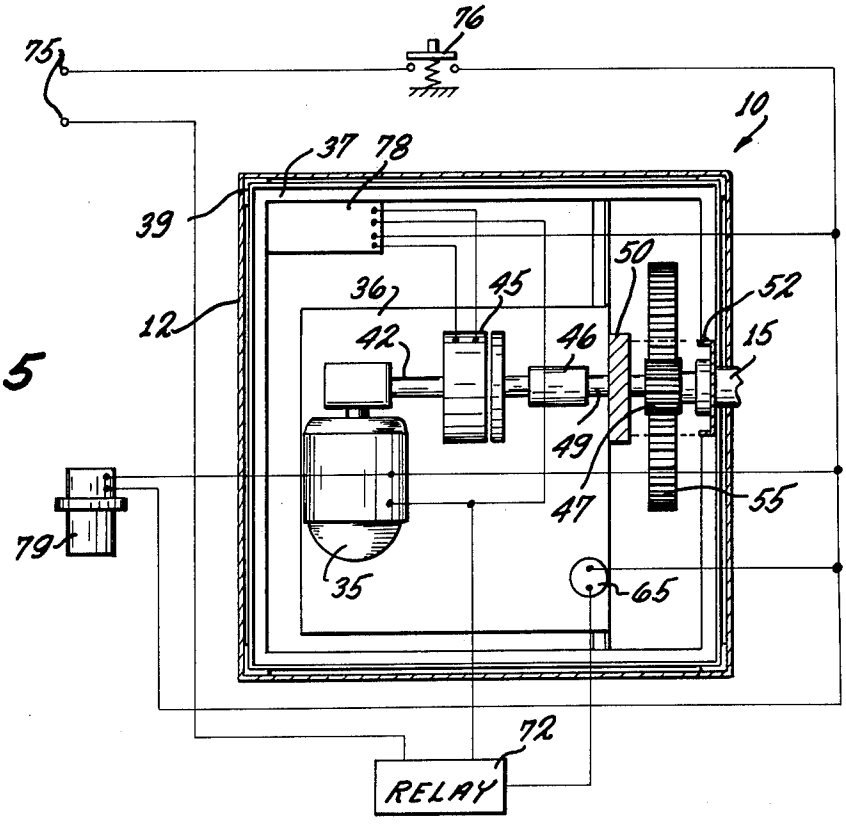

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RELAY

FIG. 5

GRAVITY OPERATED ELECTROMAGNETICALLY CONTROLLED GATE

BACKGROUND OF THE INVENTION

Automatically controlled gate assemblies are known in the prior art, particularly the gate assemblies used at railway crossings, the gate assemblies being complex in structure and operated by signals received by an advancing train.

More recently, gate assemblies have been used in automotive parking lots and are raised once a parking receipt is removed from a dispensing machine. Another variety of gate is that used in private parking lots, usually in conjunction with a coded card which is recognized electronically and actuates a mechanism permitting the gate to be raised.

In other instances, a gate is used for control of traffic on private access roads, the gate being energized by a control mechanism located in the security office normally positioned in close proximity to the access road.

Heretofore, gate assemblies have been constructed to operate in a variety of different ways, including an energizing circuit which affirmatively controls movement of the gate from the horizontal to the vertical position and from the vertical position to the horizontal. This type of arrangement is sometimes objectionable because of problems associated with a power failure or malfunction of the gate or its control apparatus. For example, if a gate is positively driven through its various positions, and is in the vertical position, a malfunction or loss of power results in the gate being maintained in a horizontal position thus obstructing the controlled flow of traffic. In high density traffic areas such as parking lots or private access roads, this is objectionable.

Other gates have been designed and operated which are somewhat complex and require highly trained individuals in order to repair or to perform routine maintenance on the gate assemblies. Some of these structures have been designed to operate on a gravity basis, that is, the gate is moved from the vertical to the horizontal position by virtue of a counterbalanced gate arm which is caused to rotate to the horizontal position by gravity.

For examples of various gate structures and control assemblies, reference is made to U.S. Pat. No. 599,020 of Feb. 15, 1898; U.S. Pat. No. 903,905 of Nov. 17, 1908; U.S. Pat. No. 1,601,783 of Oct. 5, 1926; U.S. Pat. No. 1,663,040 of Mar. 20, 1928 and U.S. Pat. No. 1,765,178 of June 17, 1930.

