Oct. 8, 1946. R. M. SNYDER 2,409,074

DRAWBRIDGE INTERLOCKING

Filed July 18, 1944 3 Sheets-Sheet 1

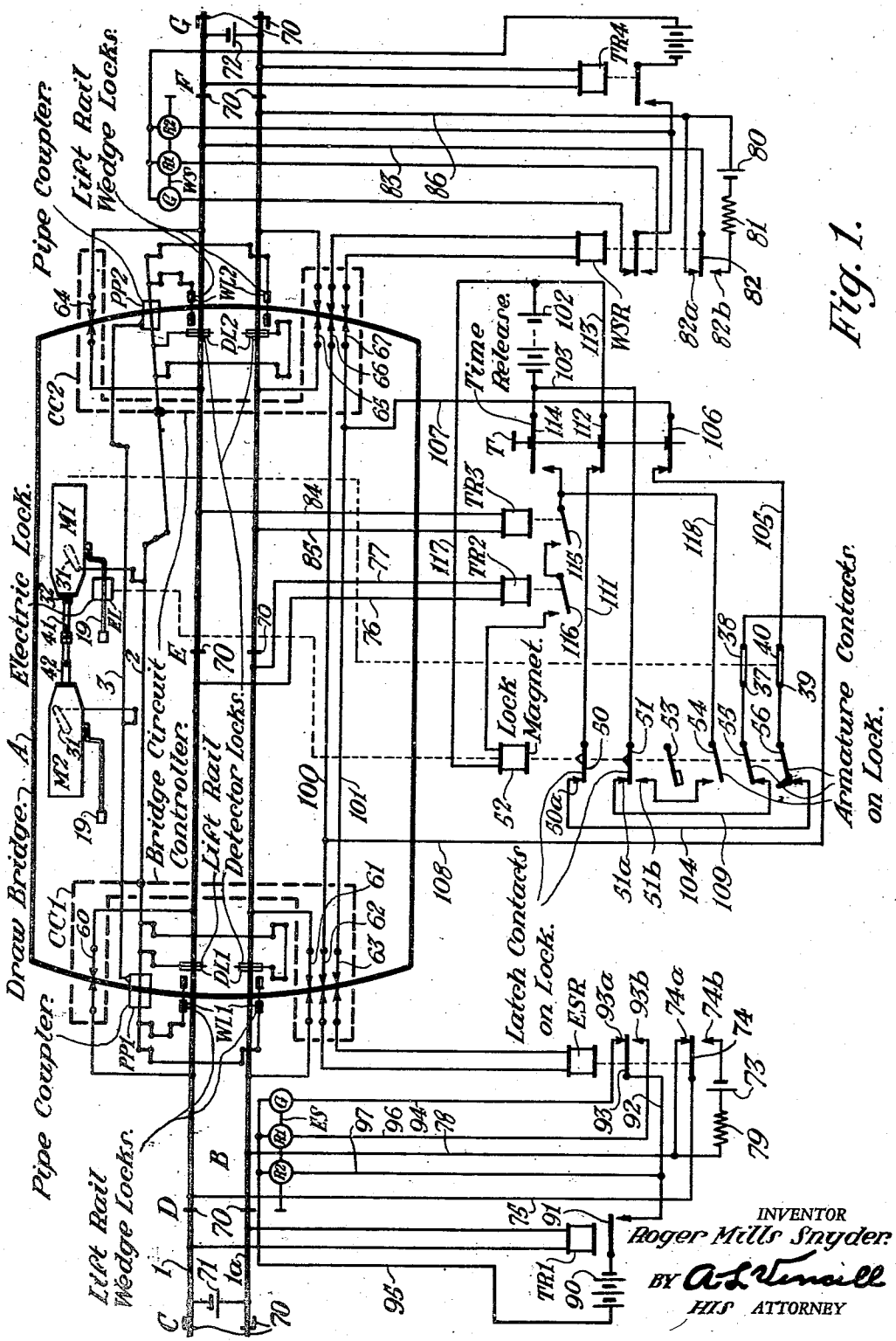


Fig. 1.

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DRAWBRIDGE INTERLOCKING

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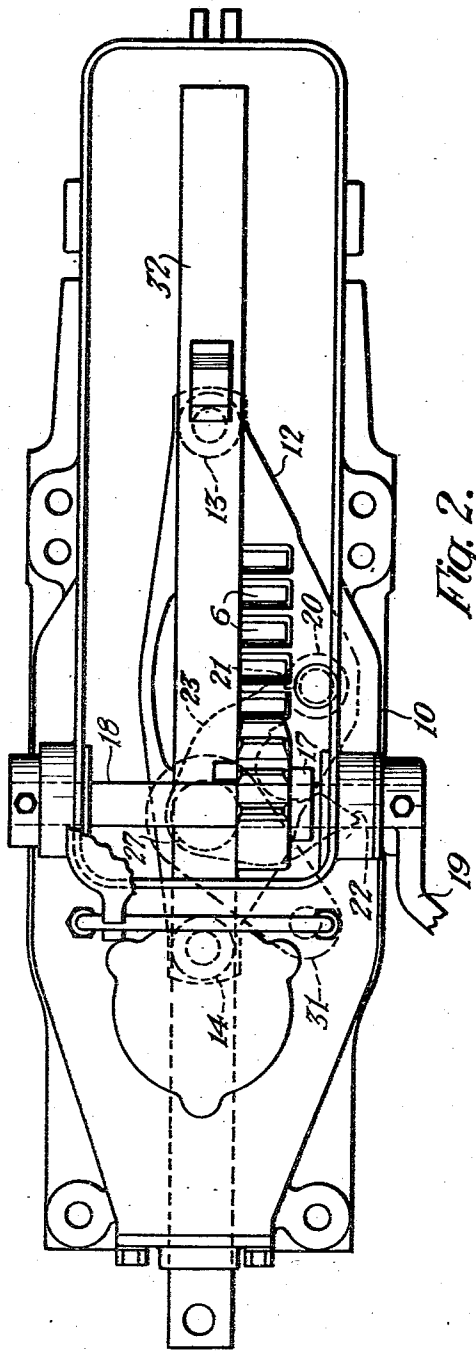


Fig. 2.

