June 11, 1940. J. W. LOGAN, JR 2,203,913

RAILWAY TRACK SWITCH OPERATING APPARATUS

Filed Sept. 24, 1938 2 Sheets-Sheet 1

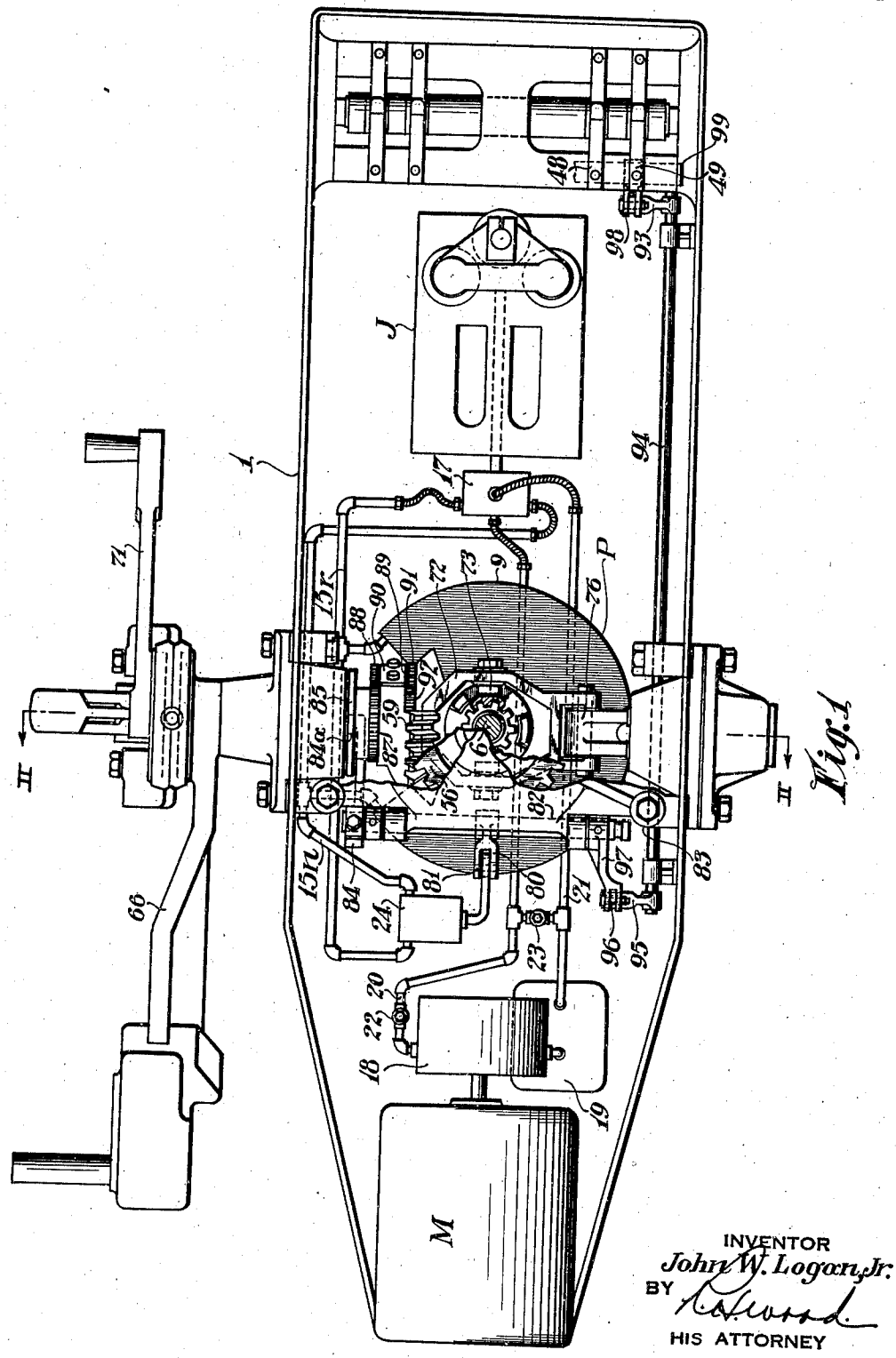


Fig. 1

INVENTOR
John W. Logan, Jr.