SUMMARY OF THE INVENTION

The present invention relates to a gate assembly and more particularly to an improved gate assembly which is electromagnetically controlled and gravity operated by a simple and reliable assembly whose principal functional components are enclosed within a single housing. By the present invention, several of the disadvantages of prior art gate assemblies have been overcome, the principal advantage of the present invention being the simplicity of the structure and its effectiveness as a controllable gate assembly. Thus, a counterbalanced gate element is used which is rotated from the horizontal to the vertical position by gravity, and driven from the vertical to the horizontal position by a motor, clutch and gear assembly. Thus, in the event of a power failure, the gate automatically raises to the vertical position and does not act as a traffic obstruction barrier.

Additionally, because of the simplicity of the structure it is possible, in the event of some mechanical malfunction, manually to raise the gate to the vertical position thus permitting flow of traffic.

The highly reliable and effective gate structure of the present invention is enclosed within a housing, thus making it ideal for outdoor use. Positioned within the housing are the major functional components of the gate assembly and its driving mechanism, the latter including a motor and clutch assembly, the output of the clutch being a gear assembly which effects rotation of a gate arm. Attached to rotate within the housing as the gate arm rotates is a follower arm which contacts a brake and shock absorber assembly as the gate is rotated from the horizontal to the vertical position, and which is engaged by an electromagnet to maintain the gate in the horizontal position. As the gate arm is rotated towards the horizontal position from a vertical position, the follower actuates a switch which de-energizes the motor but maintains an electromagnet energized to hold the follower arm and thus the gate.

To raise the gate, the control circuit is de-energized which affects release of the electromagnet and gravity causes the gate to rotate from the horizontal to the vertical position as described. The gate element itself includes a channel member mounted to be rotated by the drive shaft which is affixed to the gear assembly, the channel member carrying a gate arm which is at an angular orientation with respect to the channel member, the channel member being counterbalanced such that the counterweight tends to rotate the gate towards the vertical position from a horizontal position. The present invention can best be understood by reference to the following description taken in connection with the accompanying illustrative drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a view in perspective of the gate assembly of the present invention;

FIG. **2** is a view partly in section and partly in elevation of the interior components of the gate assembly in accordance with the present invention;

FIG. **3** is a view, partly in section and partly in elevation of the shock absorber assembly in accordance with the present invention;

FIG. **4** is a view, in perspective, of the interior working components of the gate assembly in accordance with the present invention; and

FIG. **5** is a plan view which also shows the electrical control apparatus of the gate assembly in accordance with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to the drawings which illustrate a preferred embodiment of the present invention, FIG. **1** shows the gate assembly **10** which includes a lower support member and housing **11** above which is received an upper housing member **12** such that substantially all of the interior working mechanism of the gate assembly is completely closed and protected from the outside environment.

Extending through the housing **12** is a drive shaft **15** on which is mounted a gate element **20** including a channel member **21** and a gate arm **22**, the latter affixed to the channel member **21**. As illustrated, the channel member **21** carries a weight **24** whose position

may be adjusted by sliding it along the channel member and securing it in place a proper distance from the drive shaft **15** so as to effect a change in the rate at which the gate arm rotates from the horizontal to the vertical position. Normally, the weight **24** is adjusted to overcome the inertia of the gate arm allowing gravitational forces to raise the gate arm from the horizontal position, indicated in phantom lines, to the vertical position. The rate of movement from the horizontal to the vertical position is controlled by the adjustment of the position of the counterbalance weight **24**, as described. Also mounted exteriorally of the housing **12** is a shock absorber assembly **26** which is contacted by the underside of the gate arm **22** as the latter is positively driven from the vertical position to the horizontal position.

Referring to FIG. **3**, the details of the shock absorber **26** are shown, the shock absorber including a hollow aluminum spindle **27** affixed on a support member generally indicated **28**, the interior of the spindle including a spring **29** on which is mounted a Teflon cup **30** the latter being slidable with respect to the spindle **27**.

