June 7, 1955 M. M. DILLEY ET AL 2,710,342

AUTOMATIC CROSSING GATE

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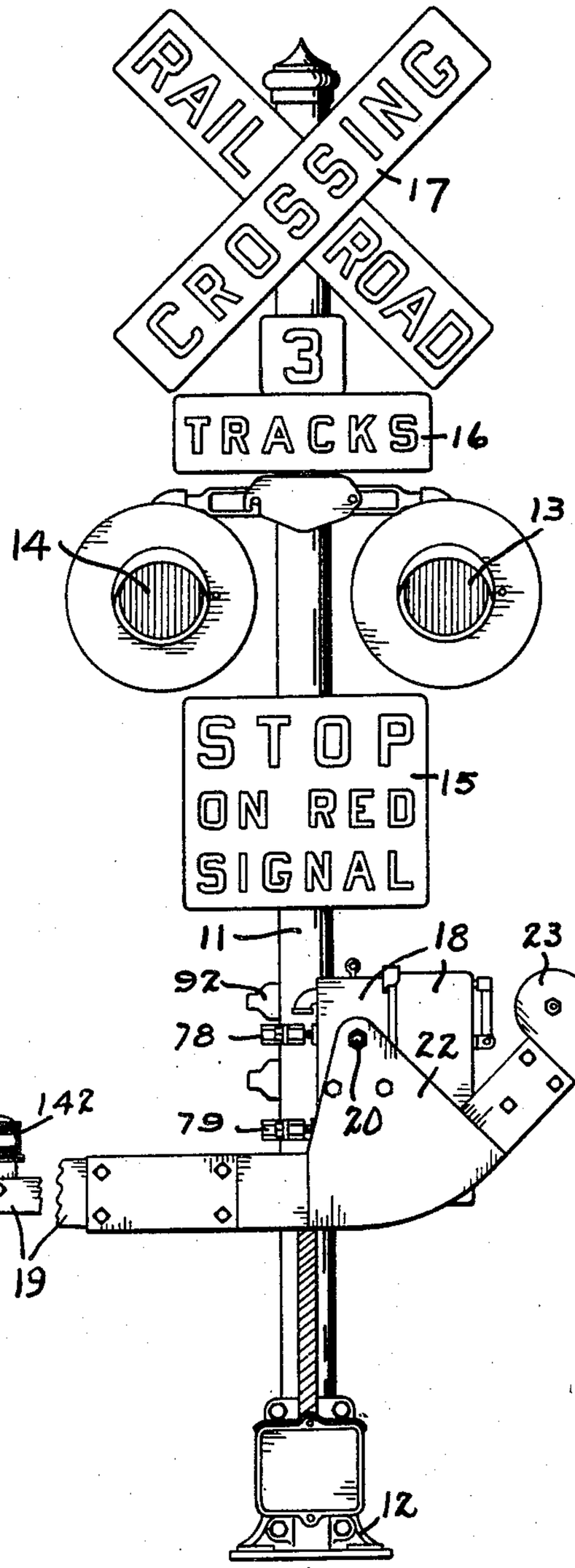

Fig. 1.

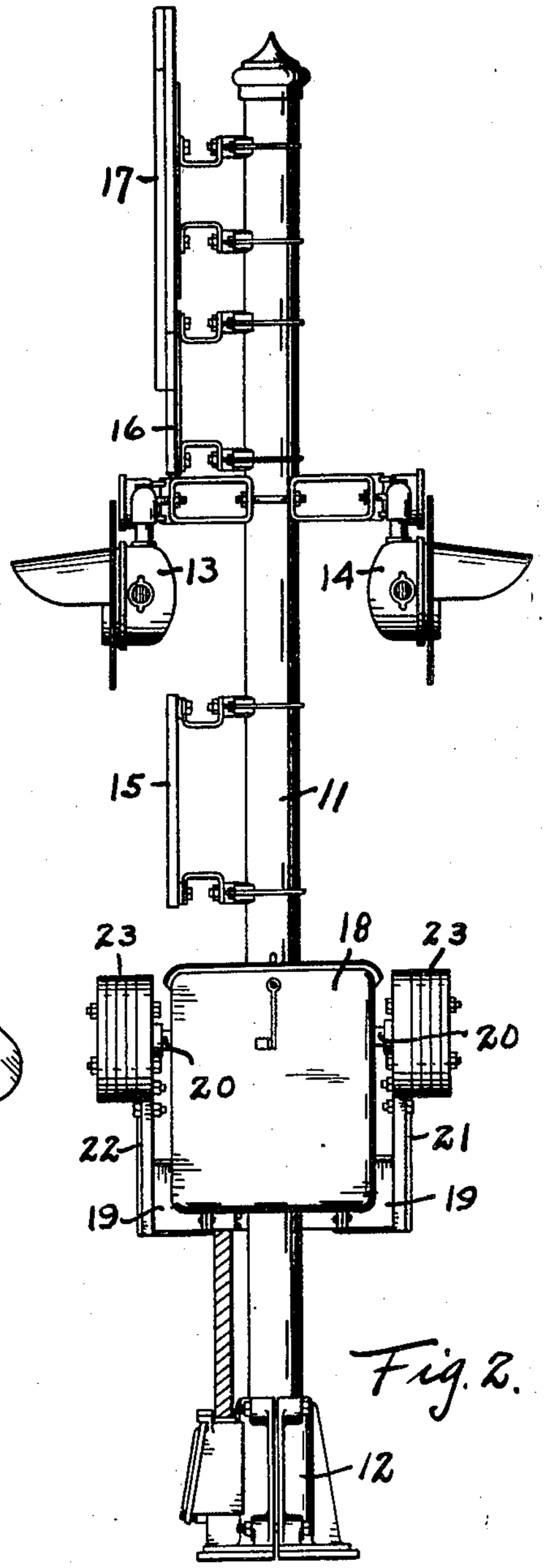

Fig. 2.

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June 7, 1955 M. M. DILLEY ET AL 2,710,342

