Feb. 9, 1943. W. S. HENRY 2,310,694

HIGHWAY CROSSING GATE FOR RAILROADS

Filed July 19, 1940 2 Sheets-Sheet 1

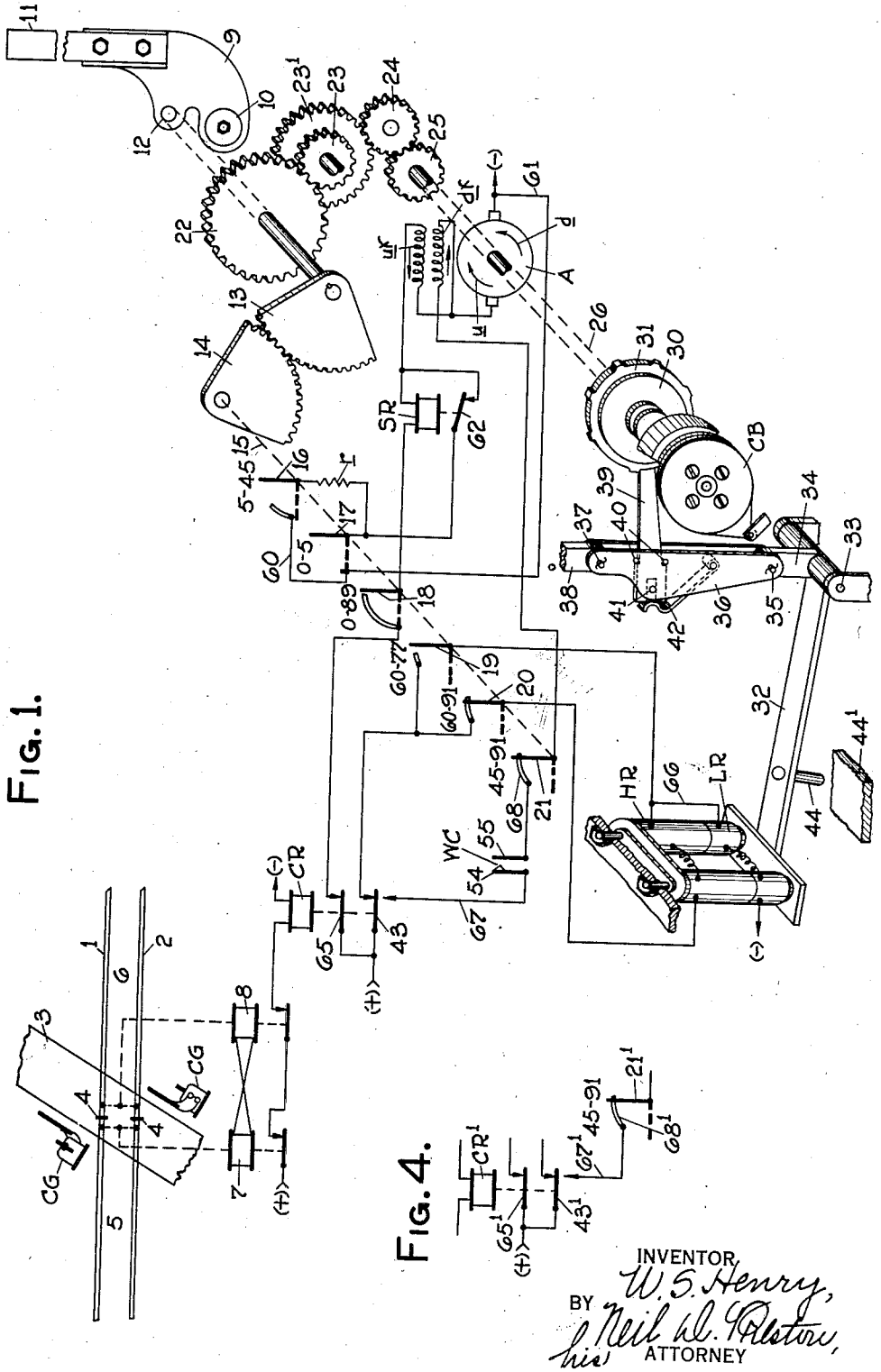


FIG. 1.

