Oct. 31, 1950 J. W. LOGAN, JR, ET AL 2,528,064

RAILWAY DRAWBRIDGE CIRCUIT CONTROLLER

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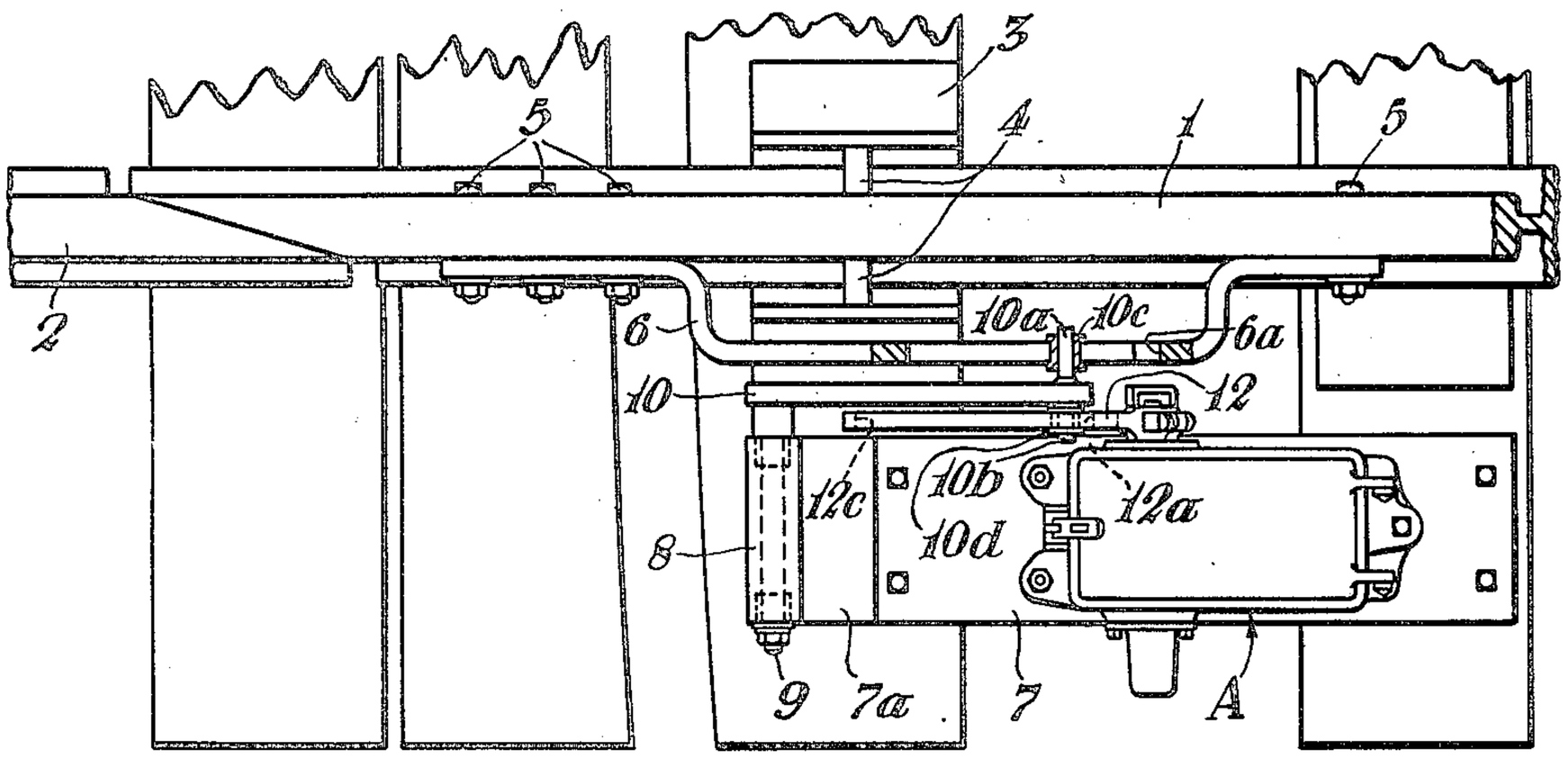

Fig. 1.

