

Nov. 7, 1933.

J. W. JENKINS

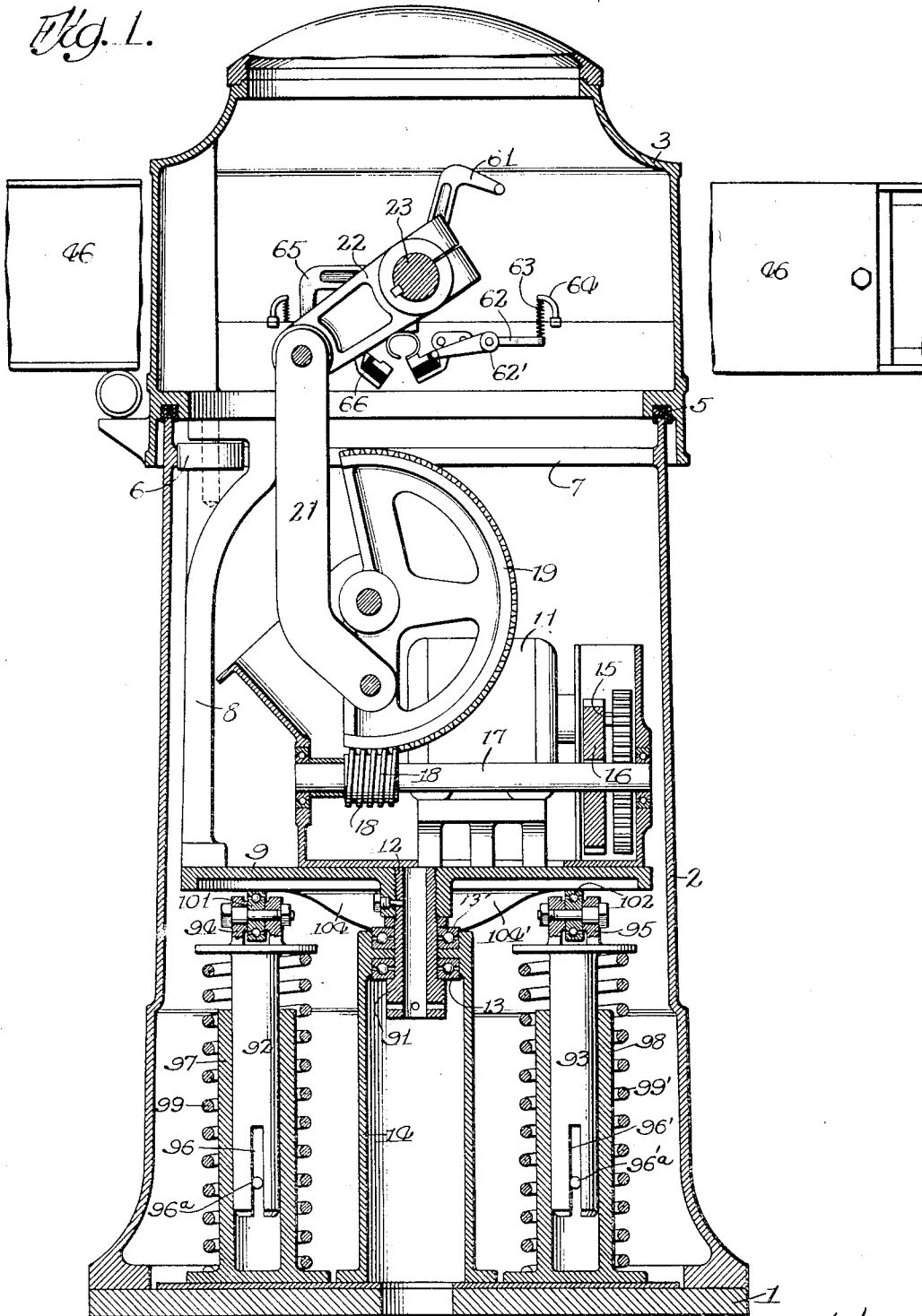
1,934,429

RAILROAD CROSSING GATE APPARATUS

Filed April 14, 1930

6 Sheets-Sheet 1

Fig. 1.



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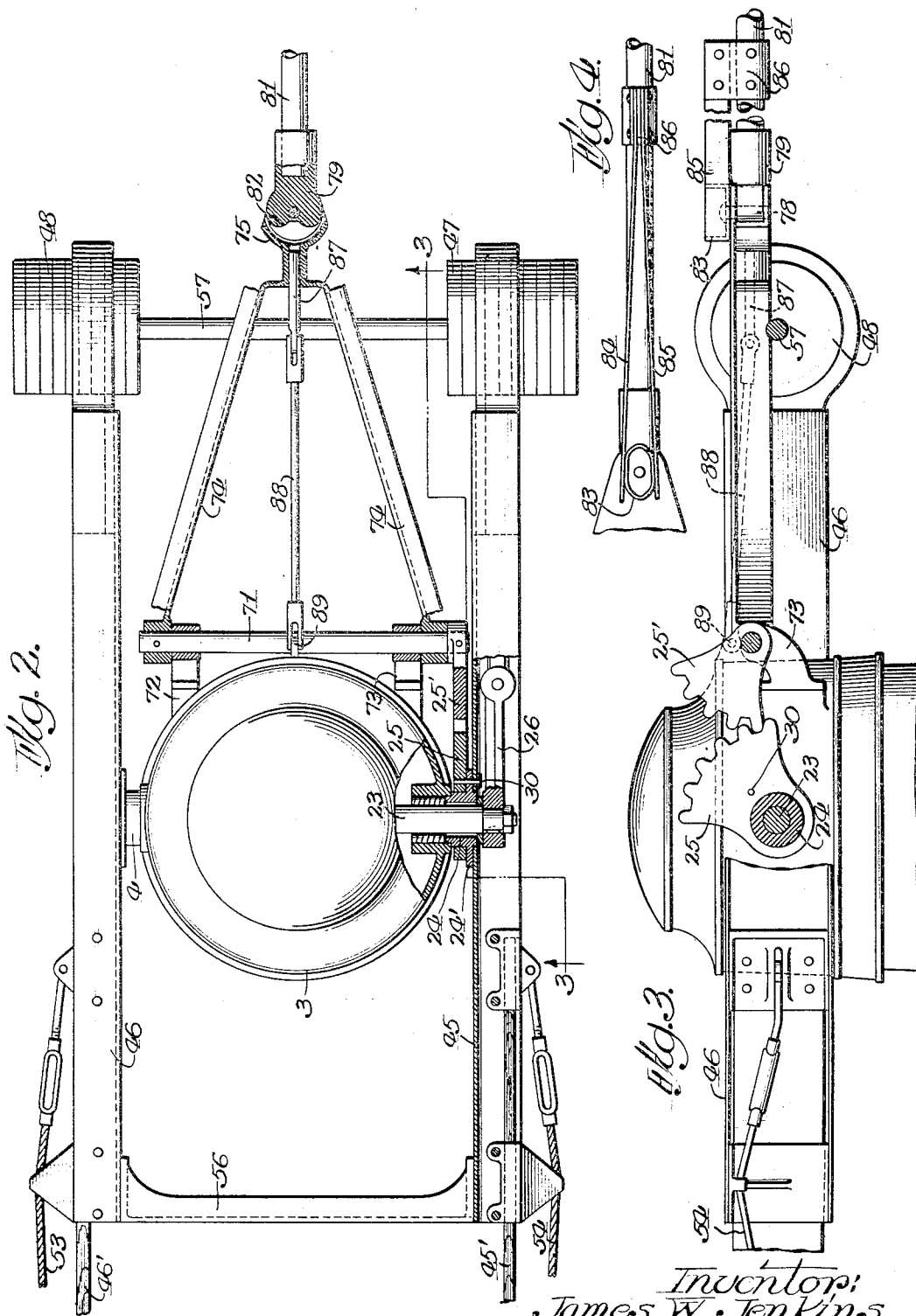
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6 Sheets-Sheet 2



