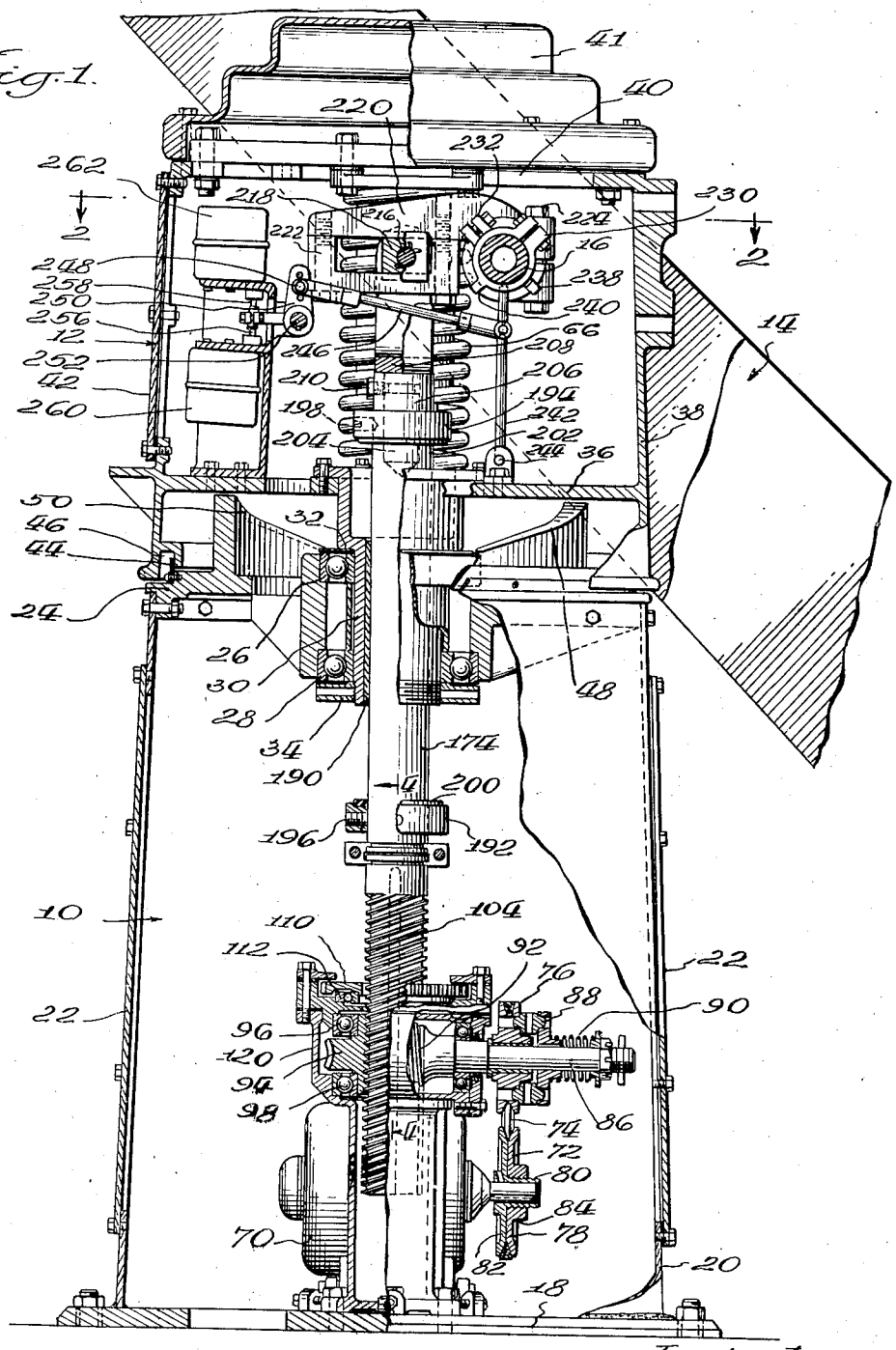
June 27, 1944. H. S. BROWN ET AL 2,352,310

RAILWAY CROSSING GATE

Filed April 8, 1941 4 Sheets-Sheet 1

Fig. 1.



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RAILWAY CROSSING GATE

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Fig. 2.

