Jan. 31, 1928. 1,657,583

B. R. PADMORE

RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed July 23, 1925 6 Sheets-Sheet 1

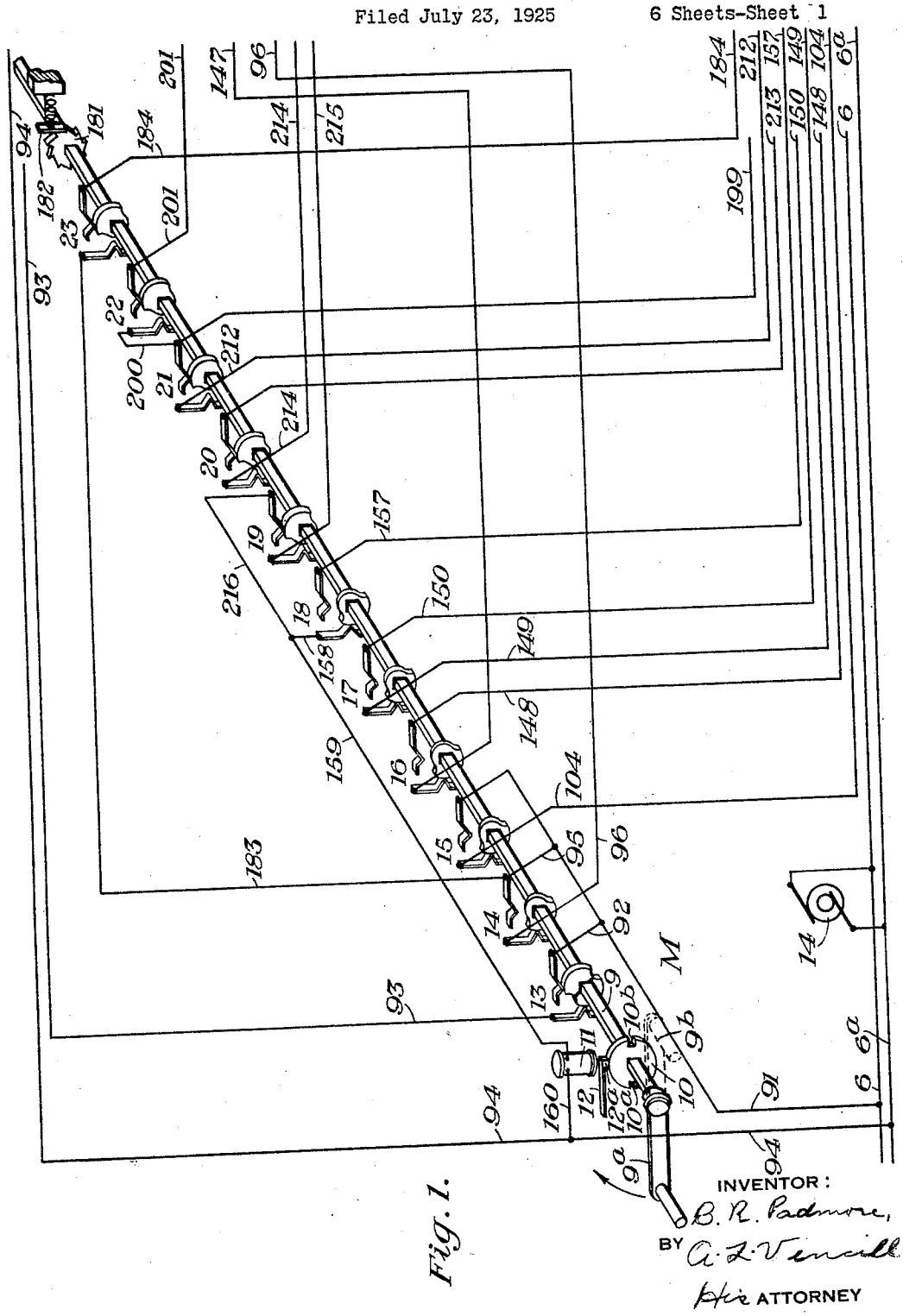


Fig. 1.

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RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed July 23, 1925 6 Sheets-Sheet 2

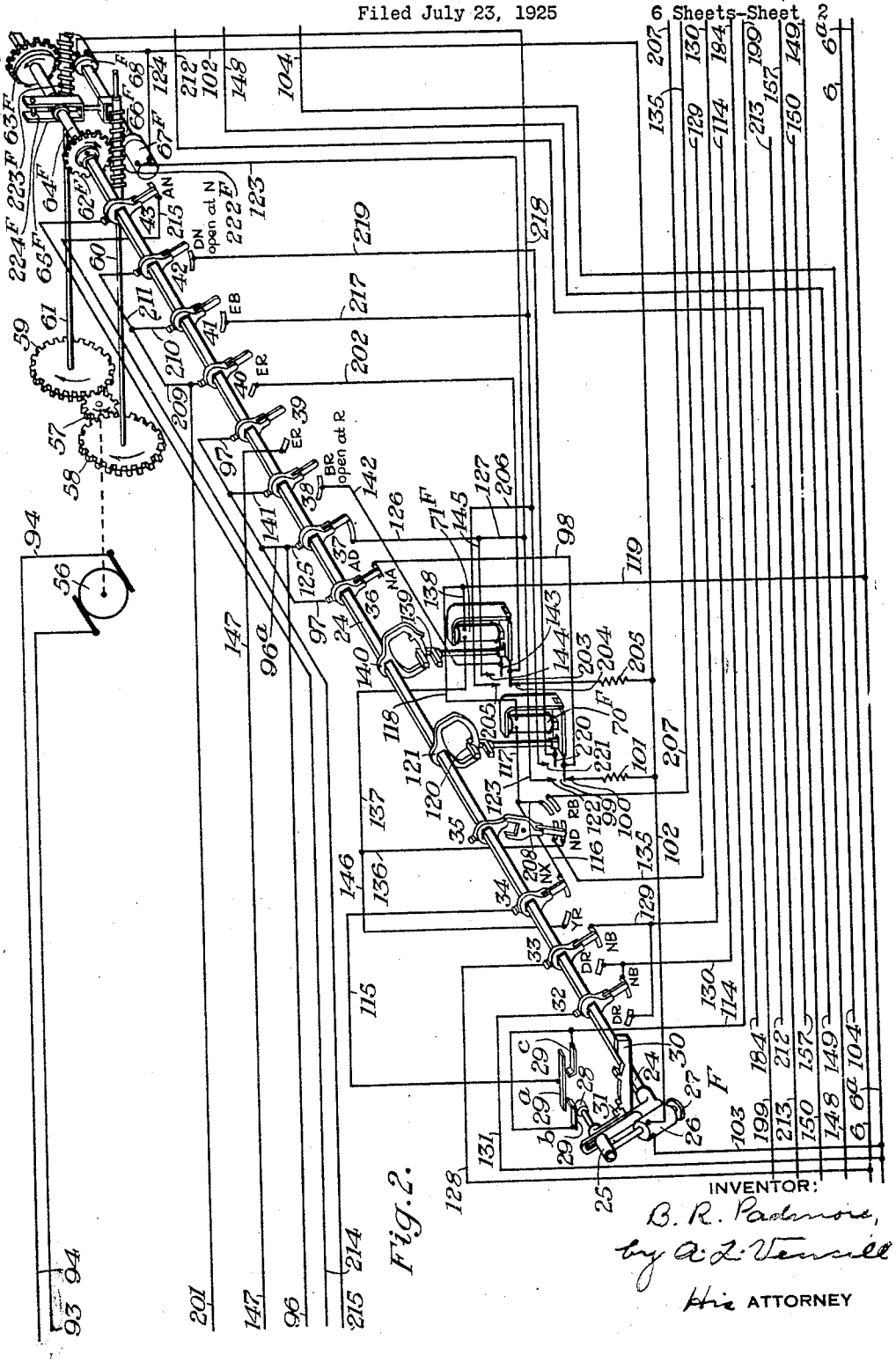


Fig. 2.