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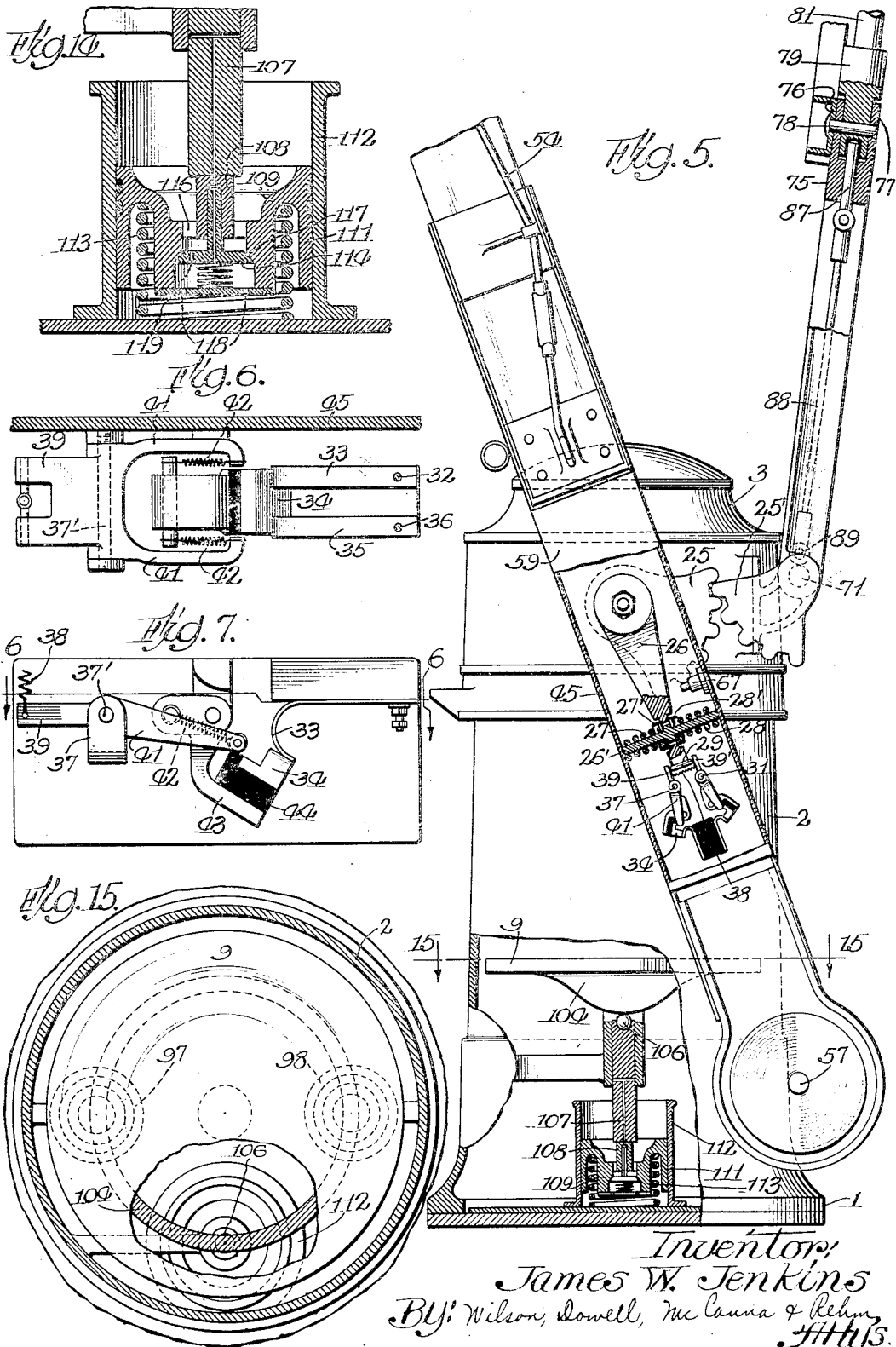
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RAILROAD CROSSING GATE APPARATUS

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6 Sheets-Sheet 3



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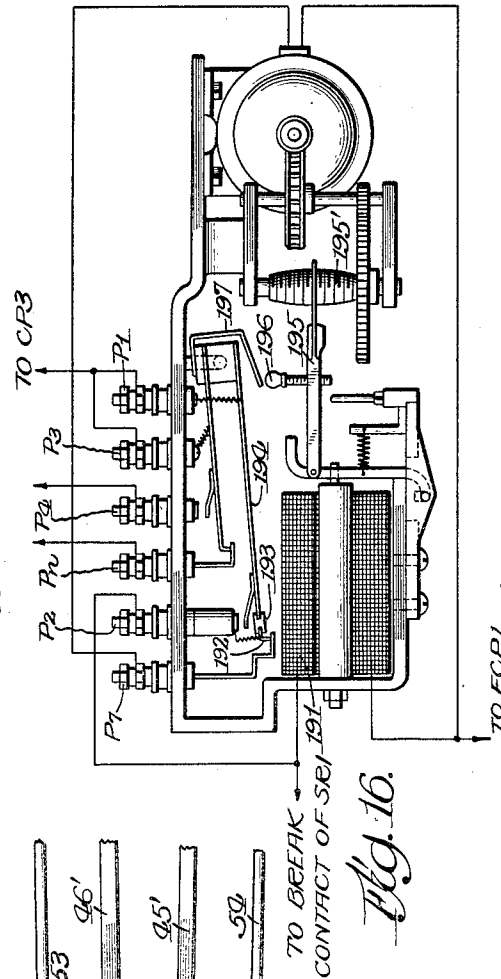
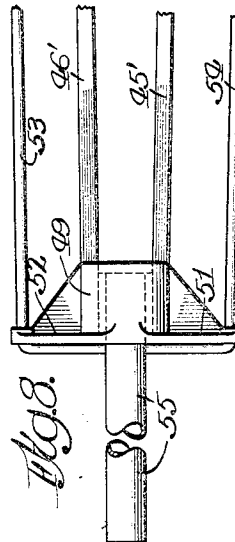
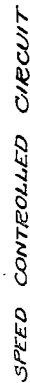
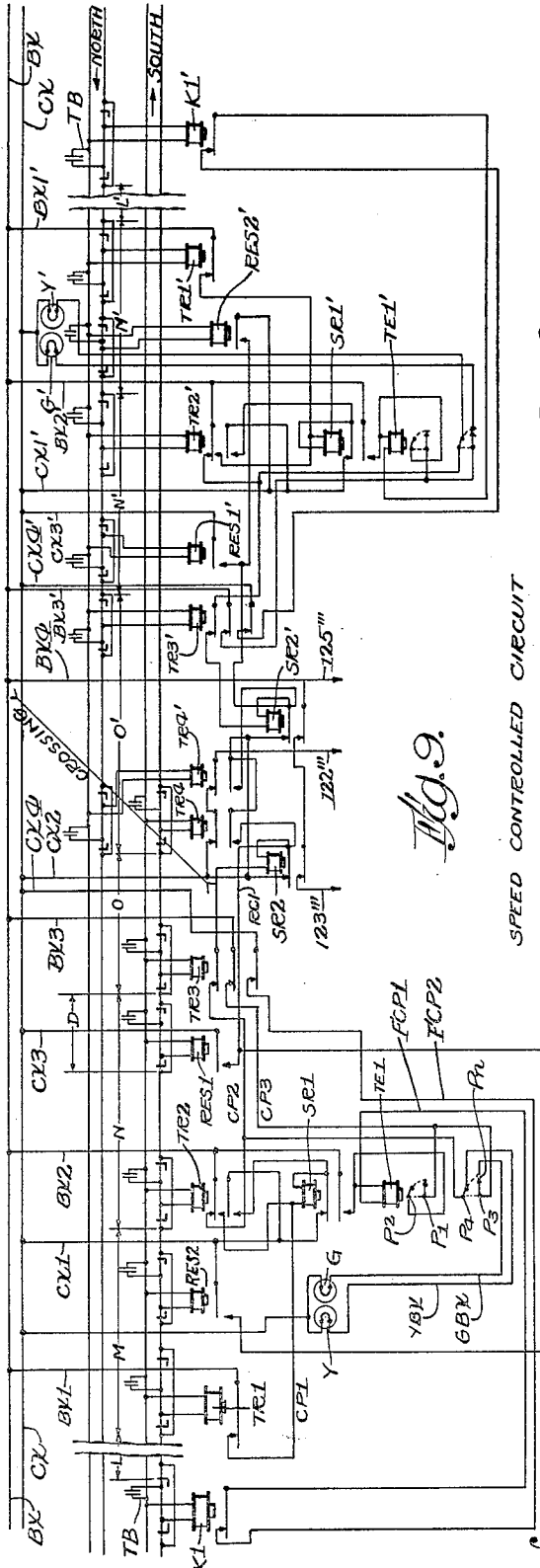
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RAILROAD CROSSING GATE APPARATUS