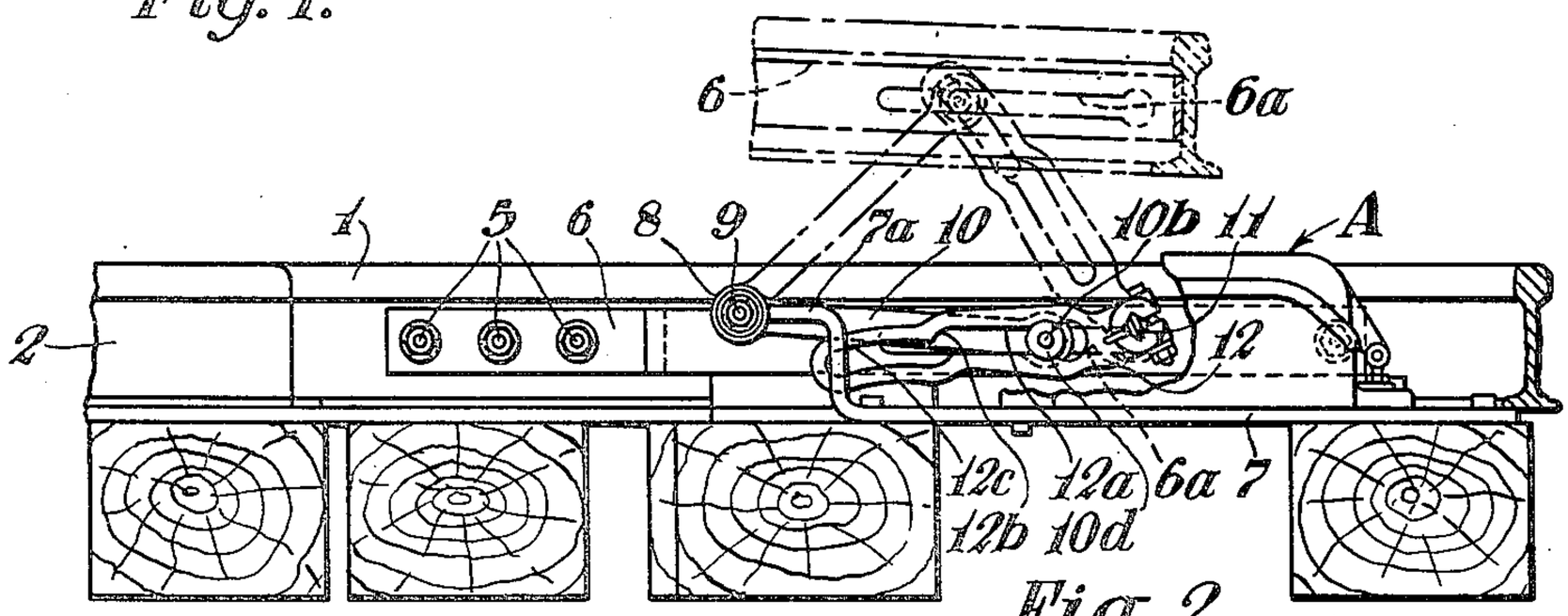

Fig. 2.