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RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed July 23, 1925 6 Sheets-Sheet 3

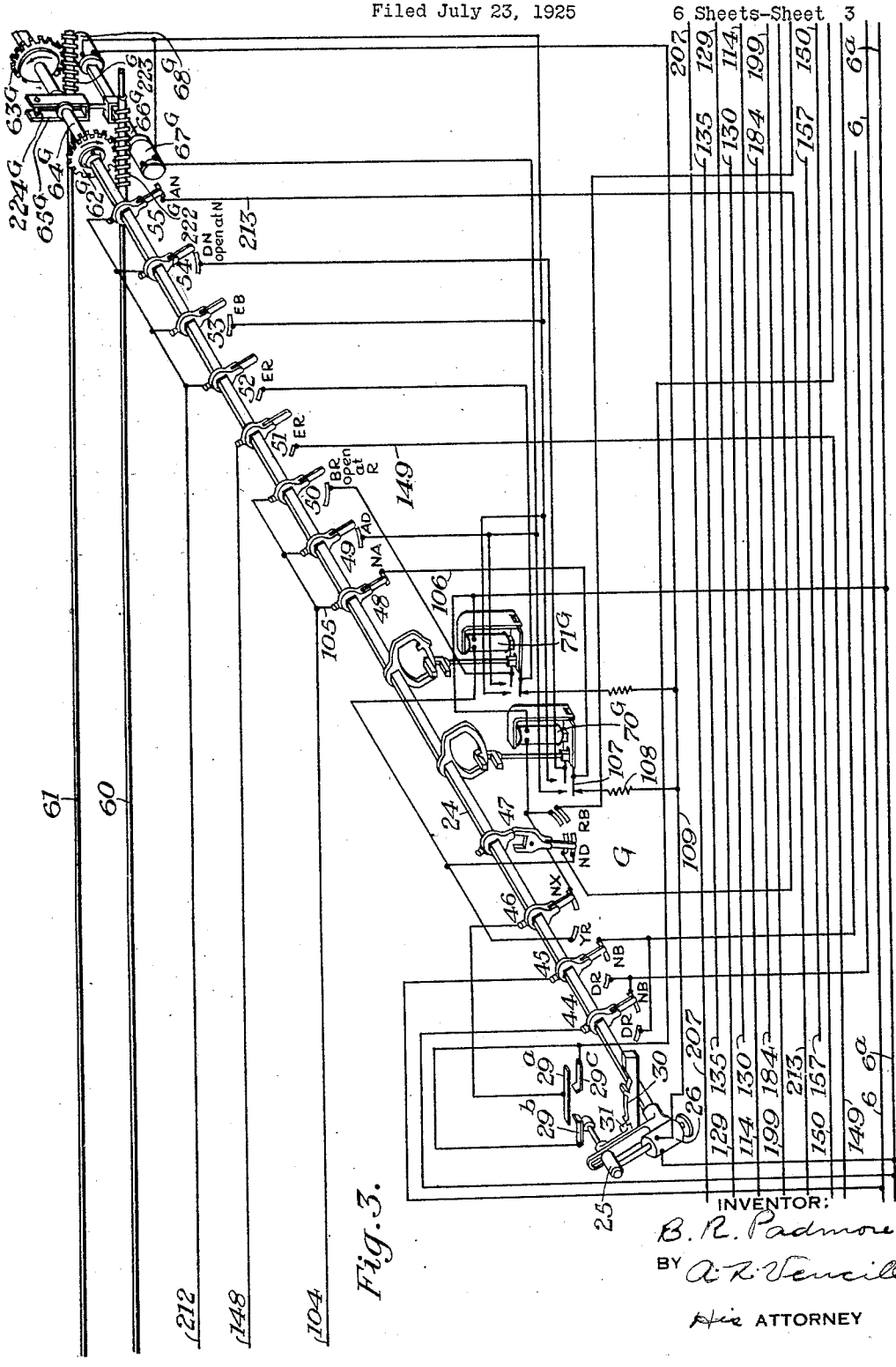


Fig. 3.

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RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed July 23, 1925 6 Sheets-Sheet 4

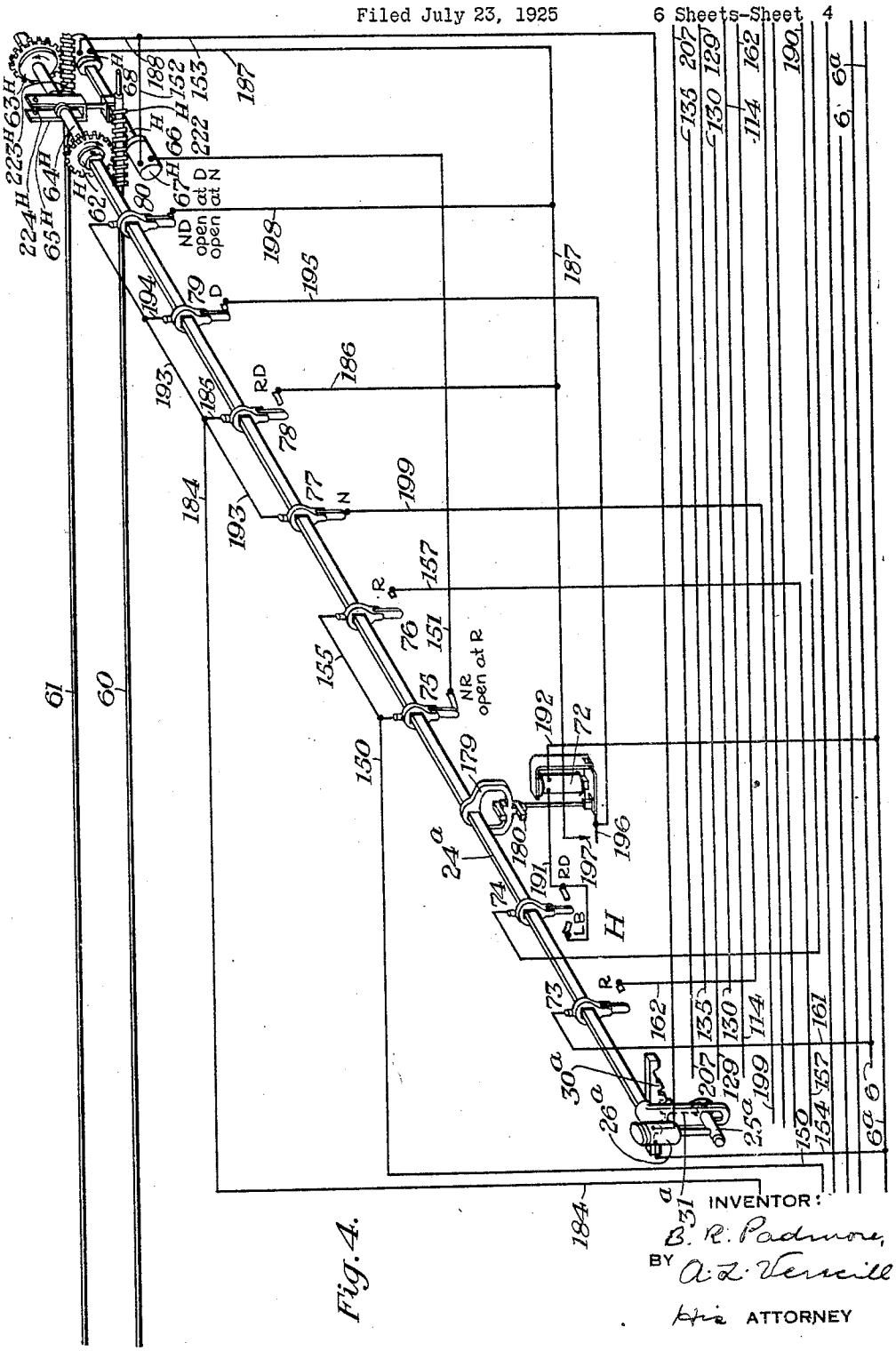


Fig. 4.