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6 Sheets-Sheet 4



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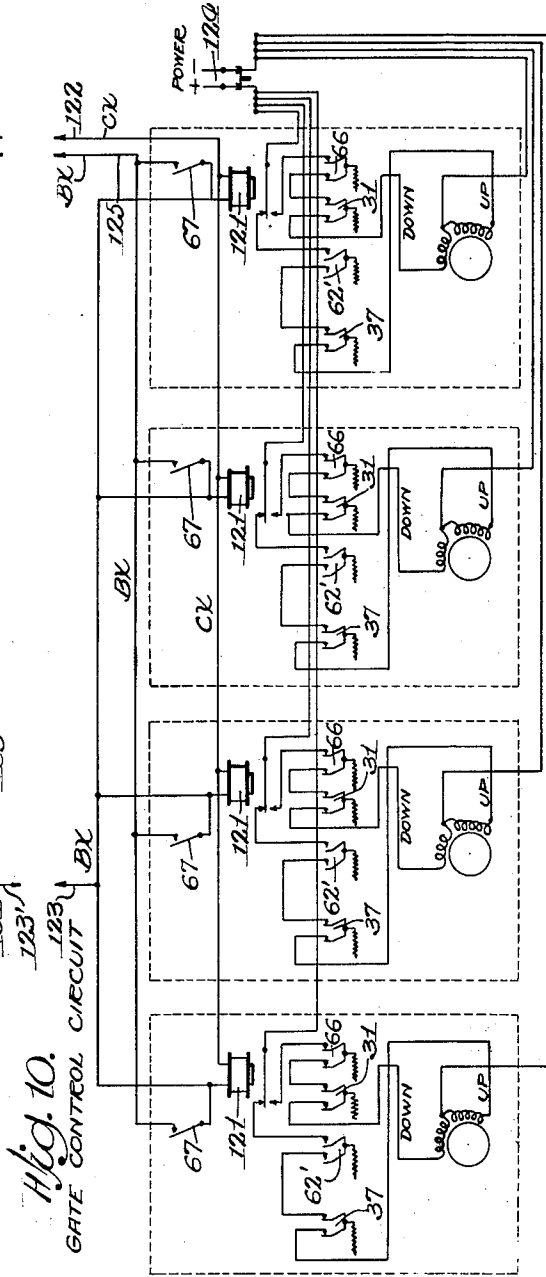
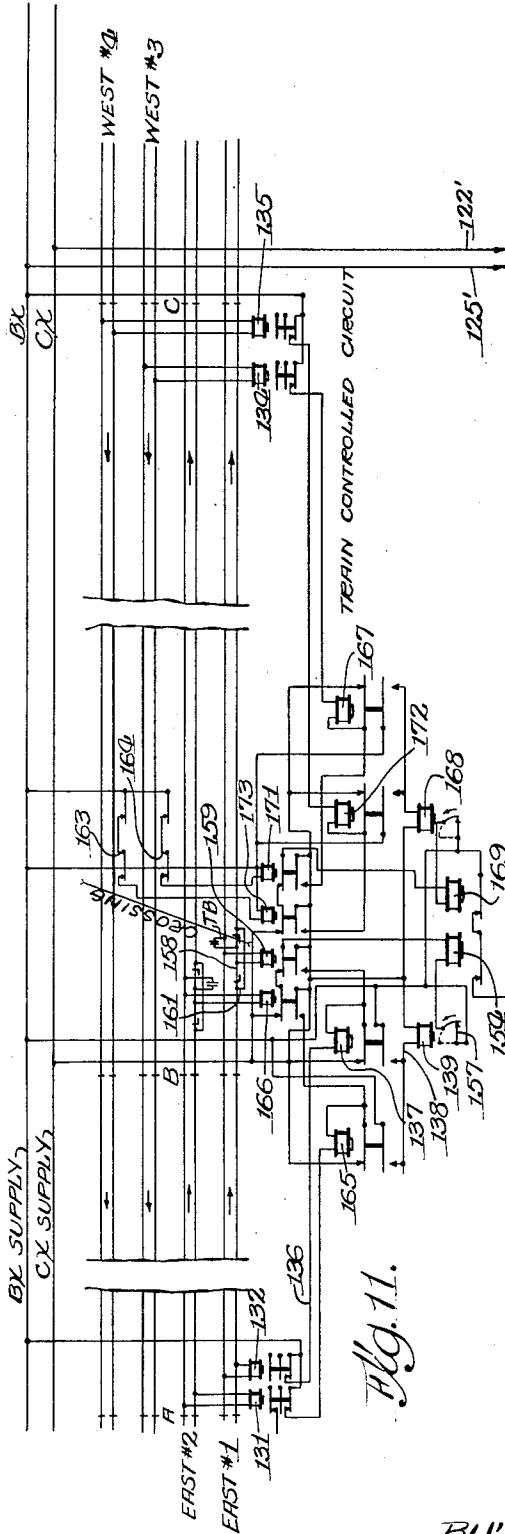
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RAILROAD CROSSING GATE APPARATUS

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6 Sheets-Sheet 5



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RAILROAD CROSSING GATE APPARATUS

Filed April 14, 1930

6 Sheets-Sheet 6

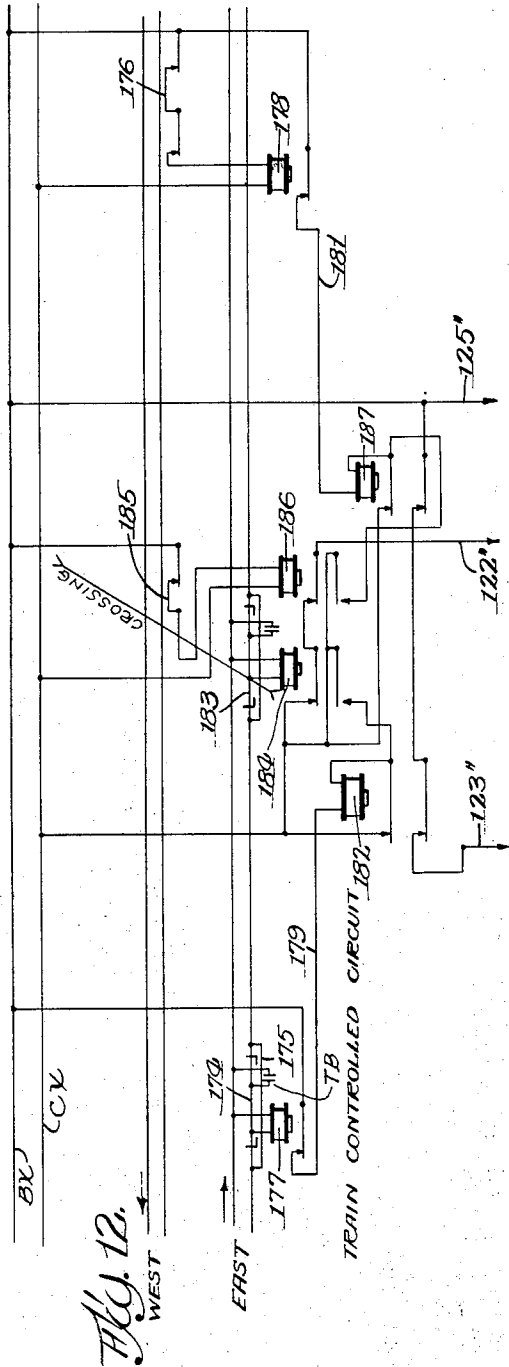
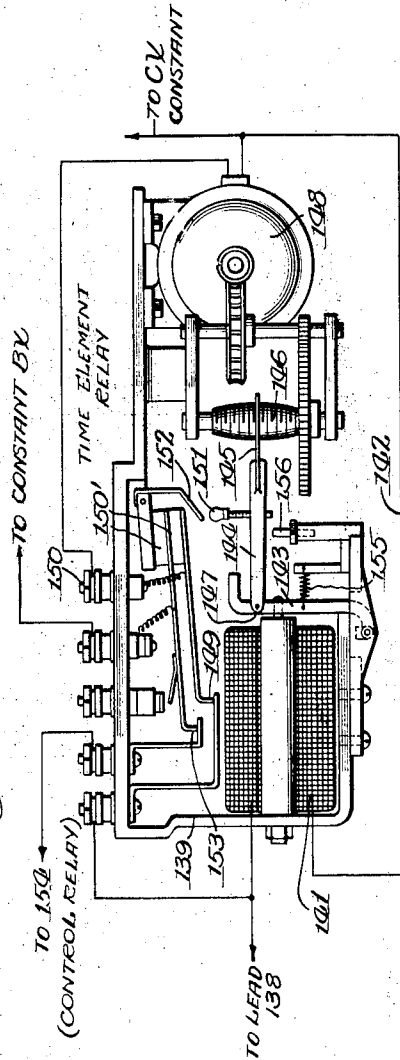


Fig. 13.



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UNITED STATES PATENT OFFICE

1,934,429

RAILROAD CROSSING GATE APPARATUS

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Application April 14, 1930. Serial No. 444,104

13 Claims. (Cl. 39—7)

This invention relates to automatic crossing gates and means for operating the same and comprises features which render it adaptable to various track, traffic, and track signal conditions which may already exist at a crossing to be guarded by gates.

It is preferred that each gate arm be operated by an individual reversible motor carried in the standard which supports the gates, and that the operation of each motor be governed by a gate control relay which for safety's sake should be held in operated condition normally and released upon the approach of a train, thus setting in operation the motor which will then bring the gate arm down into barrier position. Should the circuit which holds this gate control relay normally operated become opened or fail through any cause whatsoever, the gate arm will be brought down to barrier position. Various circuits are disclosed herein for causing the release of the gate control relay at proper times for closing the gates and also for opening them.

One of the objects of this invention is to provide crossing gates and operating circuits therefor having a number of safety features in the circuits which will protect the crossing even should adverse weather conditions or other conditions tend to interfere with the normal perfect working of the circuits.

Another object of the invention is to provide a crossing gate operating system which will hold the gate arms in barrier position not only as the train nears the crossing, but also while it still remains on the crossing.

Another object of this invention is to provide a gate control system which can be installed on a railway already equipped with a block signal system without interference with the existing signal system and so adaptable that no matter where the existing blocks begin or end this gate control system can be installed readily and operated with perfect safety and satisfaction.

Another object of this invention is to provide gate arms and operating mechanism therefor which permits the gate arms when struck in barrier position by vehicles to swing horizontally without destruction of the gate arms and with the additional feature of protecting pedestrians on the sidewalks from being injured through horizontal rotation of the sidewalk arms.

Another object of this invention is to provide a crossing gate arm and operating means therefor which will permit manual raising of the gates from barrier position to permit the disengagement of the gate arms from between the stakes of

trucks, should the gate arms drop down into such a position.

Other equally important objects and advantages of this invention, too numerous to list here as such, should become apparent upon a perusal of the specification and drawings.