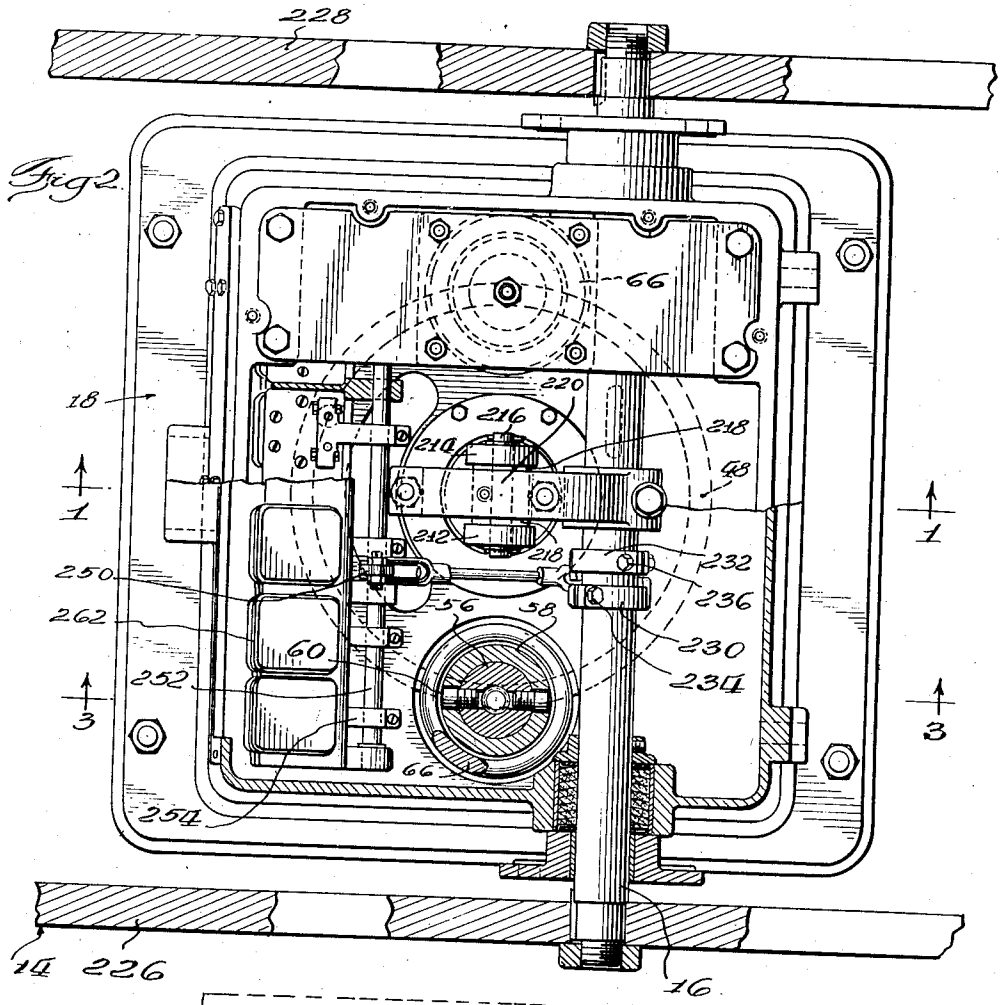
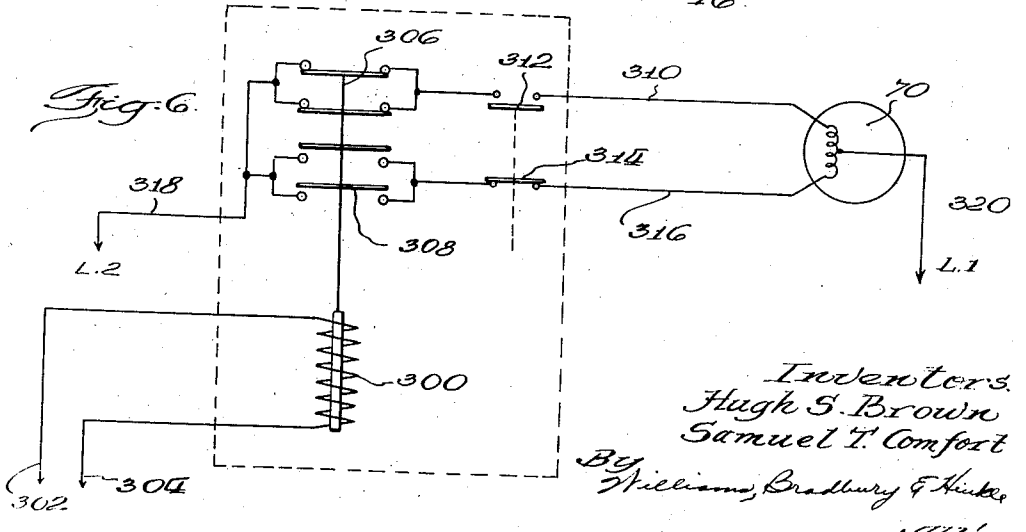


Fig. 6.



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RAILWAY CROSSING GATE

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Fig. 3.