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RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed July 23, 1925 6 Sheets-Sheet 5

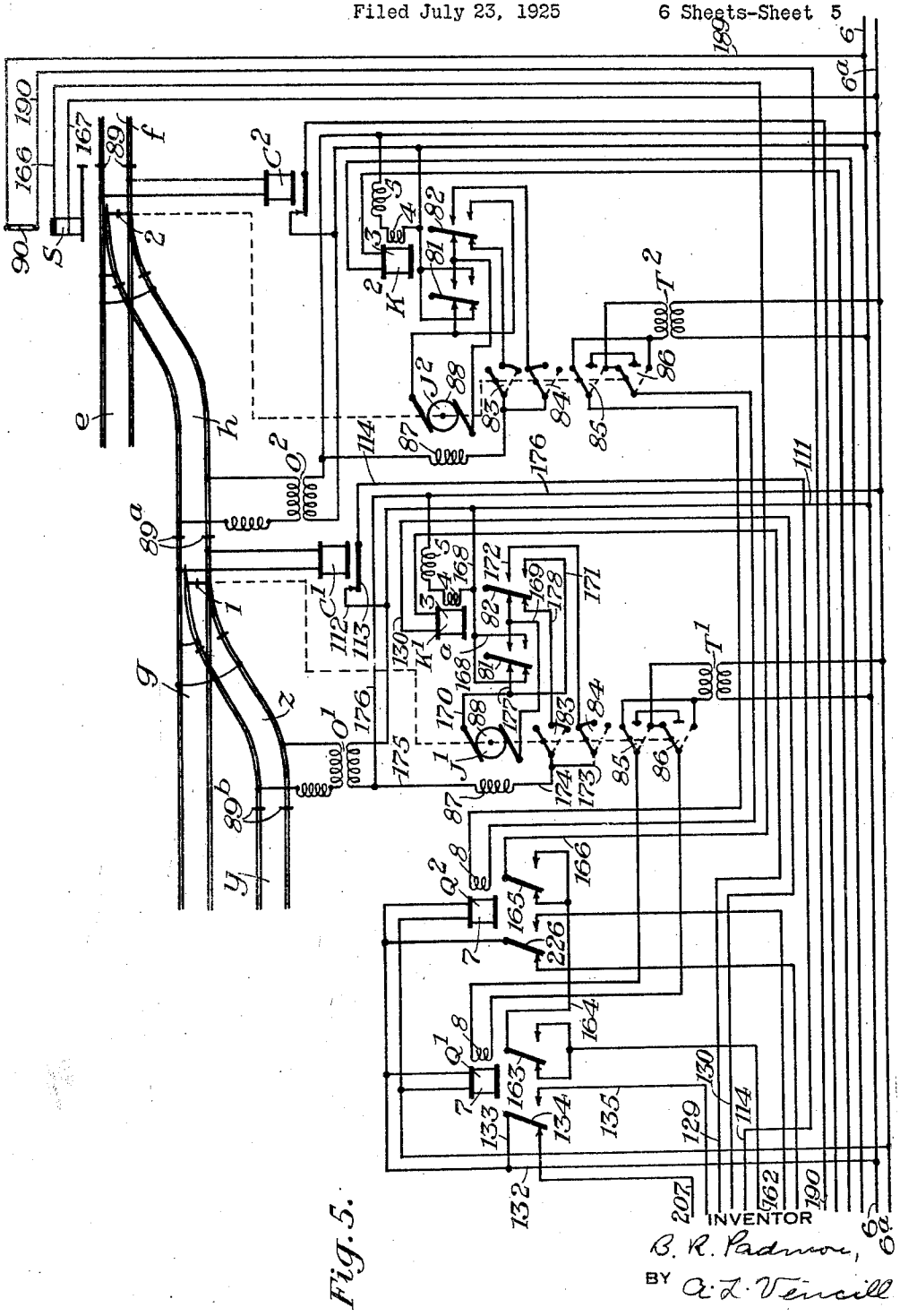


Fig. 5.

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RAILWAY TRAFFIC CONTROLLING APPARATUS

Filed July 23, 1925 6 Sheets-Sheet 6

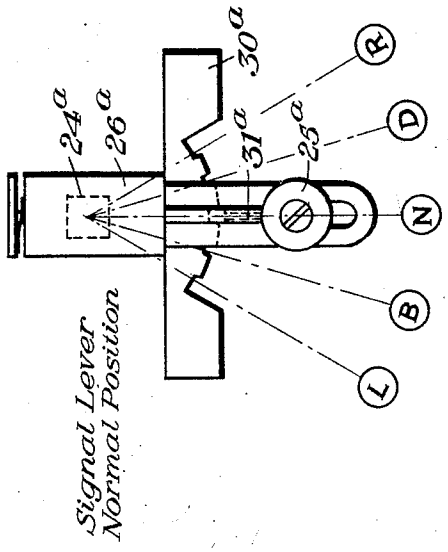


Fig. 8.

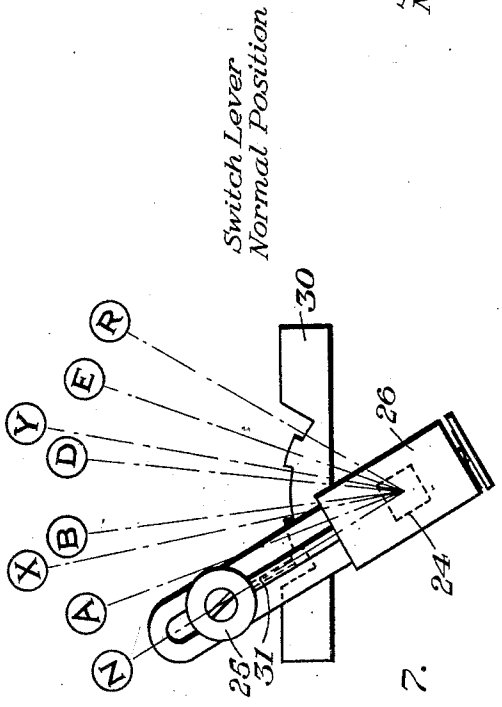


Fig. 7.

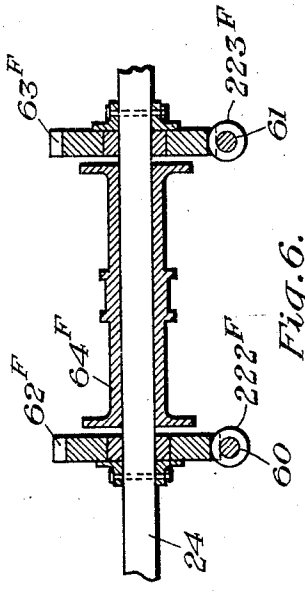


Fig. 6.

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UNITED STATES PATENT OFFICE.

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RAILWAY-TRAFFIC-CONTROLLING APPARATUS.

Application filed July 23, 1925. Serial No. 45,592.

My invention relates to railway traffic controlling apparatus, and particularly to automatic interlocking apparatus for controlling traffic over conflicting routes.

Heretofore in interlocking practice it has been customary to provide a plurality of machine levers each controlling a separate traffic governing unit such as a signal or a switch in a railway yard. Such machines are customarily located at a point remote from the units which they control, and each of the several levers being operated separately, and by hand; and locking between levers being provided to prevent operation of levers which would set up conflicting routes.

One object of my invention is the provision, in machines of the type described, of a master lever for each of a number of routes through the railway yard, and means controlled by each of these master levers for automatically operating the proper machine levers to set up the required route.