In the drawings,

Fig. 1 shows a vertical central section of a gate standard,

Fig. 2 is a plan view of the gate standard partly in section showing particularly the sidewalk arm mechanism,

Fig. 3 is a side elevation of part of the sidewalk arm mechanism,

Fig. 4 is a plan view of a detail of the sidewalk arm construction,

Fig. 5 is a side elevation with portions in section with the same gate standard showing the roadway and sidewalk arms in raised position,

Fig. 6 is a sectional view on line 6—6 of Fig. 7 showing a yield switch,

Fig. 7 is a side elevation of the same switch,

Fig. 8 is a plan view of portions of the roadway arm,

Fig. 9 is a schematic representation of a train speed controlled circuit connectable to the gate control circuits for operating the same,

Fig. 10 is a schematic representation of the gate controlled circuit,

Fig. 11 is a schematic representation of another embodiment of a train controlled circuit,

Fig. 12 is a schematic representation of a further embodiment of a train controlled circuit for use where there is no signal system already in existence,

Fig. 13 is a diagrammatic disclosure of one form of a time element relay which is used in the train controlled circuits,

Fig. 14 is an enlarged vertical sectional view showing the details of construction of the dash pot mechanism,

Fig. 15 is a horizontal section on the line 15—15 of Fig. 5 showing the position of the dash pot relative to the center of the housing, and

Fig. 16 is a diagrammatic disclosure of one form of a time element relay to be used with the circuit of Fig. 9.

The same gate control circuit may be used without change with either of the three alternative train controlled circuits.

Each crossing will be provided with one or more but preferably four gate standards each bearing a roadway arm, and if there are sidewalks at the crossing the gate standards will also support sidewalk arms. Each standard will

have a base plate 1 fixed on a concrete base and supporting an immovable or stationary housing 2. Mounted above the housing for rotation relative thereto is a housing head 3 at one side of which is a suitable bearing 4 for rotatably supporting the gate arm channel member generally indicated as 46. A packing ring 5 carried by the housing head contacts with the uppermost edge of the housing to prevent the entry of dust but permits free movement of the housing head with relation to the housing. One or more rollers 6 carried by frame 8 bear against a track 7 on housing 2 and aid in centering and guiding the rotation of the housing head. Rigidly connected to the housing head is frame 8 provided with a mechanism plate 9 for supporting the reversible motor 11. The weight of the frame, motor, and gear assembly, head arms, etc. is supported through the cams 104 and 104' of the mechanism plate on springs 99 and 99' and held to a horizontal plane by means of thrust bearings 13 and 13', the latter surrounding the depending post 12 which is threaded into the mechanism plate 9. The two thrust bearings engage the upper and lower margins of the flanged opening on the top of the hollow post 14, while any suitable thrust retainer such as the retainer 91 may be employed to hold the assembly in operative position.

Operation of roadway arms

The motor 11 drives a train of gears generally indicated as 15, one of which, 16, is keyed to the shaft 17 which shaft is also equipped with a worm gear 18. The worm gear 18 drives the segmental worm wheel 19 and causes the reciprocation of the connecting rod 21, the latter being pivotally connected to the gear 19 and the crank arm 22. This crank arm is keyed to the middle portion of the shaft 23, which upon rotation causes the roadway arm and sidewalk arm to be raised or lowered in a manner described below.

Rotatably mounted on the shaft 23 bearing on a brass bushing 23' is a sleeve 24 having an annular flange 24'. A sector gear 25 is mounted on the exterior surface of the sleeve 24 and meshes with another sector gear 25' for raising and lowering the sidewalk arm. A pin 30 extends through the sector gear 25, the flange 24' and the channel member 45, causing these three members to move together. As is explained hereinafter, the sector is not driven directly by the shaft 23, but is driven by the movement of the channel 45, which in turn is driven by the arm 26 acting through either of the compression springs 27 or 28.

The shaft 23 also has keyed thereto a crank arm 26 which, as is best shown in Fig. 5, extends rearwardly away from the roadway within the channel of the roadway arm and normally is centered between two opposed compression springs 27 and 28 which are sufficiently strong to cause the roadway arm normally to be raised and lowered as the crank arm 26 is oscillated, without any substantial disalignment of the center lines of the roadway arm and the crank arm 26. An opening in the arm 26 surrounds the middle fixed enlargement on the spring guide pin 26' which is rigidly mounted in the channel 45. The spring retaining cups 27' and 28', in which the ends of their respectively associated springs rest, normally abut against this enlargement and are slidably disposed on the pin, hence should the channel be held against rotation by an obstruction while the motor is rotating the arm 26, that arm will not remain

centered but will move against the cup 27' or the cup 28', as the case may be, and compress the respectively associated spring. For example, should the roadway arm strike an obstruction such as the top of an automobile, and its further downward movement be prevented, the crank arm 26, still being driven by the motor, may still continue to move a little further in a counter-clockwise direction, as viewed in Fig. 5, and compress the spring 28. The other spring 27 will not expand due to the abutment of its cup 27' against the enlargement on the pin. It is obvious that when this obstruction is removed the spring 28 will quickly restore the crank arm 26 and roadway arm to their usual parallel alignment.

Yield switches

Should this obstruction, such as an automobile top, oppose the downward movement of the roadway arm before it has reached barrier position, the continued counter-clockwise movement of the crank arm 26 will not only compress the spring 28 but the head 29 of the crank arm will kick open the upper toggle switch 31 and open the down drive circuit which passes through the contacts of that switch. Should a child hang onto the gate when the updrive circuit is in operation the lower toggle switch 37 will be kicked open to open the updrive circuit and stop the motor until the child lets go of the gate. A description of the operation of the updrive toggle switch will suffice for an understanding of the operation of both the updrive and down-drive toggle switches. One side only of the updrive circuit passes through the switch 37, entering at the binding post 32, continuing through the spring contact 33, across the conductor contact block 34, and out again through the spring contact 35, binding post 36, and through the remainder of the updrive circuit. A spring 38 holds the trip fingers 39 and 39' of the two toggle switches tightly against the head 29 of the crank arm. The spring 38 thus restores either toggle switch to normal when the centering springs 27 and 28 have realigned the crank arm and roadway arm. The trip finger 39 and bifurcated arms 41 constitute a rigid bell crank, and when this crank is rotated about pin 37' counter-clockwise from its normal position, as shown in Fig. 7, the associated toggle springs 42 will, after dead center has been passed, snap the contact bell crank 43 out of contact position, that is, clockwise as viewed in Fig. 7, removing the contact block 34 from contact with the spring contacts 33 and 35 thus opening the associated updrive circuit. An insulating block 44 provides a suitable means for attaching the contact block 34 to the bell crank 43. The provision of the toggle switches 31 and 37 prevents injury of the motor or blowing of fuses in the emergencies above described.

The roadway arm consists of parallel channel frame members 45 and 46 mounted on opposite sides of the gate standards, the channel 45 being supported on the sleeve 24, while channel 46 is supported rotatably on the bearing 4. (See Fig. 2). On the rear end of the channel members 45 and 46 are carried counterweights 47 and 48. Connected to the roadway side of the frame members 45 and 46 are boards 45' and 46', preferably disposed on edge and extending part way out over the roadway terminating at a lightweight metallic block 49 (Fig. 8) to which they are rigidly secured in any suitable manner. The block 49 has horizontally extending arms 51 and

52 which furnish supports for flexible cables 53 and 54 which extend back to the frame members 45 and 46 and are anchored thereto, as shown in Figs. 2 and 3. The combination of the cables and the boards forms a light-weight, but rigid, gate arm and there is the added advantage that the flexible cables 53 and 54 will absorb some of the force of collisions and protect the boards from fracture. It is preferred that the block 49 carry a light-weight tubular member 55, made preferably of aluminum, which will extend out to the center of the roadway, there to meet another gate arm of similar construction extending from the standard on the opposite side of the roadway. The gate arm may extend completely across the roadway.

The channels 45 and 46 are rigidly connected together by a front angle iron 56 and at the rear by the bumper shaft 57. As shown in Fig. 5 the shaft 57 may bump against the base of the pedestal to limit upward swinging movement of the gate arm. The gate channel member 45 is preferably a channel iron which is deep enough to provide a suitable housing for the crank arm 26 and the toggle switches 31 and 37. The space thus provided in the channel arm may be inclosed by a cover 59, thus protecting the switch mechanism from the elements.

Limit switches

Each gate standard is provided with updrive and downdrive limit switches for stopping the reversible motor when the gate arm has reached either the barrier or the clear position. Fig. 1 shows a switch operating finger 61 adapted to strike the trip lever 62 of the toggle switch generally indicated at 62', to open and hold open the same to stop the updrive of the roadway arm as it reaches maximum raised position, the operating finger being mounted to rotate with the shaft 23, while the toggle switch 62' is mounted in stationary position in the housing head 3 in any suitable manner. The construction of this toggle switch is preferably the same as that of the toggle switch shown in Figs. 6 and 7, excepting that it is normally urged toward closed position by a spring 63 connected to a spring anchor support 64 mounted in any suitable manner in the housing head. The spring will close this switch as soon as the finger 61 moves away from it during the down drive of the roadway arm. The actuation of this toggle switch will be understood by reference to the foregoing description of the toggle switch shown in Figs. 6 and 7.

Another switch operating finger 65, shown in Fig. 1, rotates with shaft 23 and trips a toggle switch generally indicated as 66 to open and hold open the same when the roadway arm has reached its lowermost position, thus opening the downdrive circuit. The construction of this switch is identical with that of the toggle switch 62 and needs no further description.