Referring to FIGS. **2** and **4**, the interior working components of the gate assembly include a motor **35** mounted on a platform **36** supported between the frame members **37** and **38**, the latter attached to the vertically extending frame members **39** which are affixed to a suitable base which may be a wood or concrete foundation. The output shaft **42** of the motor is connected to an electromagnetic clutch assembly **45** through a coupling **46** to a small spur gear **47**. By way of example, the motor **35** and associated speed reducer may be of 115 volt, 30 amp, 60 cycle, 1/50th hp motor operating at 1725 rpm. The torque generated is 32 lb. in. The clutch assembly **45** may be of a type which is a rated 9 watt d.c. voltage controlled clutch having a torque of 43 lb. in.

As illustrated in FIGS. **2** and **4**, the output shaft **49** of the coupling **46** is supported by a vertically extending frame member **50** cooperating with a vertically extending frame member **52** such that the spur gear **47** is held in fixed alignment with a larger spur gear **55** positioned vertically below it and supported between the frame members **50** and **52**. The spur gear **55** is splined to the drive shaft **15** on which the gate element **20** is mounted.

Interiorally of the housing there is also mounted on the drive shaft a follower arm **60** which rotates with the drive shaft **15** and the gate arm. As illustrated in FIG. **4**, the follower arm **60** carries a steel plate **63** and a brake shoe **64**, the steel plate cooperating with an electromagnet **65** supported on the underside of the platform **36**.

Supported beneath the lower frame member **38** is a second shock absorber **68** of a structure identical to that already described in connection with FIG. **3**. Mounted on another transverse support member **69** is a brake shoe **70** which cooperates with the brake shoe **64** carried by the follower arm **60**.

The brake shoe **70** is relatively simple in structure and is in the form of a brush with stiff bristles cooperating with the brake shoe **64** carried by the follower arm **60**. Thus, as the gate arm moves from the horizontal to the vertical position, the brake shoe **64** comes in contact with the brake shoe **70**, and the follower arm contacts the shock absorber **68** to retard the movement of the gate arm from the horizontal to the vertical. Such a feature of the present invention is of practical importance in view of the fact that movement of the gate arm from the horizontal to the vertical is by gravitational force rather than through a positive drive through the motor and clutch assembly.

The gate arm will remain in the vertical or up position for as long as the circuit is not actuated. Upon actuation of the circuit, the motor is energized and the gate is positively driven from the vertical to the horizontal position.

As the follower arm **60** rotates with the gate arm, the plate **63** cooperates with an electromagnet **65** to maintain the gate in the horizontal position. As the follower arm **60** rotates to the horizontal position, the plate also contacts a microswitch **72** which functions to de-energize the motor and clutch assembly while maintaining the electromagnet **65** energized to hold the gate in the horizontal position. As can be understood, the amount of electrical energy necessary to maintain the electromagnet energized is rather minimal, and accordingly, an effective means is provided for maintaining the gate in a horizontal position. In the event of a mechanical failure or electrical failure, the gate can be raised to the vertical position manually.

In movement of the gate arm from the vertical to the horizontal position, the underside of the gate arm contacts the shock absorber **26** so as to reduce any bouncing movement as the gate approaches the horizontal position thus enabling the electromagnet **65** to hold the plate **63** and the follower arm and the gate arm in a generally horizontal position.

Referring to FIG. **5** wherein like reference numerals have been used where applicable, electrical power is supplied through any a.c. source **75**, the electrical circuit being controlled by a switch **76** which is illustrated as a manually operated switch. It is to be understood, however, that switch **76** may be operated by a ticket dispensing machine or by a card recognition circuit, in a manner well known to those skilled in the art.

The circuit includes a d.c. converter **78** used to provide the d.c. power for the electromagnetic clutch **45**. Cooperating with the motor **35** is a starting capacitor **79** which functions in the usual manner of capacitance started motors. As illustrated, relay **72** is interconnected between the motor and the electromagnet **65** so as to maintain the electromagnet energized while de-energizing the motor upon actuation of the relay **72** by the plate **63** carried on the follower **60**.