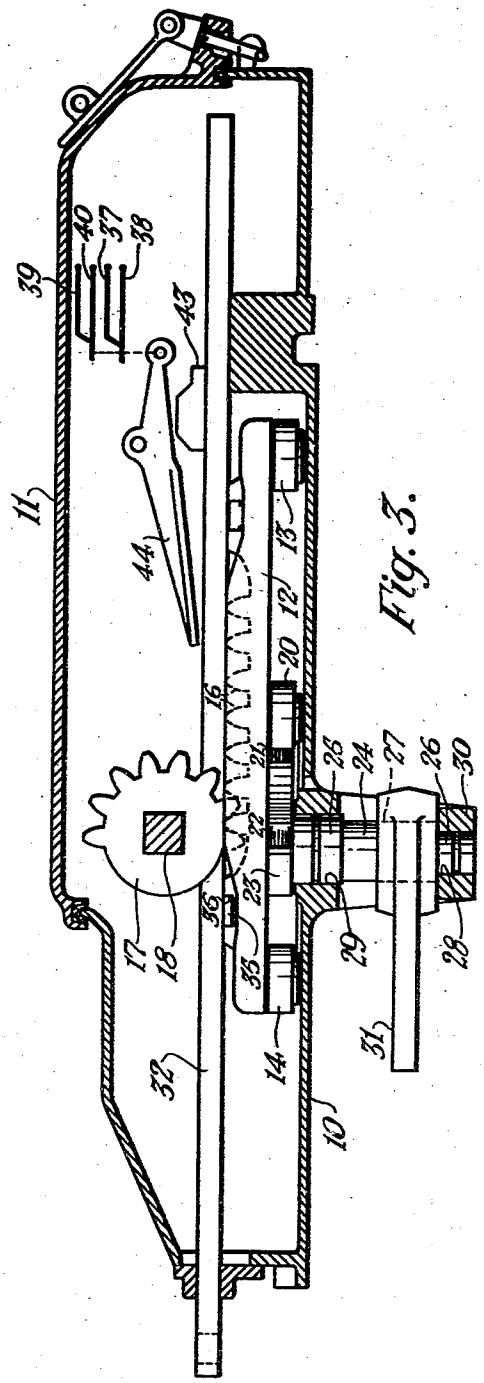


Fig. 3.

INVENTOR
Roger Mills Snyder.

BY A. L. Vensill

HIS ATTORNEY

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DRAWBRIDGE INTERLOCKING

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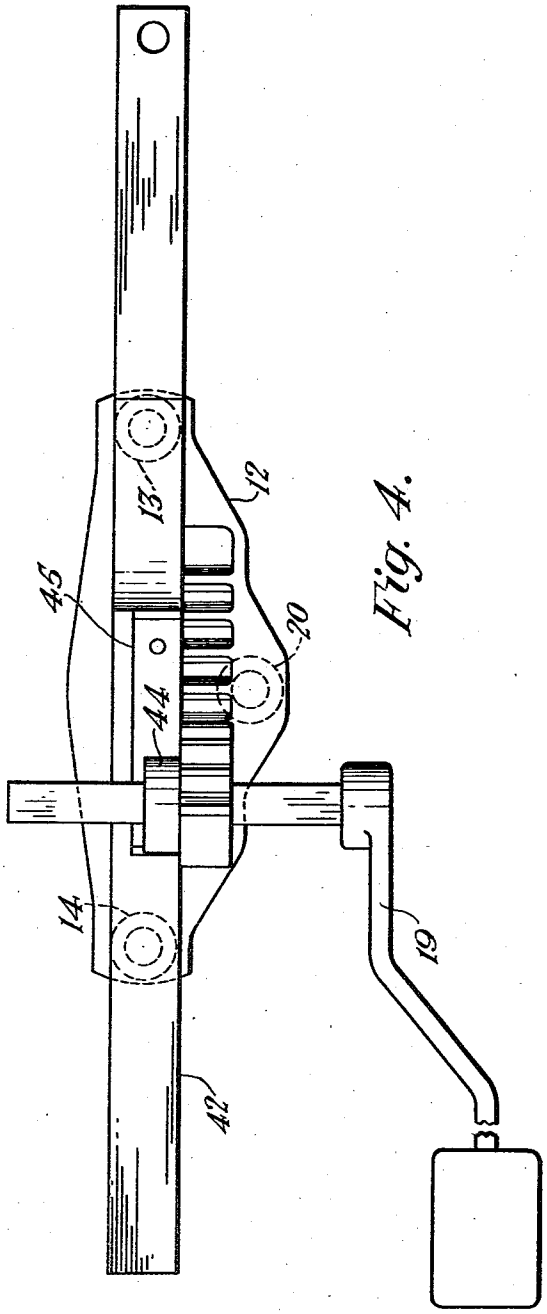


Fig. 4.

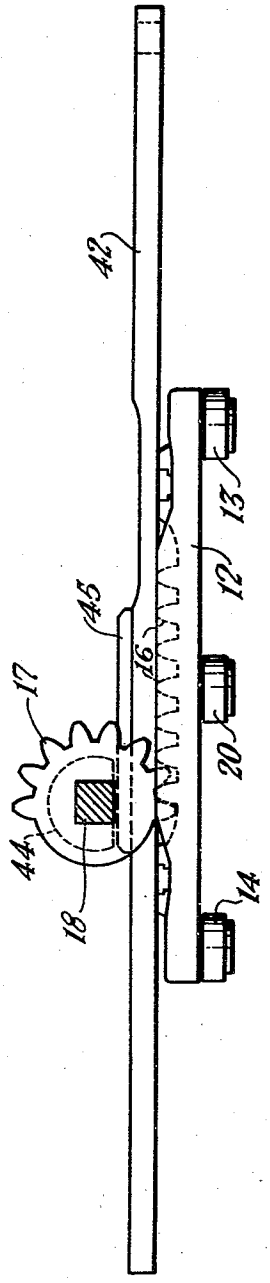


Fig. 5.