FIG. 4.

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HIGHWAY CROSSING GATE FOR RAILROADS

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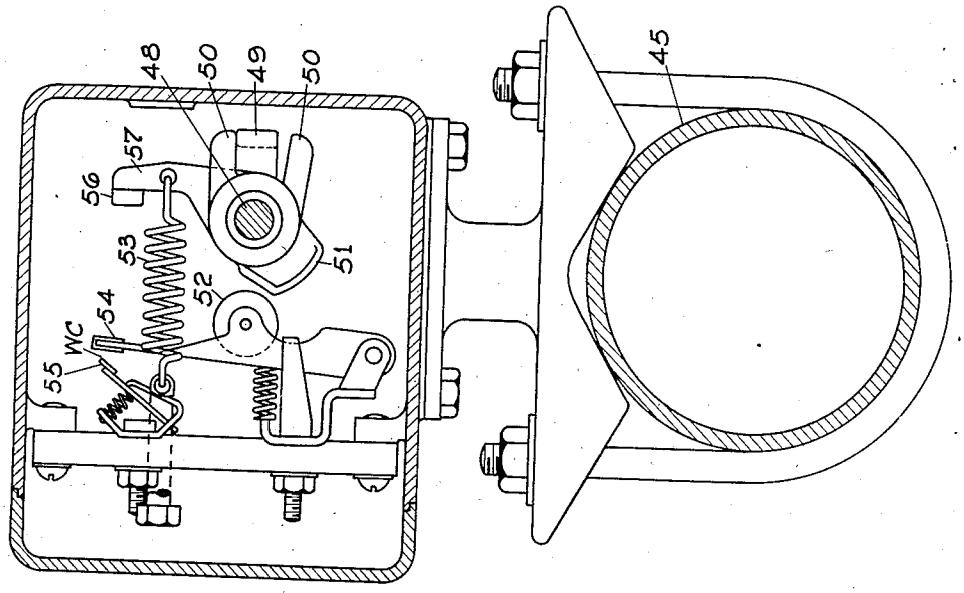


FIG. 3.

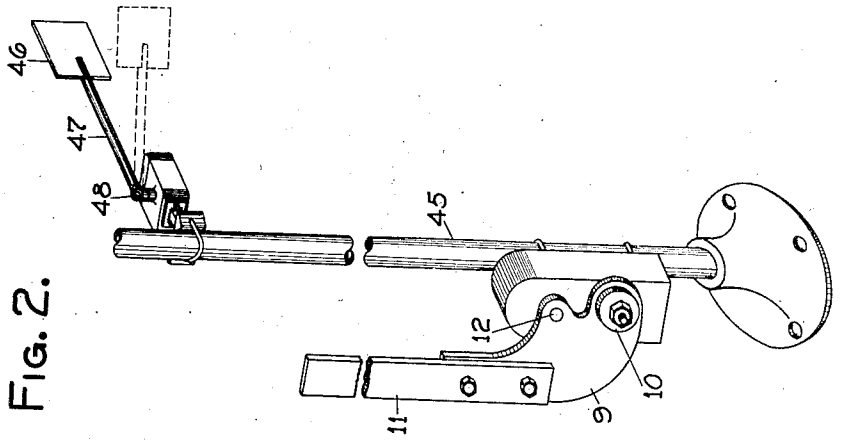


FIG. 2.

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HIGHWAY CROSSING GATE FOR RAILROADS

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Application July 19, 1940, Serial No. 346,397

9 Claims. (Cl. 39—7)

This invention relates in general to railway crossing gates for protection of highway traffic at points where highways cross railways, and has more particular reference to novel means for operating the gates.

It is usual in connection with such crossing gates to provide a long arm, pivoted at one end, and only partly counter balanced, whereby power means for raising the gate to a vertical clear position, requires but little energy, while the movement of the gate to a horizontal stop position can be accomplished by means of gravity. However, when the gate is nearly counter balanced it is possible that it may stick in clear position or that a wind of sufficient velocity and blowing in a particular direction may overcome the gravitation effect on the arm and prevent it from moving to the stop position, and thus possibly cause serious accidents.