Manual lifting

Manual lifting of the roadway arm is made possible should it, upon being lowered, rest between the stakes of a truck and the truck driver desire to disengage it therefrom, or should it be desired for any other reason to lift it. A circuit is provided for causing the motor to raise the gate in such a case, inasmuch as the motor is positively geared to the crank arm 26 at all times. Each gate arm carries a suitable contactor such as a push button switch of ordinary construction, generally indicated as 67, the button of

which will be depressed provided someone manually lifts and thus rotates the gate arm upwardly while the crank arm 26 remains stationary. When the roadway arm has been manually rotated clockwise, as viewed in Fig. 5, sufficiently to cause the button of the switch 67 to strike and be depressed by the crank arm 26, a circuit, as shown in Fig. 10, will be closed, regardless of the status of the train controlled circuits, to operate the gate control relay and thus close an updrive circuit to the motor of the particular gate arm which is being lifted, whereupon the motor will raise this gate arm until the manual pressure thereon has been released. With the upward movement of the gate arm the down drive limit switch will close. With the release of this manual pressure the equalizing spring 28 will realign the crank arm 26 and the gate arm, thus opening the switch 67 and causing the release of the gate control relay should there be at that time no other circuit, such as a train controlled circuit, closed for holding the relay operated. If the circuits are at this moment so set that the gate arm should come down, the release of the gate control relay, as will later be better understood, will again close the downdrive circuit to the associated motor and bring the gate down to barrier position whereupon the associated downdrive limit switch will be opened, thus stopping the motor. The position of the push button switch 67 in the circuit is indicated in Fig. 10 on the schematic.

Sidewalk arms

The sidewalk arm is constructed and operated as follows: A horizontal shaft 71 is supported for rotation in brackets 72 and 73, which are supported rigidly on the housing head, and has keyed to it the sector gear 25 and the yoke 74. Carried at the outer end of the yoke is a socket 75 having bifurcated portions 76 and 77. Pivoted on the pin 78 and carried between the bifurcations is a head 79 at the outer end of which is carried the main portion 81 of the sidewalk arm, preferably in the form of a light-weight hollow metallic tube. The inner end of the head 79 is recessed to form a negative cam surface 82 having the shape shown in Fig. 2. The socket member 75 also carries an elliptical member 83, the plan view of which is shown in Fig. 4 and on the outer surface of which bear a pair of leaf springs 84 and 85, the opposite ends of which are rigidly anchored at 86 to the tubular arm 81. The elliptical cam 83 and springs associated therewith are provided for the purpose of urging the sidewalk arm to remain normally extended transversely across the sidewalk but adapted to permit this arm, against the pressure of these flat springs to swing horizontally about the pivot 78. This feature is provided so that, if the roadway arm and housing head are rotated by means of a vehicle striking the roadway arm, although the yoke 74 also will naturally be swung around, the sidewalk arm 81 may fold back at its pivot 78 in case it happens to strike a pedestrian when rotating. Thus the pedestrian would be saved from any injury.

In order to hold the sidewalk arm positively extended in normal position when the gate is up there is provided a locking plunger 87 which will extend into the negative cam 82 when the sidewalk arm is raised and only when raised. Referring to Figs. 2, 3 and 5 it will be noted that this locking plunger is connected by the link 88 to a pivot 89 which is supported on the housing head

somewhat above the shaft 71. Thus as the sidewalk arm is being raised the locking pin 87 will be moved upwardly and outwardly in an obvious manner until it engages in the negative cam and finally seats itself therein as shown in Fig. 5, thus preventing the wind or anything else from moving the sidewalk arm out of its proper extended position. However, as soon as the sidewalk arm is lowered again the locking pin will be withdrawn from the cam and leave the sidewalk arm free to be moved out of its normal position if that be necessary. The cam 83 and the springs 84 and 85 will cooperate always to return the sidewalk arm to normal position as soon as the obstruction has been removed.

Should a child hang on to the lowered sidewalk arms before the updrive circuit becomes closed, his weight imposed on the arm will urge the yoke 74 to push the bumper bar 57 downwardly. However, this force will not cause the roadway arm to be lifted in view of the fact that any further downward movement of the yoke 74 will rotate the sector gear 25' in a clockwise direction, (Fig. 3) and cause the sector gear 25 to rotate counter-clockwise, whereupon the connecting pin 30 which causes the sector gear 25 and the channel member 45 to move as a unit, will, in such a case, urge the roadway arm to move counter-clockwise also, thus pushing the bumper shaft 57 upwardly against the under side of the yoke. Thus a counter balance of forces would be established, with perhaps a little aid contributed by the compression springs 27 and 28 carried in the channel member.

However, should the child be hanging onto the lowered sidewalk arm at the time the updrive circuit becomes closed, the weight of the child will tend to rotate the roadway arms counter-clockwise through the action of the sector gears 25' and 25 and the pin 30. In the meantime the motor will be rotating the crank arm 26 clockwise, and if the child's weight is sufficient to prevent the roadway arm from rotating along with the crank arm 26, the spring 27 will be compressed until the head 29 of the crank arm kicks open the lower toggle or yield switch 37, thus opening the updrive circuit and stopping the motor. As soon as the child gets off the sidewalk arm the spring 27 will restore the roadway arm into parallel alignment with the center line of the crank arm 26 whereupon the spring 38 will close the toggle switch 37, closing the updrive circuit to the motor and enabling the gate to be lifted. It will be understood without further explanation that the manner of connecting the sidewalk arm through the sector gears and pin 30 to the roadway arm, instead of directly to the shaft 23, will also cause the downdrive circuit to be opened in case the sidewalk arm should strike some obstruction during the lowering of the gate. A careful examination of the circuit disclosed herewith will reveal that the accidental or malicious obstructing of downward or upward movement of the roadway and sidewalk arms will never throw the circuit controlling the gate into such a position that the crossing would be left unguarded during the approach of a train.

Deflection of gates

In order to restore the roadway barrier to its transverse position across the roadway after it has been deflected therefrom by a vehicle, and to hold it normally in that position against the force of the wind there are provided two springs 99 and 99' mounted on plunger guides 97 and 98

which in turn are mounted on the base plate 1. Mounted within the plunger guides 97 and 98 and upon the springs 99 and 99' are plungers 92 and 93 whose upper ends carry ball bearing cam follower rollers 101 and 102 pinned to the plungers by pins 94 and 95. Passing through the plunger guides 97 and 98 and slots 96 and 96' in the plungers 92 and 93 are pins 96a and 96'a which align the plungers during their vertical motion which will be described below. The rollers 101 and 102 normally are held against the low points of cams 104 and 104' by initial pressure in springs 99 and 99'. Mounted in the vertical post 14 are thrust bearings 13 and 13' through which pass the retainer 91 which threads into extension 12 of mechanism plate 9 and shoulders against thrust bearing 13. Spacer 103 separates extension 12, mechanism plate 9 and thrust bearing 13'. Since vertical post 14 is bolted to base plate 1, obviously when the roadway arm is in the barrier position and is deflected horizontally, causing the rotation of the housing head and the gate driving assembly, the mechanism plate 9 will necessarily rotate relatively to the cam follower rollers 102 and 103 and the curved surface of the cam acting against the rollers will cause them to move downwardly thus causing plungers 92 and 93 to move downward and compress springs 99 and 99'. As soon as the pressure is relieved from the roadway arm which had caused it to be deflected from its normal transverse position across the roadway the action of springs 99 and 99' against the plungers 92 and 93 will urge the cam follower rollers 101 and 102 upwardly against the cam surfaces 104 and 104' and obviously this upward force acting against the curved cam surfaces will cause the motor base 9, driving assembly, head, etc., to rotate back to normal position thus compelling the gate arm to return to normal transverse position. The low points of cams 104 and 104' intersect in a wide V which acts as a notch for the rollers to settle into and thus when the roadway arm is in the normal transverse position it is held against wind pressure requiring an impact to start the horizontal movement.

For delaying the return of the gate arms from deflected position, thus eliminating dangerous whipping, there is provided a ball 106 which is held against the cam 104. The ball 106 is carried in the socket at the upper end of a plunger rod 107. The lower end of the plunger rod abuts against the top of the center post 108 which is formed integrally with the piston 109. The outer part of the piston comprises an annular shell 111 formed integrally therewith and bearing on the interior of the dash pot 112. Between the core and the outer shell of the piston is disposed an annular compression spring 113 which urges the piston upwardly.

When the roadway arm is in barrier position and is deflected horizontally, causing the rotation of the housing head and the gate driving assembly, the motor base 9 will necessarily rotate relatively to the cam follower 106 while the spring 113 will urge the piston 109 upwardly with the follower 106 riding upwardly along the curved surface of the cam 104. During this upward movement of the piston and cam follower the valve 114 which is normally held closed by the weak spring 115 will be opened by the difference of pressure on its upper and lower faces permitting the air at atmospheric pressure, oil or other liquid filler to enter through the port 116 in the piston head, thence past the valve 114 which is now

raised from its seat 117, thence through a plurality of ports 118 into the bottom of the dash pot. This inflow will be rapid and will enable the plunger rod 107 and follower 106 to follow quickly the rotating cam 104. As soon as the pressure which deflected the roadway arm is relieved the action of the spring 99 and 99' in the base of the standard will cause the gate arm to swing backwardly toward normal position with considerable force. However, the dash pot mechanism at this time operates to prevent a sudden whipping backward of the gate such as might endanger other vehicles toward which the returning gate arm is swinging. The return of the gate arm will force the follower 106 and plunger rod 107 downwardly, immediately closing the air valve 114 by a reversal of the pressure differential on its opposite faces and causing compression of the air or liquid which is below this valve. The pressure thus built up will retard the rotation of cam 104 and the gate arm but will be slowly relieved at a speed determined by the size of the vent 119 which extends through the valve 114, thus compelling the gate arm to return to normal transverse position at a pre-determined safe speed.

Gate control circuit

The relay contacts in the circuits to be described will be referred to as "make contacts" meaning contacts which are made upon the energizing of the relay, and "break contacts", the latter meaning contacts which are broken when the relay is energized.