INVENTOR
Roger Mills Snyder.
BY A. L. Snell
HIS ATTORNEY

Patented Oct. 8, 1946

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UNITED STATES PATENT OFFICE

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DRAWBRIDGE INTERLOCKING

Roger Mills Snyder, Norfolk County, Va., assignor to The Union Switch and Signal Company, Swissvale, Pa., a corporation of Pennsylvania

Application July 18, 1944, Serial No. 545,523

6 Claims. (Cl. 246—118)

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My invention relates to an electromechanical drawbridge interlocking.

One object of my invention is to provide an interlocking of the type described employing a two wire control circuit which affords signal indication locking, time interval approach locking, and detector locking.

According to my invention, the drawbridge is provided with two pipe lines one of which operates the usual lift rail detector and wedge locks and the usual bridge circuit controller and the other of which operates a bridge coupler which opens and closes the first mentioned pipe line where it crosses the ends of the bridge. The said pipe lines, in turn, are operated by two pipe line operating mechanisms which are mechanically interlocked so that it is necessary to actuate the two mechanisms in a predetermined sequence. One of the mechanisms is also locked by an electric lock which must be energized before the mechanism can be operated, and which lock is provided with the usual latch and armature contacts. A two wire control circuit extends across the bridge through contacts on the bridge circuit controller at each end of the bridge, and is connected at each end of the bridge with a signal control relay which controls an associated signal governing the entrance of traffic onto the bridge. The energy for the control circuit is supplied thereto over latch and armature contacts of the electric lock, over contacts of a circuit controller provided on said one pipe line operating mechanism, and over the normally closed contacts of a time release mechanism in such manner that the signal control relays will only become energized when the bridge is properly locked for traffic over it. The track rails on the bridge are divided by means of insulated joints to form two detector track sections which extend for some distance on opposite sides of the bridge, and each track section is provided with a track circuit including a track relay and contacts of the bridge circuit controller at the corresponding end of the bridge. The supply of energy to each track circuit is controlled by the signal control relay at the contiguous end of the bridge, the control being such that the track relay will only become energized when the associated signal control relay is deenergized. The electric lock is provided with a pick-up circuit including front contacts of the two track relays and a contact of the time release which time release contact becomes closed for a brief interval of time a predetermined time after the release is set into operation, and a stick circuit

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which maintains the lock energized after it once becomes energized until the latch of the lock is restored to its normal latched condition. The bridge signals may be approach controlled in accordance with well known practice.

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

I shall describe one form of drawbridge interlocking embodying my invention, and shall then point out the novel features thereof in claims.

In the accompanying drawings, Fig. 1 is a diagrammatic view showing a drawbridge provided with one form of interlocking embodying my invention. Fig. 2 is an enlarged top plan view with cover removed of the pipe line operating mechanism M1 forming part of the interlocking apparatus of the interlocking shown in Fig. 1. Fig. 3 is a vertical longitudinal sectional view of the mechanism shown in Fig. 2. Figs. 4 and 5 are fragmentary top plan and vertical sectional views of the pipe line operating mechanism M2 forming part of the interlocking apparatus of the interlocking shown in Fig. 1.

Referring first to Fig. 1, the reference character A designates a drawbridge over which the rails 1 and 1a of a stretch B of railway track extend. The drawbridge A may be of any desired type but as shown it is of the well known horizontal swing type, and it is provided at each end with the customary lift rail wedge and detector locks to insure proper alignment of the track rails on the bridge with those on the bridge abutments when the bridge is in condition for the passage of trains over it, the rail wedge locks being designated WL1 and WL2, respectively, and the rail detector locks being designated DL1 and DL2, respectively. The various locks are all operated by means of a first pipe line 2, which pipe line, in turn, is operated by a first pipe line operating mechanism M1 located on the bridge span. The portion of the pipe line 2 which operates the lift rail wedge lock at each end of the bridge is carried across the end of the bridge to the bridge abutments, and the connections between the pipes of the pipe line 2 on the bridge and those in the roadbed are made by means of the usual pipe couplers PP1 and PP2, one form of which is shown in Letters Patent of the United States No. 393,557, granted to J. T. Hambay on November 27, 1888. The pipe couplers PP1 and PP2 are operated by means of a second pipe line 3 connected to a second pipe line operating mechanism M2. The two pipe line operating mechanisms M1 and M2 are

similar, and are mechanically interlocked to insure a predetermined sequence of operation between them as will be made clear presently.

Referring now to Figs. 2 and 3, the pipe line operating mechanism M1 in the form here shown comprises a suitable casing 10 which encloses the operating parts of the mechanism, and which is closed at its upper end by a removable cover 11. Located within the casing 10 is a motion plate 12 which is guided to slide longitudinally of the casing 10 by means of guide rollers 13 and 14 secured to the underside of the motion plate adjacent its opposite ends and cooperating with a guideway not shown provided in the bottom wall of the casing. The motion plate 12 has rack teeth 16 formed in its upper surface on one side of the center line. These rack teeth mesh with a segment gear 17 mounted on a square shaft 18, which shaft, in turn, is mounted adjacent its ends in suitable bearings provided in the opposite side walls of the casing 10. Secured to the outer end of the shaft 18 is a hand throw lever 19 which serves as a means for reciprocating the motion plate between its two extreme positions.

A roller 20 is secured to the underside of the motion plate 12 adjacent one side thereof at a point equally spaced from the rollers 13 and 14, and this latter roller cooperates with cam faces 21 and 22 formed on an escapement crank 23. The escapement crank 23 is formed integrally with the upper end of a vertical shaft 24, the shank of which is provided with two bearing surfaces 25 and 26 separated by a squared portion 27. The bearing surfaces are journaled in vertically aligned bearings 29 and 23 formed respectively in the bottom wall of the casing 10, and in a depending stirrup 30 provided on the underside of the casing, and mounted on the squared portion 27 of the shaft is an operating arm 31 which is operatively connected with the pipe line 2.