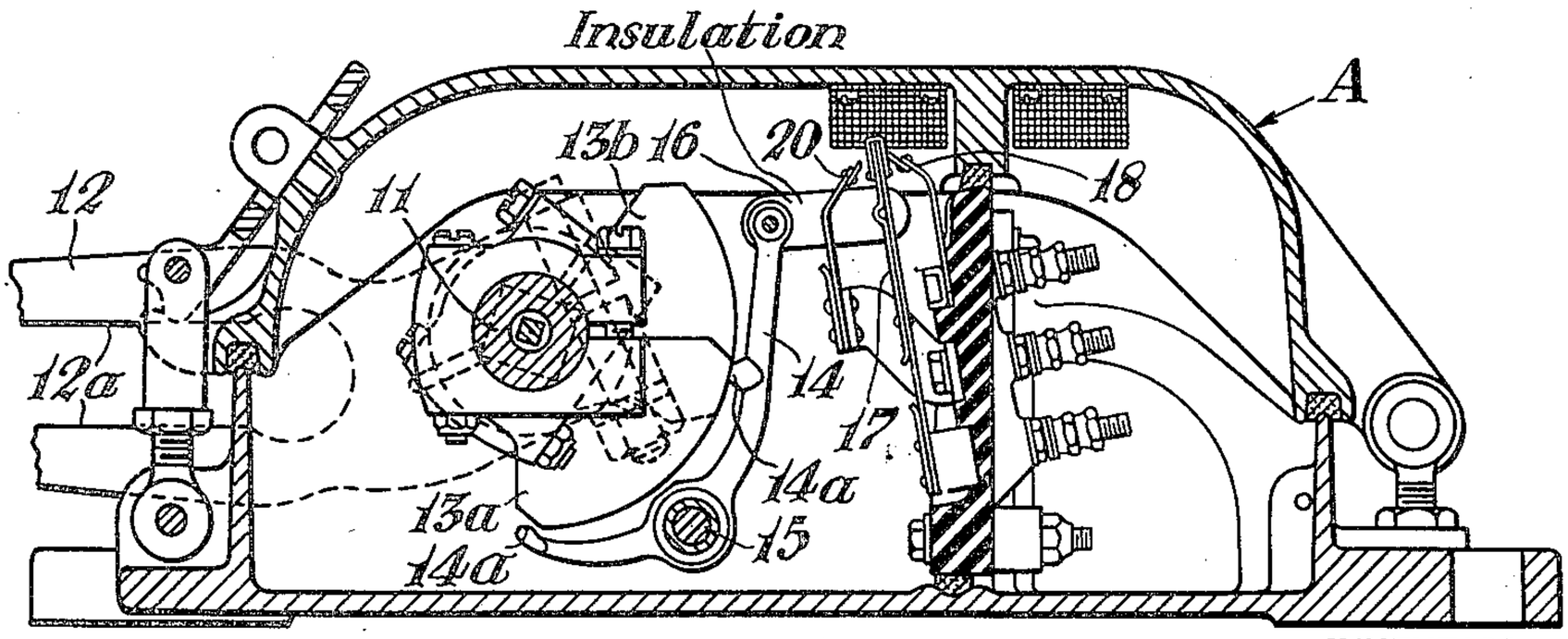

Fig. 3.

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RAILWAY DRAWBRIDGE CIRCUIT CONTROLLER

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9 Claims. (Cl. 246—118)

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Our invention relates to control apparatus, and especially to control apparatus to be operated in response to the position of a movable member.

Our invention is illustrated herein as applied to an electric circuit controller operated in response to the position of the lift rail of a railway drawbridge. While certain features of our invention are of especial utility in connection with such apparatus, other features may be used in connection with control apparatus generally.

The rail connections between the movable span and the fixed spans on a railway drawbridge are commonly made by providing lift rails on the end of one of each pair of adjacent span ends. Each lift rail has a normal or down position in which it abuts the fixed rail on the end of the adjacent span, and in which it can carry railway traffic. It is liftable from its down position to an up position in which it clears the fixed rail and the other parts of the bridge sufficiently to permit opening of the draw. The lift rail is usually arranged to have a substantial range of overtravel beyond the up position. As long as the lift rail is in the up position or in the overtravel range, it will clear the bridge structure when the draw is opened.

Signals are commonly provided to inform operators of approaching trains whether or not it is safe to proceed across the draw. It is desirable to have these signals controlled by electrical contacts which are closed only when the lift rails are in the down position. Other signals may be provided for the drawbridge operator to inform him when the rails have been lifted sufficiently so that it is safe to swing the draw open. It is desirable to have these signals controlled by contacts which are closed only when the lift rails have reached their up position or moved upwardly beyond them.

It is therefore an object of our invention to provide improved apparatus for operating an electric circuit controller in accordance with the position of the lift rail of a railway drawbridge.

Another object is to provide improved control apparatus of the type shown in the copending application of Herbert L. Bone and William C. McWhirter, Serial No. 30,535, filed June 2, 1948, for Control Apparatus, and in the copending application of Glen V. Jefferson, Serial No. 47,101, filed August 31, 1948, for Control Apparatus.

Another object is to provide improved apparatus for operating a control device in accordance with the position of a movable element.

A further object is to provide control apparatus for use in connection with the lift rail of a railway drawbridge and mounted on the ties so that its entire mechanism is above the ties.

A further object is to provide improved control apparatus of the type described which is more compact than similar devices of the prior

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art and which is arranged to reduce friction between the several moving parts.