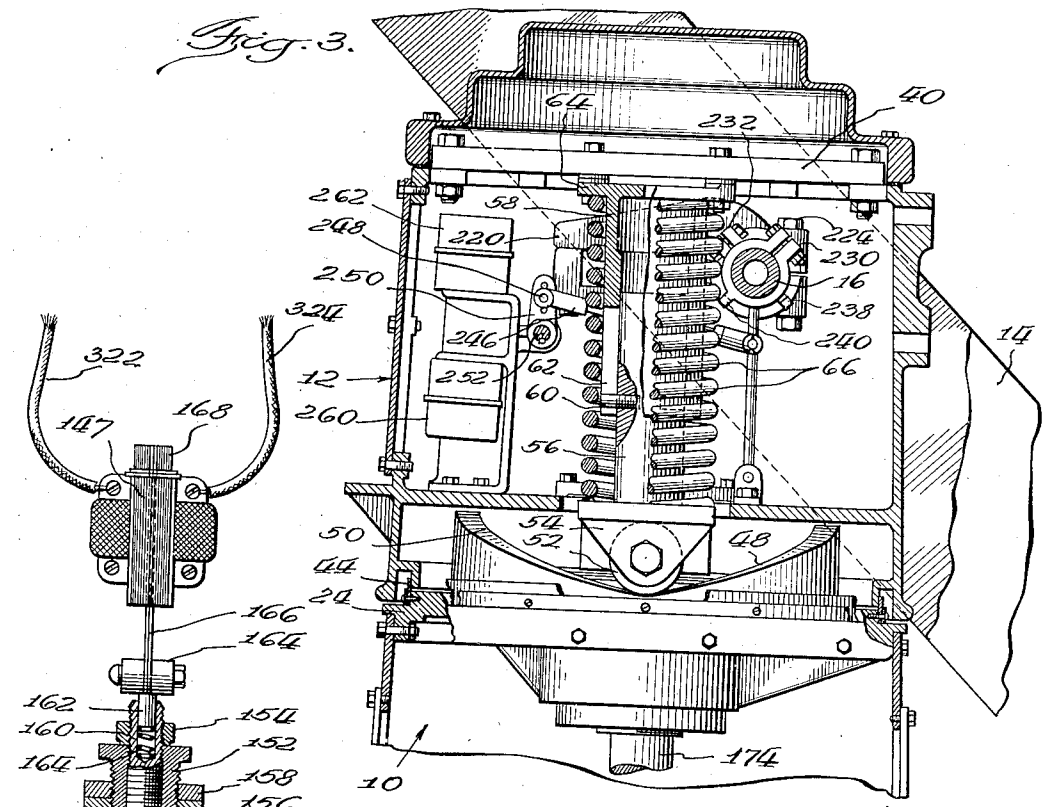
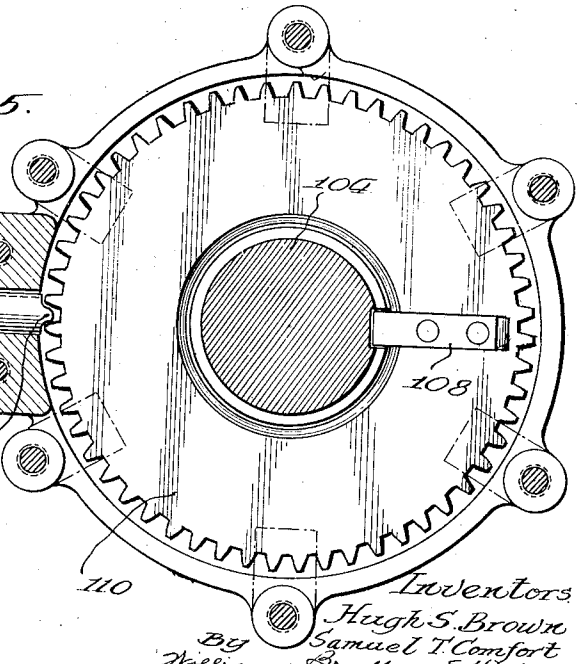


Fig. 5.



