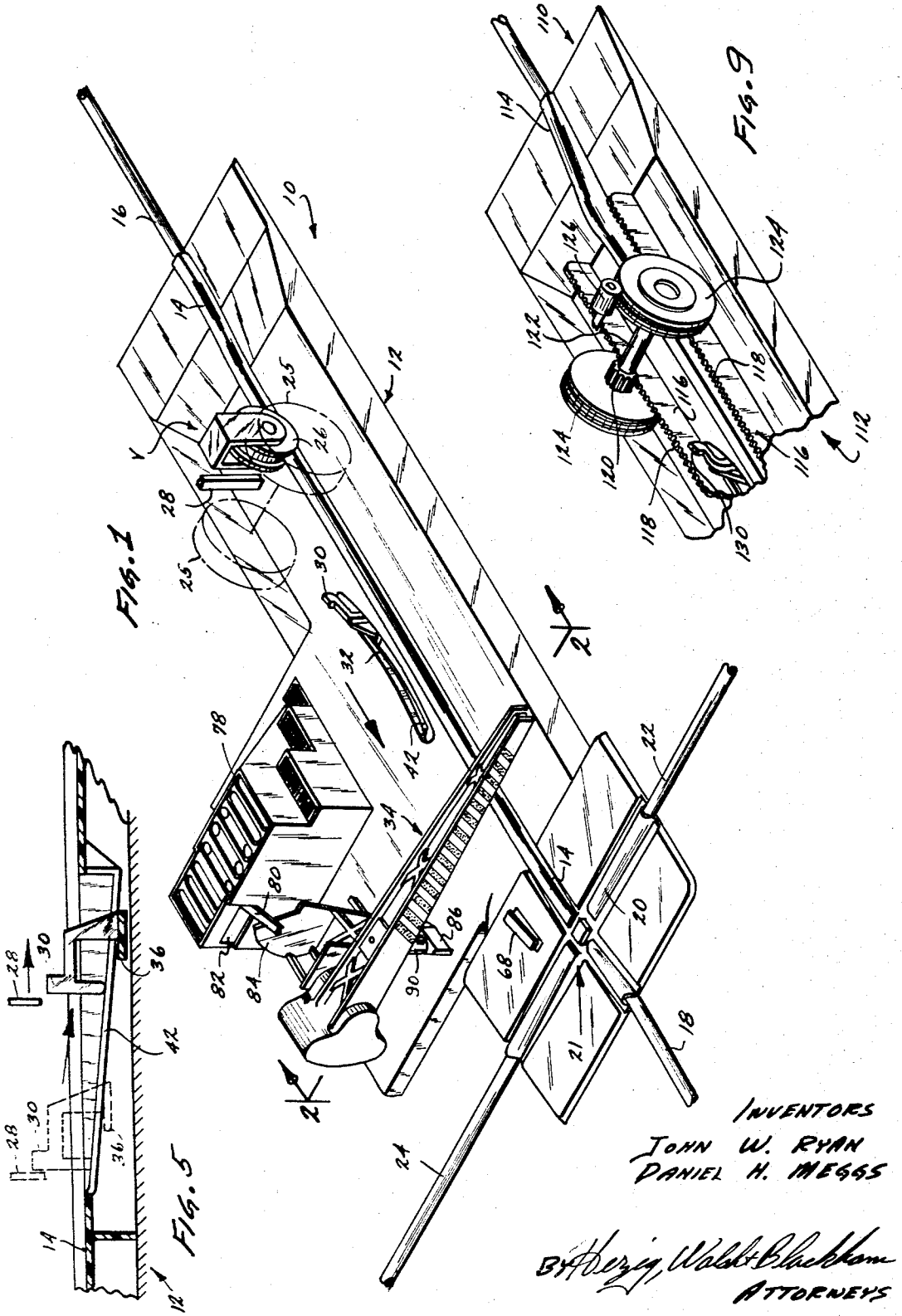
Dec. 31, 1968 J. W. RYAN ET AL 3,418,750