An interlocking bar 32 is slidably mounted in the casing 10 above the motion plate 12, and is operatively connected with the motion plate by means of a stud 35 secured to the lock bar and extending into a transversely disposed slot 36 formed in the upper side of the motion plate. The interlocking bar is intended to be operatively connected with the corresponding interlocking bar 42 of the mechanism M2 as will be made clear presently, and operates a plurality of contacts 37—38 and 39—40 through the medium of a cam 43 secured to the top of the bar and cooperating with a pivoted cam follower 44.

The operation of the mechanism M1 is as follows: When the hand throw lever 19 is rotated to its normal position in which it is shown in Figs. 1 and 2, the motion plate 12 is moved to its extreme right-hand or normal position in which it is shown in Fig. 2, and under these conditions the operating arm 31 is rotated to its clockwise extreme position by engagement of the roller 20 with the cam face 21 of the escapement crank 23. Furthermore, under these conditions the interlocking bar 32 is moved to its right-hand extreme position by engagement of the one wall of the slot 35 with the stud 36, and with the interlocking bar in this position the contacts 37—38 and 39—40 are operated to their closed positions.

If the hand throw lever is rotated from its normal position to its reverse position, the motion plate 12 will then be moved from its right-hand to its left-hand extreme position, and this movement will cause the roller 20 to engage the cam face 22 of the escapement crank 23 and rotate the escapement crank through an angle of substantially 90° in a counterclockwise direction to thereby rotate the arm 31 from its clockwise extreme position shown to a counterclockwise extreme position. The movement of the motion plate 12 to its left-hand extreme position will also cause the other wall of the slot 36 to engage the stud 35 on the interlocking bar 32 and move it to its left-hand extreme position, which latter movement, in turn, will cause the contacts 37—38 and 39—40 to become opened due to the engagement of the cam 43 with the cam follower 44.

Rotation of the hand throw lever 19 of the mechanism M1 from its reverse to its normal position will restore all parts of the mechanism M1 to the positions shown in a manner which will be obvious from an inspection of the drawings.

All parts of the mechanism M2 are similar to the corresponding parts of the mechanism M1 except the interlocking bar 42 which is of the type commonly referred to as the loose type. This interlocking bar is shown in detail in Figs. 4 and 5 from which it will be seen that the bar 42 is not provided with a driving stud or with a cam for operating circuit controller contacts, but is provided with an upstanding dog 45 which cooperates with a laterally projecting arcuate lug 44 provided on the side of the segment gear 17 to prevent rotation of the hand throw lever 19 of the mechanism M2 to or away from the extreme position shown except when the interlocking bar 42 is moved to the opposite extreme position from that in which it is shown in Figs. 4 and 5.

The two mechanisms M1 and M2 are mounted end for end on the bridge span in such positions that the two interlocking bars 32 and 42 are in alignment, and the two interlocking bars are operatively connected by an adjustable link 41 in such manner that movement of the bar 32 between its normal and reverse extreme positions will move the bar 42 between corresponding extreme positions. It will be apparent, therefore, that the mechanism M2 can only be operated away from its normal extreme position when the mechanism M1 is operated to its reverse extreme position and must be restored to its normal extreme position before the mechanism M1 can be restored to its normal extreme position, whereby a predetermined sequence of operation between the two mechanisms M1 and M2 is enforced by the interconnection of the lock bars of the two mechanisms and the cooperation of the arcuate lug 44 on the segment gear 17 of the mechanism M2 with the dog 45 on the interlocking bar 42. Since it is necessary to mount the mechanisms M1 and M2 facing in opposite directions in order to permit the two interlocking bars 32 and 42 to be connected in the manner described, and since it is desired to enable the two mechanisms to be operated as conveniently as possible the hand throw lever 19 of the mechanism M2 is assembled on the end of the shaft 18 opposite to the end of the shaft 18 on which the lever 19 of the mechanism M1 is assembled.

It will be obvious that rotation of the lever 19 of the mechanism M2 between its two extreme positions will rotate the operating arm 31 of the mechanism M2 between its two extreme positions, and the arm 31 of the mechanism M2 is operatively connected with the pipe line 3 in such manner that the pipe couplers PP1 and PP2 will function to connect the portion of the pipe line on the bridge with or disconnect it from the portion on the bridge abutments according as the hand throw lever 19 of the mechanism M2 oc-

cupies its normal position in which it is shown in Fig. 1 or its reverse position. The operating arm 31 of the mechanism M1 is operatively connected with the pipe line 2 in such manner that the wedge and detector locks will be operated to their locking or unlocking positions according as the lever 19 of this mechanism occupies its normal or its reverse position.

Associated with the hand throw lever 19 of the mechanism M1 is an electric lock EL which may have any suitable construction, but which as here shown is similar to that shown and described in detail in Letters Patent of the United States No. 1,126,834, granted on February 2, 1915, to W. P. Neubert and W. E. Smith for Electric switch locks. Since the lock EL is similar to that shown and described in the said Patent No. 1,126,834 it is believed to be sufficient for purposes of the present invention to point out that this lock includes a latch (not shown) corresponding to the latch 16 in the said patent, which latch is movable between two extreme positions and which is effective when in any position but its one extreme position to prevent movement of the hand throw lever 19 of the mechanism M1 away from the normal extreme position shown in Fig. 1. The latch is biased to an intermediate position, and is operatively connected with a handle by means of which the latch may be at times moved to its one extreme position. The latch is normally held in its other extreme position in opposition to its bias by means of a padlock (not shown), and is operatively connected with contacts 50—50*a* and 51—51*a* which are closed when the latch occupies its other extreme position but becomes opened as soon as the latch is moved away from its other extreme position, and with a contact 51—51*b* which is open when the latch occupies its other extreme position but becomes closed as soon as the latch is moved away from its other extreme position. The lock also includes an electromagnet 52 shown diagrammatically in Fig. 1. This electromagnet operates an armature 53 connected to a locking dog which cooperates with a locking segment connected to the latch. The locking dog and locking segment are not shown, but correspond respectively to the dog 27 and locking plate 25 in said Patent No. 1,126,834. The parts are so proportioned that the locking dog and locking segment are effective to prevent movement of the lever latch past its intermediate to its one extreme or unlocking position except when the armature 53 is attracted by energization of the electromagnet 52. When the armature 53 is attracted by energization of the electromagnet 52 it closes contact 54 and opens contacts 55 and 56.