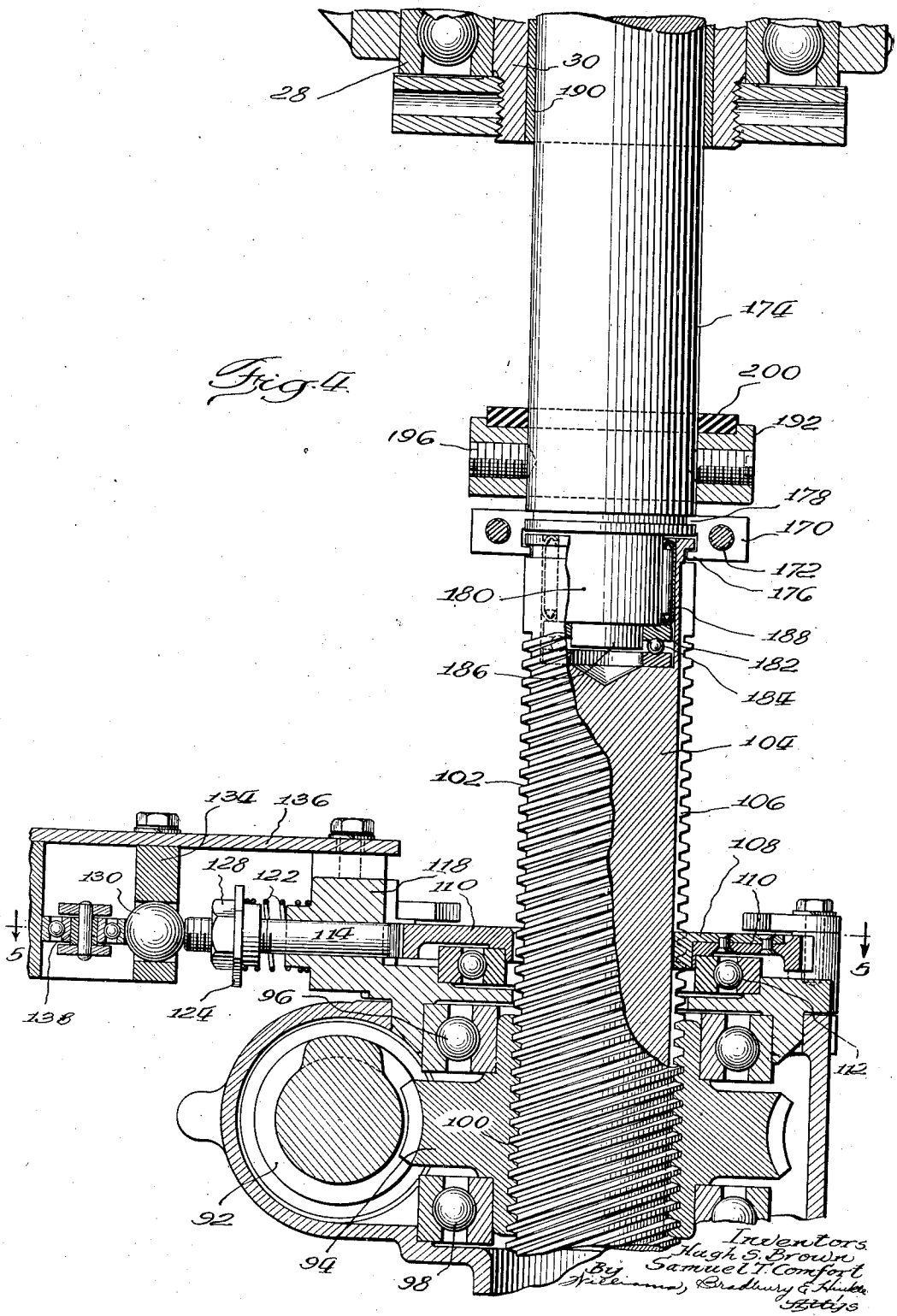
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RAILWAY CROSSING GATE

Filed April 8, 1941 4 Sheets-Sheet 4

Fig. 4



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Patented June 27, 1944 2,352,310

UNITED STATES PATENT OFFICE

2,352,310

RAILWAY CROSSING GATE

Hugh S. Brown and Samuel T. Comfort, Harvey, Ill., assignors to The Buda Company, Harvey, Ill., a corporation of Illinois

Application April 8, 1941, Serial No. 387,480

5 Claims. (Cl. 39—7)

Our invention relates to railway crossing gates of the kind used at intersections of railways and highways to warn and protect pedestrians and highway vehicles from injury.

An object of our invention is to provide a railway crossing gate of the power-operated type which is locked in all positions in normal operation, and which is automatically lowered by gravity in case of a power failure.

Another object of our invention is to provide a railway crossing gate having improved mechanism for permitting horizontal swinging of the gate arm if struck by a vehicle.

Another object of our invention is to provide a railway crossing gate having improved operating mechanism.

Another object of our invention is to provide a railway crossing gate which may be readily adjusted for different speeds of operation.

Another object of our invention is to provide a railway crossing gate having improved switch-operating mechanism.

Another object of our invention is to provide a relatively simple and inexpensive railway crossing gate which consumes a minimum of current.

Other objects and advantages will become apparent as the description proceeds.

In the drawings:

Fig. 1 is a vertical elevation of a crossing gate embodying our invention, this elevation being partially cut away on the line 1—1 of Fig. 2 to show part of the operating mechanism;

Fig. 2 is a horizontal sectional view taken on the line 2—2 of Fig. 1;

Fig. 3 is a vertical section through the upper part of the crossing gate mechanism, and is taken on the line 3—3 of Fig. 2;

Fig. 4 is a partial vertical section taken on the line 4—4 of Fig. 1, and shows the power failure release mechanism on an enlarged scale;

Fig. 5 is a sectional view taken on the line 5—5 of Fig. 4; and,

Fig. 6 is a simplified circuit diagram of the main operating circuit.

Referring particularly to Fig. 1, it will be seen that we have illustrated therein a railway crossing gate comprising in general a stationary frame 10, a head 12 rotatably mounted thereon, a gate arm 14, and a gate arm shaft 16 rotatably supported in the head 12.