GATE CROSSING APPARATUS

Filed May 9, 1966 Sheet 1 of 3



Dec. 31, 1968 J. W. RYAN ET AL 3,418,750

GATE CROSSING APPARATUS

Filed May 9, 1966 Sheet 2 of 3

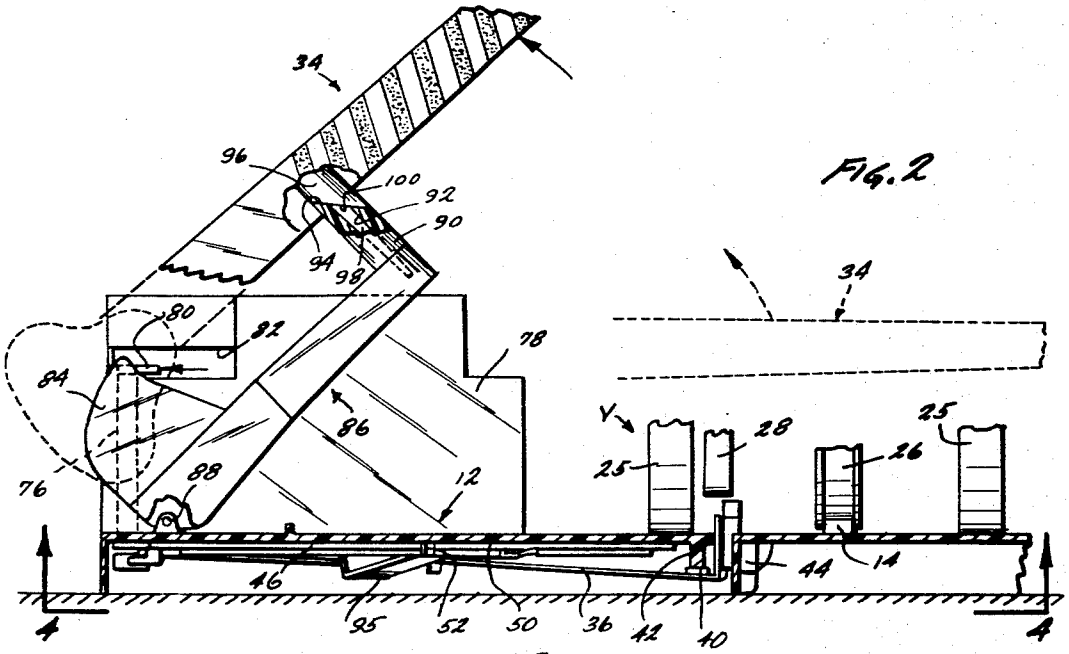


FIG. 2

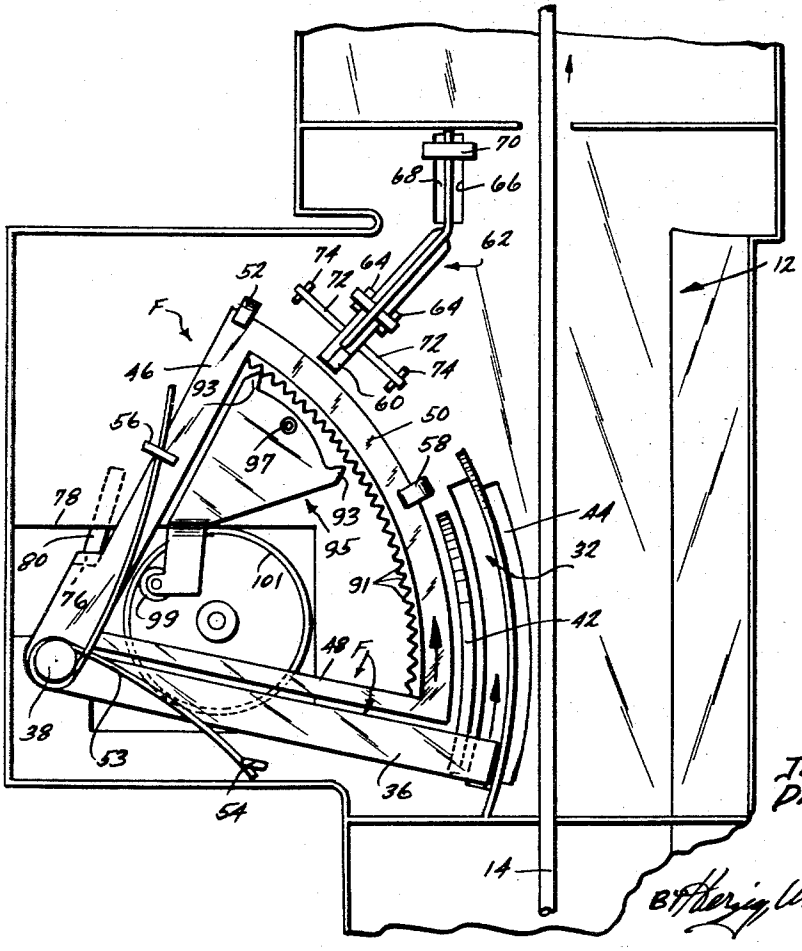


FIG. 3

INVENTORS
JOHN W. RYAN
DANIEL H. MEGGS

BY Herzig, Walker, Buckham
ATTORNEYS

Dec. 31, 1968 J. W. RYAN ET AL 3,418,750

GATE CROSSING APPARATUS

Filed May 9, 1966 Sheet 3 of 3

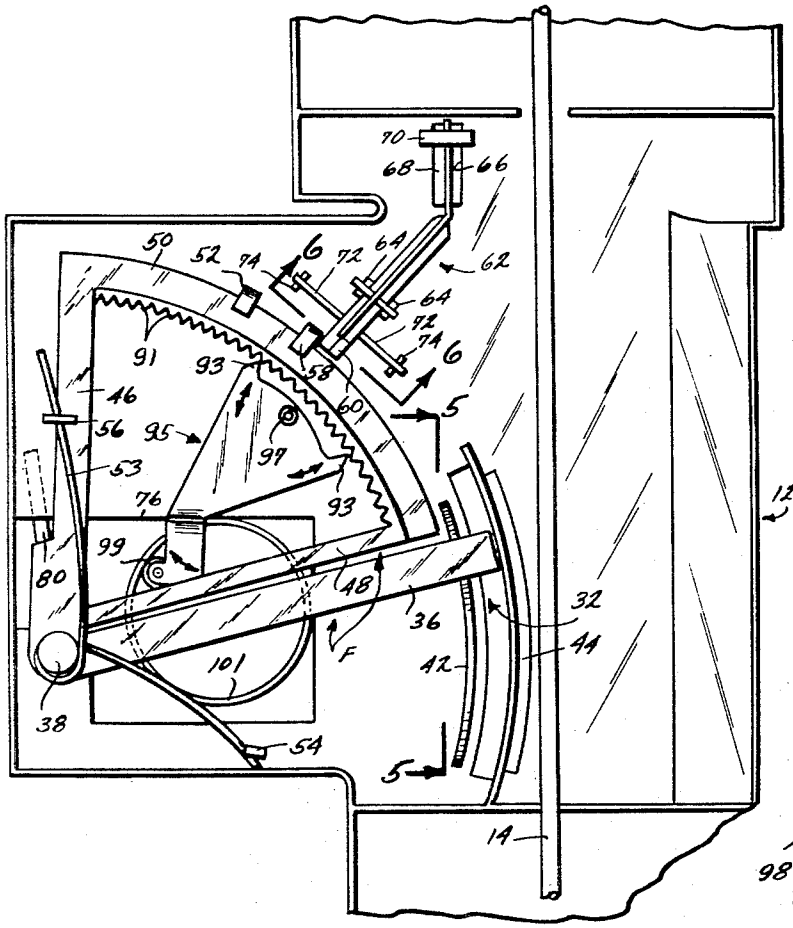


FIG. 4

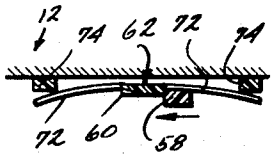


FIG. 6

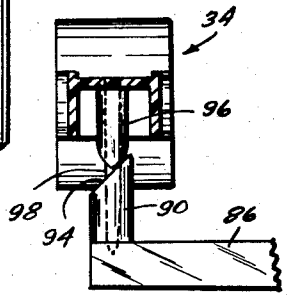


FIG. 8

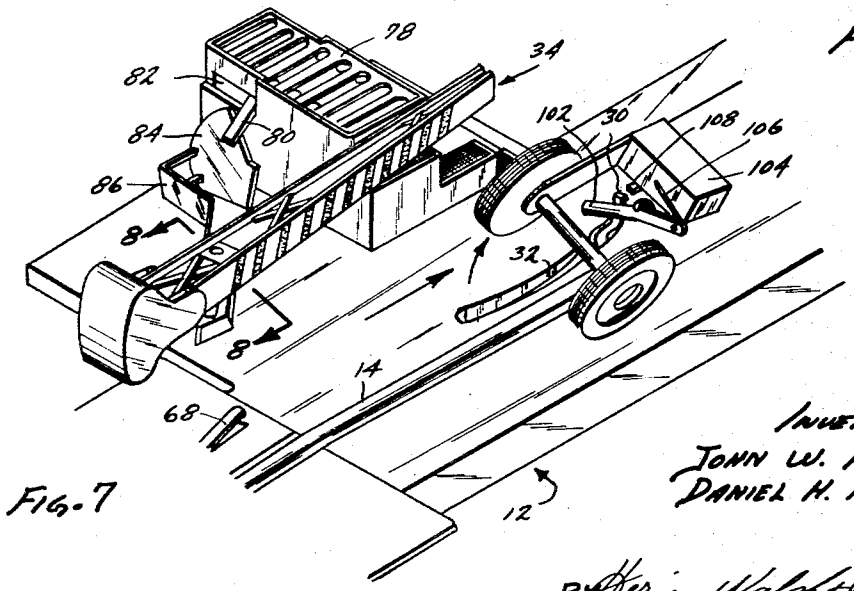


FIG. 7

INVENTORS
JOHN W. RYAN
DANIEL H. MEGGS

BY Herzig, Walsh & Blackman
ATTORNEYS

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Patented Dec. 31, 1968

3,418,750

GATE CROSSING APPARATUS

John W. Ryan, Bel Air, and Daniel H. Meggs, Redondo Beach, Calif., assignors to Mattel, Inc., a corporation of California

Filed May 9, 1966, Ser. No. 548,555
10 Claims. (Cl. 46—216)

ABSTRACT OF THE DISCLOSURE

A support pivoted on a horizontal axis and gravity held in a lower position where a crossing gate thereon extends horizontally over a track. The gate is pivoted for horizontal swinging on the support but is gravity urged to straight-ahead position. An actuator is moved forwardly and downwardly along the track, by a vehicle, to swing a pivoted frame which lifts the gate and latches it open until the latch is released by a vehicle engaging a latch release member near the track. Sounding means are actuated during gate lifting and lowering movement.

The present invention relates to apparatus for operating a movable crossing gate and, more particularly, to apparatus which is automatically operable by a moving toy vehicle for elevating a crossing gate in response to the approaching of the crossing by the vehicle.

It is an object of the present invention to provide new and improved apparatus for controlling the position of a crossing gate in response to actuating movement of a toy vehicle approaching and leaving the gate crossing.