AUTOMATIC CROSSING GATE

Filed Feb. 7, 1950 8 Sheets-Sheet 2

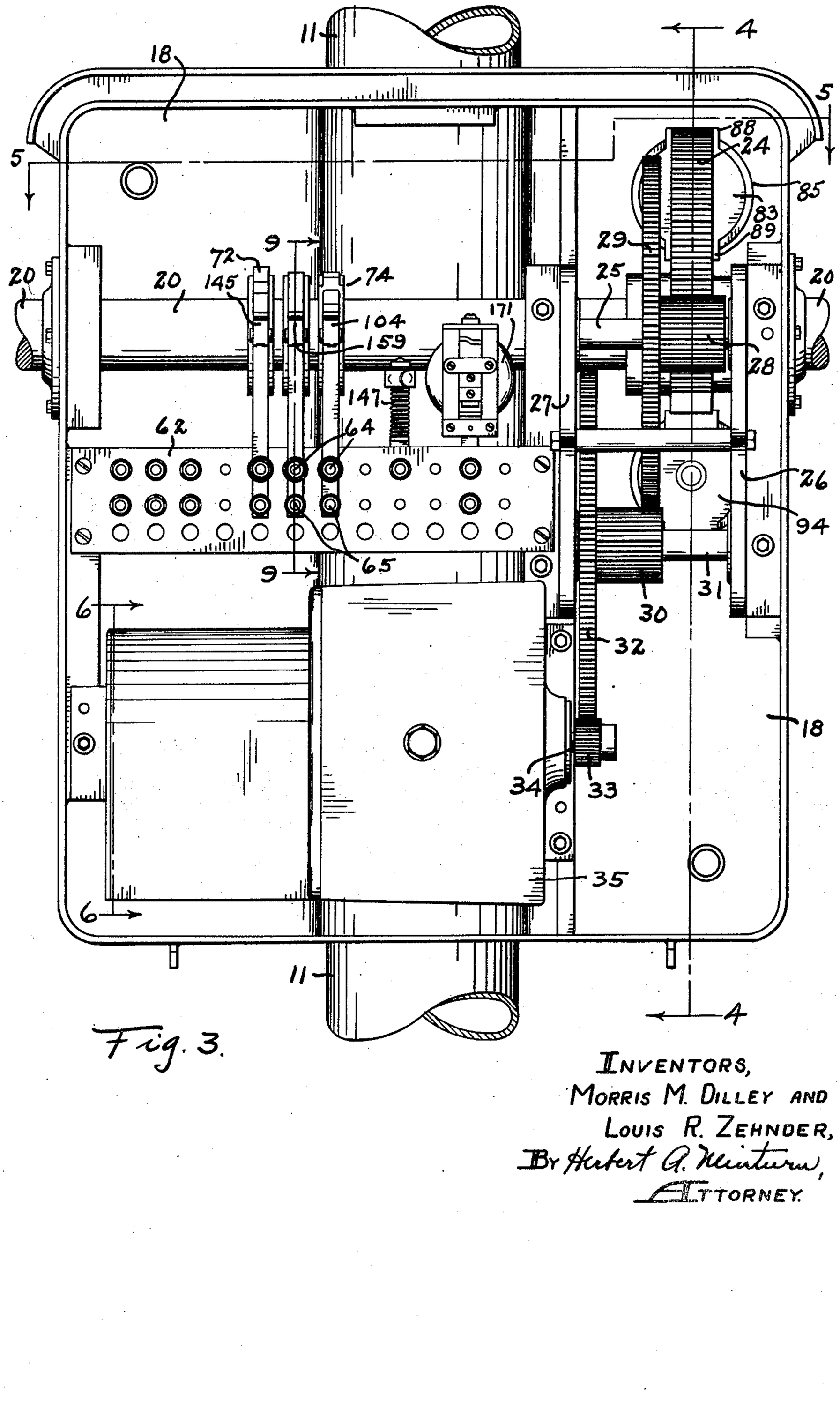

Fig. 3.

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June 7, 1955 M. M. DILLEY ET AL 2,710,342

AUTOMATIC CROSSING GATE

Filed Feb. 7, 1950 8 Sheets-Sheet 3

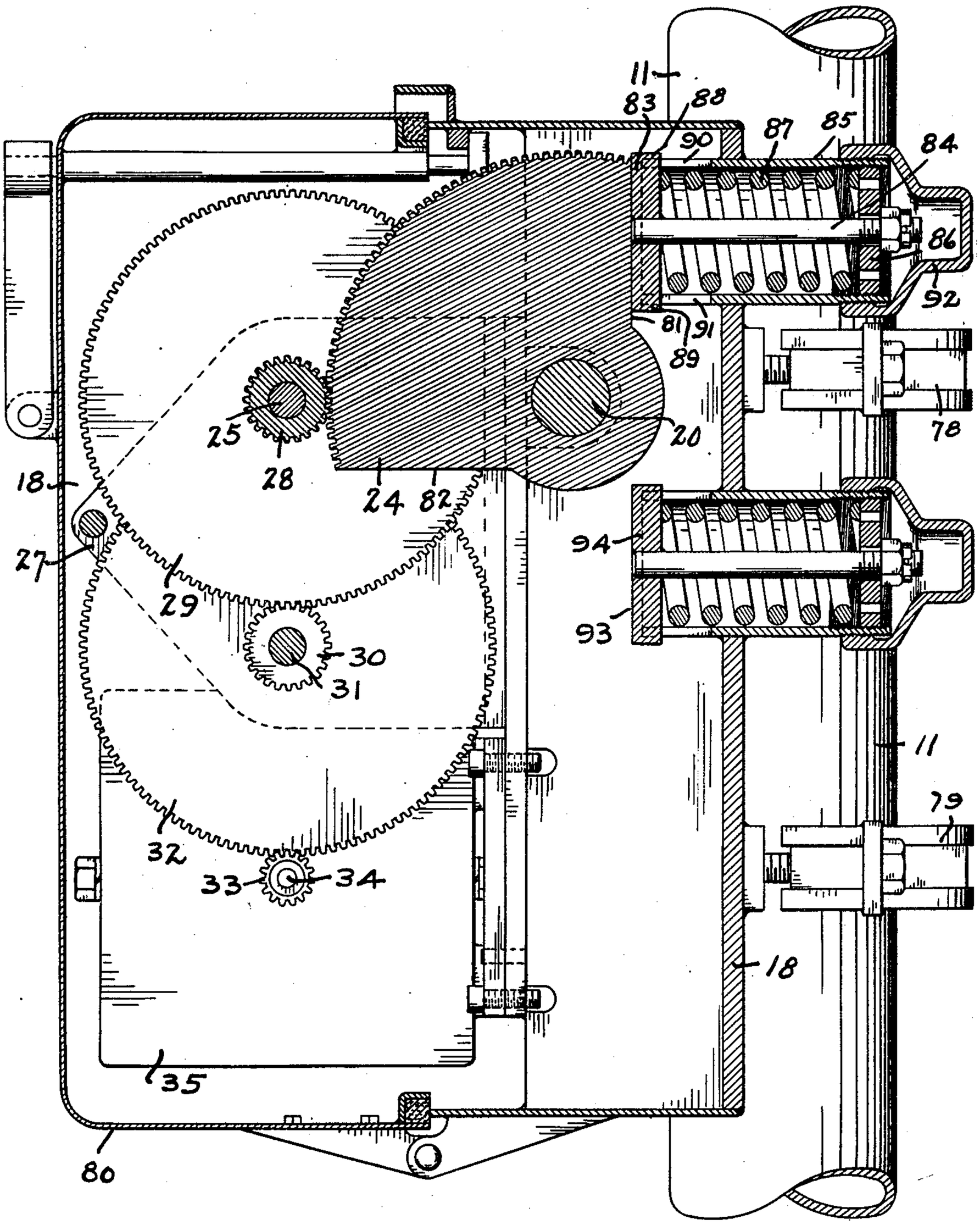

Fig. 4.