With the above and other objects in view, it is proposed in accordance with the present invention to provide a pivoted crossing gate which is nearly counter balanced, with means for power driving the gate from the horizontal stop position to the vertical clear position, and for power driving the gate from the vertical toward the horizontal position, either only in the event that the wind is such as to endanger the gravity operation of the gate, or to invariably so power drive it, regardless of wind condition.

In addition, a centrifugal brake is provided which prevents unduly fast movement of the gate in either direction, whereby to prevent possible damage to the gate or to its operating mechanism.

The present system of highway traffic protection is of the same general type as disclosed in the application to J. E. Stephenson, Ser. No. 246,859, filed December 20, 1938.

The present invention may be understood from the following description taken in connection with the accompanying drawings showing solely with a view to illustrating the principles involved, and no manner whatsoever in a limiting sense, two forms which the invention can assume. In the drawings:

Fig. 1 is a schematic showing of one form of the invention.

Fig. 2 is an elevational view of contact operating means involved in the invention.

Fig. 3 is a sectional plan view of a portion of the contact operating means of Fig. 2.

Fig. 4 is a fragmentary diagrammatic view of a modified form of the invention.

Referring now to the drawings, and first to Fig. 1, there is here shown a stretch of single track constituted by track rails 1 and 2, and crossed by a highway 3. At the intersection of the highway and the stretch of track, the rails are separated into isolated track sections by usual insulating joints 4, whereby to constitute track sections 5 and 6 with their adjacent ends meeting near, or as shown, at the highway.

At each side of the stretch of track and adjacent the sides of the highway are crossing gates CG for the protection of highway traffic.

Associated with the track sections 5 and 6 are interlocked track relays 7 and 8, mechanically interlocked in any usual or desired manner, for example, generally as disclosed in Patent No. 1,824,131, granted to O. S. Field. These relays operate in such a manner that upon one of them becoming deenergized due to occupancy of its section, it releases its armature and thereby latches the armature of the other relay against any release, so that the front contact is not opened, or the front contact is a wipe contact so that a small movement of the armature from its attracted position does not open the front contact, so that, upon a vehicle clearing the highway and vacating the approach section, the released relay picks up, but the other relay, although deenergized, does not release its armature, and accordingly, the gates, which, as explained below, are operated to stop position upon the release of the first deenergized interlocked relay, do not remain in stop position due to the receding train occupying the opposite direction approach section.

A portion of the crossing gates CG, referred to above, is shown in Fig. 1, to an enlarged scale, as constituted by a plate portion 9 carrying a partly counterweighting member 10 and a blade 11. The gate is connected to a pivoted shaft 12, which preferably is horizontally positioned. Shaft 12 carries meshing toothed sectors 13 and 14, connected to operate a shaft 15, carrying a series of circuit controlling contacts. These contacts are arranged to make and break circuits upon movement of the crossing gate arm and are shown in the positions they assume when the gate is in its shown vertical, or clear, position.

The gate, upon moving to its horizontal stop position, turns clockwise as viewed in Fig. 1, to turn shaft 12 in a clockwise direction. This movement operates the contact shaft 15 in a counterclockwise direction and results in contact 16 being closed only while the gate is positioned between the 5 and 45 degree positions. Likewise, contact 17 is closed between the 0 and 5 degree positions; contact 18 is closed between the 0 and 89 degree position; contact 19 is closed between the 60 and 77 degree position; contact 20 is closed between the 60 and 91 degree position; and contact 21 is closed between the 45 and 91 degree position.

Shaft 12, which turns with the gate, carries a gear 22, which operates through a gear train 23, 23^1, 24, and 25, to turn a shaft 26 on which is fixed the armature A of a series motor, having a gate down-drive field *df* and a gate up-drive field *uf*.