The gate control circuits shown in Fig. 10, the operation of which will now be described with reference to the schematic, has been in a large measure described above along with the explanation of the operation of the gate arms. The circuit here shown controls the operation of four gates such as will usually be installed at each railroad crossing. That is, four gate standards each containing a reversible motor and each equipped with a roadway arm and in some cases also a sidewalk arm will be the usual equipment. The circuits which control the four motors are exactly alike, hence the description of one will suffice for all.

As is indicated in the schematic of Fig. 10 the motor control relay is energized by the signal current which may be and is preferably the same signal current which is used in the train controlled circuits. The current for operating the motors, however, is preferably supplied from a power supply source at each crossing.

Fig. 10 shows the gate control circuits for the four motors with the switches and relays in the positions which they will have when the gates are fully raised and no train is approaching the crossing.

Each motor is provided with a motor control relay 121 which may be mounted preferably inside of the gate standard. It is preferred that, normally when the gates are raised, or in the clear position, this motor control relay be held energized, and that its release cause the associated motor to drive the gate downwardly. This arrangement is preferred to a system which would require a relay to be energized to drive the gate down in order to guard the crossing. Consequently, when using the circuit provided in this invention should the signal current which holds this relay operated fail through any cause whatsoever, the gate arm will come down and guard the crossing. One terminal of the motor control relay is connected to the ground side of the signal supply system, or as illustrated in the sche-

matic and using the terminology of this art, this terminal is connected to CX through the line 122. Battery, or BX, for holding this relay operative when no train is approaching the crossing will be supplied through line 123, battery being held on this line through any one of the several train controlled circuits which are described hereinafter.

When the motor control relay 121 is held energized the downdrive circuit through the break contact on this relay will be open and the updrive circuit will be closed from battery from the power supply through switch 124 through the make contact of relay 121 as far as the updrive limit switch 62' which is shown in the schematic in open position, as would be the case when the gate is in fully raised position. It will be observed that prior to the opening of the updrive limit switch the updrive circuit would previously have been closed through 62' and through the yield switch 37 to the up winding of the reversible motor and thence to ground in the power supply.

Should a train approach the crossing and cause the opening of the BX lead to the motor control relay, that relay will then release and its break contact will close the downdrive circuit from power through the downdrive limit switch which is at this time closed, through the yield switch 31, through the down winding of the motor and back to power. Since all four motor control relays 121 were previously held energized by the same BX lead, they simultaneously release and all four motors will bring their associated gate arms down through a mechanical operation that has been explained above. When the gate arms reach full lowered position each downdrive limit switch 66 will be kicked open thus opening the downdrive circuit and stopping each motor. It will be remembered that as soon as the gate arm starts to come down the updrive limit switch will be restored to closed position through the action of its restoring spring 63. Ordinarily the train controlled circuit will hold the BX supply to the gate control relay open for some time, that is, until the train has passed the crossing.

While the gate is down the roadway arm may be lifted manually and thereby, as described above, close the push button switch 67 on the associated gate arm and supply BX through lead 125, as the schematic indicates, to the motor control relay which is associated with the arm thus lifted. At this time the closing of the push button switch 67 will energize the relay 121 and close the updrive circuit lifting the gate arm until pressure on the push button switch has been released. In the meantime the downdrive limit switch, having been restored to closed position, will be ready to re-establish the downdrive circuit as soon as the opening of the switch 67 causes the release of the relay 121.

When the train controlled circuit again supplies BX to all four relays 121, as would occur after the train passes, each of these relays will become energized again, close the updrive circuits and their motors will then raise the gate arms until the updrive limit switches are kicked open mechanically.

Reference to the foregoing description of the toggle yield switches 31 and 37 will serve for a complete understanding of their functioning in the schematic of Fig. 10. It may be stated here that the updrive yield switch, or toggle switch 37, is placed in the updrive circuit and will always be closed except when some force opposes the

lifting of the gates and opens this switch. The downdrive yield switch, or toggle switch 31, is placed in the downdrive circuit and will always pass the current except when some obstruction opposes the downward movement of the gate arms and enables the crank arm 26 to kick open this toggle switch.

Train controlled circuit (Fig. 11)

The circuit shown schematically in Fig. 11 is one that will control the crossing gate control circuit of Fig. 10 and is intended for use with railroads having one or more tracks and a block signal system already installed. The relays of the circuit are shown in the positions they will normally have when no trains are within the blocks indicated in the schematic. In order to bring the gates down to barrier position before an approaching train reaches the crossing the train at a position remote from the crossing sets into operation the equipment necessary for lowering the gates. Certain features of this train controlled circuit make it unnecessary to disturb the existing block signal system, if the signal system is provided with the usual track relay at the entrance of each block, such for example as the track relays 131, 132, 134 and 135. Each track relay will always be held energized by a circuit through the rails until the trucks of a train enter the block and shunt out the track relay at the entrance of the block. The beginning and ends of the blocks are indicated in Fig. 11 by the lines intersecting the rails at the positions A, B and C. When the track relay 132 is shunted by the trucks of an approaching train moving in the direction of the arrow on the east-bound track No. 1, the make contact connected to the line wire 136 will be opened thus removing BX, or battery, from the repeat relay 137 and causing that relay to release. It is evident that the track relay 132 will remain de-energized so long as any truck of the train remains within the block AB. The line wire 136 is the only wire necessary to be carried from this track relay to the crossing where the rest of the control equipment is located. In cases where the track relay is a mile or more from the crossing the use of only one line wire per track is an important consideration.

The release of the repeat relay 137 establishes a circuit from BX through the break contact of this relay and the wire 138 through the coil of the time element relay 139 and thence to CX, thus energizing the time element relay. The construction and operation of the time element relay may be better understood by reference to Fig. 13, wherein the parts are represented somewhat diagrammatically.

The time element relay is shown in Fig. 13 with the slot coil energized, and the slot arm threadedly engaged with the worm and lifted about half of its distance of travel toward the lifter finger. At this time all of the contacts are in the normal position they would have prior to the energizing of the slot coil relay.

When the lead 138 through the break contact of the repeat relay 137 supplies battery to the slot coil 141 a circuit is thereupon established to CX through the lead 142 energizing the slot coil, rotating the pivoted lever 143 to the left and pulling the arm 144 likewise to the left causing the right margin of the elongated slot 145 which loosely surrounds the time screw 146 into contact with the threads on the time screw. A few threads are provided on the inner surface of the

right margin of the slot to engage the threads of the time screw so that rotation of the time screw will swing the arm 144 upwardly as viewed in Fig. 13, rotating about its pivot 147. The time screw is rotated by the motor 148 the circuit for which is closed from BX through the lead 138, the break contact 149, binding post 150 through the winding of the motor CX. Any suitable train of gears such as those shown will thereupon cause the time screw to rotate at a predetermined speed governed by the gear ratio to cause the lifter pin 151 in a desired number of seconds after the start of the motor to raise the lifter finger 152 and break the spring contacts 149 and 153. When the contact 149 is opened the BX supply will be cut off from the motor causing the latter to stop, but the slot coil will still remain energized. At the same time the contact 153 will be opened cutting off the BX supply from the gate control relay 154, the release of which will thereupon cut off BX from the motor control relays 121, causing the gates to lower. The purpose of the time element relay is to cause the gates to start lowering a predetermined number of seconds after a train shunts out the track relay so that the gates will be in barrier position in ample time before the train reaches the crossing. It is evident that by varying the gear ratio the gate closing time interval may be varied to comply with different conditions that may be encountered, such as different lengths of signal system blocks, different requirements of the laws relating to gate closing, and in accordance with differently calculated maximum train speeds. When the slot coil subsequently becomes de-energized, as will later be explained, the spring 155 will pull the pivoted lever 143 and the slot arm 144 to the right disengaging the threaded slot 145 from the time screw and permitting the slot arm 144 to drop by gravity back to its normal released position where the arm 144 may bump against the adjustable stop screw 156.

In the schematic the time element relay 139 is indicated as is customary in this art showing a pointer 157 as though the pointer rotated maintaining the BX circuit for the relay 154 so long as the arrow of the pointer remains in contact with the solid line and breaking that contact thereafter. However, what actually occurs has been described above in connection with Fig. 13.

The train once having entered the block AB and released the track signal relay 132 and the repeat relay 137, even though the track relay will again operate as soon as the last truck of the train leaves the block AB the repeat relay cannot again operate until with the track relay energized a truck of the train rolls onto the short one-rail circuit 158 and shunts out the hold relay 159. The short rail 158 may be insulated as is schematically indicated from the remainder of the track. A bond 161 may be extended around this short insulated rail to avoid interfering with the existing block signal system. In place of the short rail circuit, one may use, if desired, a track instrument, schematically indicated, such as 163 and 164 placed under the rail and depressed by the weight of a train passing thereover to open its contacts. Any one of several well known track instruments may be employed for this purpose and their construction is so well known in the art as to require no explanation here. As soon as the last truck of the train has cleared the block AB and while a truck of the train still has the hold relay shunted out a circuit is closed from BX supply through the make contact of the track relay 132, 150

through the coil of the repeat relay 137, through the break contact of the hold relay 159 to CX. As soon as the repeat relay becomes energized it will then stick in that condition by completing its control circuit to CX through its own make contact, it thereafter remaining energized independent of the hold relay. When the repeat relay becomes operated the time element relay 139 will release and all of its parts will be restored to normal position. However, even though the release of the time element relay will restore battery to the gate control relay 154 yet the latter cannot become operated because its circuit to CX is now held open through the make contact of the de-energized hold relay. However, as soon as the last truck of the train passes beyond the crossing and allows the hold relay to reoperate the circuit through the gate control relay will then be completed and the BX supply to the gate control circuits will be restored, raising the gates.