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AUTOMATIC CROSSING GATE

Filed Feb. 7, 1950 8 Sheets-Sheet 4

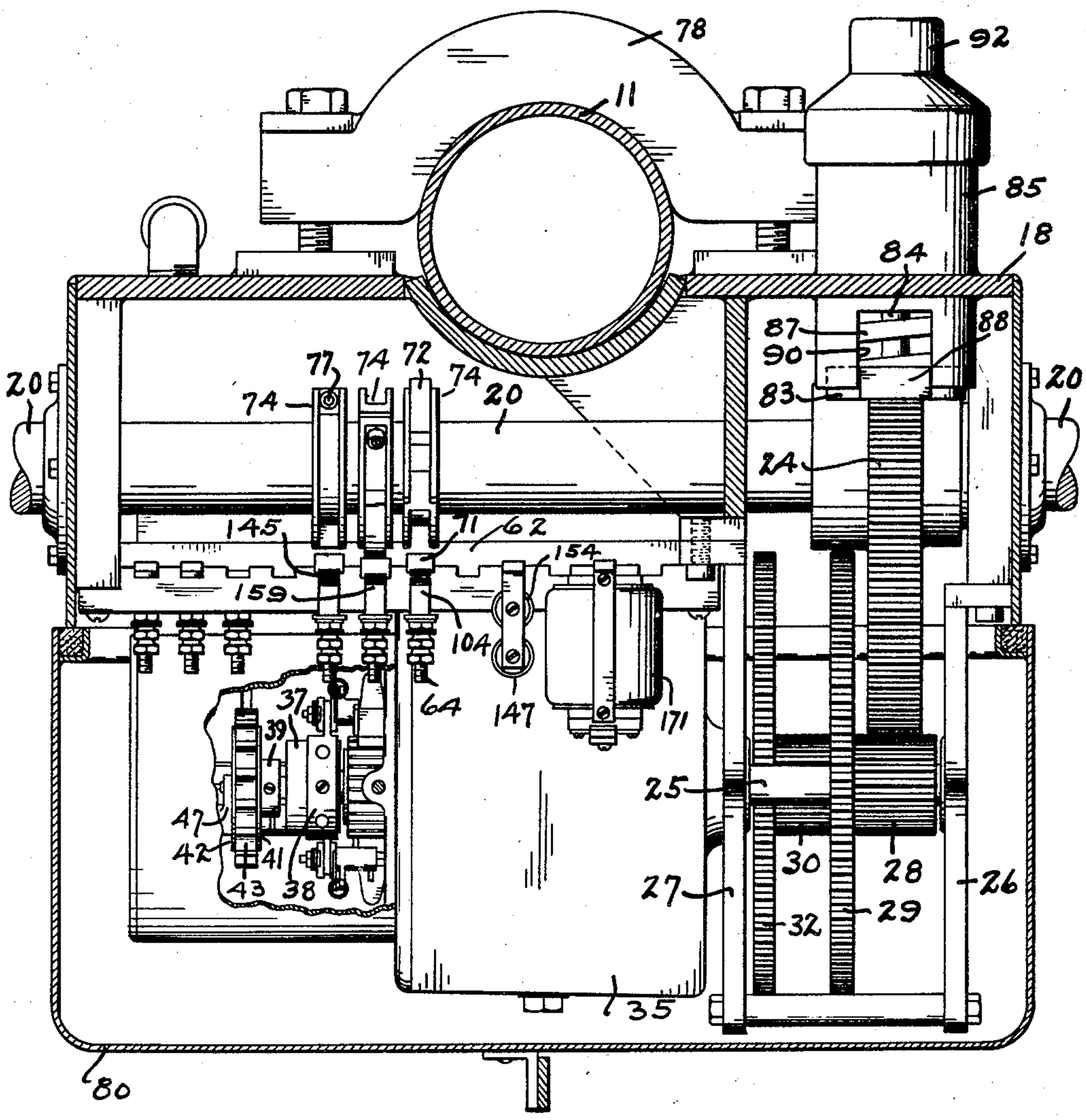

Fig. 5.

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AUTOMATIC CROSSING GATE

Filed Feb. 7, 1950 8 Sheets-Sheet 5

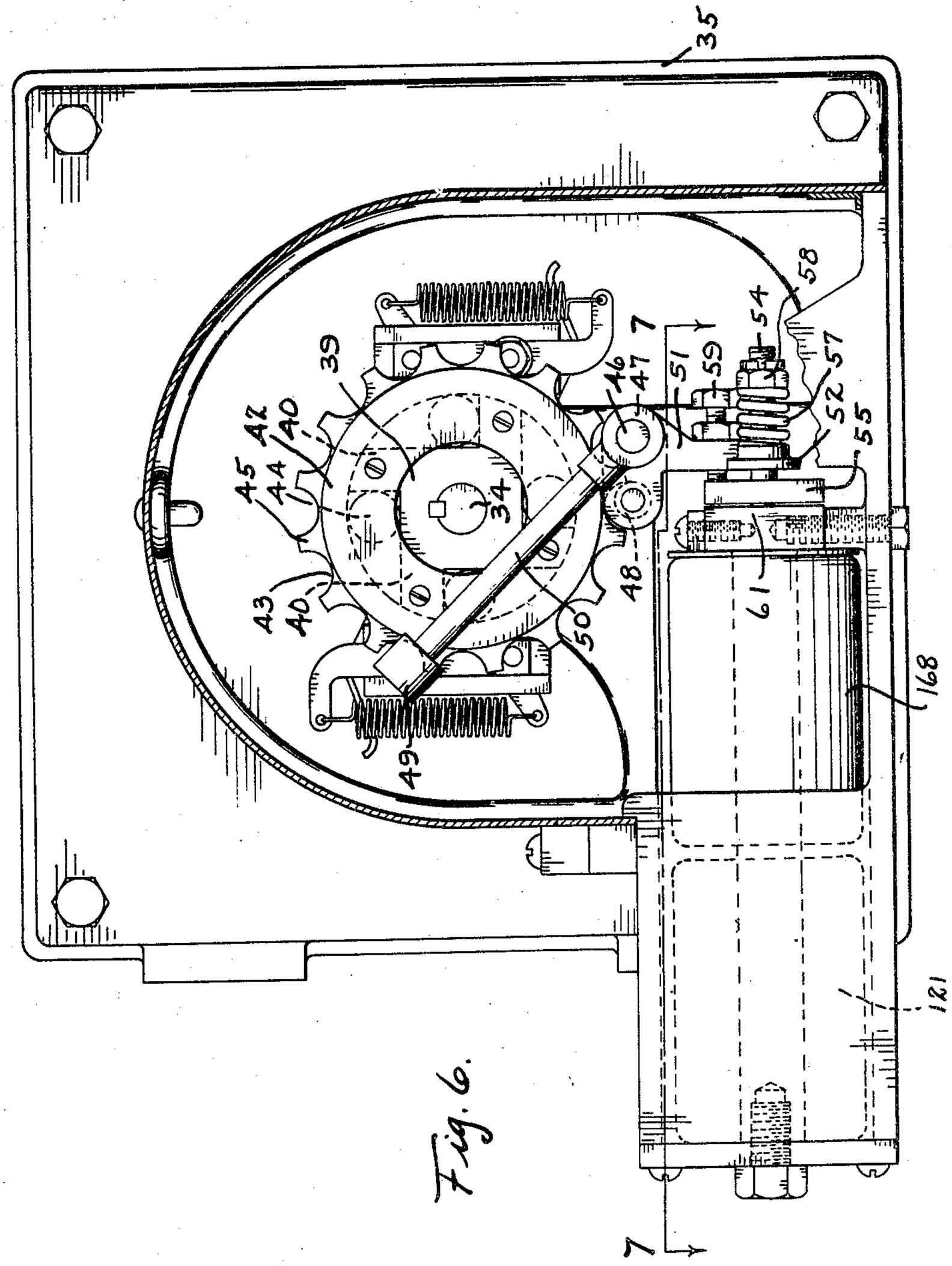

Fig. 6.