Also, on shaft 26 is a centrifugal brake CB, which can be of any usual or desired construction such, for example, as disclosed in the application of Stephenson, referred to above. This brake operates to exert a braking effect on shaft 26 when the speed of rotation of the shaft becomes excessive, and it increases its braking effect as the speed increases, regardless, of course, of the direction of rotation of the shaft.

Shaft 26 also carries a friction clutch or detent member comprising plates 30 (one only of which is shown) on opposite sides of a toothed wheel 31. Plates 30 are pressed against wheel 31 by spring or other elastic means, and are themselves keyed to shaft 26 to turn therewith. Wheel 31 is mounted on shaft 26 so as to be free to turn relatively thereto, thus constituting a friction clutch, and ordinarily wheel 31 turns with shaft 26.

Cooperating with the friction clutch is a hold-clear mechanism, comprising an electro-magnetic means having low resistance coils LR, and high resistance coils HR. Cooperating with the cores which are in these coils is an armature 32 pivoted on a shaft 33, and having an arm 34 fixedly connected thereto. Arm 34 is pivoted at 35 to a control link 36 which at its upper end is pivoted at 37 to a fixed support 38. Control link 36 carries a detent arm 39, limited to a restricted field of motion by pins 40 and 41, and urged forwardly toward the friction clutch by a spring 42.

The hold-clear mechanism, above described, is shown in its holding position wherein the high and low resistance coils HR and LR are energized in series through a circuit including contact finger 43 and front point of relay CR, and contact 20 in its closed position. With the coils so energized armature 32 is in its attracted position, whereby the support pin 44 is raised above a support base 44^1. The integral arm 34 is thereby rocked in a clockwise direction to move the lower end of link 36 to the right, and engage the detent arm 39 under one of the teeth on the slip clutch wheel 31, to thereby prevent rotary movement of shaft 26, and with it the crossing gate arm toward its horizontal position.

For controlling the operation of the motor, a snubbing relay SR is employed, and a snubbing resistance *r* is used.

A wind controlled contact WC is employed in the control of the motor, this contact being shown more in detail in Figs. 2 and 3.

In Fig. 2, for example, the support pole 45 is shown on which is carried the gate 11. On this same pole is arranged a wind operated vane 46, with an arm 47, carried on a generally vertically positioned pivoted member 48. The pivoted member 48 carries a lug 49 operating between spaced lugs 50, having a cam 51 for contacting a roller 52. Cam 51 is retained in its position shown in Fig. 3, by a biasing spring 53 to thereby maintain contact WC open, this contact including a movable contact member 54 and a fixed contact member 55. A stop abutment 56 limits the movement of the cam arm 57 under the urge of spring 53.

Vane 46 is positioned to have its flat face in a vertical plane, which is at right angles to the direction of motion of wind which would tend most strongly to prevent the gate arm from moving from its vertical, to its horizontal, position, under the influence of gravity, all as shown in the drawings.

Upon the wind being of a velocity and direction to possibly prevent the movement of the gate to its stop position, the force of the wind on vane 46 turns the pivot member 48 in a clockwise direction as viewed in Fig. 3. After a short movement, to take up the loose motion connection lug 49 picks up a lug 50 on the cam member 51 to turn cam member 51 in a clockwise direction, whereby to operate on roller 52 and close contacts 54 and 55 of the wind contact WC.

It should be noted that mere gusts of wind, which might cause oscillations of vane 46, will merely result in moving the operation lug 49 between the two lugs 50 within the zone of lost motion, and thus it is assured that a relatively steady, and hence harmful, wind must exist before these contacts are closed.

If, however, the wind is sufficient to overcome the spring biasing tension, and of sufficient duration to cause travel over the lost motion portion, a very short movement of cam 51, in contact with roller 52, causes the complete closure of contacts 54 and 55, and further movement of the vane merely moves the remaining portion of cam member 51 over roller 52 without further movement of the roller carrying arm, since this further portion of the cam is concentric with pivot member 48.

The differences in the operative functions of the two forms of the invention will appear as the description progresses.