We accomplish the foregoing and other objects of our invention by attaching to the lift rail a bracket having a portion which is spaced from and parallel to the lift rail and provided with a horizontal slot. A guide arm is pivotally mounted on the ties adjacent the lift rail for rotation about an axis extending perpendicular to the lift rail. This guide arm lies between the bracket just described and a normally parallel crank arm on an electric circuit controller of the type described in the copending application of Herbert L. Bone and Glen V. Jefferson, Serial No. 1,955, filed January 13, 1948, for Control Apparatus. The guide arm carries at its end a pair of oppositely projecting pins. One of these pins extends into the horizontal slot on the bracket attached to the lift rail. The other pin extends into a cam slot formed in the crank arm of the circuit controller. The portion of the cam slot nearest the operating shaft of the circuit controller is designed to be horizontal when the lift rail is in its down position. Since the cam slot is horizontal and the initial movement of the pin is vertical, the circuit controller is very sensitive to movements of the lift rail away from its down position. This sensitivity is increased by arranging the parts so that the pin is near the axis of the controller crank arm when the lift rail is down. The outer end of this straight portion of the cam slot terminates in a steeply curved portion which is provided to cause a rapid movement of the circuit controller arm when the lift rail reaches its up position. Beyond this steeply curved portion, the cam slot has another curved portion, designed to be concentric with the axis of rotation of the guide arm when the circuit controller crank arm reaches its position corresponding to the up position of the lift rail. This latter portion of the cam slot permits overtravel of the lift rail without changing the position of the circuit controller operating arm.

Other objects and characteristic features of our invention will become apparent as the description proceeds.

We shall illustrate and describe herein one embodiment of our invention, and shall then point out the novel features thereof in claims.

In the accompanying drawings, Fig. 1 is a plan view of a fragment of a railway drawbridge, showing the adjacent ends of a fixed rail and a lift rail, with our invention applied to the lift rail. Fig. 2 is an elevational view of the rails and circuit controller structure shown in Fig. 1, with certain parts broken away to permit better illustration of the invention. Fig. 3 is a sectional view of a circuit controller which may be used in the control apparatus of Figs. 1 and 2.

There is shown in the drawings a lift rail 1 which cooperates with a fixed rail 2. The lift rail

1 is shown in its down position in Fig. 1 and in full lines in Fig. 2. It is shown in its up position in dotted lines in Fig. 2. When the lift rail is down, it is received in a rail chair 3. Spacer pads 4 are attached to the web of the rail 1 and are contoured to guide the lift rail 1 in its movement into the rail chair 3. Bolts 5 hold the ends of a generally U-shaped bracket 6 on the rail 1. The center portion of bracket 6 is offset and parallel to the rail 1, and is provided with a horizontal slot 6*a*.

Attached to the ties alongside the lift rail 1 is a mounting plate 7. Bolted on the plate 7 is a circuit controller generally indicated at A, which may be of the type shown in the copending Bone and Jefferson application previously referred to.

One end of the plate 7 is offset upwardly, as at 7*a* (Fig. 2). A sleeve 8 is welded or otherwise suitably attached to the offset portion 7*a* of the plate 7, and serves as a journal for a shaft 9 which carries a guide arm 10. The free end of guide arm 10 supports oppositely disposed pins 10*a* and 10*b* carrying rollers 10*c* and 10*d*, respectively. The pin 10*a* is received in and cooperates with the slot 6*a* in the bracket 6 attached to lift rail 1. One end of slot 6*a* is enlarged to receive roller 10*c* during assembly.

The circuit controller A is provided with an operating shaft 11 on which is mounted a crank arm 12. The crank arm 12 is provided with a cam slot 12*a*—12*b*—12*c* which cooperates with and receives the pin 10*b* on the guide arm 10.

The portion 12*a* of the cam slot nearest the shaft 11 of the circuit controller 8 is straight and is designed to be horizontal when the lift rail 1 is in its down position.

The shaft 9 which carries the guide arm 10 is rigidly mounted at a fixed distance from the axis of crank arm 12. The guide arm 10 is made almost as long as that fixed distance so that pin 10*b* is near the axis of crank arm 12 when the lift rail is adjacent its down position. Also, the path of motion of pin 10*b* is at such times substantially at right angles to the portion of cam slot 12*c* which it engages. This construction produces a relatively large movement of the crank arm 12 for a given movement of the lift rail, and thereby makes the controller very sensitive when it is checking the down position of the lift rail. This sensitivity is highly desirable, since it is essential, for reasons of safety, that the lift rail be completely down in its traffic-carrying position whenever the circuit controller position indicates that it is down. This is the most critical position of the lift rail, and hence the sensitivity of the circuit controller must be maximum at this position, as it is in the construction shown.