BY
HIS ATTORNEY

June 11, 1940. J. W. LOGAN, JR 2,203,913

RAILWAY TRACK SWITCH OPERATING APPARATUS

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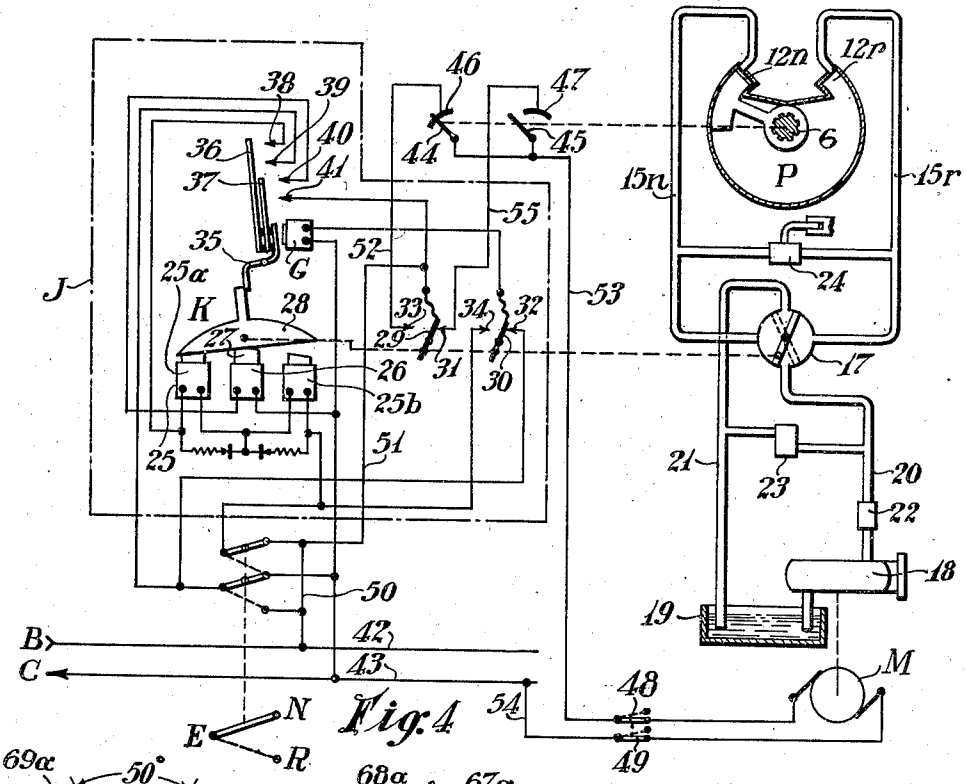