Considering now the showing of Fig. 1, wherein the stretch of track is unoccupied, and the crossing gates are in their vertical clear positions, and are held in such positions by the hold-clear devices, which are effective, because the high and low resistance coils of the devices are energized in series through the circuit, as traced above, to hold the armatures in attracted positions.

Assuming now that a train approaches the highway from the west and occupies block 5, the interlocked relay 7 releases, thereby to release relay CR and deenergize the hold-clear devices at contact finger 43 and front point. The hold-clear device, as shown, releases its armature 32 to withdraw detent arm 39 from operative position and permit rotation of shaft 26 and with it movement of gate 11 in a clockwise direction toward its horizontal stop position.

It can be assumed first that there is no wind or only a harmless wind, so that the gate will move under the influence of gravity to its stop position. In moving to its stop position, it operates shaft 26 in a counterclockwise direction to turn the armature of the motor in a counterclockwise direction. Due to residual magnetism in the field of the motor, the driven motor acts as a generator and produces a current which is employed to brake the motor, and prevent excessive speed of movement of the gate arm. This braking effect is not produced during the first part of the movement of the arm to its horizontal position, but upon the arm reaching the 45° position, contact 16 closes a circuit including the motor armature, wire 60, wire 61, contact 16 in its closed position, resistance *r*, contact 62 and back point, and the up-field *uf* of the motor, whereby to produce a relatively strong field excitation through which the armature must cut, and hence be retarded. This degree o f dynamic braking continues until the gate arm reaches the 5° position, whereupon contact 17 closes, to complete a shunt around resistance *r*, so as to increase the current flow through the up-field *uf* and materially increase the dynamic braking effect. This insures that the gate arm shall reach its final horizontal po-

sition at a slow speed, and obviates all danger of breakage. Furthermore, if the speed should be for any reason excessive, the centrifugal brake CB will become effective to maintain the gate arm speed within safe limits.

Assume now that, upon the train entering section 5, the wind is in a direction and of a velocity, sufficient to endanger the proper gravity operation of the gate arm, and hence is sufficient to cause the closure of contact WC.

With the wind contact WC closed and relay CR retracted, an energizing circuit for the motor is completed for causing the motor to turn counter-clockwise so as to drive the crossing gate arm downwardly towards its horizontal stop position. This circuit includes contact finger 43 and back point, wind contact WC in its closed position, gate operated contact 21 in its closed position, and the motor field winding *df*, the energizing current passing through field winding *df* in the direction indicated by the arrow adjacent thereto.

The downward drive of the gate continues until the energizing circuit is opened upon the gate passing its 45° position, whereupon the motor is driven by the gate to operate as a generator and produce a current flowing in the direction reverse to that of its former energizing current, that is, in a direction from right to left through armature A. This current flows through a circuit to produce dynamic braking and to slow down the speed of gate movement. The braking circuit includes the left-hand terminal of armature A, up-field *uf*, through which the current flows from left to right, that is, in the direction reverse to that of flow when the motor is driving upwardly, and hence in a direction to increase the strength of the flux which still remains in the down-field, contact finger 62 and back point of relay SR, resistance *r*, gate contact 16 in its closed position, to the other side of armature A.

This braking effect continues until the gate passes its 5° position, whereupon resistance *r* is shunted out by a shunt circuit closed by gate contact 17 in its closed position. With resistance *r* shunted out, a larger current flows through the up-field in the same direction as referred to just above, to thereby increase the excitation of the motor, and thus increase the braking effect. Thus, the braking effect is increased from the 5° position to the 0° position to thereby insure that the gate shall reach its stop position without undue jar or shock.

Assume now that the vehicle occupying section 5 passes beyond the highway and vacates section 5. Although section 6 is now occupied, interlocked relay 8 cannot release its armature since it is latched up, and upon relay 7 picking up its armature, relay CR picks up to thereby complete an energizing circuit for the motor. This circuit includes contact finger 65 and front point of relay CR, gate contact 18 in its 0° closed position, the winding of relay SR, the up-field *uf*, etc., whereby to cause relay SR to pick up, and cause the motor to operate in a clockwise direction to drive the gate toward its vertical position.