Another object is the provision of new and improved apparatus for operating a movable crossing gate, which is automatically operable to open the gate by a moving toy vehicle approaching the crossing.

A further object is to provide new and improved apparatus for operating a movable crossing gate, which is automatically operable to effect the closing of the gate as a moving vehicle passes the gate.

Still another object is the provision of new and improved apparatus for automatically operating a crossing gate in response to travel of a moving vehicle toward the crossing, which apparatus comprises a simple mechanical assembly for actuation by the moving vehicle and for the moving of the gate.

A still further object is to provide gate crossing apparatus that is operable in response to movement of a vehicle, and which is so constructed and arranged that the gate is freely swingable about substantially horizontal and vertical axes, and is normally maintained by the force of gravity in a closed position wherein it extends substantially transversely across the path of the vehicle.

An additional object is the provision of apparatus for automatically operating a movable crossing gate in response to movement of a vehicle toward the gate, the apparatus being so constructed as to produce an audible warning or indicating sound during both the elevation and descent of the gate.

Another object is to provide new and improved apparatus for operating a crossing gate in response to movement of a vehicle approaching the gate, without adversely affecting or substantially retarding the travel of the vehicle or away from the gate crossing.

Yet another object is to provide new and improved apparatus for operating a crossing gate in response to movement of a vehicle approaching and leaving the gate, which apparatus is simple in construction, economical to manufacture, comprises of a minimum of moving parts, and is reliable in operation.