I will describe one form and arrangement of apparatus embodying my invention, and will then point out the novel features thereof in claims.

Referring to the accompanying drawings, Figs. 1, 2, 3, 4 and 5, when placed end to end in the order mentioned, comprise a figure, partially diagrammatic and partially in perspective, illustrating one form of railway traffic controlling apparatus embodying my invention. Fig. 6 is a sectional view of a portion of the clutch mechanism associated with switch lever F. Fig. 7 is a diagram showing the various positions into which each of the switch levers may be moved with reference characters corresponding to these various positions. Fig. 8 is a diagram similar to Fig. 7 but showing the positions into which each of the signal levers may be moved, with reference characters corresponding to these positions.

Similar reference characters refer to similar parts in each of the several views.

Referring first to Figs. 1, 2, 3, 4 and 5, there is illustrated at the extreme right, a portion of a railway yard comprising a plurality of tracks and switches for permitting trains to pass through the yard over different traffic routes. One stretch of track is divided into two track sections *e* and *f* by insulated joints 89. A second stretch of track is divided into two track sections *g* and *h* by insulated joints 89ª, and a third stretch of track is divided into two track sections *y* and *z* by insulated joints 89ᵇ. Track section *h* is connected with track section *e* by a switch 2, and track section *z* is connected with track section *g* by a switch 1. For purposes which will appear hereinafter a track transformer O′ is connected across the rails adjacent the left hand end of section *z* and a similar transformer O² is connected across the rails adjacent the left hand end of section *h*. The primary of each of transformers O′ and O² is constantly supplied with alternating current from a suitable source of energy such as an alternator 14 over line wires 6 and 6ª. A track relay C′ is connected across the rails adjacent the right hand end of section *g* and a similar track relay C² is connected across the rails adjacent the right hand end of section *e*. Switch 1 is operated by a motor J′ comprising a field winding 87 and an armature 88. This motor is in turn controlled by a circuit controller K′ which comprises two windings 3 and 4. Winding 4 is constantly supplied with alternating current from line wires 6 and 6ª, and the controller is responsive to reversals in the relative polarity of current supplied to winding 3 to swing armatures 81 and 82 to one extreme position or the other. When winding 3 is supplied with alternating current of one relative polarity, which I will term normal relative polarity, armatures 81 and 82 are swung to the left, and when winding 3 is supplied with alternating current of the other relative polarity, which I will term reverse relative polarity, armatures 81 and 82 are swung to the right. As shown in the drawing controller K′ is energized in the normal direction and motor J′ has been operated to move switch 1 to the normal position. I will now assume that current of

reverse relative polarity is supplied to winding 3 of circuit controller K'. Armatures 81 and 82 are therefore swung to the right and current flows from line wire 6, through wires 111, 168 and 168ª, armature 81, wire 169, armature 88 of motor J', wires 170 and 171, armature 82 of controller K', wire 172, a contact 84 operated by motor J', wires 173 and 174, field winding 87 of motor J', and wires 175 and 176 back to line wire 6ª. Contact 84 is arranged to be closed when switch 1 is in the normal position and to be opened just before the switch moves into its extreme reverse position. Contact 83 also operated by motor J' is arranged to be closed when the switch 1 is in the reverse position and to be opened just before this switch moves into its extreme normal position. Current supplied to motor J' over the circuit just traced operates the motor in such direction that switch 1 is moved to the reverse position. Just before reaching this position contact 84 opens and disconnects motor J' from the line wires 6 and 6ª. I will now assume that winding 3 of controller K' is supplied with current of normal relative polarity. Armatures 81 and 82 are then returned to their left hand positions and current flows from line wire 6 through wires 111 and 168, armature 81 of controller K', wires 177 and 170, armature 88 of motor J', wire 169, armature 82 of controller K', wire 178, contact 83 operated by switch 1, wire 174, field winding 87 of motor J' and wires 175 and 176 back to line wire 6ª. When this circuit is closed current is supplied to both field and armature of motor J' but it should be noticed that the current now supplied to armature 88 flows through this armature in a direction opposite to the direction of the current supplied to the armature when circuit controller K' is energized in the reverse direction. Motor J' therefore operates to move switch 1 to the normal position. Just before the switch attains the extreme normal position contact 83 opens and disconnects energy from motor J'.

Associated with the switch 1 is a detector relay Q' comprising two windings 7 and 8. Winding 7 is constantly supplied with alternating current from line wires 6 and 6ª, and alternating current is supplied to winding 8 from a transformer T' which is in turn supplied with alternating current from line wires 6 and 6ª. The relative polarity of the current supplied to winding 8 of detector relay Q' by transformer T' is controlled by two contacts 85 and 86 operated by switch 1, which contacts constitute a pole changer. It will be plain from the drawing that when switch 1 is in the normal position current of one relative polarity, which I will term normal relative polarity, is supplied to detector relay Q' and armatures 134 and 163 then occupy their left hand or normal positions. When switch 1 is moved to its reverse position contacts 85 and 86 are reversed and winding 8 of relay Q' is then supplied with alternating current of reverse relative polarity so that armatures 134 and 163 are then swung to their right hand or reverse positions.

Switch 2 is controlled by a motor J² and a circuit controller K² similar to the corresponding parts just described in connection with switch 1, and a second detector relay Q² is controlled in accordance with the positions of switch 2 in the same way that relay Q' is controlled in accordance with the positions of switch 1.

A trackway signal S, here shown as a two-position semaphore signal, is arranged to control traffic through switch 2, this signal being capable of indicating proceed when the route is properly set up for trains to move from section *f* through switch 2 into section *h* and thence through switch 1 into section *z*, but not when either switch 1 or 2 is normal. Before proceeding further it should be pointed out that while for purposes of simplicity I have shown a small portion of railway yard comprising only two switches and a single signal for controlling traffic over one route through the e switches. I wish it to be particularly understood that my invention is not limited to the specific arrangement here illustrated and described.

Each of the trackway governing units located in the railway yards, that is, switch 1, switch 2 and signal S, is controlled by an individual lever located in an interlocking machine at a central control point such as an interlocking cabin. For example, in the present embodiment of my invention lever F (Fig. 2) controls switch 1, lever G (Fig. 3) controls switch 2 and lever H (Fig. 4) controls the signal S.

The switch lever F comprises a shaft 24, supported in suitable journals not shown in the drawing, and provided at its forward end with a handle 25 controlling a latch 31 which co-operates with a latching quadrant 30. A projection 28, outstanding from the handle 25 co-operates with certain latch contacts 29ª, 29ᵇ and 29ᶜ as will appear in detail hereinafter. A magnet 26 mounted on the lever F is provided with an armature 27 which controls the handle 25 so that when the magnet is energized the latch 31 is lifted out of the range of the dogs or quadrant 30.

Referring now to Fig. 7 the switch lever F is capable of assuming eight distinctive positions which will be referred to hereinafter by the letters N, A, X, B, D, Y, E and R, in order from left to right as shown in the drawings. The latch 31 and the dogs or quadrant 30 are so arranged that during motion of the lever in a direction from N to R the latch must be lifted to permit the lever to move from N to A and the latch

must also be lifted to permit the lever to move from D to E. Similarly when the lever is moved in a direction from R to N the latch must be lifted to permit the lever to move from R to E and again from B to A.

The shaft 24 controls a plurality of contacts which are arranged to be opened or closed in accordance with the angular position of this shaft. The small letters beside each contact on the drawing indicate the lever positions between which the adjacent contact is closed. For example contact 36 bears the legend NA. This means that contact 36 is closed only when lever F is in the N position, the A position, or a position intermediate these two.