It will be clear, therefore, that when the padlock is in place in the electric lock, as will normally be the case, the lock will act to prevent movement of the lever 19 of the mechanism M1 away from the position shown in Fig. 1, and that under these conditions the latch contacts 50—50*a* and 51—51*a* will be closed, and the latch contact 51—51*b* will be open. Furthermore, under these conditions the electromagnet 52 will normally be deenergized and the armature contact 54 will be open and the contacts 55 and 56 will be closed. When it is desired to operate the mechanism M1, the operator will first remove the padlock from the latch. The latch will thereupon move due to its bias to its intermediate position, and will thus cause contacts 50—50*a* and 51—51*a* to open and contact 51—51*b* to close. However, the hand throw lever 19 will still be prevented from moving away from the extreme position shown in Fig. 1 unless the magnet 52 is first energized and the latch handle is then operated. Assuming that this is done, contact 54 will become closed and contacts 55 and 56 will become opened as soon as the magnet becomes energized, and when the latch handle is operated the latch will be moved out of the path of movement of the lever 19 and the lever may therefore be moved to its reverse position. As soon as the lever is moved away from its normal position, the lever will function to retain the latch in its other or unlocking position through suitable means not shown until the lever is subsequently returned to its normal position, whereupon the biasing means will return the latch to its intermediate position. To restore the parts to the positions shown in Fig. 1 it is necessary to manually move the latch in opposition to its bias to its one extreme position and reinsert the padlock. When this is done all parts will then be in their normal positions.

The pipe line 2, in addition to being operatively connected with the lift rail wedge and detector locks, is also connected with two circuit controllers CC1 and CC2 disposed respectively at the left and right-hand ends of the bridge. These circuit controllers are of well known construction, and for a clear understanding of my present invention it is sufficient to point out that the circuit controller CC1 includes four contacts 60, 61, 62 and 63 which are closed or open according as the pipe line operating mechanism M1 is operated to its normal or its reverse position, while the circuit controller CC2 similarly includes four contacts 64, 65, 66 and 67 which are closed or open according as the pipe line operating mechanism M1 occupies its normal or its reverse extreme position.

The rails 1 and 1*a* of the stretch of track B are divided by means of insulated joints 70 to form four track sections C—D, D—E, E—F and F—G. Track sections D—E and E—F are detector track sections and extend in opposite directions from a point located near the center of the bridge to points in the trackway disposed some distance from the left and right-hand ends, respectively, of the bridge, while the sections C—D and F—G are approach sections.

The approach section C—D is provided with the usual track circuit comprising a track battery 71 connected across the rails adjacent one end of the section and a track relay TR1 connected across the rails adjacent the other end of the section.

The approach section F—G is similarly provided with a track circuit comprising a track battery 72 connected across the rails of the section adjacent one end of the section and a track relay TR4 connected across the rails adjacent the other end of the section.

The detector section D—E is provided with a track circuit which passes from a track battery 73 through a back contact 74—74*b* of an eastbound signal control relay ESR, wire 75, the portion of rail 1 between point D and the left-hand end of the bridge, contact 60 of bridge circuit controller CC1, the portion of the rail 1 between the left-hand end of the bridge and point E, wire 76, the winding of track relay TR2, wire 77, the portion of rail 1*a* between point E and the left-hand end of the bridge, contact 61 of bridge circuit controller CC1, the portion of rail 1*a* between the left-hand end of the bridge and point D, wire 78, and a resistor 79 back to battery 73.

The detector section E—F is provided with a similar track circuit which passes from a track battery 80 through a resistor 81, back contact 82—82b of a westbound signal control relay WSR, wire 83, the portion of the track rail 1 between point F and the right-hand end of the bridge, contact 64 of circuit controller CC2, the portion of rail 1 between the right-hand end of the bridge and point E, wire 84, the winding of a track relay TR3, wire 85, the portion of rail 1a between point E and the right-hand end of the bridge, contact 65 of circuit controller CC2, the portion of rail 1a between the right-hand end of the bridge and point F, and wire 86 back to battery 80.

The entrance of eastbound traffic into section D—E is controlled by an eastbound signal ES, while the entrance of westbound traffic into section E—F is controlled by a westbound signal WS. These signals may be of any suitable type, but as here shown they are light signals and each comprises a green lamp G and two spaced red lamps R1 and R2. When the green lamp G and red lamp R2 are both energized the signal indicates proceed, whereas when the two red lamps are both energized, the signal indicates stop.

The green lamp G of signal ES is provided with an energizing circuit which is controlled by track relay TR1 and the eastbound signal control relay ESR, and which passes from a suitable source of current here shown as a battery 90, through back contact 91 of track relay TR1, wire 92, front contact 93—93a of relay ESR, wire 94, the filament of lamp G, and wire 95 back to battery 90. It will be seen, therefore, that lamp G will become energized when and only when relay TR1 is deenergized and relay ESR is energized.

Lamp R1 of signal ES is provided with an energizing circuit which is also controlled by track relay TR1 and the eastbound signal control relay ESR, and which passes from battery 90 through back contact 91 of relay TR1, wire 92, back contact 93—93b of relay ESR, wire 96, the filament of lamp R1, and wire 95 back to battery 90. It follows that lamp R1 of signal ES will become energized when and only when relays TR1 and ESR are both deenergized.

Lamp R2 of signal ES is provided with a circuit which becomes closed whenever relay TR1 becomes deenergized and which passes from battery 90 through back contact 91 of relay TR1, the filament of lamp R2, and wire 95 back to battery 90.