To illustrate the simplicity of the gate assembly of the present invention, the motor may be of the Bodine type "N-1RG" gear motor. The clutch assembly **45** may be of a Stearns style MSR electromagnetic clutch while the coupling **46** is a ½ in. × ½ in. FCS coupling. Gear **47** is a 1 in. diameter spur gear while gear **55** is a 9 in. diameter spur gear. The electromagnet **65** includes a d.c. rectifier as part of its structure, the electromagnet being interconnected to the d.c. converter **78** as illustrated in FIG. **5**.

The gate arm is preferably of wood, metal or plastic, and mounted on the channel member **21**. As illustrated in FIG. **1**, the gate arm **22** is offset approximately 10° with respect to the channel member **21** such that with the gate in the horizontal position, the channel member is offset in the direction of pivotal or rotational movement of the gate element. In this way, the weight **24** is positioned above the horizontal arrangement of the gate arm, and once the electromagnet is de-energized by de-energizing the circuit, gravitational forces act im-

mediately to raise the gate from the horizontal to the vertical position. The angular disposition of the channel member with the gate arm thus assists in overcoming the inertia tending to maintain the gate arm in the horizontal position.

As will be apparent to those skilled in the art, the rate at which the gate moves from the horizontal to the vertical position may be adjusted by sliding adjustment of the weight **24** within the channel member **21.**

One of the features of the present invention is the function of the shock assemblies **26** and **68** which in addition to absorbing the shock of movement of the follower arm also operates to provide an initial movement of the gate arm as it moves from the horizontal to the vertical position and as it moves from the vertical to the horizontal position. This is apparent by virtue of the spring member which is compressed slightly once the respective shock members are contacted either by the gate arm or by the follower arm.

It will be apparent to those skilled in the art that various changes and modifications may be made with respect to the structure herein described without departing from the scope of the invention as set forth in the appended claims.

I claim:

1. An electromechanically controlled, gravity operated gate assembly comprising:

an enclosed housing containing an electromechanical assembly for effecting movement of a gate arm positioned externally of said housing,

gear means contained within said housing and connected to a drive shaft which extends through said housing,

a gate element mounted on the extending portion of said drive shaft,

said gate element including a counterbalanced channel member affixed for movement with said drive shaft and a gate arm secured to said channel member,

a motor and clutch assembly supported within said housing and connected to drive said gear means,

a follower arm mounted within said housing for rotation with said shaft,

electromagnetic means supported within said housing and cooperating with said follower arm to maintain said gate in a generally horizontal position,

switch means supported within said housing and engageable by said follower arm to maintain said electromagnet energized while said gate arm is in said horizontal position,

circuit control means operative in an energized state to activate said motor and clutch assembly for moving the gate arm from a vertical position to a horizontal position,

said switch means being energized in response to contact by said follower arm to de-energize said motor and clutch assembly and to maintain said electromagnetic means energized to maintain said gate arm in said horizontal position, and

said circuit control means in the de-energized state being operative to de-energize said switch means whereby said gate arm is moved to the vertical position by gravity.

2. A gate assembly as set forth in claim **1** wherein said switch means is mounted such that said motor and clutch assembly is de-energized as said follower arm contacts said switch.

3. A gate assembly as set forth in claim **1** wherein a shock assembly is mounted within said housing to contact said follower as said gate arm is raised to the vertical position.

4. A gate assembly as set forth in claim **1** wherein said gate arm is offset about 10° with respect to said channel member such that with the gate arm in the horizontal position the channel member is offset in the direction of pivotal movement of said gate element.

5. A gate assembly as set forth in claim **1** wherein said channel member is positioned at an angle above the vertical with the gate arm in the vertical position.

6. A gate assembly as set forth in claim **1** wherein a resilient shock member is mounted outside of said housing for contact by said gate arm as the latter approaches the horizontal position.

7. A gate assembly as set forth in claim **6** wherein said shock member urges said gate arm from the horizontal position towards said vertical position in response to de-energization of said electromagnet means.

8. A gate assembly as set forth in claim **3** further including friction brake means mounted within said housing and cooperating with said follower arm to slow movement of said gate arm as the latter approaches the vertical position.

9. A gate assembly as set forth in claim **8** wherein a resilient shock member is mounted outside of said housing for contact by said gate arm as the latter approaches the horizontal position.

10. A gate assembly as set forth in claim **9** wherein said shock member urges said gate arm from the horizontal position towards said vertical position in response to de-energization of said electromagnet means.

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