The lever F controls, among others, two contacts 32 and 33 which constitute a pole changer for controlling the relative polarity of the current supplied to winding 3 of circuit controller K'. As shown in the drawing lever F is in the N position so points NB of contacts 32 and 33 are closed. Current of normal relative polarity therefore flows from line wire 6, through wire 128, contact 33, wire 129, winding 3 of circuit controller K', wire 130, contact 32, and wire 131 back to line wire 6^a. Circuit controller K' is therefore energized in the normal direction so that switch 1 is normal. If points DR of contacts 32 and 33 are closed current flows from line wire 6 through wire 128, contact 33, wire 130, winding 3 of circuit controller K', wire 129, contact 32, and wire 131 back to line wire 6^a. It will be noticed that under this condition current of reverse relative polarity is supplied to winding 3 so that circuit controller K' is energized in the reverse direction and switch 1 is then reversed.

Under certain conditions motion of the shaft 24 is prevented by segment locks. For example the segment 121 which is fixed to shaft 24 co-operates with a latch 120 operated by magnet 70^F so that the lever can be moved from the normal position only when magnet 70^F is energized. In similar manner a segment 140 and a latch 139 prevent motion of the lever from D to E unless magnet 71^F is energized.

Switch lever G for controlling switch 2 is similar to lever F and the construction of this lever will be understood without further explanation.

Contacts 44 and 45 on lever G constitute a pole changer for controlling the polarity of the current supplied to winding 3 of circuit controller K^2 in a manner similar to that already described in connection with the control of circuit controller K' by contacts 32 and 33 of lever F.

The signal lever H comprises a rotatable shaft 24^a having a handle 25^a and a latch 31^a operated thereby. This latch 31^a co-operates with a locking quadrant 30^a as best illustrated in Fig. 8. A magnet 26^a is arranged to disengage the latch when the magnet is energized. From this diagram it will be seen that the signal lever has only five positions, L, B, N, D and R. It should also be pointed out that while the two switch levers F and G normally occupy their extreme left hand positions, the signal lever H normally occupies its middle position. The latch 31^a must be operated to move the signal lever H from any of the five positions illustrated to any other position. A locking segment 179 is rigidly fixed to shaft 24^a and co-operates with a latch 180 controlled by a magnet 72 so that when the lever H is in the normal position the lever can be moved in either direction without interference from the segment 179 but to return the lever to its normal position from either extreme position latch 180 must be lifted by energization of magnet 72. Shaft 24^a also controls certain contacts which are designated by reference characters and are also provided with legends similar to those explained in connection with lever F and corresponding to the lever positions indicated in Fig. 8 for indicating when these contacts are closed.

I also provide a master lever designated in general by the reference character M (Fig. 1) the purpose of which is to control certain selected ones of the machine levers to set up a predetermined route through the railway yard. The master lever M, illustrated in this drawing, is intended to set up a route from section *f* to section *y*. This master lever comprises a shaft 9 rotatably supported in journals not shown in the drawing and carrying a locking disk 10 controlled by a latching dog 12^a on an armature 12. The armature 12 is in turn controlled by a latching magnet 11 so that the dog 12^a is lifted out of engagement with the latching disk 10 when the magnet 11 is energized. By means of a handle 9^a, shaft 9 may be rotated in the direction indicated by the arrow through 360°. As shown in the drawing the lever occupies its normal position, in which all of the contacts controlled thereby are open. When the lever is moved through an angle of 90° in the direction indicated by the arrow further motion in this direction is prevented by the engagement of dog 12^a with slot 10^a in the locking disk 10. When the lever is in this position however contacts 13, 14, 15, 16, 17 and 18 are closed and the remaining contacts are open. If magnet 11 is now energized armature 12 is lifted to permit further motion of handle 9^a. When this handle has been moved 180° from its normal position so that it occupies the reverse position indicated in broken lines at 9^b on the drawing all of the contacts on the lever are again open. If the motion of the handle 9^a is continued until it occupies a position at 270° from its normal position in which it is illustrated in the drawing the latching

dog 12ª will engage slot 10ᵇ in disk 10 to prevent any further motion until the magnet 11 is energized. In this position contacts 13, 19, 20, 21, 22 and 23 are closed and the remaining contacts on the lever are open. By means of a ratchet wheel 181 rigidly attached to a shaft 9 and a pawl 182 co-operating with this wheel, motion of the shaft in a direction opposite to that indicated by the arrow is prevented.

The lever M controls a motor 56 which is arranged to be coupled at times with certain of the machine levers of the interlocking machine to cause operation of these levers. The circuit for motor 56 may be traced from line wire 6 through wires 91 and 92, contact 13 on lever M, wire 93, motor 56, and wire 94 to line wire 6ª. It is therefore plain that motor 56 is operated only when contact 13 on lever M is closed, that is, when handle 9ª of lever M has been moved either 90° or 270° from the position in which it is illustrated in the drawing.

Two rotatable spindles 60 and 61 are supported in parallel relation by means not shown in the drawing. These spindles extend the entire length of the interlocking machine and are arranged, as will now be explained, to operate the several machine levers. Spindle 60 is provided with a gear 58, and spindle 61 is provided with a similar gear 59. The two gears 58 and 59 mesh with a driving pinion 57 which is operatively connected with motor 56, so that when motor 56 is operated, spindles 60 and 61 are rotated in the directions indicated by the arrows. Spindles 60 and 61 are provided with worm threads of right hand pitch and left hand pitch respectively. Referring particularly to switch lever F, the shaft 24 of this lever carries two worm wheels 62^F and 63^F freely mounted on the shaft 24 and meshing with the worms 222^F and 223^F of spindles 60 and 61 respectively (see Fig. 6). It therefore follows that when motor 56 is operated, worm wheels 62^F and 63^F are rotated in opposite directions. Mounted upon shaft 24 intermediate the two worm wheels 62^F and 63^F is a clutch device comprising a sleeve 64^F slidably mounted on the shaft, and a yoke 65^F pivotally mounted at 224^F and arranged to shift the sleeve into frictional engagement with one or the other of the worm wheels. This sleeve 64^F is provided with a square hole to accommodate the square shaft 24. The yoke 65^F is shifted in one direction or the other by a drive rod 66^F controlled by two magnets 67^F and 68^F. When 67^F and 68^F are both de-energized the drive rod 66^F and the yoke 65^F, due to the force of gravity active on the yoke 65^F, assume a position in which the sleeve 64^F is out of engagement with both the worm wheels 62^F and 63^F. When magnet 67^F is energized, the drive rod 66^F is drawn toward the left as viewed in the drawing and the clutch sleeve 64^F is urged against the inner face of worm wheel 62^F. Under this condition the worm wheel 62^F, driven by spindle 60, rotates the clutch sleeve 64^F, carrying with it shaft 24, and causes the shaft to move in a direction from N to R. If, however, magnet 68^F is energized, the drive rod 66^F is moved to the right to urge the clutch sleeve 64^F against the worm wheel 63^F, thereby driving shaft 24 in a direction from R to N. Should rotation of shaft 24 be prevented when the clutch sleeve engages one of the worm wheels, such worm wheel merely slips with respect to the sleeve and so the operation of motor 56 is not interfered with.

The clutch mechanism for the remaining machine lever will be readily understood without further explanation.

As shown in the drawing, the master lever M is in its normal position in which all of the contacts controlled thereby are open and magnet 11 is de-energized. Motor 56 is therefore de-energized and at rest. All of the clutch magnets for connecting the spindles 60 and 61 with the machine levers are de-energized, and all of the machine levers F, G and H are latched in their normal positions. Controllers K′ and K² both occupy their normal positions, and detector relays Q′ and Q² are energized in the normal direction. Signal S indicates stop and switches 1 and 2 both occupy their normal positions. The portions of track shown in the drawing are all unoccupied and relays C′ and C² are both energized.