It follows from the foregoing that when section C—D is unoccupied so that relay TR1 is energized all lamps of signal ES will be extinguished. When, however, section CD becomes occupied, the resultant deenergization of relay TR1 will cause lamps G and R2 or lamps R1 and R2 to become energized according as relay ESR is then energized or deenergized.

The lamps G, R1 and R2 of signal WS are controlled by the track relay TR4 and by the westbound signal control relay in the same manner that the lamps G, R1 and R2 of signal ES are controlled by the relays TR1 and ESR. It is believed, therefore, that the circuits for these lamps will be obvious from an inspection of the drawings without further detailed description.

The signal control relay ESR is connected through the contacts 62 and 63 of the circuit controller CC1 with one end of a pair of wires 100 and 101 which extend across the bridge, and the signal control relay WSR is connected with the other end of the wires 100 and 101 through

the contacts 66 and 67 of the circuit controller CC2. The wires 100 and 101 comprise part of a control circuit which is supplied with energy from a suitable source, here shown as a battery 102, and which circuit may be traced from the battery 102 through a wire 103, latch contact 51—51a, wire 109, armature contact 55 of electric lock EL, circuit controller contact 37—38 of mechanism M1, wire 108, wire 100, the windings of relays ESR and WSR in multiple, wire 107, normally closed contact 106 of a time release T, wire 105, contact 39—40 of mechanism M1, armature contact 56 of electric lock EL, wire 104, latch contact 50—50a of lock EL, wire 111, normally closed contact 112 of time release T, and wire 113 back to battery 102.

The time release T may be of any desired type, but as here shown it is a clockwork time release similar to that shown and described in Letters Patent of the United States No. 1,989,522, granted to William C. McWhirter on January 29, 1935, for Time governed circuit controlling mechanisms. For a clear understanding of my present invention it is sufficient to point out that the time release T is provided, in addition to the contacts 106 and 112 which are closed only in the normal or run-down position of the release, with a contact 114 which is open in both the wound-up and run-down positions of the release and which becomes closed only for a short period of time (usually 20 seconds) during the total run-down time interval.

The lock magnet 52 is provided with an energizing circuit which passes from battery 102 through contact 114 of the time release T, front contact 115 of track relay TR3, front contact 116 of track relay TR2, the winding of lock magnet 52 and wire 117 back to battery B. The lock magnet 52 is also provided with a stick circuit which passes from battery 102 through wire 103, latch contact 51—51b on electric lock EL, armature contact 54 on lock EL, wire 118, front contact 115 of track relay TR3, front contact 116 of track relay TR2, the winding of electric lock 52, and wire 117 back to battery 102. It follows that the lock magnet 52 will only become energized if the time release is operated to close its contact 114 while the track relays TR2 and TR3 are both energized, and that after the magnet once becomes energized it will then remain energized by virtue of its stick circuit until one or the other of the track relays TR2 and TR3 becomes deenergized to interrupt its stick circuit.

As shown in Fig. 1, the pipe line operating mechanisms M1 and M2 are both in their normal positions, and as was pointed out hereinbefore, when the mechanisms are in their normal positions the portion of the pipe line 2 on the bridge is connected with the portions on the bridge abutments by means of the pipe couplers PP1 and PP2, the lift rail wedge and detector locks are both in their locking positions, and the contacts of the circuit controllers CC1 and CC2 are all closed. That is to say, the bridge is locked in position for traffic movements over it. Furthermore, as shown in Fig. 1, the signal control relays ESR and WSR are both energized, and the track circuit for detector section DE is therefore open at back contact 74—74b of relay ESR so that track relay TR2 is deenergized, while the track circuit for detector section E—F is open at back contact 82—82b of relay WSR so that track relay TR3 is also deenergized. With track relays TR2 and TR3 deenergized, all circuits for lock magnet 52 are open, and this lock magnet

is accordingly deenergized. Approach sections CD and F—G are both unoccupied, and the track relays TR1 and TR4 are therefore both picked up. All lamps of signals ES and WS are therefore extinguished.

In explaining the operation of the apparatus as a whole I shall assume that with the parts in the positions shown in Fig. 1, an eastbound train traverses the stretch of track shown in the drawings. When the train enters the approach section CD, track relay TR1 will become deenergized due to the train shunt and will close its back contact 91. The closing of this contact will complete the previously traced energizing circuits for the lamps G and R2 of signal ES, and these lamps will therefore become lighted to cause the signal to display its proceed indication. As the train proceeds into the detector sections D—E and E—F nothing will happen since the track relays TR2 and TR3 are both deenergized. However, as soon as the train clears the approach section C—D the track relay TR1 will pick up and will extinguish the lamps G and R2 of signal ES so that this signal will again become dark, whereby energy is supplied to the signal ES only for the brief interval of time required for the train to traverse the approach section C—D. When the train enters the approach section F—G, the resultant deenergization of track relay TR4 will cause the westbound signal to display its proceed aspect. However, only one train is permitted to approach the bridge at one time within the range of the signals ES and WS and it is therefore impossible for the lighting of the signal WS under these conditions to result in a dangerous condition. As soon as the train leaves section F—G, track relay TR4 will pick up and will deenergize signal WS, and all parts will then be restored to the positions shown.

When a westbound train traverses the stretch of track shown in the drawings, the operation of the apparatus as a whole is similar to that just described, and it is believed that this operation will be obvious from an inspection of the drawings without further detailed description.