A train approaching a crossing on the eastbound track number 2 will utilize the track signal relay 131, the repeat relay 165, the time element relay 139, the gate control relay 154 and the hold relay 166 to control the operation of the crossing gates, these relays operating, as is obvious, in the same manner as do the relays associated with track number 1. A train approaching on the westbound track number 3 will utilize the track relay 134, the repeat relay 167, the time element relay 163, the gate control relay 169 and the hold relay 171 for controlling the crossing gates. A train on the westbound track number 4 will utilize the track relay 135, the repeat relay 172, the time element relay 169 and the hold relay 173 for controlling the crossing gates. Even though one or more trains are approaching the crossing and one or more may also be on or leaving the crossing the circuits for the four tracks are so interconnected that in no instance will the gates remain up or go up at a time when they should be down and guarding the crossing.

Train controlled circuit (Fig. 12)

This circuit shown in Fig. 12 with all relays in normal position is provided for use at a crossing on a railroad which is not already equipped with a signal system employing track relays. Hence it is necessary to provide each track either with a short insulated rail 174, and a bond wire 175, as shown in the eastbound track or with a track instrument switch 176, the latter being shown on the westbound track, each controlling a specially installed track relay 177 and 178, respectively. The short one rail circuit or the track instrument switch, will in a simplified installation be set in the track a sufficient distance from the crossing so that when a train at maximum speed releases either of these track relays the associated mechanism may have sufficient time to bring the gates to lowered position well in advance of the arrival of the train at the crossing. The line wires 179 and 181 will therefore be provided paralleling the tracks to the crossing. The shunting out of the track relay 177 by the trucks of a train rolling onto the short insulated rail 174 will cut off BX from the gate control relay 182 which then releases and cuts off BX from the lead 123'', which latter lead is to be connected to the BX lead 123 in the gate control circuit. The cutting off of BX from the gate control circuit will thereupon cause the gates to be lowered as has been explained above. As soon as the last truck of a train rolls off the short rail 174 the track relay 177 will re-operate but the control relay 182 can-

not re-operate at this time unless and until the front end of the train reaches the short insulated rail 183 at the crossing and shunts out the hold relay 184. When the hold relay is thus released a circuit to operate the control relay 182 will be closed from BX through the make contact of the track relay 177 through the coils of relay 182,, through the break contact of the released hold relay, thence to CX. As soon as this relay operates it will then stick itself through its make contact, being thereafter independent of relay 184. The energizing of the relay 182 while a train is still on the crossing will restore BX to the gate control circuit, but will not cause the gates to rise because at this time the de-energized hold relay 184 will have opened the circuit to CX from the lead 122''. When the circuit of Fig. 12 is used with the gate control circuit of Fig. 10 the CX lead 122'' will be connected to the CX lead 122, the latter being in the gate control circuit. The gate control circuit will not be operated to raise the gates until the last truck of the train has left the short rail 183 whereupon the hold relay at the crossing will re-operate and restore the circuit CX from the gate control circuit. Power at this time then being supplied to the gate control circuit, that circuit will cause the gates to rise.

The westbound track is shown equipped with track instrument switches 176 and 185 which operate by the pressure of a car upon the rail underneath which these switches are placed. The westbound track is provided with the hold relay 186 and the control relay 187 whose operation will be understood by reference to the previous description of operation of relays for the eastbound track. In order that BX may be supplied to the push button switches 67 in the gate control circuit of Fig. 10 there is provided a BX lead 125'' for connection to the BX lead 125 in the gate control circuit.

Speed controlled circuit (Fig. 9)

The speed controlled circuit shown in Fig. 9 is illustrated with all of its relays in the normal position which they would have when no trains are within the track areas shown in the drawings.

The circuit, which may be used with the gate control circuit of Fig. 10, is designed especially for operating the crossing gates under the control of the speed of the approaching trains. Such a circuit will be of considerable value where the speed of the trains may differ quite considerably and where it is imperative that the crossing be not blocked by crossing gates more than a minimum number of seconds in advance of the arrival of the trains at the crossing.

The circuit is designed to provide control of the crossing gates also in accordance with the direction of travel of trains which may enter the control area, stop and back out again.

The track area M is such that a train traveling at x miles per hour will just travel the distance M in y seconds. The length N plus O is such a distance that a train traveling therethrough at maximum speed, faster than x miles per hour, will reach the crossing z seconds after the gates are down. z seconds will be the length of time that the gates must be down before the train reaches the crossing to satisfy the regulations of the railroad. The space O is such that a train traveling at x miles per hour therethrough may initiate the lowering of the gates upon entering space O and reach the crossing z seconds after the gates are down.

A track relay TR1 is provided in the southbound track, being provided with a short one-rail circuit for holding it normally operated, as is indicated. At a distance L further north on this track, a distance greater than the estimated length of the longest train which may use this track, another short one-rail circuit is provided and equipped with a track relay K1.

The gates are normally held in raised position by maintaining BX on the lead 123'', which is connected to the BX lead 123 in the gate control circuit of Fig. 10. BX is normally supplied on this BX lead through the make contacts of the gate control relay SR2 and SR2'. CX is maintained normally on the CX lead 122'' to the gate control circuit CX lead 122 through the make contacts of the normally energized hold relays TR4 and TR4'.

Assuming that a train traveling at x miles per hour, or slower approaches on the southbound track, as soon as it rolls onto the insulated short rail it shunts out the relay K1 which is connected thereto. The release of this relay will cut off CX from the time element relay TE1, to release the latter if it should happen to be energized at the time. As the train proceeds further it rolls off the short rail to which relay K1 is connected permitting that relay to become energized again. Subsequently the train rolls onto the short insulated rail connected to the relay TR1 whereupon that relay is shunted out and removes BX from the relay SR1 causing the latter relay in turn to release. The release of the relay SR1 will start the operation of the time element relay TE1 by supplying BX from the lead BX2 through a break contact of SR1 through the coil of TE1, line FCP1, make contact of K1, line FCP2, make contact of TR3 and thence to CX4. The train of gears in the time element relay will be arranged to cause that relay in y seconds after its slot coil has been energized and its motor started to raise the lifter finger to break the normally closed contacts and to close certain open contacts.

When the release of the SR1 relay connects BX2 to the slot coil 191 of the time element relay TE1, BX is simultaneously supplied (see Fig. 16) through the binding post P2 and a flexible connector to the spring contactor 192, the latter being mounted in the end of an insulating block 193 which is mounted on a spring contact lever 194. The circuit is completed through binding post P7 through the motor, through the winding of the motor to FCP1, the slot coil and the motor becoming operated simultaneously. The time screw then begins to rotate and the slot arm 195 travels upwardly and y seconds after the motor is energized the lifter 196 will strike the lifter finger 197 and break the contact 192, thus cutting off BX from the motor and stopping the same. As soon as the time element relay has tripped its slot coil will stick in operated position by a circuit maintained from BX3, the make contact of relay TR3, CP3, binding post P1 and P2 of the time element relay, through the slot coil of that relay, line FCP1, make contact of K1, line FCP2, make contact of TR3 to CX4. At this time the green signal light G which was burning after the train had left the contact rail associated with relay K1 and before it had caused the time element relay to trip, will now be extinguished upon the opening of its circuit through Pn and P3. The yellow signal light Y, a cautionary light, will remain lit through either of two circuits, one from BX3, make contact of TR3, line CP3, through binding posts P3 and P4 of the time element relay, line

YBX and through the yellow light to CX, the other circuit being traced from BX2, make contact of TR2, binding post P4, to YBX, through the yellow light to CX.

At any time prior to the lapse of y seconds after energy has been applied to the time element relay TE1, that is, before the relay trips, the time element relay is fully under the control of the released SR1 relay and if the latter relay again becomes energized during this period of y seconds the opening of its break contact will de-energize TE1, which will then immediately drop back to normal condition.

Assuming that the same train traveling at x miles per hour or slower continues through the space M into the spaces N and O and passes the crossing, at the time the front trucks on the train reach the short rail circuit to which TR2 relay is connected the time element relay will be stuck through its own contacts in energized condition, as has been explained above, and the SR1 relay will still be released. The shunting out of TR2 relay by the trucks of the train will, however, connect BX2 through its upper break contact, through the winding of SR1 relay, thence through the lower break contact of TR2, thence to CX1, restoring SR1 to normal energized condition.