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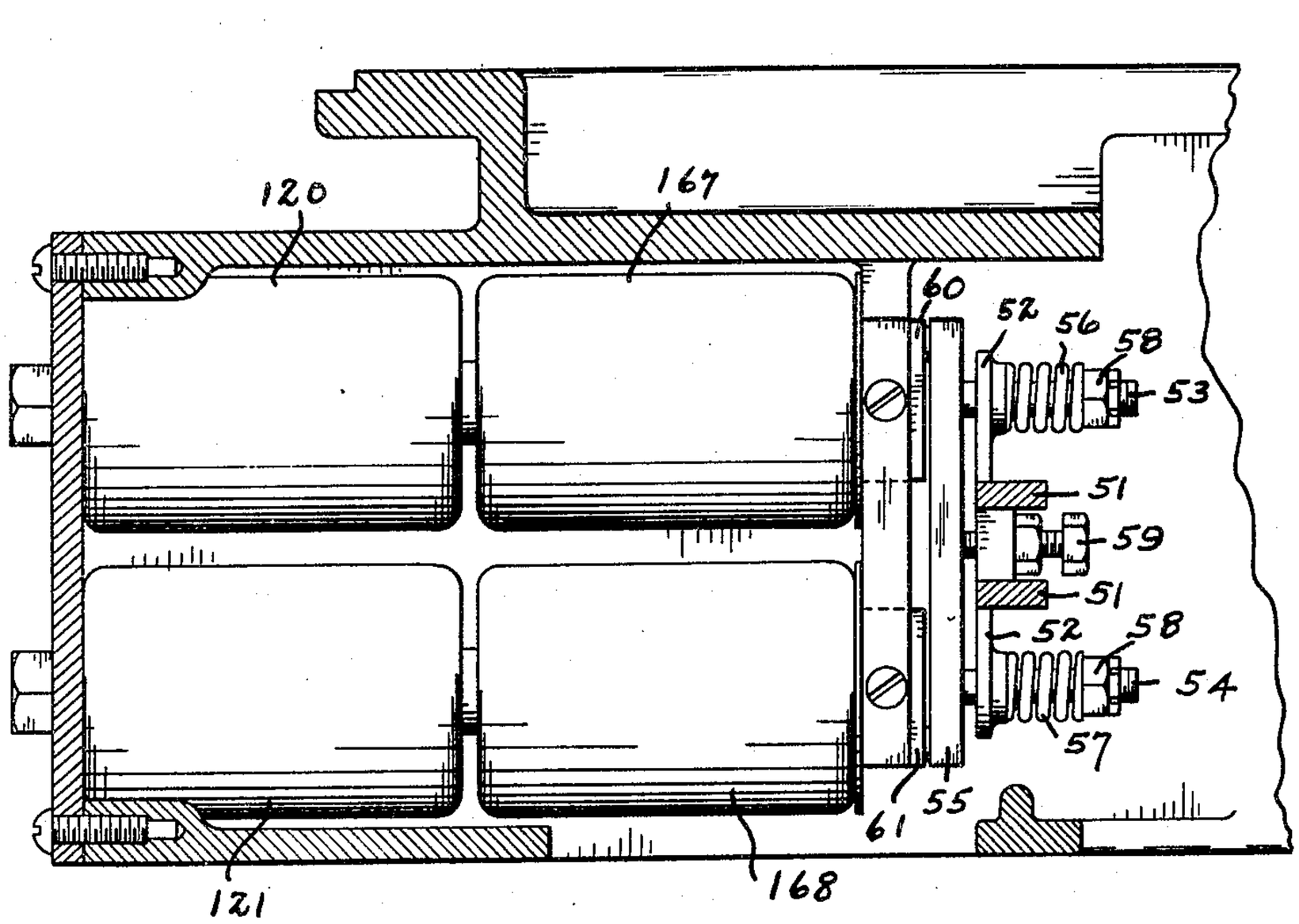

Fig. 7.

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AUTOMATIC CROSSING GATE

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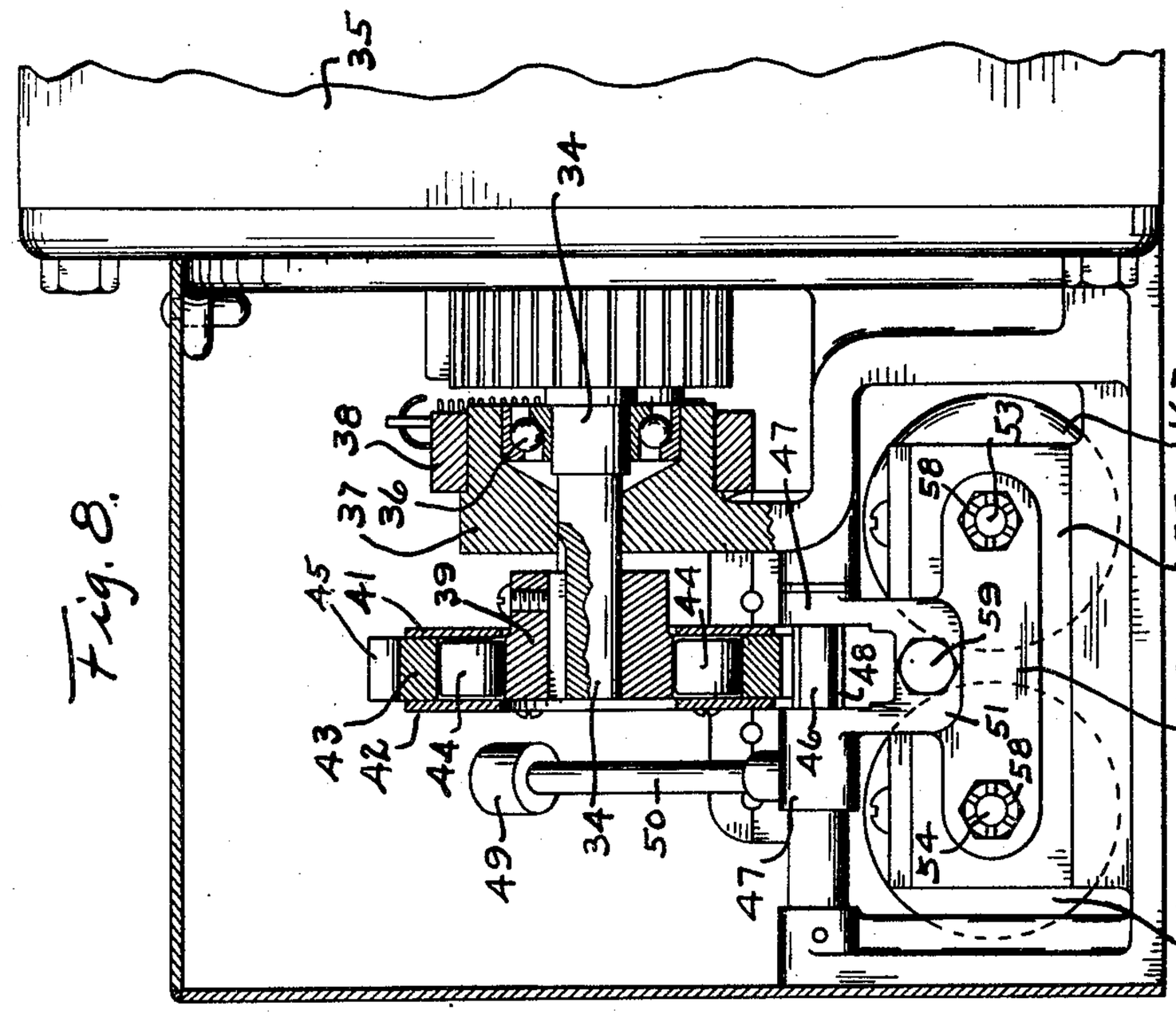

Fig. 8.