The frame 10 comprises a base 18 adapted to be bolted or otherwise secured to a concrete block or other suitable support. Sides 20 are provided with removable plates 22 to facilitate inspection, adjustment, and repair. The upper end of the frame is closed by a cover 24 carrying ball bearings 26 and 28 rotatably supporting a sleeve 30, which carries the head 12. Vertical movement of the sleeve 30 is prevented by shoulder 32 and nut 34.

The head 12 comprises a floor 36 bolted or otherwise suitably secured to the upper end of the sleeve 30, sides 38, top 40, and cover 41. The sides 38 may be provided with one or more removable plates 42 for inspection, adjustment, or repair. A ring 44 extending into a recess 46 in the head 12 excludes dirt from the joint between the rotatable head 12 and the frame 10.

In order to maintain the gate arm 14 in a plane transverse to the highway and still permit this arm to swing under the impact of a vehicle, we provide yielding means, which we shall now describe.

As best shown in Figs. 1 and 3, the top 24 of the frame 10 provides a pair of V-shaped cam surfaces 48 and 50. A spring-pressed roller 52 (Fig. 3) is associated with each of these surfaces and serves normally to maintain the head 12 in such position that the rollers rest in the low points of these cam surfaces.

Each roller 52 is rotatably mounted in a foot 54 having an upwardly extending leg 56 slidably received in a sleeve 58. Each leg has a cross pin 60 projecting into slots 62 in the sleeve 58 to prevent rotation of the foot 54 and leg 56 around a vertical axis.

The sleeves 58 are secured to the top 40 and provide annular seats 64 for springs 66 which engage the upper surfaces of the feet 54 and press the rollers into engagement with the cam surfaces 48 and 50, respectively.

The gate arm 14 and gate arm shaft 16 are normally oscillated by an electric motor 70 mounted on the base 18 and connected to the gate arm shaft by suitable driving mechanism, which we shall now describe.

The motor 70 drives a pulley 72 connected by a V-belt 74 with a second pulley 76. The pulley 72 is preferably made in two parts, the part 78 having a hub which is adjustably threaded to a sleeve-like extension 80 of the other part 82. The effective diameter of the pulley 72 can be varied by rotating the part 78 with respect to the part 82 and the parts can be locked in adjusted position by a set screw 84. The motor 70 is pivotally mounted on the base 18 so that the requisite tension is maintained on the belt 74 for all adjustments of the pulley 72.

The pulley 76 drives worm shaft 86 through a friction clutch 88 which is normally maintained

in driving relation by spring 90. The worm shaft 86 has a worm 92 which drives a nut 94 mounted on ball bearings 96 and 98. The nut 94 has threads 100 which engage the threads 102 of a threaded shaft 104. The threaded shaft 104 has a keyway 106 which receives one end of a key 108 attached to a gear 110 mounted on a ball bearing 112.

The gear 110 and threaded shaft 104 are normally held against rotation by a latch 114 having a projection 116 engaging the teeth of the gear 110. The latch 114 is slidably mounted in a part 118 which is attached to the housing 120 enclosing the worm 92, nut 94, and associated mechanism. As long as the current for operating the crossing gate does not fail, the latch 114 remains in the position shown in Fig. 5.

The latch 114 is urged outwardly to disengaging position by a spring 122 confined between the stationary part 118 and the flange 124 of a nut 126 threadedly secured to the latch 114. A lock nut 128 serves to maintain the nut 124 in adjusted position. Outward movement of the latch 114 is limited by a ball 130 mounted in a hole 132 in frame 134 attached to the housing 120 by plate 136.

A ball bearing 138 is located between the ball 130 and the side 140 of the U-shaped frame 134, the bearing 138 being mounted in the yoke-shaped end 142 of a rod 144 slidably mounted in the frame 134.

In Fig. 5, the bearing 138 is illustrated as being held against an adjustable stop 146 by a solenoid 147 which is always connected with the source of electrical energy for operating the crossing gate. As long as an adequate source of electrical energy is available to operate the crossing gate, the bearing 138 is maintained in the position shown in Fig. 5, but upon failure of this source, springs 148 and 150 move rod 144 upwardly, as viewed in Fig. 5, thereby permitting ball 130 and latch 114 to move toward the left, as viewed in this figure. Spring 148 is confined between the frame 134 and a sleeve 152 adjustably secured to the threaded end of the rod 144, and retained in adjusted position by lock nut 154. The second spring 150 is confined between the frame 134 and a nut 156 adjustably secured to the sleeve 152, and maintained in adjusted position by lock nut 158. A single spring could be used in lieu of the two springs 148 and 150, but our experience has shown that two springs result in better operation because of the more desirable force characteristics resulting from a selection of properly complementary springs.

As viewed in Fig. 5, the upper end of rod 144 is recessed at 160 to receive a finger 162 and a spring 164 for urging this finger into contact with a block 165 mounted on a strap 166 attached to the main armature 168 of the solenoid 147.