According to the present invention, the gate crossing apparatus generally comprises a base panel having toy vehicle guiding or track means thereon, and an upwardly extending actuating abutment that is movably mounted on the base panel and is disposed adjacent the vehicle guiding means and in the path of a vehicle approaching the crossing. The abutment is connected to a lever member which is part of an actuating frame that is pivotally mounted for swinging movement on the underside of the base panel. When the abutment is engaged by a vehicle approaching the crossing, the lever and frame are pivotally moved to bring a finger member thereon into engagement with a crossing gate to elevate it. The crossing gate is pivotally mounted on the base panel and is normally maintained in a closed or down position under the force of gravity, wherein it extends substantially transversely across the path of the vehicle.

The actuating abutment is slidably mounted in an arcuate slot in the base panel, the slot being sloped in a manner such that an approaching vehicle engages the abutment when it is at one end of the slot, and clears the abutment when it has been moved to the other end of the slot into a gate-elevating position, so that forward travel of the vehicle will not be impeded by the abutment. When the abutment is in its lower, gate-elevating position, the lever member to which it is attached is restrained from returning to its initial position, to which it is biased by a spring member, by engagement of a tab on the actuating frame with a latching member that is pivotally mounted on the underside of the base panel. The latching member is tiltable to release the frame tab by the depression of one of its ends which extends upwardly from the upper portion of the base panel, the end being engageable by a vehicle as it travels past the gate. Upon release of the frame tab, the spring member returns the lever and frame to their initial position, to move the finger out of engagement with the crossing gate, and to thereby enable the latter to move by gravity to its down or closed position.

As an additional feature, a bell or other type of sound-producing member is mounted on the underside of the base panel and is engageable by one end of a pivotally mounted dog member. The other end of the dog member comprises a pair of laterially spaced teeth which are engageable with complementary teeth on a toothed portion formed on a portion of the actuating frame. Engagement of the toothed portion with the teeth on the dog member causes the latter to be oscillated or rocked about its pivot to successively engage the bell to produce an audible sound during gate-elevating or gate-descending movement of the abutment, lever and actuating frame.

The present invention, both as to its organization and manner of operation, together with further objects and advantages thereof, may best be understood by reference to the following description, taken in connection with the accompanying drawings in which like reference characters refer to like elements in the several views.

In the drawings:

FIGURE 1 is a perspective view of a gate crossing apparatus constructed in accordance with the principles of the present invention;

FIGURE 2 is an enlarged sectional view taken substantially along line 2—2 of FIGURE 1;

FIGURE 3 is a plan view of the underside of the instant gate crossing apparatus, showing the apparatus in a position wherein the gate is closed;

FIGURE 4 is a view similar to FIGURE 3, taken substantially along line 4—4 of FIGURE 2, showing the instant apparatus in a position wherein the gate is fully open or elevated;

FIGURE 5 is an enlarged sectional view taken substantially along line 5—5 of FIGURE 4;

FIGURE 6 is an enlarged sectional view taken substantially along lines 6—6 of FIGURE 4;

FIGURE 7 is a view similar to FIGURE 1, showing the upsetting of a vehicle when it approaches the instant gate crossing apparatus in a direction opposite to that shown in FIGURE 1;

FIGURE 8 is an enlarged sectional view taken substantially along line 8—8 of FIGURE 7; and

FIGURE 9 is a fragmentary perspective view similar to FIGURE 1, showing a modified form of the instant apparatus, wherein the gear ratio between the vehicle power source and its driving wheels is changed to increase the actuating force of the vehicle as it approaches the crossing gate.

As a preferred or exemplary embodiment of the present invention, FIGURE 1 illustrates a gate crossing apparatus **10** comprising a base panel **12**, preferably unitarily formed or molded from a suitable plastic material, and having a single track **14** formed thereon. Preferably, the track **14** is hollow so as to frictionally receive flexible and hollow track members **16** and **18** at the ends thereof. The flexible track members **16** and **18** may form part of a single, flexible track system such as that disclosed in United States patent application, Ser. No. 465,558, filed June 21, 1965.

At one end of the base panel **12**, a second track section **20** is formed integrally thereon and is disposed in substantially perpendicular relation to the track section **14** to define a track crossing **21** on the panel. The transverse track section **20** preferably is of hollow configuration so as to frictionally receive the ends of hollow and flexible track members **22** and **24**, which may form part of the same single flexible track system as the flexible tubes **16** and **18**.

A toy vehicle V of any suitable type, partially shown in FIGURE 1, may be mounted and driven on the flexible track system comprising the hollow tubes **16**, **18**, **22** and **24**, and on the track sections **14** and **20** of the base panel **12**. Preferably, the vehicle V is of the self-propelling type disclosed in United States patent application, Ser. No. 470,148, filed July 7, 1965, now Patent No. 3,337,985 and comprises supporting wheels **25** and a pulley-type wheel **26** which is engageable with and is adapted to follow the hollow tubes and track sections **14** through **24**. It is noted, however, that the vehicle may be of any other suitable type of construction, and that any other suitable type of vehicle guiding means may be provided, other than the single track sections and members **14** through **24**, without departing from the scope of the instant invention.

The vehicle V preferably is also provided with a depending actuating arm **28** which is adapted to engage an abutment **30** that extends upwardly from and is slidably mounted within an arcuate slot **32** in the upper surface of the base panel **12**, when the vehicle is disposed on the track section **14** of the base panel **12** and is moving in a direction toward the crossing gate **34**, as shown in FIGURE 1.