I will now assume that handle 9ª of master lever M is rotated in the direction of the arrow through 90°. Upon completion of this movement the dog 12ª of armature 12 drops into slot 10ª in disk 10 and prevents further motion of the shaft 9. With lever M in this position current is supplied over the circuit previously traced to motor 56, and spindles 60 and 61 are therefore set into operation. At the same time circuits are closed for energizing the latch magnets 26 for all switch levers which must be operated to set up the required route. In the present case magnets 26 for both levers F and G are energized. Referring particularly to lever F the closing of contact 14 of lever M completes a circuit over which current flows from line wire 6, through wires 91 and 95, contact 14 of lever M, wires 96, 96ª and 97, contact 36 on lever F, wire 98, back contact 99—100 operated by magnet 70^F, impedance 101, wire 102, latch magnet 26 of lever F, and wire 103 back to wire 6ª. The latch magnet 26 therefore becomes energized, and the projection 28, operated thereby, closes contact 29ª—29ᵇ. Current then flows from wire 6, through wires 111 and 112, (Fig. 5) front contact 113 of track

relay C′, wire 114, contact 29^a—29^b operated by latch magnet 26 of lever F, wire 115, contact 34 of lever F, wires 116 and 117, winding of magnet 70^F, and wires 118 and 119, to line wire 6^a. Magnet 70^F thereupon becomes energized, lifting the latch 120 to free the locking segment 121. The quadrant latch 31 has already been lifted by operation of magnet 26 and therefore the shaft 24 is free to turn. The energization of magnet 70^F opens the preliminary circuit just traced for magnet 26 but the closing of contact 99—122 completes a circuit for the clutch operating magnet 67^F and the latch magnet 26 in series, which circuit is from line wire 6, through wires 91 and 95, contact 14 of master lever M, wires 96, 96^a and 97, contact 36 on lever F, wire 98, contact 99—122 operated by magnet 70^F, wire 123, clutch magnet 67^F, wires 124 and 102, latch magnet 26, and wire 103 to line wire 6^a. It will be noticed that this circuit contains magnets 26 and 70^F in series but does not include impedance 101. The purpose of this impedance in the circuit first traced for the latch magnet 26 is to limit the current flowing through this magnet during the short interval that this magnet is connected directly with the energy source 14. The energization of magnet 67^F couples the shaft 24 with the worm wheel 62^F and the shaft 24 is therefore rotated from the N position to the A position. At the A position, however, contact 36 included in the circuits just traced for magnets 26 and 67^F is opened but contact 37 on lever F is now closed, and a branch is therefore closed from wire 96, through wire 125, contact 37 and wires 126 and 127 to wire 123. This branch omits contact 99—122 operated by magnet 70^F, and also omits contact 36 on lever F. The circuit is therefore maintained through the branch just described until the lever 24 has been moved to the D position, when contact 37 opens. At the D position of lever F, further motion of the shaft is prevented by engagement of locking segment 140 with latch 139. In this position, however, contacts 32 and 33 are reversed, and the reversal of these contacts reverses the relative polarity of the current supplied to winding 3 of circuit controller K′ so that this circuit controller reverses. The reversal of armatures 81 and 82 of this circuit controller causes operation of motor J′ to move switch 1 to its reverse position as hereinbefore described. When switch 1 reaches its extreme reverse position the operation of contacts 85 and 86 reverses the relative polarity of the current supplied to winding 8 of relay Q′, which relay now becomes energized in the reverse direction and swings armatures 134 and 163 to their right hand positions. The closing of reverse contact 134 completes a circuit for magnet 71^F which may be traced from line wire 6, through wires 132 and 133, reverse contact 134 of relay Q′, wire 135, points N^D of contact 35 of lever F, wires 136 and 137, winding of magnet 71^F and wires 138 and 119 to line wire 6^a. The energization of magnet 71^F raises latch 139 to disengage the locking segment 140. At the same time the energization of magnet 71^F closes contact 143—144 and current is now supplied from line wire 6, through wires 91 and 95, contact 14 on lever M, wires 96, 96^a, 97 and 141, contact 38 on lever F, wire 142, contact 143—144 operated by magnet 71^F, wires 145, 127 and 123, magnet 67^F, wires 68 and 102, magnet 26 and wire 103 to line wire 6^a. This circuit includes contact 38 on lever F, which contact was closed when the lever passed the B position and remains closed until just before the lever moves into its R position, in which latter position contact 38 is open. Since both the latch 31 and the latch 139 are now disengaged and the clutch magnet 67^F is energized, shaft 24 is rotated from the D position toward the R position.

The circuit for accomplishing this motion however depends upon contact 35 which contact is arranged to reverse immediately after the shaft rotates out of the D position toward the R position. When this reversal occurs, contact 35 interrupts the circuits already traced for magnet 71^F. Contact 34 however is closed as soon as the lever attains the Y position, and this contact closes a second circuit for magnet 71^F. The Y position and the position at which the contact 35 reverses are so close together that after the breaking of the circuit including contact 35 the second circuit including contact 34 is closed for magnet 71^F before this magnet has time to drop the latch 139. This second circuit passes from line wire 6, through wires 111 and 112, front contact 113 of relay C′, wire 114, latch contact 29^c—29^a operated by projection 28 on lever F, wire 115, contact 34 of lever F, wires 146 and 137, winding of magnet 71^F and wires 138 and 119 to line wire 6^a. Magnet 71^F continues to be energized by this second circuit until the lever 24 has been moved to its full reverse or R position. The circuit for the clutch magnet 67^F and the latch magnet 26 is then broken at contact 38 so that the latch 31 drops and latches the lever 24 in the R position. The release of latch 31 opens contact 29^c—29^a, and this contact opens the second circuit for magnet 71^F.

Simultaneously with the operation of lever F just described, lever G has been actuated in a similar manner. That is to say, the closing of contact 15 of lever M completes the circuit for latch magnet 26 of lever G over contact 48 of lever G. The operation of the latch 31 closes contact 29^b—29^a, and thereby completes the circuit for magnet

70[G], lever G is therefore unlocked. The energization of magnet 70[G] lifts contact 107, and completes the circuit for clutch magnet 69[G]. The lever is therefore moved to the A position, where contact 48 opens, but contact 49 is closed from A to D, and the lever is therefore moved to the D position, further motion being prevented by the segment lock controlled by magnet 71[G]. As lever G moves into the D position contacts 44 and 45 operate to reverse the polarity of the current supplied to winding 3 of circuit controller K[2]. Motor J[2] is therefore operated to reverse switch 2. When this switch reaches its extreme reverse position relay Q[2] is energized in the reverse direction, due to operation of contacts 85 and 86 controlled by switch J[2]. The closing of reverse contact 226 of relay Q[2] completes a circuit for magnet 71[G] over contact 47 of lever G. The lever is therefore unlocked. The energization of magnet 71[G] also completes a circuit for latch magnet 26 and clutch magnet 67[G] in series with contact 51 of lever G. Lever G is therefore moved toward the R position. When contact 47 operates, the circuit previously established for magnet 71[G] is broken, but a new circuit is now closed for this magnet over contact 46. The lever therefore completes its stroke to the R position, where the opening of contact 50 de-energizes the clutch magnet 67[G] and latch magnet 26. The latch 31 therefore drops, and latches lever G in the R position.

Since both levers F and G now occupy their R positions, contact 39 on lever F and contact 51 on lever G are closed. Current then flows from line wire 6, through wires 91 and 95, contact 14 on master lever M, wires 96, 96[a] and 97, contact 39 on lever F, wire 147, contact 16 on master lever M, wire 148, contact 51 on lever F, wire 149, contact 17 on lever M, wire 150, contact 75 of signal lever H, Magnet 69[H], wires 152 and 153, latch magnet 26[a] of lever H, and wire 154 to line wire 6[a]. The latch 30[a] on lever H is therefore released and the clutch sleeve 64[H] is shifted against worm wheel 62[H], causing shaft 24[a] to rotate from the N position toward the R position. As soon as lever H reaches the R position a circuit is completed for signal S which may be traced from wire 6, through wire 161, contact 73 of lever H, wire 162, contact 163 of relay Q', wire 164, contact 165 of relay Q[2], wire 166, operating mechanism of signal S and wire 167 to line wire 6[a]. When this circuit is closed signal S is operated to indicate proceed. When the lever H reaches its R position contact 75 opens, allowing the magnet 26[a] to become de-energized and causing latch 31[a] to engage the locking quadrant 30[a] to hold the lever in the position to which it has been moved. Clutch magnet 69[H] is de-energized so that the shaft 24[a] is disconnected from the spindle 60.