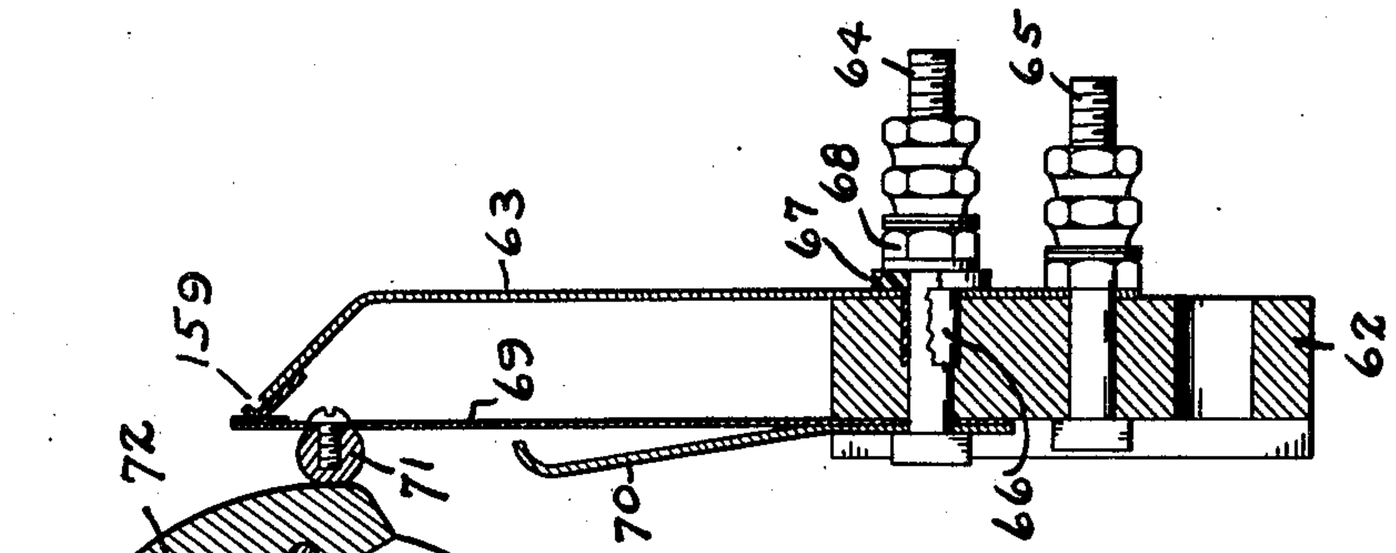

Fig. 9.

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June 7, 1955 M. M. DILLEY ET AL 2,710,342

AUTOMATIC CROSSING GATE

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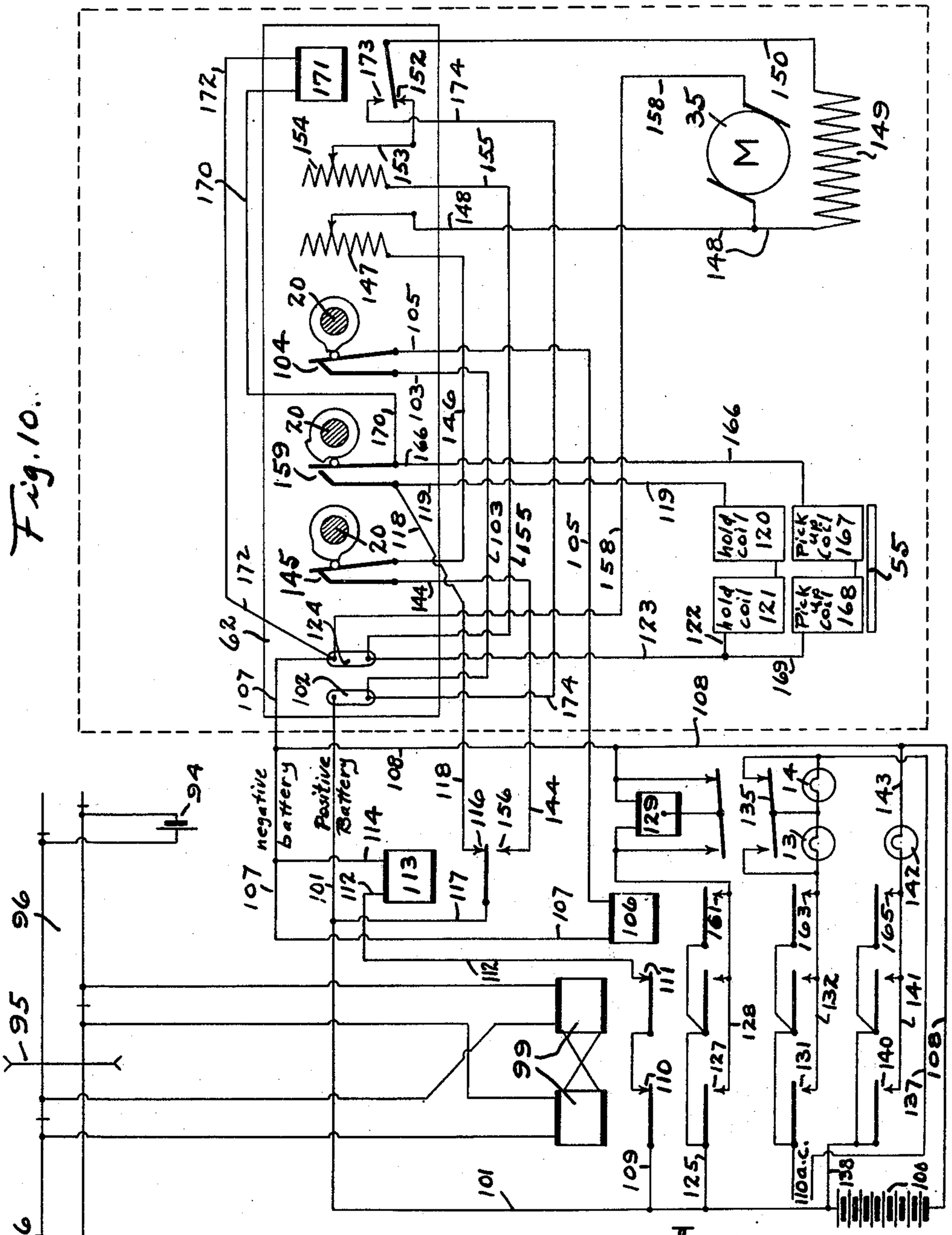
Fig. 10.



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United States Patent Office

2,710,342

Patented June 7, 1955

2,710,342

AUTOMATIC CROSSING GATE

Morris M. Dilley and Louis R. Zehnder, Louisville, Ky., assignors to Transport Products Corporation, Louisville, Ky., a corporation of Kentucky

Application February 7, 1950, Serial No. 142,771

4 Claims. (Cl. 246—130)

This invention relates to an automatic crossing gate and signal assembly for use at highway crossings over railways and the like. The mechanism is controlled by the usual track block circuits. The invention provides for several material advantages over the structures heretofore employed. It provides for driving the gate arm from a vertical position downwardly at a constant speed to at least a 45 degree position from which position the gate arm is dropped by gravity. The power down drive in the initial part of the arm travel is provided to insure lowering of the gate against any hold action which may arise such as under sleet and freezing or under high wind conditions. It is to be understood that the gate arm, in conformance with railway requirements is of that type which will normally drop by gravity to the horizontally disposed or zero position to stop traffic on the highway when there is a power failure from any reason.