Thus far no circuit for lowering the gates will have been formed. Prior to the sticking of the time element relay and the shunting out of TR2, the SR2 relay obtained battery through the make contact of TR2,—now it will still remain energized, preventing the gates from lowering as a circuit for holding relay SR2 energized, preventing the gates from lowering as a circuit for holding relay SR2 energized will now be obtained from BX3 through a make contact of TR3, line CP3, P3 and P4 of the time element relay, line CP2, another make contact of TR3, through the winding of SR2 and thence through the upper make contact of SR2 to CX2. However, as the front trucks of the train traveling at x miles per hour reach the short insulated rail associated with TR3, that relay will be shunted out and the battery circuit to SR2 supplied through the two make contacts of TR3 will be cut off and SR2 will release, cutting off BX from the gate control circuits of Fig. 10 and causing the gates to lower. The shunting out of TR3 also opens the stick circuit of TE1 restoring the latter to normal de-energized condition. The distance O to the crossing is of such a length that after the TR3 relay has been released by a train traveling at x miles per hour the gates will be in full lowered position z seconds before the train reaches the crossing. After the last trucks of the train have cleared the short rail circuit of TR3 that relay will again operate supplying BX to the SR2 relay. Provided some part of the train is at this time at the crossing on the short insulated rail to which relay TR4 is connected, the shunting out of TR4 will enable the SR2 relay to become energized by a circuit from BX2 through the make contact of TR2, line CP2, a make contact of TR3, winding of SR2, break contact of TR4 relay which is now released, thence to CX2. Even though the SR2 relay now operates and places BX upon the lead 123'', yet the shunting out of the crossing relay TR4 will withhold CX from the CX lead 122'' preventing the energizing of the relays 121 in the gate control circuits. Hence at this time the gates cannot rise. As soon as the SR2 relay operates it sticks itself through its make contact getting CX through the lead CX2, and is no longer de-

pendent for CX upon the break contact of TR4. As soon as the last truck of the train clears the crossing and TR4 once more becomes energized the CX supply through the lead 122''' will be re-

5 stored and the gates will rise.

Assuming that a train traveling at a speed greater than x miles per hour enters the TR1 control area, the SR1 relay will be de-energized and the time element relay set into operation in the manner described above. However, as it requires y seconds for the time element relay to trip and stick, the head of the train reaching the TR2 control area before the elapse of y seconds will shunt out the TR2 relay and will immediately cut off the battery from the SR2 relay, releasing the latter and causing the gates to immediately start to lower, as may be necessary in order that the gates may be lowered z seconds before a train traveling, possibly at maximum speed, reaches the crossing. Simultaneously with the shunting out of TR2 and the release of SR2 the break contacts of TR2 will close a circuit from BX2 through the winding of the SR1 relay to CX1, energize the SR1 relay and cut off battery from BX2 to the TE1 relay. The release of the slot coil in the TE1 relay will immediately disengage the threads of the slot arm 195 from the time screw 195' and that relay will then drop back to normal de-energized condition. The gates will remain down until after the last truck of the train passes beyond the crossing whereupon the gates will rise due to a re-setting of relays which occurs in the same manner as was explained above in connection with the movement of a train running at x miles per hour.

Should a train run into the area M at less than x miles per hour and into the area N and stop within the area N the gates will not go down because of the functioning of the relays described above. However, the train after making a stop, as for example, at a local station, can proceed into the area O and beyond the crossing and the gates will operate in time to protect the crossing. As soon as the train has reached the track circuit of the TR3 relay the shunting of that relay will cut off the BX supply from the SR2 relay releasing that relay and lowering the gates. It may be observed therefore that this circuit may be utilized where a station for local trains is positioned within the area N and the crossing to be protected has a position relative to the station as shown in Fig. 9. The circuit will protect the crossing whether trains making such a local stop approach it or whether through trains not making this local stop approach the crossing.

Should a train run into the area O and stop and back out of O without continuing across the crossing, the gates of course will have been lowered at least by that time but as the train backs across the short rail circuit of the RES1 relay and shunts out that relay, the CX3 lead becomes thereby connected to the SR2 relay which will be at this time receiving battery through the make contact of the TR3 relay, line CP2, make contact of the TR2 relay and BX2. The energizing of the SR2 relay will thereupon raise the gates and clear the crossing. As the train continues to back through the area N it shunts out the TR2 relay cutting off BX from the SR2 relay, however, as soon as the train recedes beyond the track circuit of TR2 and while it is on the track circuit of relay RES2 both BX and CX will be connected to the SR2 relay to energize the same and raise the gates promptly.

75 Circuits and relays for the north bound track

correspond to those for the south bound track and are indicated by prime numbers and letters. Wherever short insulated rails are employed to establish short track circuits a track battery is shown connected thereto for energizing the relay associated with such circuit. Such a battery is indicated by reference character TB in Figs. 9, 11 and 12, and extensive duplication of the reference is obviously unnecessary.

It should be understood that modifications of this invention differing in details of construction may be devised which will nevertheless employ the principles of this invention.

Having shown and described my invention, I claim:

1. In combination, a railroad crossing horizontally pivoted signal arm, means for supporting the arm, operating means including a motor, a train of gears and a crank rotatable thereby for raising and lowering the arm, spring controlled means carried by said arm yieldably connecting said crank to said arm and means carried by said arm actuated by relative movement of the arm and crank for stopping the action of the operating means between the limits of its raising and lowering movements.

2. In combination, a railroad crossing horizontally pivoted signal arm, means for supporting the arm, operating means resiliently connected with said arm for raising and lowering the arm including a motor and electrical circuits for controlling the operation of the same, and pressure actuated means including a switch to be tripped for opening the motor circuit to stop the action of the operating means between the limits of its raising and lowering movements.

3. In combination, a railroad crossing horizontally pivoted signal arm, means for supporting the arm, operating means resiliently connected with said arm for raising and lowering the arm including a motor and electrical circuits for controlling the operation of the same, and pressure actuated means carried by said arm including a switch to be tripped for opening the motor circuit to stop the action of the operating means between the limits of its raising and lowering movements.

4. In combination, a railroad crossing horizontally pivoted signal arm and reversible means for operating the same including resilient driving connection thereto, means operable by a substantial yielding of said connection for stopping the operating means and means operable by a further yielding in the same direction for starting the operating means in a reverse direction.

5. In a crossing signal arm apparatus in combination, a horizontally pivoted signal arm, motor driven means including a rotatable crank for operating said arm, said crank being connected to said arm through springs for yieldably driving the same, and means including a switch controlling the circuit to said motor actuated by movement of said crank relative to said arm for opening the motor circuit to stop the operating means.

6. In a crossing signal arm apparatus, in combination, a horizontally pivoted signal arm, motor driven means including a rotatable crank for operating said arm, said arm being connected through springs to said arm for yieldably driving the same, the arm being held by said springs under normal operating conditions in one position relative to said crank, and means including a switch controlling the circuit to said motor

actuated by relative movement of the crank and arm from said relative position for opening the motor circuit to stop the operating means.

7. In a crossing signal arm apparatus, in combination, a horizontally pivoted signal roadway arm, a horizontally pivoted signal sidewalk arm, motor driven means for operating said arms through a resilient driving connection, and means connected to one of said arms operable upon the interposition of a force opposing movement of the same arm by said operating means acting through said connection for stopping the operation of both arms.

8. In a crossing signal arm apparatus, in combination, horizontally pivoted roadway and sidewalk arms, motor driven means for operating said arms through a resilient driving connection, and means operated by a force opposing the movement of either arm by said operating means through a resilient driving connection for stopping the operation of both arms.

9. In a crossing signal arm apparatus, in combination, a horizontally pivoted signal arm, motor driven means for operating said arm including a resilient driving connection to said arm, said connection permitting relative movement of the arm and operating means, and means actuated by a predetermined movement of the arm relative to the operating means when the latter is stationary for closing a circuit to the motor to start the operating means.

10. In a crossing signal arm apparatus, in combination, a horizontally pivoted signal arm, motor driven means for operating said arm including a driving connection yieldably engaged with said arm, said connection normally holding said arm and driving means resiliently in a substantially immovable relative relation, said connection permitting relative movement of the arm and operating means, means actuated by a predetermined relative movement of the arm and operating means occasioned by a force exerted on the arm opposing its movement by the operating means for stopping the operating means, and means actuated by a further relative movement of the arm and operating means in the same direction for starting the operating means.

11. In combination, a crossing signal arm pivoted horizontally, a vertically disposed stationary housing, a support for said arm constructed for rotation relative to said housing to provide movement of the arm about the vertical axis, means for driving said arm mounted for rotation with said support, and means permitting rapid deflection of the arm approximately 90° from its normal position parallel to the railway and for returning it to said position, a cam carried by said support, and a dash pot and plunger therein constructed to follow said cam to permit rapid deflection of said arm and for causing the arm to return slowly to normal position and to yieldably lock the same thereat.

12. In combination, a crossing signal arm pivoted horizontally, a vertically disposed stationary housing, a support for said arm constructed for rotation relative to said housing to provide movement of the arm about the vertical axis, means for driving said arm mounted for rotation with said support, and means permitting rapid deflection of the arm approximately 90° from its normal position parallel to the railway and for returning it to said position, a cam carried by said support, and a dash pot and plunger therein constructed to follow said cam to permit rapid deflection of said arm and for causing the arm to return slowly to normal position and to yieldably lock the same thereat against deflection by any force less than a predetermined force.

13. In a crossing signal apparatus, having a signal arm, a reversible motor for raising and lowering said arm, a gate control circuit connected to said motor including a single relay normally held energized while the arm is up, the release of which will cause the motor to lower the arm and the energizing of which will cause the motor to raise the arm, and means for stopping the motor during the raising of the arm actuated by a predetermined downward pressure against said arm before the latter has reached fully raised position.

JAMES W. JENKINS.

CERTIFICATE OF CORRECTION.

Patent No. 1,934,429.

November 7, 1933.

JAMES W. JENKINS.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 10, line 20, claim 8, for "through a resilient driving" read acting through said; and line 35, claim 10, for "yeldably" read resiliently; and that the said Letters Patent should be read with these corrections therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 12th day of December, A. D. 1933.

F. M. Hopkins

Acting Commissioner of Patents.

(Seal)