Referring now to FIGURES 2 and 3, the abutment **30** is formed integral with or otherwise rigidly attached to a generally horizontally extending lever or arm **36** which is pivotally mounted on a pin **38** on the underside of the base panel **12**. The arm **36** is provided with an upstanding bead **40** adjacent the outer end thereof which is in frictional slidable engagement with a depending, arcuate, inclined cam track **42** that is formed integral with the base panel **12**. The cam track **42** is disposed inwardly of and is substantially parallel with the arcuate recess **32** in the base panel **12**. A second cam track **44** is formed in the upper surface of the base panel **12** adjacent the outer side of the arcuate slot **32**, and is substantially parallel to and inclined similarly to the inner cam track **42**. The second cam track **44** is disposed beneath a portion of the abutment **30**, and the undersurface of this abutment portion is in slidable engagement with the cam track **44**. It will be readily seen, therefore, that the engagement of the abutment **30** and arm **36** with the cam tracks **44** and **42**, respectively, serves to support the abutment **30** in an upper position, wherein it is engageable by the actuating arm **28** on the vehicle V, when the abutment **30** is disposed adjacent to the end of the slot **32** nearest the approaching vehicle, as shown in FIGURE 1. Also, when the abutment **30** has been moved to the opposite end of the slot **32**, as shown in FIGURE 5, the cam track **42** serves to move the abutment to a lower position wherein it is no longer engageable by the vehicle actuating arm **28**, thereby enabling the vehicle V to travel past the abutment **30** after it has been moved to the opposite end of the slot **32**.

As shown in FIGURE 3, the arm **36** is integrally connected to a second arm **46** which extends generally radially outwardly from the pivot pin **38** at an angle to the arm **36**. A third arm **48**, disposed adjacent to and extending substantially parallel to the arm **36**, is integrally formed with the second arm **46** at its inner end, and is connected to the second arm **46** at its outer end by an arcuate arm **50**. It will be noted, therefore, that the arms **36**, **46**, **48** and **50** are all integrally formed to define an actuating frame F which is pivotally mounted on the pin **38**, and preferably is formed or molded from a suitable flexible and resilient plastic material. The base panel **12** is provided with a depending retaining lug **52** which extends beneath and is in slidable engagement with the arcuate arm **50** for the purpose of retaining the arms **46**, **48** and **50** of the actuating frame F in a position closely adjacent to the undersurface of the base panel **12**.

A torsion spring **53** surrounds the pivot pin **38** and has one end that is secured to the undersurface of the base panel **12** at **54**, and an opposite end that is in engagement with an extension **56** on the undersurface of the arm **46** (see FIGURES 3 and 4). The torsion spring **53** serves to normally urge the integrally formed arms **36**, **46**, **48** and **50** of the actuating frame F in a clockwise direction about the pivot pin **38** (as seen in FIGURES 3 and 4). It will be understood that the spring **53** also serves to urge the abutment **30**, secured to the outer end of the arm **36**, to the position shown in FIGURE 1 and in broken lines in FIGURE 5, wherein the abutment **30** is in its upper position on the cam track **44** for engagement by the actuating arm **28** on the vehicle V.

When the abutment **30** is moved toward the opposite end of the slot **32** in the base panel **12**, the arm **36**, and thus the arms **46**, **48** and **50** of the actuating frame F are rotated about the pivot pin **38**, against the force of the torsion spring **52**, in a counter-clockwise direction (as seen in FIGURES 3 and 4). During this movement, a radially extending tab **58**, preferably formed integral with the arcuate arm **50**, engages an inclined cam surface **60** on the adjacent end of an elongated latching element **62** that is pivotally mounted on bearing members **64** on the undersurface of the base panel **12** for substantially vertical movement (see FIGURE 3). The opposite or upper end of the latching lever **62** extends upwardly through an opening **66** in the base panel **12** and terminates in a generally flat end or abutment portion **68** which is disposed above the adjacent portion of the base panel **12** (see FIGURE 1). The base panel **12** is provided with a generally U-shaped retaining member **70** extending beneath the aperture **66** for the purpose of preventing downward movement of the end or abutment portion **68** of the latching element **62** beyond a predetermined extent.

Adjacent its inner end, the latching lever **62** is provided with a pair of laterally extending, flexible and resilient arms **72** which are engageable at their outer ends with depending ribs **74** on the undersurface of the base panel **12**. The flexible and resilient arms **72** serve to normally urge the lower end of the latching element, having the cam surface **60**, to a position wherein it is spaced a predetermined distance downwardly from the undersurface of the base panel **12** (see FIGURE 6). When the tab **58** engages the cam surface **60**, in response to counter-clockwise movement of the actuating frame F about the pivot pin **38**, as described above, the tab **58** moves the inner end of the latching element **62** upwardly toward the under-

surface of the base panel **12**, thereby deforming the resilient arms **72** of the latching element **62**. When the tab **58** has moved beyond the inner end of the latching element **62**, the tabs **72** will again urge the inner end of the latching element downwardly to its initial spaced position from the undersurface of the base panel **12**. In this position, the inner end of the latching element **62** prevents movement of the tab **58** in a return direction, and thus clockwise rotation of the arms **36**, **46**, **48** and **50** of the actuating frame F under the influence of the spring **53**, to thereby lock the abutment **30** in the end of the arcuate slot **32** wherein the abutment is disposed in its lower position and is no longer engaged by the actuating arm **28** of the moving vehicle (see FIGURE 5).