With lever H in the R position contact 76 is closed and a circuit may be traced from wire 6, through wires 91 and 95, contact 14 on lever M, wires 96, 96[a] and 97, contact 39 on lever F, wire 147, contact 16 on lever M, wire 148, contact 51 on lever G, wire 149, contact 17 on lever M, wires 150 and 155, contact 76 on lever H, wire 157, contact 18 on lever M, wires 158 and 159, magnet 11 of lever M and wires 160 and 94 to line wire 6[a]. Magnet 11 is therefore energized, lifting armature 12 and disengaging contact 13 from the locking disk 10. Handle 9[a] can then be moved to the position indicated at 9[b], in which position all of the contacts on lever M are opened and motor 56 is de-energizing. It will be plain that after the operation thus described the route is set up for traffic from section *f* to section *y*, that is, switches 1 and 2 are both reversed and signal S indicates proceed. To accomplish this result it will be seen that it was only necessary to maniplate lever M and that operations of the remaining parts were entirely automatic. It should also be pointed out that the automatic operation of the machine levers must be performed in a certain predetermined sequence and that each operation must be completed before the next operation can be accomplished.

To restore the apparatus to its initial condition handle 9[a] of lever M is moved through an additional 90°, that is, to such position that the dog 12[a] falls into notch 10[b] in the disk 10. In this latching position contact 13 is again closed and motor 56 is operated to rotate spindles 60 and 61 as explained hereinbefore. At the same time the closing of contact 23 on lever M completes a circuit from line wire 6, through wires 91, 95 and 183, contact 23 on lever M, wires 184 and 185, contact 78 on lever H, wires 186 and 187, magnet 68[H], wires 188 and 153, magnet 26[a] of lever H, and wire 154, to line wire 6[a]. When this circuit is closed the latch 30[a] of lever H is released by magnet 26[a] and at the same time the shaft 24[a] of this lever is coupled with spindle 61 so that the lever is moved from the R position toward the D position. At the D position of the lever latch 180 engages segment 179 to prevent further motion of the lever. Although the motion just described for lever M initiates the operation of the signal lever H, the switch levers are not yet operated because the circuits for returning these levers to their normal positions are open at contact 90 of signal S, which contact is closed only when the signal indicates stop. When lever H moves away from the R position the opening of contact 73 thereon breaks the operating circuit previously traced for signal S,

and the signal therefore goes to stop, closing contact 90. Current then flows from wire 6 over wire 189, contact 90 controlled by signal S, wire 190, contact 74 of lever H, wire 191, magnet 72, and wire 192, to line wire 6^a. The magnet 72 therefore becomes energized to release locking segment 179 and permit lever H to be restored to its N position. As soon as the lever moves out of the D position the circuit just traced for clutch magnet 68^H and latch magnet 26^a is opened at contact 78, but when the lever is in the D position a branch is closed around contact 78 from wire 184, through wires 193 and 194, contact 79 on lever H, wire 195, contact 196—197 operated by magnet 72, wire 187, winding of magnet 68^H, wires 188 and 153, winding of magnet 26^a and wire 154 to line wire 6^a. This circuit is effective to continue the motion of shaft 24^a toward the N position, but soon after the shaft moves out of the D position this circuit is opened. After such motion is started however the latch 180 is lifted by magnet 72 past the edge of the locking segment 179 so that subsequent de-energization of magnet 72 by the opening of contact 74 does not prevent further operation of the shaft. As soon as the lever H has moved out of the D position in returning to the N position a second branch is provided for the latch magnet and clutch magnet circuit which may be traced from wire 184, through wire 193, contact 80 of lever H, wires 198 and 187, magnet 68^H, wires 188 and 153, magnet 26^a, and wire 154 to line wire 6^a. By virtue of the circuit through this branch the lever H is restored to its full normal position and when this position is attained contact 80 opens to de-energize the latch magnet 26^a and to disengage the clutch sleeve 64^H from worm wheel 63^H.

When lever H reaches the N position the closing of contact 77 permits current to flow simultaneously to the operating circuits for all of the switch levers which are to be restored to their normal positions. For example, the operating circuit for switch lever F passes from line wire 6, through wires 91, 95 and 183, contact 23 on lever M, wires 184 and 193, contact 77 on lever H, wires 199 and 200, contact 22 on lever M, wire 201, contact 40 on lever F, wire 202, contact 203—204 operated by magnet 71^F, impedance 205, wire 102, magnet 26 of lever F, and wire 103 to line wire 6^a. The latch magnet 26 is therefore energized to disengage the latch 31 from the quadrant 30 and to close contact 29^a—29^c, it being remembered that the lever F is now in the R position. A circuit is therefore established from line wire 6, through wires 111 and 112, front contact 113, of track relay C', wire 114, contact 29^c—29^a of lever F, wire 115, contact 34 of lever F, wires 146 and 137, winding of magnet 71^F, and wires 138 and 119 to line wire 6^a. Magnet 71^F therefore becomes energized, lifting the latch 139 to release the locking segment 140 to permit the shaft 24 to return toward its N position. The lifting of latch 139 opens the contact 203—204 and the circuit just traced for latching magnet 26 is therefore open. Contact 203—205 is now closed, however, and current therefore flows from wire 201 through contact 40, wire 202, contact 203—205, wires 206 and 218, magnet 68^F, wire 102, latch magnet 26 and wire 103 back to wire 6^a. The latch 31 is therefore lifted and the shaft 24^a is coupled with spindle 61 so that the shaft 24 is moved to the E position. At the E position contact 40 opens but contact 41 is now closed and current therefore flows from wire 201, through wires 209 and 210, contact 41, and wire 217 to wire 218. The clutch magnet 68^F and the latch magnet 26 are therefore both energized, and the lever F is moved to the B position further motion being prevented by latch 120 and segment 121. During the motion just described contacts 32 and 33 operate to reverse the relative polarity of the current supplied to circuit controller K'. Armatures 81 and 82 of this circuit controller are therefore swung to the left, operating motor J' to restore switch 1 to its normal position. When switch 1 reaches the normal position the operation of contacts 85 and 86 reverses the relative polarity of the current supplied to winding 8 of relay Q', and contacts 134 and 163 of this relay swing to the left or normal position, thereby completing a circuit from line wire 6, through wires 132 and 133, normal contact 134 of relay Q', wire 207, contact 35 of lever F, wires 208 and 117, winding of magnet 70^F, and wires 118 and 119 to line wire 6^a. Magnet 70^F therefore becomes energized to close contact 220—221, and a branch is then closed for the circuit for magnets 68^F and 26 from wire 201, through wires 209 and 211, contact 42 of lever F, wire 219, contact 220—221 operated by magnet 70^F and wire 218 to magnet 68^F. The circuit being closed through this branch for magnets 68^F and 26, lever 24 moves toward the A position. Contact 35 reverses immediately after the lever moves away from the B position. Contact 34 is closed so soon after the opening of switch 35 that magnet 70^F does not have time to release, and the circuit for magnet 70^F then passes from line wire 6, through wires 111 and 112, front contact 113 of relay C', wire 114, contact 29^c—29^a of lever F, wire 115, contact 34 of lever F, wires 116 and 117, winding of magnet 70^F, and wires 118 and 119 to line wire 6^a. Contact 220—221 is therefore held closed and the latch magnet 26 and the clutch magnet 68^F continue to be energized to complete the stroke of lever F. When the lever is moved to its full N position contact 42 opens. As a result, the cir-

cuit for magnets 68F and 26 is opened, thereby disconnecting the clutch and de-energizing the latch. Lever F is then latched in the N position.