The picking up of relay SR opens a circuit which otherwise would shunt out the up-field *uf*, and the motor armature, and which includes contact finger 62 and back point, and the gate contact 17, in its 0°, closed position. The motor drives the gate upwardly until it reaches a position beyond the 89° position, whereupon the motor circuit is opened and the gate continues, under its own momentum, to move any further slight distance to its final, and likely its vertical position.

During the upward drive of the gate, upon it reaching the 60° position, a circuit for energizing the low resistance windings of the hold-clear device is completed which includes contact finger 43 and front point, contact 19 in its 60°–77° position, and the windings LR. Upon passing the 77° position, this pick-up circuit for the hold-clear device is broken, upon which a circuit including the high resistance and low resistance windings HR and LR, in series, becomes effective, and continues effective through the 91° position, or in other words, continues effective after the gate has reached its limiting upward position. This holding circuit includes contact finger 43 and front point, gate contact 20 in its 60°–91° position, winding HR, wire 66, and winding LR.

Accordingly, the hold-clear device remains energized to maintain the crossing gate in its raised clear position, until such time as a vehicle occupies one of the approach sections on approaching the highway so as to cause the gate to automatically assume its stop position.

With the form above described, it is clear that, unless the wind be of a harmful velocity, and direction, the gate moves to its stop position solely under the influence of gravity, but if the wind be harmful, such as to possibly interfere with proper gravity operation, the motor is automatically cut in to drive the gate down and insure proper operation.

The particular angle of movement through which the motor drives the gate downwardly, is not critical, and depending upon conditions, can be increased or decreased within reasonable limits.

Referring now to Fig. 4, there is here shown a slightly modified form of the invention, wherein the wind operated contact WC has been omitted, the wire 67^1 of Fig. 4 being continuous from the back point of contact finger 43^1 to the sector 68^1. In the form shown in Fig. 1, the corresponding wire 67, which connects the back point of finger 43 with the sector 68 is not continuous, and is effective to cause a down-drive by the motor only in the event the wind is of a dangerous character.

In the form of Fig. 4, relay CR^1 is controlled as is relay CR of Fig. 1, and the motor invariably drives the arm downwardly, and here again, the angle through which it drives the arm is not critical, or restricted to the values described herein, although it is assumed that after the gate arm has reached the 45° position, or thereabout, gravity will be sufficient to continue the motion regardless of weather conditions.

In both forms of the invention, the centrifugal brake CB is employed and accordingly, should the arm accumulate sufficient sleet or snow, for example. as to cause an undue speed in its downward movement, the centrifugal brake will care for this and prevent damage. Likewise, should the arm break off, so that the counter-weight together with the upward drive would cause an unsafe speed of movement upwardly of the broken arm, here again the centrifugal brake will care for the situation and prevent further shock and damage.

The above rather specific description of two forms of the present invention is given solely by way of example, and is not intended, in any manner whatsoever, in a limiting sense. It is to be understood that various modifications, adaptations and alterations can be employed to

meet the requirements of practice, without in any manner departing from the spirit or scope of the invention except as limited by the appended claims.

What I claim is:

1. In railway crossing gates, in combination, a gate movable from stop to clear position, and, normally, under the influence of gravity, from clear to stop position, a reversible motor operatively connected to the gate, and current means controlling the motor to drive the gate from stop to clear position, and controlling means separate from the motor and responsive to ambient conditions to close a circuit for energizing the motor and cause it to move the gate from clear to stop position only if gravity be undependable to cause such operation.

2. In railway crossing gates, in combination, a crossing gate, means supporting the gate for movement from stop to clear position, and for movement, normally, under the influence of gravity, from clear to stop position, a reversible motor operatively connected to the gate, automatic means controlling the motor to drive the gate toward clear, and toward stop, position, and a wind controlled contact effective to prevent said motor drive toward stop position only under wind conditions favorable to effective drive to stop position by gravity.