If the outer end portion **68** of the latching element **62** is depressed, it will be readily seen that the inner end thereof is pivoted upwardly to deform the resilient arms **72** and to move the inner end out of blocking engagement with the tab **58**, thereby enabling the torsion spring **53** to rotate the actuating frame F in a clockwise direction about the pivot pin **38**, from the position shown in FIGURE 4 to that shown in FIGURE 3, wherein the abutment **30** is again in the elevated position shown in FIGURE 1.

Referring to FIGURES 1 through 3, the arm **46** comprises an upwardly extending portion **76** which is disposed within an upstanding housing **78** on the base panel **12** that simulates a control housing for a switching mechanism. The arm portion **76** terminates at its upper end in a laterally extending, transverse finger member **80** that extends outwardly of the housing **78** through an elongated slot **82** therein. The laterally extending finger member **80** is engageable with the adjacent portion of a substantially vertically extending plate member **84** which is integrally formed with or secured to one end of an elongated support **86** for the crossing gate **34**. The support **86** is pivotally mounted at one end at **88** on the base panel **12** for pivotal movement about a substantially horizontal axis. The opposite or free end of the support **86** is provided with an upstanding, generally cylindrical bearing portion **90** having a central bore or opening **92** extending axially therethrough and terminating in an adjacent portion of the support **86** (see FIGURES 2 and 8). The upstanding bearing portion **90** is provided with a generally flat, upper face **94** which is inclined downwardly toward the free end of the frame member **86** for a purpose to be hereinafter described.

The crossing gate **34** may be of any suitable construction and preferably comprises a depending, generally cylindrical pivot member **96** having a depending pivot pin **98** extending downwardly therefrom and being slidably and rotatably receivable in the bore **92** of the bearing portion **90** on the support **86** (see FIGURE 2). The pivot member **96** of the crossing gate **34** has a substantially flat bottom face **100** which is engageable with the upper face **94** of the bearing member **90** when the pin **98** on the pivot member **96** is inserted into the bore **92** of the bearing portion **90**. The lower face **100** of the pivot member **96** is inclined in a manner substantially the same as that of the upper face **94** of the bearing member **90**, to thereby normally maintain the crossing gate **34** in a position wherein it extends substantially transversely to the track section **14** on the base panel **12**, as shown in FIGURES 1 and 2.

It will be appreciated, therefore, that the crossing gate **34** is freely pivotally mounted about a substantially vertical axis on the support **86**, and is normally maintained by gravity in the position shown in FIGURE 1. If the gate **34** is moved out of this position, the inclined faces **94** and **100** of the bearing portion **90** and the pivot member **96**, respectively, serve to cooperate in a cam-like manner to return the gate **34** to its normal position of FIGURE 1 under the force of gravity.

As illustrated in FIGURES 3 and 4, the inner edge portion of the arcuate arm **50** of the actuating frame F comprises a plurality of teeth **91** which are engageable with a pair of complementary teeth **93** on one end of a dog member **95** that is pivotally mounted at **97** on the undersurface of the base panel **12**. The other end of the dog member **95** comprises a disc-like hammer element **99** which is engageable with the inner surface of a bell or other sound producing member **101** disposed within the housing **78** on the base panel **12**. It will be understood that pivotal movement of the actuating frame F in a clockwise or counter-clockwise direction about the pivot pin **38**, results in alternate engagement of the dog member teeth **93** by the teeth **91** on the arcuate arm **50**, with a consequent oscillatory movement of the dog member **95** about its pivot **97** to successively engage the hammer element **99** with the bell member **101**.

In the operation of the instant gate crossing apparatus, when the abutment **30** and actuating frame F are in the positions shown in FIGURES 1 and 3, the actuating arm **28** of a vehicle V travelling along the base panel **12** and following the track section **14** in the direction shown in FIGURE 1, engages the abutment **30** in its elevated position and moves it toward the opposite end of the arcuate slot **32** in the base panel **12**. This movement of the abutment **30** results in a counter-clockwise rotation (as seen in FIGURE 3) of the arm **36**, formed integral with the abutment **30**, and the arms **46**, **48** and **50** of the actuating frame F, about the pivot pin **38** and against the force of the torsion spring **53**. The finger member **80** extending outwardly from the housing slot **82**, being integrally formed with the portion **76** on the arm **46**, is pivoted in the same direction as the latter to engage the upper portion of the plate member **84** secured to the support **86** for the crossing gate **34**. The support **86** and gate **34**, therefore, are pivoted about the pivotal pin **88** on the base panel **12** in a counter-clockwise direction (as seen in FIGURE 2) to thus elevate the gate **34** in response to the approaching movement of the vehicle V.

During the counter-clockwise rotation of the arcuate arm **50** of the actuating frame F, induced by movement of the abutment **30** by the vehicle actuating arm **28**, the tab **58** on the arm **50** engages the inclined cam surface **60** on the adjacent end of the latch element **62** to press the lower latch element end upwardly toward the undersurface of the base panel **12**, against the resilient force of the arms **72**, as hereinbefore described. When the tab **58** is moved beyond the adjacent end of the latch element **62** to the position shown in FIGURE 4, the resilient arms **72** urge the lower latch element end downwardly away from the undersurface of the base panel **12** to block return movement of the tab **58**, and to prevent movement of the actuating frame F under the force of the torsion spring **53**. It will be readily seen, therefore, that the gate **34** is maintained in the elevated position shown in FIGURE 2.

As the actuating frame F is moved in a gate-elevating direction, from the position shown in FIGURE 3 to that shown in FIGURE 4, the teeth **91** on the inner side of the arcuate arm **50** engage the complementary teeth **93** on the pivotal dog member **95** to cause the oscillation of the dog member **95** about its pivot **97** on the undersurface of the base panel **12**. The oscillation of the dog member **95** results in the successive engagement of the hammer element **99** on its free end with the inner surface of the bell member **101**, to thereby produce an audible sound during the elevation of the gate **34**.