I shall now assume that the parts are in the positions shown in Fig. 1 and that it is desired to open the drawbridge. To this end, the operator will first remove the padlock from the electric lock. As was pointed out hereinbefore, the removal of the padlock from the electric lock will cause the latch contacts 50—50*a* and 51—51*a* to immediately open and the latch contact 51—51*b* to immediately close. The opening of the latch contacts 50—50*a* and 51—51*a* will open the control circuit for the signal control relays ESR and WSR, and these relays will therefore become deenergized and will complete the track circuits for the detector sections D—E and E—F so that track relays TR2 and TR3 will become energized. The deenergization of the signal control relays ESR and WSR will also condition the circuits for the signals ES and WS so that if a train now enters either one of the approach sections the signal controlled by the track relay for such section will display its stop aspect. The operator will next operate the time release T which will thereupon immediately open its contacts 106 and 112, but will not close its contact 114 for a time interval which is sufficiently long to insure that if a train is approaching either one of the signals ES and WS it will either have had time to stop before this contact becomes closed, or else will have entered one or the other of the detector sections D—E and E—F before this contact becomes closed. The opening of the contacts 106—112 of time release T will interrupt the circuit for the relays ESR and WSR at these contacts, thus insuring that the relays ESR and WSR cannot again become energized at least until the time release mechanism has returned to its normal position. When contact 114 of time release T becomes closed, if the track relays TR2 and TR3 are then still energized as will be the case if no train has entered one or the other of the detector sections during the time interval required for this contact to become closed, lock magnet 52 of electric lock EL will become energized and will complete its stick circuit so that this magnet will now remain energized as long as the track relays TR2 and TR3 continue to be energized. The energization of the lock magnet 52 unlocks the hand throw lever 19 of the mechanism M1, and the operator will now proceed to operate the mechanism M1 to its reverse position. As was pointed out hereinbefore, this operation will actuate the lift rail wedge and detector locks to their unlocking positions, and will also actuate the bridge circuit controllers CC1 and CC2 to the positions in which their contacts are open. The opening of the contacts 60 and 61 of the circuit controller CC1 will interrupt the track circuit for the detector section D—E, while the opening of the contacts 64 and 65 of the circuit controller CC2 will interrupt the track circuit for the detector section E—F. The track relays TR2 and TR3 will therefore become deenergized and will deenergize the electric lock EL. Due, however, to the construction of the electric lock EL the latch of this lock will remain in its unlatching position until the lever 19 of the mechanism M1 is subsequently restored to its normal position. The opening of the contacts 62 and 63 of the circuit controller CC1 will maintain the circuit for relay ESR open, and the opening of the contacts 66 and 67 of circuit controller CC2 will maintain the circuit for relay WSR open, thus providing additional protection that these relays cannot pick up and clear the signal ES or WS if a train should subsequently enter the approach section C—D or F—G. With mechanism M1 in its reverse position, mechanism M2 is unlocked, and the operator next operates mechanism M2 to its reverse position. This operation actuates the pipe couplers PP1 and PP2 to disconnect the portion of the pipe line 2 on the bridge from the portions on the bridge abutments, and when this operation is completed the bridge is ready to be operated to its open position by the usual operating means.

It should be pointed out that if a train had entered either one of the detector sections D—E or E—F during the time which elapsed between the setting into operation of the time release T and the closing of the time contact 114 of the release, the resultant deenergization of the track relay TR2 or TR3, as the case may be, would have prevented lock magnet 52 from becoming energized, and would thus have provided a safeguard to insure that the operator could not release the rail locks after the train had proceeded past the position where it would normally have been stopped by the stop indications provided by the signals ES and WS.

I shall now assume that after the bridge has been opened in the manner just described and has been returned to its closed position, the operator wishes to again condition it for traffic

over it. To do this, he will first restore the mechanism M2 to its normal position and will then restore the mechanism M1 to its normal position. The restoration of the mechanism M2 to its normal position will operate the pipe couplers PP1 and PP2 to connect the portion of the pipe line 2 on the bridge with the portions on the bridge abutments, while the operation of the mechanism M1 to its normal position will act to restore the bridge locks to their locking positions and the circuit controllers CC1 and CC2 to the positions in which their contacts are closed. The restoration of the mechanism M1 to its normal position will also actuate the interlocking bar 42 of the mechanism M2 to the position in which it functions to lock the mechanism M2 against movement, and will actuate the circuit controller contacts 37—38 and 39—40 to their normally closed positions. As soon as the hand throw lever 19 of the mechanism M1 is restored to its normal position the padlock can be reinserted in the electric lock and all parts will then be restored to their normal positions in which they are shown in the drawings.

It should be particularly noted that the interlocking shown only requires two circuit wires spanning the bridge, and that under normal conditions all parts of the apparatus are deenergized except the two signal control relays ESR and WSR and the two track relays TR1 and TR4, thus effecting a considerable saving in energy.

It will also be noted that this two wire control circuit affords signal indication locking, time interval approach locking, and detector locking.

Although I have herein shown and described only one form of drawbridge interlocking embodying my 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 my invention.

Having thus described my invention, what I claim is:

1. In an interlocking for a drawbridge over which the rails of a stretch of railway track pass, locks for locking the rails on said bridge in the proper positions relative to the rails on the bridge abutments for the passage of trains over said bridge, manually operable means operatively connected with said rail locks for actuating them between locking and unlocking positions, an electric lock controlling the operation of said manually operable means, two detector track sections one extending onto said bridge at each end of said bridge, means controlled in part by said detector sections for controlling the energization of said electric lock, said electric lock being effective when deenergized to prevent operation of said manually operable means away from the position in which said rail locks are in their locking positions, a control circuit controlled in accordance with the energized or deenergized condition of said electric lock and including a single pair of control wires extending across said bridge, and signals governing the passage of trains over said bridge controlled by said control circuit.

2. In an interlocking for a drawbridge over which the rails of a stretch of railway track pass, locks for locking the rails on said bridge in the proper positions relative to the rails on the bridge abutments for the passage of trains over said bridge, manually operable means operatively connected with said rail locks for actuating them between locking and unlocking positions, an electric lock controlling the operation of said manually operable means, two detector track sections one extending onto said bridge at each end of said bridge, a time release, means controlled in part by said detector sections and in part by said time release for controlling the energization of said electric lock, said electric lock being effective when deenergized to prevent operation of said manually operable means away from the position in which said rail locks are in their locking positions, a control circuit controlled in accordance with the energized or deenergized condition of said electric lock and including a single pair of control wires extending across said bridge, and signals governing the passage of trains over said bridge controlled by said control circuit.