3. In railway crossing gates, in combination, a crossing gate, means supporting the gate for movement from stop to clear position, and for movement under the influence of gravity from clear to stop position, a reversible series motor operatively connected to the gate, automatic means controlling energizing circuits for the motor to cause it to drive the gate toward clear, and toward stop, position, the motor having a toward-stop drive field and a toward-clear drive field, means discontinuing the toward-stop drive of the motor, by deenergizing the toward-stop drive field, before the gate reaches its final stop position, and a snubbing circuit for the motor effective after the discontinuance of the toward-stop drive and including the toward-clear drive field.

4. In railway crossing gates, in combination, a crossing gate, means supporting the gate for movement from stop to clear position, and for movement under the influence of gravity from clear to stop position, a reversible motor operatively connected to the gate, automatic means controlling the motor to drive the gate toward clear, and toward stop, position, a wind controlled contact effective to prevent the motor drive toward stop position only under wind conditions that are favorable to effective drive to stop position by gravity, the motor having a toward-stop drive field, and a toward-clear drive field, means discontinuing the toward-stop drive before the gate reaches its final stop position, and a snubbing circuit for the motor effective upon the discontinuance of the toward-stop drive, and including the toward-clear drive field.

5. In railway crossing gates, in combination, a crossing gate, means supporting the gate for movement from stop to clear position, and, normally, for movement under the influence of gravity from clear to stop position, a reversible motor operatively connected to the gate, automatic means controlling the motor to drive the gate toward clear, and toward stop, position, a wind controlled contact effective to prevent the drive toward stop position only under wind conditions favorable to effective drive toward stop position by gravity, the motor having a toward-stop drive field and a toward-clear drive field, means discontinuing the toward-stop drive before the gate reaches its final stop position, and a snubbing circuit for the motor closed after the discontinuance of the toward-stop drive and including the toward-clear drive field, which last said field is energized with a polarity of current opposite to that of its energization during toward-clear drive by the motor.

6. In railway crossing gates, in combination, a crossing gate, means supporting the gate for movement from stop to clear position, and for movement, normally, under the influence of gravity from clear to stop position, a reversible motor operatively connected to the gate, automatic means controlling the motor to drive the gate toward clear, and toward stop, position, a wind controlled contact effective to prevent the motor drive toward stop position only under wind conditions favorable to effective drive toward stop position by gravity, the motor having a toward-clear drive field and a toward-stop drive field, means discontinuing the toward-stop drive prior to the arrival of the gate at its stop position, and a dynamic braking circuit closed during said discontinuance and including, in series, the toward-clear drive field.

7. In railway crossing gates, in combination, a crossing gate, means supporting the gate for up movement from stop to clear position, and for down movement, normally, under the influence of gravity from clear to stop position, a reversible motor operatively connected to the gate, automatic means controlling the motor to drive the gate to clear, and to stop, position, a wind controlled contact effective to prevent the drive to stop position only under wind conditions favorable to effective drive to stop position by gravity, the motor having an up-drive field and a down-drive field, means discontinuing the down-drive prior to the arrival of the gate at stop position, and a dynamic braking circuit closed during said discontinuance and including, in series, the up-drive field, and a centrifugal brake operatively connected to the gate to prevent excessive rate of movement of the gate.

8. In railway crossing gates, in combination, a railway crossing gate, means supporting the gate for movement from stop to clear position, and from clear to stop position, a reversible series motor operatively connected to the gate, circuit means for energizing the motor for forward operation to move the gate to clear position, and circuit means which is closed, only when gravity is insufficient to move the gate toward stop position, and when closed is effective to energize the motor for reverse operation to move the gate toward its stop position.

9. In railway crossing gates, in combination, a railway crossing gate, means pivotally supporting the gate for movement from a horizontal stop to a vertical clear position, and from clear to stop position, a reversible series motor operatively connected to the gate, circuit means for energizing the motor for forward operation to move the gate to clear position, and circuit means which is closed, only when gravity is insufficient to move the gate toward stop position, and effective for energizing the motor for reverse operation to move the gate toward its stop position.

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