As the abutment **30** is being moved along the slot **32** in the base panel **12** by the actuating arm **28** of the moving vehicle, the abutment **30** also is moved downwardly relative to the slot **32** to the position shown in solid lines in FIGURE 5, owing to the cam tracks **42** and **44** disposed on opposite sides of and parallel to the arcuate slot **32**, as hereinbefore described. The abutment **30** is moved downwardly to a position wherein the actuating arm **28** passes freely over it so that the vehicle

continues to move along the track section **14** on the base panel **12** in a direction toward the track crossing **21** on the panel.

In accordance with one embodiment of the instant invention, the flat upper end or abutment **68** of the latching element **62** is positioned to be engageable by the wheels or other portion of a vehicle (not shown) travelling along the transverse track section **21** in a direction perpendicular to the direction of travel of the vehicle V. The positioning of the abutment **68** is such that it is not engageable by any portion of the vehicle V on the track section **14**, with the result that after the gate **34** has been elevated in response to approaching movement of the vehicle V, it will remain in an elevated position after the vehicle V has passed under it. Thereafter, when a vehicle passes over the transverse track section **20** at the crossing **21**, it will engage and depress the abutment **68** in the base panel opening **66**, to thereby pivot the lower end of the latching element **62** upwardly toward the undersurface of the base panel **12** and against the biasing force of the resilient arms **72**. This upward movement of the inner end of the latching element **62** moves it out of locking relation to the tab **58** on the arcuate arm **50** of the actuating frame F and enables the torsion spring **53** to rotate the frame F about the pivot pin **38** in a clockwise direction from the position shown in FIGURE 4 to that shown in FIGURE 3.

The return movement of the actuating frame F returns the abutment **30** to its original elevated position shown in FIGURE 1, and enables the crossing gate **34** and support **86** therefor to be returned to their closed or lower positions under the force of gravity. During this return movement, the teeth **91** on the arcuate arm **50** again engage the teeth **93** on the dog member **95** to effect the successive engagement of the hammer element **99** with the bell member **101**, thereby again producing an audible sound as the crossing gate **34** is descending to its closed position.

As a second embodiment of this invention, it will be understood that the abutment **68** may be positioned for engagement by the vehicle V as it is travelling along the track section **14**, so that the gate **34** will be automatically opened in response to approaching movement of the vehicle V and automatically closed as the vehicle V passes under it.

From the foregoing description, it will be readily understood that the instant gate crossing apparatus functions to automatically elevate the crossing gate **34** as a vehicle is approaching the crossing, and also may automatically effect the closing of the gate **34**, after the same vehicle has passed under it or in response to subsequent movement of the same or a different vehicle in a perpendicular direction. Further, as the abutment **30** is being moved in the base panel slot **32** by the actuating arm **28** of the vehicle V, it is also moved downwardly to a point wherein the actuating arm **28** of the vehicle can pass freely over it, thereby not impeding the forward movement of the vehicle and enabling it to continue to follow the track section **14** and thereafter the flexible tube **18** of the track system in a smooth and relatively continuous manner.

Referring now to FIGURE 7, the vehicle V may be provided with an upsetting mechanism comprising an arm **102** pivotally mounted on a substantially horizontal axis on a portion of its frame **104**, and normally biased in a downward direction by a torsion spring **106**. A tab **108** is provided on the frame portion **104** for normally maintaining the lever **102** in an elevated position (not shown) against the force of the spring **106**. If the vehicle is travelling in the direction shown in FIGURE 7, which is opposite to that shown in FIGURE 1, and the crossing gate **34** is in a down position, it engages the gate and pivots it on the support **86** to the position shown in FIGURE 7. When the vehicle pases the gate **34**, the depending arm **102** thereon engages the abutment **30** and is moved away from the retaining tab **108**, thereby enabling the torsion spring **106** to pivot the lever **102** downwardly into engagement with the base panel **12** with a force sufficient to upset the vehicle, as shown in FIGURE 7.

Thus, it will be readily seen that if a vehicle is travelling in the wrong direction on the track **14** of the base panel **12** and crashes into the gate **34**, it will be upset by the engagement of the abutment **30** with its lever arm **102** and thrown from the track section **14**. An upsetting mechanism for such a self-propelling vehicle is shown and described in detail in United States patent application, Ser. No. 526,411, filed Feb. 10, 1966. After the vehicle has passed the gate **34** and has been upset, the gate will return to the normal position of FIGURE 1, wherein it extends substantially transversely across the track section **14** under the force of gravity, owing to the inclined, mutually engaging faces **94** and **100** of the bearing portion **90** and the gate support pivot member **96**, respectively, as hereinbefore described (see FIGURES 2 and 8).

It is noted that if the gate **34** is in an elevated position, a vehicle approaching it in the direction shown in FIGURE 7 will pass freely under it and will not be upset, owing to the recessed position of the abutment **30** in the base panel slot **32**, which enables the lever **102** to pass over it without engagement.

A modified form of the instant gate crossing apparatus is shown in FIGURE 9, wherein a modified base panel **112** is provided with an inclined track section **114** which leads to a pair of elongated, parallel and upwardly extending rack members **116** which extend across the base panel **12** on both sides of the upstanding abutment **130** in the arcuate slot **132** of the base panel. Each of the rack members **116** is provided with teeth **118** on the upper surface thereof which are engageable by complementary teeth on pinions **120** provided on the axle **122** for the vehicle wheels **124**. The vehicle wheels **124** may be self-propelled in any suitable manner, such as by a friction wheel **126** in engagement with the outer periphery of one of the wheels **124**, the friction wheel **126** being driven in any suitable manner.