As the lift rail moves upwardly, the bracket 6 carries pin 10*a* upwardly with it, thereby rotating the guide arm 10 on its shaft 9, and carrying pin 10*b* and the crank arm 12 upwardly also. During this movement, the guide arm 10 rotates counterclockwise and the crank arm 12 rotates clockwise. Pin 10*b* moves toward the outer end of the cam slot.

As the pin 10*b* moves toward the outer end of the cam slot, the increment of motion of the crank arm 12 for each increment of motion of the guide arm 10 becomes progressively less, until, when pin 10*b* nears the end of the straight portion 12*a* of the cam slot, the crank arm is almost tangential to the arc of travel of pin 10*b*, and hence is substantially at rest. This construction allows the lift rail to move through a relatively long distance between its down and up positions without much movement of the controller crank arm.

When the lift rail 1 reaches its up position, the pin 10*b* reaches the end of the straight portion 12*a* of the cam slot and moves into the steeply curved portion 12*b*, which causes a substantial counterclockwise movement of crank arm 12. This up position of the lift rail 1 is the position at which it sufficiently clears the fixed rail and the other parts of the drawbridge to permit opening of the swing span of the draw. The steeply curved portion 12*b* of the cam slot insures operation of the controller when the lift rail reaches its up position, and may be contoured as required to make the circuit controller sufficiently sensitive to movements of the lift rail adjacent its up position. This position of the lift rail is not nearly as critical from the safety standpoint as the down position, and hence the sensitivity of the circuit controller need not be as great.

The mechanism for operating the lift rail usually includes provision for overtravel of the lift rail beyond its up position. The portion 12*c* of the cam slot is provided to accommodate this movement. Portion 12*c* is arcuate and is arranged to be concentric with the guide arm 10 when the lift rail is in its up position. Therefore, as soon as the lift rail reaches its up position, the pin 10*b* enters the arcuate portion 12*b* of the cam slot. As long as the pin 10*b* remains in the arcuate portion 12*b*, its continued upward movement rotates guide arm 10, but causes no rotation of the crank arm 12 or of the circuit controller shaft 11.

The horizontal slot 6*a* in the bracket 6 permits expansion and contraction of the lift rail 1 without causing operation of the circuit controller, and also accommodates lateral movement of pin 10*a* due to its circular path of movement.

The circuit controller A includes two cams 13*a* and two cams 13*b*, only one each of which appears in Fig. 3. These cams are carried by the shaft 11 and operate rocker arms 14 pivoted on a rockshaft 15 and carrying followers 14*a* which cooperate with the cams. One end of each rocker arm 14 is connected through a link 16 to a movable contact 17. Each contact 17 engages a stationary contact 18, and is movable away from its contact 18 and into engagement with a stationary contact 20.

The contacts 17 operated by the cams 13*a* are connected in the circuits of the signals which control the railway traffic moving across the drawbridge. When these contacts 17 engage their associated contacts 18, the signals are controlled to permit traffic movement over the bridge. When these contacts 17 engage their associated contacts 20, the signals are controlled to prevent traffic movement over the bridge.

The contacts 17 operated by the cams 13*b* are connected in the circuits of the signals which indicate to the swing bridge operator whether or not it is safe to operate the swinging mechanism. When these contacts 17 engage their associated contacts 18, these signals indicate that the lift rail is in a position where it will not clear the other parts of the bridge structure if the swing span is moved. When these contacts 17 engage their associated contacts 20, the signals indicate that the lift rail has reached its up position and that it is safe to move the swing span.

Any suitable signal controlling circuits may be used in connection with our invention. The particular contact arrangement described herein

is preferred, but other equivalent contact arrangements may be used with equal facility.