The operation also provides for a power operated hold clear device to operate initially with a maximum desired power input and to maintain the hold clear condition with a reduced current consumption. Further, the operation provides for the lifting operation of the gate arm regardless of the operation of the hold clear device.

The many objects and advantages to be derived from the invention will be better understood by those versed in the art by the description of one particular form of the invention as illustrated in the accompanying drawings, in which

Fig. 1 is a view in front elevation of a structure embodying the invention;

Fig. 2, a view in end elevation;

Fig. 3, a view in elevation with the cover removed of the operating mechanism case;

Fig. 4, a view in vertical section on the line 4—4 in Fig. 3;

Fig. 5, a view in transverse section on the line 5—5 in Fig. 3;

Fig. 6, a detail in vertical section on the line 6—6 in Fig. 3;

Fig. 7, a transverse section on the line 7—7 in Fig. 6 showing the pick up and hold coils;

Fig. 8, a detail in elevation and partial section of the hold clear mechanism;

Fig. 9, a view in vertical section on the line 9—9 in Fig. 3, and

Fig. 10, a wiring diagram.

Referring to the drawings, in which like characters of reference indicate like parts throughout the several views, the standard mounting construction is employed and comprises the standard 11 carried by a suitable base 12 and supported by upper portions thereof at the desired elevation, the desired flasher lamps 13 and 14 to give the visual light by illumination; the warning signal 15 related to the flasher light operation; the sign board 16 gives the number of tracks; and the cross arm 17 indicating the position of the railroad crossing. Then below at the proper elevation, there is mounted the mechanism

case 18 which supports the gate arm 19 being herein shown for sake of simplicity without a sidewalk crossing side arm as may be desired in certain localities. In any event the arm 19 is of that type which straddles the case 18 to have the arm supported upon the rockable shaft 20 extending from each side of the case 18 through arm brackets 21 and 22. Also as is the usual case, the arm 19 is counter-balanced in part by a number of weights 23 carried back of each of the brackets 21 and 22 depending upon the length and weight of the arm 19. In any event the arm 19 is always left in that state whereby it will drop to the horizontal or zero position, Fig. 1, unless otherwise restrained by some mechanism. That is, the gate is of that type that will drop to the zero position upon power failure.

Referring to Figs. 3, 4 and 5, primarily, the shaft 20 is revolubly carried through an upper portion of the case 18. There is fixed on this shaft 20 a gear segment 24. A shaft 25 is revolubly carried between the shaft plates 26 and 27 supported by the case 18. Fixed on this shaft is a spur gear 28 in constant mesh with the segment gear 24. At the side of the gear 28 is fixed a larger diameter gear 29 which in turn is in constant mesh with a spur gear 30 fixed on a shaft 31 revolubly carried by the plates 26 and 27. A larger diameter gear 32 is fixed to the shaft 31 and is in constant mesh with the spur gear 33 that is fixed on the motor armature shaft 34.

This shaft 34 extends horizontally from the operating motor 35 which is of an extremely heavy duty type. In other words, the shaft 20 is interconnected through a reduction gear drive with the motor shaft 34.

The motor shaft 34 extends from the left hand side of the motor 35 as viewed in Figs. 3, 5, and 8, to be supported by a bearing 36 mounted in a bracket 37. This bracket 37 carries a brush supporting ring 38 that may be revolved to give the desired brush setting, the details of which do not per se enter into the present invention. In any event after the angularity of the brush positions is determined, they remain constant and are not shiftable thereafter. That is, the motor depends upon other controls rather than by shifting of the brushes.

The shaft 34 extends through the bracket 37 to have fixed thereon a clutch hub 39, this hub constituting a part of an over-running clutch. The hub 39 in the present showing has four non-radial arms 40 and carries inside and outside plates 41 and 42 respectively between which is revolubly mounted a toothed ring 43 to be revolubly carried by an inner cylindrical surface on the outer ends of these arms 40. Mounted between adjacent arms 40 in each instance is a roller 44. This structure permits rotation of the shaft 34 in a counterclockwise direction as viewed in Fig. 6, without driving the ring 43, but when the shaft 34 turns relatively in a clock-wise direction which is that direction for driving the gate downwardly to the zero position, the ring 43 will be driven therewith due to the wedging action of the rollers 44 between the leading sides of the arms 40 and the inside cylindrical surface of the ring 43. As indicated, this ring 43 is toothed and in the present showing the teeth 45 are formed by cutting away a substantially semi-cylindrical portion of the ring therebetween.

Below the clutch mechanism just described is mounted a shaft 46. Then there is revolubly mounted on this shaft 46 a bifurcated lever 47 which carries a roller 48 in spaced relation to the rear of the shaft 46 to be in the path of the teeth 45 upon rocking of the lever 47. Normally the roller 48 is rocked out of the path of these teeth 45 by means of a weight 49 carried on the outer upper end of a post 50 that is fixed to the lever 47 to extend diagonally upwardly and rearwardly therefrom, Figs. 6 and 8.

The down-turned leg 51 of this lever 47 carries an elongated foot 52 to receive slidingly therethrough studs 53 and 54 that are fixed to a bar armature 55. Springs 56 and 57 respectively surround the studs 53 and 54 to be engaged by the foot 52 and nuts 58 screw-threadedly carried in the studs whereby the foot 52 may be yieldingly urged toward the armature 55 by adjusting the nuts 58. The foot 52 carries an adjusting screw 59 passed screw-threadedly therethrough to abut the armature 55 and thereby determine the amount of pressure exerted by the springs 56 and 57 between the foot 52 and the nuts 58.

This armature 55 extends across pole pieces 60 and 61 which are terminals of the cores of a pick-up coil 167 and a hold coil 120 in the one instance and a pick-up coil 168 and a hold coil 121 in the other instance, Fig. 7.

A number of control switches, herein shown as three in number indicated by the numerals 104, 159, and 145, and mounted on an insulated terminal panel 62, are normally in open condition. Referring to Fig. 9, the switch 159 is shown in detail. The other two switches are identical in construction, and hence a description of the one switch will suffice for all three.

Secured on the front side of the panel 62, is a spring tongue 63, herein shown as having its base clamped thereto by the terminal bolts 64 and 65. The bolt 64 is insulated from the tongue 63 by the insulating sleeve 66 mounted in the panel 62 and extending through the tongue 63, and by an insulating washer 67, against which the securing nut 68 is turned. The bolt 65 is electrically connected to the tongue 63.

On the back side of the panel 62, is fixed a spring tongue 69, held under the head of the bolt 64 in electrical contact therewith. A back stop 70 is likewise held under the head of the bolt 64 to extend upwardly and rearwardly from the tongue 69. The tongue 69 is normally spaced by its upper end from the upper, rearwardly bent end of the front tongue 63. The tongue 69 carries a cam follower block 71 which is in the path of the cam 72 that is circumferentially adjusted around the shaft 20 to the required position. This cam 72 is secured to one section 73 of a clamp bracket 74, the other section 75 of which is hinged thereto by the pin 76, and, together, the sections encircle the shaft 20 to be clamped thereto by drawing up the bolt 77 extending through the free ends of the sections.