The solenoid 147 is of the conventional type wherein the main portion 168 of the armature comprises a transverse bar so that the maximum force is exerted by the solenoid when this bar is in contact with the ends of the magnetic core. Since it is important that the minimum of current be consumed by the solenoid 147, which is always energized, we have provided the lost motion connection between the finger 162 and rod 144 to permit the solenoid to remain in its most efficient operating position without unnecessary refinement in the positioning of the solenoid relative to the frame 134. It will be understood that the spring 164 is stronger than the combined springs 148 and 150.

The solenoid 147 need exert only the lightest possible force in addition to the force necessary to overcome the springs 148 and 150 to hold the bearing 138 in the position shown in Fig. 5. After a power failure and after correction of the difficulties so that solenoid 147 is again energized, only a slight force is required to move bearing 138 back into the position shown in Fig. 5, the principal force exerted by the solenoid being utilized to compress springs 148 and 150. A feature of the latch control mechanism resides in the fact that as soon as the current to the solenoid 147 is reestablished, the gate-operating mechanism is immediately and automatically restored to normal condition, and if the gate is down at the time of such restoration, the gate arm will be returned to elevated position in the usual manner.

As best shown in Fig. 4, a split collar 170 formed of two semi-circular sections held together by bolts 172 secures the threaded shaft 104 to a second vertical shaft 174 which constitutes in effect a continuation of the shaft 104. The collar 170 has a lower flange 176 received in an annular recess in the upper end of the shaft 104 and an upper flange 178 received in a similar annular recess in the lower end of the shaft 174. The shaft 174 has a reduced lower end 180 received in a cylindrical recess in the upper end of the shaft 104, and a shoulder 182 resting on the ball bearing 184. The extreme lower end 186 of the shaft 174 extends into the upper race of the ball bearing 184 and a needle bearing 188 is confined between the end 180 and the wall formed by the upper end of the shaft 104.

Referring particularly to Fig. 1, it will be seen that the shaft 174 is mounted for sliding movement in a bushing 190 in sleeve 30. Stop collars 192 and 194 are adjustably secured to the shaft 174 by set screws 196 and 198, respectively, and carry flexible gaskets 200 and 202 which, under unusual conditions, may engage adjacent ends of the sleeve 30 to limit extreme movement of the shafts 104 and 174.

The upper end of the shaft 174 is provided with a bore 204 for receiving the depending pin 206 of a yoke 208. The yoke is secured to the upper end of the shaft 174 in rotatable relation thereto by a set screw 210 which engages an annular groove in the pin 206.

The upwardly extending arms 212 and 214 of the yoke 208 carry a pin 216 pivoted in a cross head 218 sliding in the guideway formed by arm 220 and the U-shaped guide 222 bolted or otherwise secured to the under side of the arm 220. The arm 220 is firmly clamped by bolt 224 to the gate arm operating shaft 16 so that upward or downward movement of the arm 220 as a result of vertical movement of the shafts 104 and 174 will rotate the gate arm shaft 16 and the gate arm 14 carried thereby. From an inspection of Fig. 2, it will be seen that we have illustrated the gate arm as having side members 226 and 228 secured to ends of the gate arm shaft 16 for rotation therewith.

A pair of collars 230 and 232 are adjustably secured to the gate arm shaft 16 by bolts 234 and 236, respectively. The collars 230 and 232 provide laterally projecting lugs 238 and 240 for engaging the upper end of a lever 242 pivotally mounted at 244. A link 246 is pivoted to the lever 242 intermediate its ends and is pivotally connected by an adjustable pin 248 to arm 250 on switch control shaft 252.

A plurality of switch control fingers 254 are clamped to the shaft 252, and each finger is adjustably connected to one or more switch control rods 256 or 258. The rods 256 control switches located in the lower series of switch boxes 260 and the rods 258 control switches located in the upper series of switch boxes 262. Any desired number of switch boxes may be provided for switches controlling the motor 70, alarm bells or other audible signals, flashing, and non-flashing lights, interlocking control circuits, and all other circuits which it is desired to control by the position of the gate arm.

In Fig. 6, we have shown a simplified diagram of the circuit for controlling the normal operation of the crossing gate. In this figure, we have shown a track relay 300 having leads 302 and 304 adapted to be connected to a source of electromotive force in parallel relationship to a section or sections of track adjacent the crossing. The relay 300 is normally energized to hold the switches 306 and 308 in elevated position. In this position, the two sets of parallel contacts of the switch 306 are closed, while the contacts of the switch 308 are open. The motor 70 is not operating, however, since the line 310 connecting this motor with the switch 306 is broken by a second switch 312, which was opened by engagement of the lug 238 with switch control lever 242. The complementary switch 314 in the line 316 connecting the motor 70 with switch 308 is closed.