During the operation of lever F from the R to the N position lever G has also been operated in a similar manner, and when both of these levers have returned to their N positions a circuit is completed for the latch magnet of lever M. This circuit passes from wire 6, through wires 91, 95 and 183, contact 23 of lever M, wires 184 and 193, contact 77 of lever H, wire 199, contact 21 of lever M, wire 212, contact 55 of lever G, wire 213, contact 20 of lever M, wire 214, contact 43 of lever F, wire 215, contact 19 of lever M, wires 216 and 159, winding of latching magnet 11 for lever M, and wires 160 and 94 to line wire 6^a. When this circuit is closed the latch magnet 11 becomes energized to lift dog 12^a out of the slot 10^b in locking disk 10. The lever M is therefore released so that the stroke may be completed, restoring the handle 9^a to the position in which it is illustrated in solid lines in the drawing. In this position motor 56 is de-energized and all of the contacts operated by the lever M are open.

All of the parts of the apparatus are thus restored to the positions in which they are illustrated in the drawing.

Each of the switch levers F and G and the signal lever H may be manually operated to control the associated traffic governing unit independently of the master lever M.

One advantage of my invention is that a large number of signaling units may be automatically operated in the proper sequence simply by operating the proper master lever corresponding to such units. With apparatus embodying my invention a master lever similar to the master lever M may be provided for each separate route which it may be desirable to set up through the railway yard. A complete route may then be set up, an operation which may require the actuation of a large number of machine levers, simply by the manipulation of the proper master lever. Each such master lever will control the motor 56 and will also control the clutch device 66 associated with those of the machine levers which control the traffic governing units necessary to set up the route controlled by such master lever. It is manifest, therefore, that my invention provides apparatus by means of which a given number of manipulations may be performed by fewer operators and in a shorter amount of time than is possible when it is necessary to operate each machine lever separately.

Another advantage of my invention is that when the route is being set up each unit which is successively operated can be operated only when the previous levers in the sequence have properly performed their functions. My invention therefore provides a measure of safety which is not readily obtainable with interlocking machines of the usual and well known form.

Although I have herein shown and described only one form of railway traffic controlling apparatus 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. Railway traffic controlling apparatus comprising a plurality of traffic governing units, a plurality of machine levers one for controlling each said unit, and means for operating certain of said levers automatically in a predetermined sequence.

2. In combination with railway tracks over which traffic may pass over a plurality of routes, a plurality of traffic governing units for said tracks, a plurality of machine levers one for controlling each said unit, and means for automatically operating certain of said levers associated with a predetermined route.

3. In combination, a railway track provided with a switch, a signal for governing traffic through said switch, a manually operable machine lever for said switch, a manually operable machine lever for said signal, a master controlling device, and means effective when said device is operated to automatically actuate said switch controlling lever and said signal controlling lever.

4. In combination, a railway track provided with a switch, a signal for governing traffic through said switch, a manually operable machine lever for said switch, a manually operable machine lever for said signal, a master lever, and means effective when said master lever is operated to successively actuate said switch controlling lever and said signal controlling lever automatically.

5. In combination, a railway track provided with a switch, a signal for governing traffic through said switch, a manually operable machine lever for said switch, a manually operable machine lever for said signal, a master lever, and means effective when said master lever is operated to automatically actuate said switch controlling lever and means also controlled by said master lever but effective only when said switch has been actually operated to actuate said signal controlling lever.

6. In combination, a railway yard through which traffic may move over a plurality of routes, a plurality of switches for said yard, a plurality of signals for governing traffic through said yard, an interlocking machine comprising a separate manually operable lever for controlling each switch and

each signal, and a master lever corresponding to a predetermined route for automatically controlling the levers associated with said route.

7. In combination, a railway yard through which traffic may move over a plurality of routes, a plurality of switches for said yard, a plurality of signals for governing traffic through said yard, an interlocking machine comprising a separate manually operable lever for controlling each switch and each signal, a master lever corresponding to a predetermined one of said routes, and means controlled by said lever for automatically actuating all of said levers associated with said route in a predetermined sequence.

8. In combination, a railway yard comprising a plurality of traffic governing units, an interlocking machine comprising a separate manually operable machine lever for controlling each said unit, and a master lever for automatically operating certain of said machine levers in a predetermined sequence.

9. In combination, a railway yard comprising a plurality of traffic governing units, an interlocking machine comprising a separate manually operable machine lever for controlling each said unit, a master lever, a driving motor, and means controlled by said master lever for operatively connecting certain of said machine levers with said motor.

10. In combination, a railway yard comprising a plurality of traffic governing units, an interlocking machine comprising a manually operable machine lever for controlling each said unit, a master lever, a driving motor, means controlled by said master lever for operatively connecting certain of said machine levers with said motor, and means controlled by each such machine lever for subsequently disconnecting such machine lever from said motor.

11. In combination, a railway yard comprising a plurality of traffic governing units, an interlocking machine comprising a manually operable machine lever for controlling each said unit, a master lever, a driving motor controlled by said master lever, and means controlled by said master lever for operatively connecting certain of said machine levers with said motor.

12. In combination, a railway yard comprising a plurality of traffic governing units, an interlocking machine comprising a separate manually operable machine lever for controlling each said unit, a master lever, a driving motor, and means controlled by said master lever for operatively connecting certain of said machine levers with said motor in a predetermined sequence.

13. In combination, a railway yard comprising a plurality of traffic governing units, an interlocking machine comprising a separate manually operable machine lever for controlling each said unit, a latch for each machine lever, a master lever, and means controlled by said master lever for automatically operating the latches of certain of said machine levers in a predetermined sequence.

14. In combination, a railway yard comprising a plurality of traffic governing units, an interlocking machine comprising a plurality of manually operable machine levers one for controlling each said unit, a master lever, means controlled by said master lever for initiating the operation of certain predetermined ones of said machine levers, and means controlled by said master lever and responsive to traffic conditions in said yard for completing such operation of said machine levers.

15. In combination, a railway yard comprising a plurality of traffic governing units, an interlocking machine comprising a plurality of manually operable machine levers one for controlling each said unit, a master lever, means controlled by said master lever for initiating the operation of certain predetermined ones of said machine levers, means controlled by said master lever and responsive to traffic conditions in said yard for completing such operation of said machine levers, and means also controlled by said master lever for restoring said machine levers to their initial condition.

16. In combination, a railway yard comprising a plurality of traffic governing units, an interlocking machine comprising a plurality of manually operable machine levers one for controlling each said unit, a master lever, means controlled by said master lever for initiating the operation of certain predetermined ones of said machine levers, means controlled by said master lever and responsive to traffic conditions in said yard for completing such operation of said machine levers, and means effective only when certain of such machine levers have actually completed their operation for operating certain others of such machine levers.

17. In combination, a railway yard having a plurality of switches, a plurality of signals for governing traffic through said switches, an interlocking machine having a machine lever for each said switch and for each said signal, a master lever corresponding to a predetermined route through said yard, means effective upon a partial operation of said master lever to operate a predetermined sequence of said machine levers and means effective upon a complete operation of said master lever to restore said machine levers to their initial positions.

18. In combination, a railway yard having a plurality of switches, a plurality of signals for governing traffic through said switches, an interlocking machine having a machine lever for each said switch and for each said signal, a master lever correspond-

ing to a predetermined route through said yard, means effective upon a partial operation of said master lever to operate a predetermined sequence of such switch machine levers, means controlled also by said master lever and responsive to the condition of such switch machine levers for operating certain signal machine levers, and means controlled by said master lever for successively restoring said signal machine levers and said switch machine levers to their initial conditions.

In testimony whereof I affix my signature.

BERTRAM R. PADMORE.