Operation

The parts of the circuit controller are illustrated in Fig. 3 in their positions corresponding to the down position of the lift rail 2, which is shown in full lines in Fig. 2. When the lift rail begins to move upwardly from that position, the arm 12 moves rapidly because the projection 10*b* engages slot 12*a* near the axis of rotation of crank arm 12 and is moving at right angles to the slot. The consequent rotation of cams 13*a* moves their contacts 17 quickly away from their contacts 18 and into engagement with contacts 20. As the rail continues to move upwardly, the rate of movement of cam 13 is slowed as compared to the rate of movement of the rail, because the pin 10*b* moves outwardly along the slot 12*a*. The parts are so proportioned that the cams 13*b* do not move their contacts 17 away from their contacts 18 and into engagement with their contacts 20 until the rail reaches its up position and pin 10*b* enters the steeply curved portion 12*b* of the cam slot.

The circuit controller 8 is provided with a torsion spring which biases the shaft 11 toward an intermediate position. This springs loads the crank arm 12, and thereby the guide arm 10 and so yieldably holds the pins 10*a* and 10*b* and rollers 10*c* and 10*d* against the upper sides of their respective slots. This prevents rattling of the pins in their slots due to vibration, and materially reduces the wear which otherwise might take place between the various moving parts.

The details of construction of the circuit controller A are set forth only briefly herein. For a more complete description, reference is made to the copending Bone and Jefferson application, Serial No. 1,955, previously mentioned.

It should be noted that all the parts of the control apparatus shown are mounted on the ties and do not require the cutting of any tie for the installation on an existing drawbridge.

Although we have herein shown and described only one embodiment of our invention, it is understood that various changes and modifications may be made therein within the scope of the appended claims without departing from the spirit and scope of our invention.

Having thus described our invention, what we claim is:

1. Control apparatus to be operated in accordance with the position of the lift rail of a railway drawbridge, comprising an electric circuit controller, a first member connected to the lift rail for concurrent movement therewith, a second member connected to the circuit controller for concurrent movement therewith, a third member supported at one end on a fixed pivot and positioned between said first and second members, a first connection between said third and first members which moves the third member as the first member moves vertically but which permits independent horizontal movement of the first member relative to said third member, and a second connection between the third and second members which causes the second member to move and operate the circuit controller as said third member moves.

2. Control apparatus to be operated in accordance with the position of the lift rail of a railway drawbridge, comprising an electric circuit controller, a first member connected to the lift rail for concurrent movement therewith, a second member connected to the circuit controller for concurrent movement therewith, a third member guided for movement along a fixed path and positioned between said first and second members, said third member having projections extending from its opposite sides to engage said first and second members, said first member having a horizontal slot which receives one of said projections and cooperates therewith to move the third member as the first member moves vertically but which permits independent horizontal movement of the first member relative to said third member, said second member having a cam slot which receives the other projection and cooperates therewith to move and operate the circuit controller as said third member moves.

3. Control apparatus to be operated in accordance with the position of the lift rail of a railway drawbridge, comprising an electric circuit controller, a first member connected to the lift rail for concurrent movement therewith, a second member connected to the circuit controller for concurrent movement therewith, a third member supported at one end on a fixed pivot and positioned between said first and second members, said third member having projections extending from its opposite sides to engage said first and second members, said first member having a horizontal slot which receives one of said projections and cooperates therewith to move the third member as the first member moves vertically but which permits independent horizontal movement of the first member relative to said third member, said second member having a cam slot which receives the other projection and cooperates therewith to move and operate the circuit controller as said third member moves.

4. Control apparatus to be operated in accordance with the position of the lift rail of a railway drawbridge, said lift rail being movable between a down position wherein it can carry railway traffic and an up position wherein it clears the other parts of the bridge sufficiently to permit opening of the draw, comprising an electric circuit controller, a first member connected to the lift rail for concurrent movement therewith, a second member connected to the circuit controller for concurrent movement therewith, and a third member extending between the first and second members, said second and third members being pivoted for rotation about spaced parallel axes, said third member having projections extending oppositely from its free end to engage said first and second members, said first member having a horizontal slot which receives one of said projections and cooperates therewith to move the third member as the first member moves vertically and to permit independent horizontal movement of the first member relative to said third member, said second member having a cam slot which receives the other projection and cooperates therewith to move and operate the circuit controller as said third member moves, said second and third members lying substantially parallel to each other when the lift rail is in its down position so that said other projection engages said cam slot near the axis of rotation of said second member and causes a substantial movement of the circuit controller in response to a small movement of the lift rail from its down position.