The case 18 with its mechanism so far described is mounted on the mast 11 at the desired height by the clamp brackets 78 and 79, Figs. 4 and 5. A cover 80 is provided to enclose the case 18 and protect the mechanism therein from tampering and the elements. The segment 24 is provided with upper and lower faces 81 and 82 respectively to serve as stops limiting travel of the shaft to substantially ninety degrees, Fig. 4. In the path of the upper face 81 is a head 83 fixed on a rod 84 extending axially through a cylinder 85 and slidingly passing through an adjusting plate 86 screw-threaded into the cylinder 85. A compression spring 87 surrounds the rod 84 to bear between the head 83 and the plate 86. The head 83 is provided with upper and lower lugs 88 and 89 which enter slots 90 and 91 in the cylinder wall as means holding the head 83 against rotation relative to the axis of the rod 84. This spring buffer arrangement is mounted in the back wall of the case to extend outwardly therefrom and to have the adjusting plate end of the cylinder covered by a cap 92. In like manner, a second spring buffer 93 of the identical construction is mounted through the case back wall to have its head 94 in the path of the segment face 82.

Electrical control and operation

Referring to the diagram Fig. 10, that part thereof which is outside of the dash line rectangle constitutes standard construction, operating in the usual manner, and the devices thereof are usually mounted in a cabinet, or box, apart from the crossing gate mast. All of the devices within the dash-line enclosure are embodied within the case 18 carried on the mast 11.

Conditions in the railway track 96, as to presence or absence of a train within the control track section on each side of the highway crossing 95, are reflected at the interlocking relay 99 which is normally energized to be short circuited by a train in a controlling track section. In Fig. 10, this relay 99 is in the energized condition, and the gate arm 19 is in the ninety degree or up position. Starting at the power battery 100, there is a light control relay circuit through a wire 101 therefrom (positive side), to the panel 62 bus bar 102; across the bar 102; the wire 103; switch 104; wire 105; the coil of the relay 106; wire 107; and the wire 108 back to the negative side of the battery 100. This circuit energizes the relay 106 to hold open all of its contacts hereinafter described.

With the relay 99 still energized, there is a gate arm holding circuit maintained as follows: from the battery 100; through the wire 101; wire 109; closed relay front contacts 110 and 111; wire 112; winding of a delayed action relay 113; wire 114; wire 107; and through the wire 108 to the battery 100. By reason of this closed circuit just described the front contact 116 of the relay 113 is held closed to maintain thereby a closed circuit from the battery 100; wire 101; wire 117; wire 118; wire 119; hold clear coils 120 and 121; wire 122; wire 123; bus bar 124 on the panel 62; wire 107; and wire 108 back to the battery 100. This last circuit held by the relay 113 causes the armature 55 to be held against or toward the pole pieces 60 and 61 to maintain the roller 48 between a pair of adjacent teeth 45 and thereby, through the clutch above described to hold the shaft 34 against turning by tendency of the gate arm 19 to drop under gravity influence. These hold clear coils 120 and 121, thus continuously energized in the gate arm "hold" condition, consume but little current, having 500 ohms resistance.

Now upon a train entering either crossing track control section, the relay 99 is deenergized to open the front contacts 110 and/or 111 as the case may be, and to close the respective back contacts as will be explained. A circuit closes from the battery 100, through the wire 125; back contact 127; wire 128; light flasher 129; and wire 108 back to the battery to set into operation the warning flashing lights 13 and 14 on the mast 11, and also such other lamps in parallel as may be desired, such for example (not shown) as a lamp or lamps on the gate arm. These flashing lamps 13 and 14 are placed in an A. C. circuit by the rocking of the relay controlled armature 135, alternately closing a circuit for each of the lamp sets from the 110 volt A. C. source through the relay 99 back contact 131; wire 132; and the wire 137.

A constant non-flashing light circuit is also established from the battery 100; wire 138; relay 99 back contact 140; wire 141; lamp 142; wire 143; and wire 108 back to the battery 100.

The front contact 110 being opened, the relay 113 is deenergized to open the front contact 116 and close the back contact 156 after the inherent delayed action of the relay 113. Then a circuit is established from the battery 100; through the wire 101; wire 117; contact 156; wire 144; switch 145; wire 146; an adjustable resistance 147; wire 148; motor 35 field winding 149; wire 150; back contact 152 of a deenergizing relay 171; wire 153; an adjustable resistance 154; wire 155; bus bar 124; wire 107; and wire 108 back to the battery 100. Also a circuit is established from the battery 100; through the wire 101; wire 117; contact 156; wire 144; switch 145; wire 146; resistance 147; wire 148; motor 35; wire 158; wire 107; and wire 108 back to the battery 100; thereby starting the motor 35 to drive the gate arm 19 from its ninety degree position toward the zero position.

Simultaneously with the opening of the contact 116, the hold clear coils 120 and 121 are deenergized to release the roller 48 from the clutch teeth 45, the circuit then

open being that normally established from contact **116**; wire **118**; wire **119**; hold clear coils **120** and **121**; wire **122**; wire **123**; bar **124**; wire **107**; wire **108**; battery **100**; wire **101**; and wire **117**.

The cams **72** are adjusted and fixed around the shaft **20** to cause the switch **145**, during shaft travel to be closed only from ninety-three degrees, around to forty-five degrees; the switch **159**, closed from zero up to eighty-nine degrees of travel; and then open; and the switch **104** closed only between eighty-six and ninety-three degrees of travel.

Thus the motor **35** will drive the gate arm down to the forty-five degree position where the switch **145** opens. In the meantime, when the gate arm **19** is released and starts dropping, the switch **159** closes at the eighty-nine degree position and the switch **104** thereafter opens at the eighty-six degree position. Since the contact **116** is open, nothing happens upon the initial closing of the switch **159**. When the switch **104** opens, the relay **106** is denergized and all its contacts (hereafter described) open without affecting any other circuits.

However, when the switch **145** opens at the forty-five degree position (switch **159** closed; switch **104** open), the circuit opens from the battery **100**; wire **101**; wire **117**; contact **156**; wire **144**; through the open switch **145**; wire **146**; resistance **147**; wire **148** to the motor **35**; but a circuit is closed from the bar **124**; through the wire **158**; the field winding **149**; the wire **150**; contact **152**; resistance **154**; wire **155**; to the bar **124**; whereby the motor **35** then, under its turning by the dropping gate arm acts as a generator with its output passing through the resistance **154** which is initially adjusted and then held constant to absorb the generator output and thus control the arm speed from the forty-five to the zero position. At the zero position, the gear segment face **82** strikes the buffer head **94** and, the gate arm **19** comes to rest.

When the track section is clear adjacent the crossing **95** upon a train departing therefrom, the relay **99** is then energized from the track battery **94** (in either case) to close its front contacts **110** and **111** and open all the back contacts to the position depicted in Fig. 10. The relay **106** is deenergized due to the open switch **104**, and hence the relay contacts **161**, **163** and **165** remain closed to maintain the light circuits closed.

Then the relay **113** is energized to close its front contact **116** to complete a "pick up" coil circuit from the battery **100**; wire **101**; wire **117**; contact **116**; wire **118**; wire **119**; coils **120** and **121**; also through closed switch **159**; wire **166**; through the pick up coils **167** and **168**; and wire **169**; wire **123**; bar **124**; wire **107**; and wire **108** to the battery **100**; thereby energizing both sets of hold clear and pick up coils having a resistance of 25 ohms to give a maximum pull on the armature **55** to engage the roller **48** between teeth **45** and hold the ring **43** stationary, this overrunning feature permitting lifting of the gate arm but not its reverse down travel of its own accord.