When a train approaches the crossing, the wheels of the train short-circuit the solenoid 300, allowing the armature and switches 306 and 308 to drop under their own weight. This opens the contacts of the switch 306 and closes the contacts of the switch 308, establishing a closed circuit from battery lead 318 through switch 308, switch 314, and conductor 316 to motor 70, which is also connected by lead 320 to the other side of the battery connected to lead 318. This causes the motor 70 to operate in a direction to lower the gate arm. As soon as lug 238 moves away from switch lever 242, switch 312 closes under the action of its spring. When the gate arm has moved to lowered position, lug 240 engages switch lever 242 to open switch 314. Opening of switch 314 breaks the circuit to the motor 70, and the gate arm remains in its lowered position.

After the train has left the track section controlling the crossing gate, the relay 300 is again energized and raises the movable contacts of switches 306 and 308 to the position shown in Fig. 6. Since switch 312 is now closed, the motor 70 is energized in reverse direction and operates to raise the gate arm. When the gate arm reaches its upper limit, lug 238 shifts switch lever 242 to open switch 312 and thereby break the circuit to the motor.

We have found that a direct current motor with a split field gives satisfactory results, and we have diagrammatically illustrated such a motor in Fig. 6. Other types of reversing motors may be used, however, and our invention is not limited to a crossing gate using a direct current split field motor.

The leads 322 and 324 of the solenoid 147 shown in Fig. 5 are connected to the same battery or other source of electromotive force to which the leads 318 and 320 are connected so that failure of this source will release the solenoid 147 and permit the springs 148 and 150 to shift bearing 138 from between ball 130 and frame 140. This permits spring 122 to move latch 114 outward from engagement with the teeth of gear 110. This gear is then free to rotate with threaded shaft 104. This shaft is provided with a steep pitch multiple thread, such as the septuple thread shown in the drawings. The nut 94 is held against rotation by the worm 92, but the weight of the shafts 104 and 174 is sufficient to cause shaft 104 to rotate in nut 94, thereby permitting both shafts 104 and 174 to drop under their own weight, and to lower gate arm 14. Where the gate arm is in other than a truly vertical position, the weight of this gate arm will also assist in this automatic lowering as a result of power failure.

The shaft 174 is free to rotate in the bushing 190, and the swivel connection between this shaft and the yoke 108 provides for such rotation. There is considerable frictional resistance to rotation of the shaft 174, however, and we have thus provided the free-running swivel connection between the shafts 174 and 104 to permit practically frictionless rotation in case of power failure.

When the gate is first installed, the pulley 72 is adjusted to give the desired speed of operation of the gate arm, and the collars 230 and 232 are adjusted to give the desired limits of travel to this arm. After these adjustments have been made and the electrical circuits have been connected, our crossing gate is ready for operation. When the motor 70 is energized by the approach of a train, in the manner previously described, the pulley 72 is rotated and drives the pulley 76 through the belt 74. Power from the pulley 76 is transmitted through friction clutch 88 to worm shaft 86, thereby rotating worm 92 and nut 94. Threaded shaft 104 is held against rotation by key 108, and rotation of the nut 94 moves shafts 104, 174, and arm 220 on gate control shaft 16 downwardly, thus lowering the gate arm 14. In case the gate arm should strike the top of an automobile or other object, the friction clutch will yield to prevent injury to the mechanism.

In normal operation, the mechanism will continue to operate until the gate arm 14 assumes a substantially horizontal position, when the motor control circuit will be opened by switch 314, thus stopping the motor.

If the gate arm 14 is struck by a moving automobile, the gate arm and head 12 will rotate in a horizontal plane. This yielding of the gate arm tends to prevent injury to the gate arm and also to the vehicle which strikes it.

As the gate arm swings laterally, the rollers 52 will move upwardly on their tracks 48 and 50, compressing springs 66, which resist such movement. As soon as the vehicle which struck the gate arm is moved away from contact with the arm, the head 12 and gate arm are returned to normal position by the force exerted by the spring 66.

When the train has passed the crossing, the motor 70 is again energized to revolve in the opposite direction and to raise the gate arm. If children should hang on the gate arm or this arm should meet other unusual resistance, the clutch 88 will yield to prevent injury to the mechanism. In ordinary operation, the gate arm returns to its uppermost position when lug 238 strikes switch control lever 242 and opens the motor circuit.

In normal operation, the nut 94, worm 92, key 108, and latch 114 cooperate to lock the gate arm against accidental movement in all positions thereof. It is only when the power fails that the latch 114 releases and permits the gate arm to fall under the action of gravity.

The switches which are controlled by the position of the gate arm are preferably of a type which are spring held in normal position. This normal position may be either open or closed, depending upon the function of the switch and the particular circuit in which it is located. A switch is only moved from normal position when the lug **238** or the lug **240** engages the switch lever **242**, and the switch is immediately returned to normal position upon disengagement of such lug from the switch lever.

While we have described our crossing gate as being particularly adapted for use at the intersections of railways and highways, it will be understood by those skilled in the art that our invention is not limited to such use, but may be placed at any point on a highway, walk, railroad, bridge, or other right of way where it is desired to provide a movable barrier against traffic. In such location, our novel crossing gate may be controlled by any desired type of electrical circuit and manual or automatic switch mechanism.