5. Control apparatus to be operated in accordance with the position of the lift rail of a railway drawbridge, said lift rail being movable between a down position wherein it can carry rail-

way traffic and an up position wherein it clears the other parts of the bridge sufficiently to permit opening of the draw, comprisiing an electric circuit controller, a first member connected to the lift rail for concurrent movement therewith, a second member connected to the circuit controller for concurrent movement therewith, and a third member extending between the first and second members, said second and third members being pivoted for rotation about spaced parallel axes, said third member having projections extending oppositely from its free end to engage said first and second members, said first member having a horizontal slot which receives one of said projections and cooperates therewith to move the third member as the first member moves vertically and to permit independent horizontal movement of the first member relative to said third member, said second member having a cam slot which receives the other projection and cooperates therewith to move and operate the circuit controller as said third member moves, said second and third members lying substantially parallel to each other when the lift rail is in its down position so that said other projection engages said cam slot near the axis of rotation of said second member and causes a substantial movement of the circuit controller in response to a small movement of the lift rail from its down position, said cam slot having a portion contoured to provide a substantial movement of the circuit controller as the lift rail reaches its up position.

6. Control apparatus to be operated in accordance with the position of the lift rail of a railway drawbridge, said lift rail being movable between a down position wherein it can carry railway traffic and an up position wherein it clears the other parts of the bridge sufficiently to permit opening of the draw, comprising an electric circuit controller, a first member connected to the lift rail for concurrent movement therewith, a second member connected to the circuit controller for concurrent movement therewith, and a third member extending between the first and second members, said second and third members being pivoted for rotation about spaced parallel axes, said third member having projections extending oppositely from its free end to engage said first and second members, said first member having a horizontal slot which receives one of said projections and cooperates therewith to move the third member as the first member moves vertically and to permit independent horizontal movement of the first member relative to said third member, said second member having a cam slot which receives the other projection and cooperates therewith to move and operate the circuit controller as said third member moves, said second and third members lying substantially parallel to each other when the lift rail is in its down position so that said other projection engages said cam slot near the axis of rotation of said second member and causes a substantial movement of the circuit controller in response to a small movement of the lift rail from its down position, said cam slot having a portion contoured to provide a substantial movement of the circuit controller as the lift rail reaches its up position and an adjacent portion concentric with the axis of the third member when the lift rail is in its up position to provide substantially no movement of the circuit controller during overtravel of the lift rail beyond its up position.

7. Control apparatus to be operated in accordance with the position of the lift rail of a railway drawbridge, comprising an electric circuit controller, a first member connected to the lift rail for concurrent movement therewith, a second member connected to the circuit controller for concurrent movement therewith, a third member guided for movement along a fixed path and positioned between said first and second members, said third member having a projection extending toward said first member, said first member having a horizontal slot which receives said projection and cooperates therewith to move the third members as the first member moves vertically but which permits independent horizontal movement of the first member relative to said third member, and a connection between the third and second members which causes the second member to move and operate the circuit controller as said third member moves.

8. Control apparatus, comprising an element movable along a predetermined path but subject to lateral deviations therefrom, a control device to be operated in accordance with the position of said element along said path, a first member connected to the movable element for concurrent movement therewith, a second member connected to the control device for concurrent movement therewith, a third member supported at one end on a fixed pivot and positioned between said first and second members, said third member having projections extending from its opposite sides to engage said first and second members, said first member having a slot extending laterally with respect to the path of movement of said element, said slot receiving one of said projections and cooperating therewith to move the third member as the element moves along its path while permitting independent lateral movement of the element relative to said third member, said second member having a cam slot which receives the other projection and cooperates therewith to move and operate the control device as said third member moves.

9. Control apparatus to be operated in accordance with the position of the lift rail of a railway drawbridge, comprising an electric circuit controller mounted on and above the ties alongside the lift rail, a first member connected to the lift rail for concurrent movement therewith, a second member connected to the circuit controller for concurrent movement therewith, a third member mounted on and above the ties between said first and second members and guided for movement along a fixed path, a connection between said third and first members which causes the third member to move along said fixed path as the first member moves vertically, and a second connection between the third and second members which causes the second member to move and operate the circuit controller as said third member moves along said path.

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GLEN V. JEFFERSON.

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The following references are of record in the file of this patent:

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