Further, a motor relay control circuit is closed from the battery **100**; through the wire **101**; wire **117**; contact **116**; switch **159**; wire **170**; a motor relay **171**; wire **172**; wire **107**; and wire **108** back to the battery **100**, thereby opening the back relay contact **152** and closing a front contact **173** to close a motor drive circuit from the battery **100**; through the wire **101**; bar **102**; wire **174**; contact **173**; wire **150**; the motor series field winding **149**; wire **148** across the motor **35** armature; wire **158**; wire **107**; and wire **108** to the battery **100**; and thereby drive the shaft **20** in the direction to rock the gate arm **19** from the zero position back up to the ninety degree position, with the motor shaft **34** overrunning in the stationary ring **43** as held by the roller **48**.

During this upward travel of the gate arm **19**, the switch **145** closes at the forty-five degree position, but the contact **156** is open, so no energized circuits are affected. Coming on up to the eighty-six degree position, the switch **104** closes, to close the relay **106** circuit to open the contacts **161**, **163**, and **165** to deenergize all the lamps. Finally; coming to the eighty-nine degree position, the switch **159** opens (**145** and **104** then closed) to deenergize the pick up coils **167** and **168**, to leave the hold clear coils **120** and **121** energized, to maintain the holding of the arm **19** against down travel. The motor control relay **171** is also deenergized when the switch **159** opens thereby opening the contact **173** and restoring the contact **152**, which action opens the motor **35** drive circuit.

Thus it is to be seen that the gate arm is positively driven from the ninety to the forty-five degree positions, under a constant speed controlled by initial adjustment of a resistance used as a shunt across the armature of the motor **35**, and from the forty-five to the zero degree positions, the arm, which dropping by gravity, is still under selected constant speed control through absorption of the output of the motor then acting as a generator. The plan of operation permits use of very simple structure, including a quickly replaceable motor drive unit for easy servicing.

While we have herein shown and described our invention in the one particular form, it is obvious that many changes from the particular showing may be made without departing from the spirit of the invention, and we therefore do not desire to be limited to that precise form beyond the limitations which may be imposed by the following claims.

We claim:

1. In a railroad track circuit controlled crossing gate having an arm pivoted for travel in a vertical plane, over balanced tending to drop to a zero position, a track circuit; a gate; a motor for lowering and lifting the gate, and control means comprising the combination of an overrunning clutch mounted on the shaft of said motor, said clutch being characterized by a plurality of circumferentially, non-radially spaced arms fixedly carried by said shaft, a ring encircling and revoluble about said arms, shiftable rollers between the arms and said ring, said ring having an outer periphery notched by substantially semicircular indentations therearound to define thereby teeth spaced around and projecting from said ring; a lever rockably mounted intermediate its ends adjacent said ring on a fixed axis; a roller carried by said lever on a length thereof toward one end and mounted to be swung between and away from said teeth upon selective rocking of the lever about said axis; means normally rocking the lever to roller non-engagement with said teeth; electromagnetic means for rocking said lever into roller engagement between adjacent teeth; said roller having a diameter approximately equal to that of said indentations whereby the holding of said roller between said teeth effectively holds said ring against rotation in either direction; said electromagnetic means comprising a pair of electro-magnets having a common core; an armature carried by said lever on an end portion removed from said other end portion; one of said magnets having a greater resistance than that of the other; and electric control means energizing and deenergizing said magnets and said motor responsive to said track circuit conditions; said clutch arms being directed within said ring to interlock through said shiftable rollers with the ring upon the ring being held stationary by said lever roller to prevent ring turning in down travel direction upon motor failure during gate raising.

2. In a railroad track circuit controlled crossing gate having an arm pivoted for travel in a vertical plane, over balanced tending to drop to a zero position, a track circuit; a gate; a motor for lowering and lifting the gate, and control means comprising the combination of an overrunning clutch mounted on the shaft of said motor, said clutch being characterized by a plurality of circumferentially, non-radially spaced arms fixedly carried by

said shaft, a ring encircling and revoluble about said arms, shiftable rollers between the arms and said ring, said ring having an outer periphery notched by substantially semi-circular indentations therearound to define thereby teeth spaced around and projecting from said ring; a lever rockably mounted intermediate its ends adjacent said ring on a fixed axis; a roller carried by said lever on a length thereof toward one end and mounted to be swung between and away from said teeth upon selective rocking of the lever about said axis; means normally rocking the lever to roller non-engagement with said teeth; electro-magnetic means for rocking said lever into roller engagement between adjacent teeth; said roller having a diameter approximately equal to that of said indentations whereby the holding of said roller between said teeth effectively holds said ring against rotation in either direction; said electro-magnetic means comprising a pair of electro-magnets having a common core; an armature carried by said lever on an end portion removed from said other end portion; one of said magnets having a greater resistance than that of the other; and electric control means energizing and deenergizing said magnets, and said motor responsive to said track circuit conditions; said clutch arms being directed within said ring to interlock through said shiftable rollers with the ring upon the ring being held stationary by said lever roller to prevent ring turning in down travel direction upon motor failure during gate raising; and a time delay acting relay in said electric control means delaying deenergization of said magnets and energizing said motor following an initial track circuit shorting.

3. In a railroad track circuit controlled crossing gate having an arm pivoted for travel in a vertical plane, over balanced tending to drop to a zero position, a track circuit; a gate; a motor for lowering and lifting the gate, control means comprising the combination of an overrunning clutch mounted on the shaft of said motor; an outer rotatable peripheral ring element of said clutch having approximately semi-circular indentations therearound to define spaced teeth therebetween; a lever mounted on a fixed axis adjacent said ring element, said lever having two arms, each extending from said axis; a roller carried by one of said arms of a diameter to fit into each of said indentations upon rocking of the lever,

said roller effectively holding said ring against rotation in either direction; an armature carried by said other lever arm; an electro-magnet having a core present in juxtaposition with said armature, and electric control means for energizing and deenergizing said magnet to rock said roller into and out of said indentation engagement response to track circuit conditions.

4. In a railroad crossing gate, a vertically rockable gate arm overbalanced tending to drop to a zero position; a railroad track circuit; a motor; drive means between the motor and said arm for rocking of the arm; and control means comprising the combination of an overruning clutch in said drive means; a clutch peripheral ring element; a plurality of spaced apart teeth around said element; a lever shiftably mounted to have a portion enterable between said teeth to hold said element against travel in either direction of said clutch; means for biasing said lever toward a tooth free position; electromagnetic means for shifting said lever to a tooth engaging position; means responsive to a track circuit clear condition energizing said magnetic means to hold said ring stationary, thereby holding said clutch to restrain said arm from dropping; and said motor operating said clutch within the stationarily held ring element to rock upwardly said arm; and means responsive to said track circuit reflecting a train approach to said crossing deenergizing said electro-magnetic means; said clutch and ring element cooperating to restrain said arm from falling and to have said drive means lift the gate while said ring is held stationary by said lever.

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2,362,710	Miskelly	Nov. 14, 1944
2,435,824	Goodlin	Feb. 10, 1948
2,465,601	Ochtman	Mar. 29, 1949