3. In an interlocking for a drawbridge over which the rails of a stretch of railway track pass, locks for locking the rails on said bridge in the proper positions relative to the rails on the bridge abutments for the passage of trains over said bridge, manually operable means operatively connected with said rail locks for actuating them between locking and unlocking positions, an electric lock controlling the operation of said manually operable means, two detector track sections one extending onto said bridge at each end of said bridge, a time release including a first contact which opens immediately when said release is set into operation and a second contact which becomes closed for a brief interval of time a predetermined time after said release is set into operation, means controlled in part by said detector sections and in part by said second contact of said time release for controlling the energization of said electric lock, said electric lock being effective when deenergized to prevent operation of said manually operable means away from the position in which said rail locks are in their locking positions, a control circuit controlled in part by said first contact and in part in accordance with the energized or deenergized condition of said electric lock and including a single pair of control wires extending across said bridge, and signals governing the passage of trains over said bridge controlled by said control circuit.

4. In an electric interlocking for a drawbridge over which the rails of a stretch of railway track pass, locks for locking the rails on said bridge in the proper positions relative to the rails on the bridge abutments for the passage of trains over the bridge, first and second operating mechanisms each operable between normal and reverse positions, means mechanically interlocking said mechanisms in such manner that said second mechanism cannot be operated between its normal and reverse positions unless said first mechanism occupies its reverse position, a first pipe line operatively connecting said rail locks with said first mechanism in such manner that said rail locks will be operated to locking or unlocking positions according as said first mechanism occupies its normal or its reverse position, said first pipe line extending across the ends of the bridge to the bridge abutments, a pipe coupler at each end of the bridge for connecting and disconnecting the portion of said first line on the bridge with the portions on the bridge abutments, a second pipe line connecting said pipe couplers with said second mechanism in such manner that said couplers will be operated to their pipe coupling or uncoupling positions according as said second mechanism occupies its normal or its reverse position, an electric lock associated with said first mechanism and effective when deenergized but not when energized to prevent opera-

tion of said first mechanism away from its normal position, means for energizing said lock at the expiration of a time interval provided no train is within a predetermined distance of said bridge, a control circuit controlled in accordance with the energized or deenergized condition of said electric lock and including a single pair of control wires extending across said bridge, and signals governing the passage of trains over said bridge controlled by said control circuit.

5. In an electric interlocking for a drawbridge over which the rails of a stretch of railway track pass, locks for locking the rails on said bridge in the proper positions relative to the rails on the bridge abutments for the passage of trains over the bridge, first and second operating mechanisms each operable between normal and reverse positions, means mechanically interlocking said mechanisms in such manner that said second mechanism cannot be operated between its normal and reverse positions unless said first mechanism occupies its reverse position, a first pipe line operatively connecting said rail locks with said first mechanism in such manner that said rail locks will be operated to locking or unlocking positions according as said first mechanism occupies its normal or its reverse position, said first pipe line extending across the ends of the bridge to the bridge abutments, a pipe coupler at each end of the bridge for connecting and disconnecting the portion of said first pipe line on the bridge with the portions on the bridge abutments, a second pipe line connecting said pipe couplers with said second mechanism in such manner that said couplers will be operated to their pipe coupling or uncoupling positions according as said second mechanism occupies its normal or its reverse position, an electric lock associated with said first mechanism and effective when deenergized but not when energized to prevent operation of said first mechanism away from its normal position, two detector track sections one extending onto said bridge at each end of said bridge, a time release including a first contact which opens immediately when said release is set into operation and a second contact which becomes closed for a brief interval of time a predetermined time after said release is set into operation, means controlled in part by said detector sections and in part by said second contact of said time release for controlling the energization of said electric lock, a control circuit controlled in part by said first contact and in part in accordance with the energized or deenergized condition of said electric lock and including a single pair of control wires extending across said bridge, and signals governing the passage of trains over said bridge controlled by said control circuit.

6. In an electric interlocking for a drawbridge over which the rails of a stretch of railway track pass, locks for locking the rails on said bridge in the proper positions relative to the rails on the bridge abutments for the passage of trains over the bridge, first and second operating mechanisms each operable between normal and reverse positions, means mechanically interlocking said mechanisms in such manner that said second mechanism cannot be operated between its normal and reverse positions unless said first mechanism occupies its reverse position, a first pipe line operatively connecting said rail locks with said first mechanism in such manner that said rail locks will be operated to locking or unlocking positions according as said first mechanism occupies its normal or its reverse position, said first pipe line extending across the ends of the bridge to the bridge abutments, a pipe coupler at each end of the bridge for connecting and disconnecting the portion of said first line on the bridge with the portions on the bridge abutments, a second pipe line connecting said pipe couplers with said second mechanism in such manner that said couplers will be operated to their pipe coupling or uncoupling positions according as said second mechanism occupies its normal or its reverse position, an electric lock associated with said first mechanism and effective when deenergized but not when energized to prevent operation of said first mechanism away from its normal position, two detector track sections one extending onto said bridge at each end of said bridge, a bridge circuit controller at each end of said bridge operatively connected with said first pipe line and including contacts which are closed or open according as said first operating mechanism occupies its normal or its reverse position, two signal control relays one disposed at each end of the bridge, two detector track sections one extending onto said bridge at each end of the bridge; a track circuit for each track section including a track relay connected with the rails of the section at the bridge end of the section, a source of current connected with the rails of the section at the bridge abutment end of the section over a back contact of the signal control relay at that end of the bridge and contacts of the bridge circuit controller at that end of the bridge, a time release including a first contact which opens immediately when said release is set into operation and a second contact which becomes closed for a brief interval of time a predetermined time interval after said release is set into operation, a control circuit for said signal control relays controlled in part by said first contact and in part in accordance with the energized or deenergized condition of said electric lock including a single pair of control wires extending across the bridge and connected at each end of the bridge with the signal control relay at that end of the bridge over contacts of the bridge circuit controller at that end of the bridge, an energizing circuit for said electric lock including front contacts of said track relay and said second contact of said time release, and signals governing the passage of trains over said bridge controlled by said control circuit.

ROGER MILLS SNYDER.