While we have illustrated and described only a single embodiment of our invention, it is to be understood that this invention is not limited to the details shown and described, but may assume numerous other forms. Our claims, therefore, are not to be construed as limited to the details shown, but are intended to cover various modifications thereof.

We claim:

1. A crossing gate of the class wherein a gate arm is arranged to swing in a vertical plane under the normal control of swing mechanism and a solenoid is provided to permit lowering of the gate arm upon failure of a power source, a motor for elevating said gate arm, said motor being adapted for connection to a source of current through said switch mechanism, driving means connecting said motor and gate arm and normally effective to lock said gate arm in elevated position, a latch associated with said driving means and releasable to permit said gate arm to lower under the action of gravity, a spring for biasing said latch toward open position, a ball normally preventing movement of said latch under the force of said spring, a U-shaped frame providing guide means for said ball and an opposing wall, a bearing movable into and out of position between said ball and wall, an adjustable stop normally holding said bearing in substantially exact axial alignment with said ball, a slidable rod carrying said bearing, spring means for urging said rod to move said bearing out of alignment with said ball, said solenoid being connected to said current source for moving said rod and bearing in opposition to said spring means, said solenoid having a movable armature movable into and out of a position of maximum efficiency, and a lost motion connection between said rod and solenoid, whereby said solenoid may maintain said bearing in axial alignment with said ball with the armature of said solenoid in said position of maximum efficiency.

2. A crossing gate of the class wherein a gate arm is raised or lowered by power operated means controlled by switch mechanism responsive to different positions of the gate arm and a solenoid is provided to control lowering of the gate arm upon failure of a power source, comprising a reversible motor adapted to be connected to a source of current, a nut driven by said motor, a threaded shaft driven by said nut, said shaft and nut having steep-pitched threads, a latch normally preventing rotation of said shaft and spring for disengaging said latch to idle position, a movable part normally preventing movement of said latch under the influence of said spring, said solenoid being connected to said current source and controlling the position of said ball, a crossing gate arm moved to raised or lowered position by said shaft, driving means connecting said shaft and crossing gate arm, and whereby the force of gravity acting on said gate arm and driving connections tends to move said threaded shaft to a position corresponding to the lowered position of said gate arm.

3. A crossing gate of the class wherein a gate arm adapted to swing in a vertical plane under the influence of power operated means controlled by switch mechanism responsive to different positions of the gate arm and a solenoid is provided to permit lowering of the gate arm upon the failure of a power source, comprising a motor for elevating said gate arm, said motor being adapted for connection to a source of current, driving means connecting said motor and gate arm and normally effective to lock said gate arm in elevated position, a latch associated with said driving means and releasable to permit said gate arm to lower under the action of gravity, a spring for biasing said latch toward open position, a frame providing a wall, a bearing movable into and out of position between said latch and wall, a slidable rod carrying said bearing, spring means for biasing said rod to move said bearing out of alignment with said latch, said solenoid being connected to said current source for moving said rod and bearing in opposition to said spring means, said solenoid having a movable armature movable into and out of a position of maximum efficiency, and a resilient connection between said rod and solenoid whereby said solenoid may maintain said bearing in alignment with said latch with the armature of said solenoid in said position of maximum efficiency.

4. In a power operated crossing gate of the class wherein a gate arm is raised and lowered and has switch mechanism for controlling the raising and lowering of the gate arm and a solenoid responsive to failure of the power source to permit said gate arm to assume operative position, the combination of a reversible motor adapted for connection to said power source through said switch mechanism, a worm driven by said motor, a worm wheel driven by said worm, a nut driven by said worm wheel, a threaded shaft driven by said nut, said shaft and nut being provided with threads permitting either to drive the other, a latch for preventing rotation of said shaft, means connecting said shaft with said gate arm whereby the latter is driven by longitudinal movement of said shaft resulting from rotation of said nut, a latch normally preventing rotation of said shaft, and means connecting said latch with said solenoid whereby failure of power releases said latch and permits rotation of said shaft with resulting lowering of said gate arm.

5. In a power operated crossing gate of the class wherein a gate arm is raised and lowered and has switch mechanism for controlling the raising and lowering of the gate arm and a solenoid responsive to failure of the power source to permit said gate arm to assume operative position, the combination of a reversible motor adapted to be connected to said source of power through said switch mechanism, a nut driven by said motor, a threaded shaft driven by said nut, said shaft and nut having septuple threads, a latch normally preventing rotation of said shaft,

a spring for shifting said latch to idle position, a ball normally preventing movement of said latch under the influence of said spring, means responsive to said solenoid for controlling the position of said ball, and driving means connecting said shaft and gate arm so that the force of gravity acting on said gate arm and driving connections tends to move said threaded shaft to a position corresponding to the lowered position of said gate arm whereby said gate arm is automatically lowered upon failure of said power source.

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