In the operation of the modified vehicle and base panel construction shown in FIGURE 9, the vehicle is supported on its wheels **124** until it approaches the rack members **116** on the base panel **112**. As the vehicle reaches the rack members **116**, the upwardly inclined track section **114** on the panel **112** elevates the axle **122** to engage the pinions **120** with the teeth **118** on the rack members **116**. Thereafter, the driving of the vehicle through the reduced diameter pinions **120** effects a gear reduction which retards the forward travel of the vehicle and enables it to be driven forwardly with a greater force as it engages the gate-operating abutment **130** to open the gate. This gear reduction is advantageous in that it enables the vehicle to travel at a substantially constant speed, without being materially slowed in its forward progress, when it engages the abutment **130** for operating the crossing gate. This general type of vehicle gear reduction mechanism is shown and described in the above-identified United States Patent application, Ser. No. 470,148, now Patent No. 3,337,985.

While the foregoing description has been directed to the operation of a crossing gate in response to movement of a vehicle along a predetermined path, it is noted that any other suitable type of vehicle or track accessory could be operated in the manner described above, without departing from the spirit and scope of the present invention. It is to be understood, therefore, that the use of the terms "gate" or "crossing gate" herein is to be construed as including all other suitable types of similar accessories.

It is thought that the invention and many of its attendant advantages will be understood from the foregoing description, and it will be apparent that various changes may be made in the form, construction and arrangement of the parts without departing from the spirit and scope of the invention or sacrificing all of its material advantages,

the forms hereinbefore described being merely preferred embodiments thereof.

What is claimed is:

1. Apparatus for operating a crossing gate in response to movement of a toy vehicle in a predetermined direction, comprising:

movable supporting means for said gate which is so constructed as to normally maintain said gate in a closed position,

first movable abutment means, mounted for movement in the direction of vehicle movement and disposed in the path of said vehicle and being engageable and movable by said vehicle when it is moving in said predetermined direction and approaching said gate, and

gate actuating means connected to said abutment means and being engageable with said supporting means for moving it to a position wherein said gate is disposed in open position when said abutment means is moved by said vehicle in said predetermined direction,

and means for moving said abutment downwardly out of the path of said vehicle in response to its movement in said predetermined direction.

2. The apparatus of claim 1, further comprising means for latching said gate in open position and second movable abutment means disposed adjacent said crossing and being engageable by a vehicle passing said crossing, said second abutment means being operatively connected to said latching means to release the same when it is engaged by a vehicle.

3. The apparatus of claim 1, further comprising a base on which said gate supporting means is pivotally mounted for movement between upper and lower positions, said base having track means for guiding said vehicle thereon.

4. The apparatus of claim 3 wherein said base comprises an elongated slot extending in substantially the same direction as said track means and in which said first abutment means is mounted for movement between a first position adjacent one end of said slot, wherein it is engageable by an approaching vehicle, and a second position adjacent the other end of said slot, wherein it is not engageable by said vehicle, said other end of said slot being disposed nearer said gate than said one end thereof.

5. The apparatus of claim 4 wherein said gate actuating means comprises an actuating frame pivotally mounted on said base and connected to said first abutment means, said actuating frame comprising a member that is engageable with said gate supporting means to elevate said gate when said first abutment means is moved to said second position, and wherein resilient biasing means is provided on said base in engagement with said actuating frame for urging it to a position wherein said member is out of engagement with said gate supporting means and said first abutment means is in said first position.

6. The apparatus of claim 5 wherein locking means is movably mounted on said base for engaging said actuating frame and locking it in a gate elevating position against the force of said resilient means when said first abutment means is moved to said second position by said vehicle.

7. The apparatus of claim 6 wherein second movable abutment means is mounted on said base adjacent said crossing, said second abutment means being connected to said locking means and being engageable by a vehicle passing said crossing to move said locking means out of locking engagement with said actuating frame, thereby enabling said resilient means to return said actuating frame to said position wherein said member is out of engagement with said gate supporting means and the latter is movable to close said gate.

8. Apparatus for operating a movable crossing gate in response to movement of a toy vehicle in a predetermined direction, comprising:

means movable about a first axis for supporting said gate in upper and lower positions relative to the path of said vehicle, said supporting means being normally maintained in a position wherein said gate is in said lower position under the force of gravity,

said gate being movably mounted on a portion of said supporting means for movement about a second axis extending generally vertically when said gate is in said lower position, said gate and said supporting means portion having cooperable means normally urging said gate to a position wherein it extends across the path of said vehicle under the force of gravity but being horizontally swingable about said second axis, in response to engagement thereof by a vehicle, to a position laterally of the path of movement of said vehicle,

movable abutment means disposed in the path of said vehicle and being engageable by said vehicle when it is moving in said predetermined direction and approaching said gate, and

gate actuating means connected to said abutment means and being engageable with said supporting means for moving it about said first axis to elevate said gate when said abutment means is moved by said vehicle travelling in said predetermined direction.

9. The apparatus of claim 8 wherein said supporting means comprises a frame pivotally mounted for movement about said first axis, and wherein said gate is pivotally mounted on said frame for movement about said second axis.

10. The apparatus of claim 9 wherein said gate and said frame have abutting complementary camming surfaces that serve to enable said gate to be pivotally biased about said second axis under the force of gravity to said position on said frame wherein it extends across said vehicle path.

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LOUIS G. MANCENE, *Primary Examiner.*

C. R. WENTZEL, *Assistant Examiner.*