Fig. 4

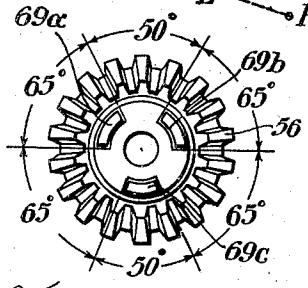


Fig. 5

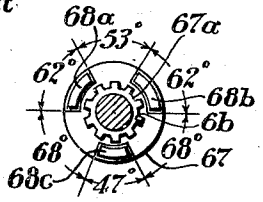


Fig. 6

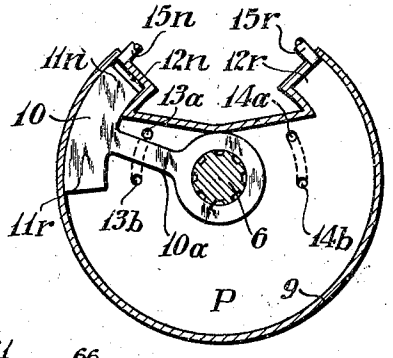


Fig. 3

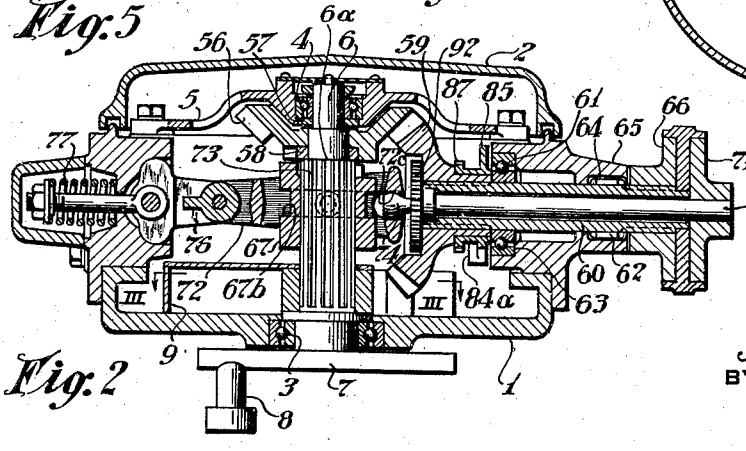


Fig. 2

INVENTOR
John W. Logan, Jr.
BY
HIS ATTORNEY

Patented June 11, 1940 2,203,913

UNITED STATES PATENT OFFICE

2,203,913

RAILWAY TRACK SWITCH OPERATING APPARATUS

John W. Logan, Jr., Forest Hills, Pa., assignor to The Union Switch & Signal Company, Swissvale, Pa., a corporation of Pennsylvania

Application September 24, 1938, Serial No. 231,520

8 Claims. (Cl. 246—258)

My invention relates to railway track switch operating apparatus.

An object of my invention is the provision of novel and improved power actuating means for a switch actuating shaft wherewith the torque applied to the shaft is proportioned in accordance with the force required to be exerted by the shaft in operating the switch actuating and switch locking means.

Another object of my invention is the provision of novel and improved means for reversibly actuating a switch actuating shaft wherewith the power supply element is required to be operated in but one direction.

Another object of my invention is the provision of novel and improved means for permitting manual operation of the switch operating apparatus without disconnecting the power actuated member from the switch actuating shaft.

Other objects and advantages of my invention will appear as the specification progresses.

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

In the accompanying drawings, Fig. 1 is a top plan view showing one form of a railway track switch operating apparatus embodying my invention, the cover of the mechanism being removed and certain of the parts broken away to more clearly illustrate the construction thereof. Fig. 2 is a sectional view taken on the lines II—II of Fig. 1. Fig. 3 is a sectional view taken on the lines III—III of Fig. 2, showing on an enlarged scale the power actuating element for the switch actuating shaft 6. Fig. 4 is a diagrammatic view of the power actuating means and the control apparatus therefor, for the switch actuating apparatus shown in Fig. 1. Fig. 5 is a bottom view of the gear wheel 56 forming part of the mechanism shown in Figs. 1 and 2. Fig. 6 is a top view of the clutch member 67 forming part of the mechanism shown in Figs. 1 and 2.

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

Referring to Figs. 1 and 2, the reference character 1 designates a casing or housing, the upper end of which is closed by a removable cover 2, which permits convenient access to the interior of the housing. The housing 1 is formed with a bearing 3 in the bottom thereof, and with a bearing 4 supported by a bracket 5 which is secured to the side walls of the housing. A vertically extending switch actuating shaft 6 is journaled in the bearings 3 and 4, and is provided at its lower end with a crank 7 provided with a crank pin 8. The crank 7 and crank pin 8 cooperate with suitable mechanism for actuating and locking a railway switch, which mechanism is not shown in the drawings, and which may, for example, be similar to that shown and covered in United States Letters Patent No. 1,293,290, granted to William Zabel on February 4, 1919. In the patent, the crank 55 and crank pin 58 correspond respectively to the crank 7 and crank pin 8 in the present disclosure.

The reference character P designates a fluid pressure motor operatively connected with the switch actuating shaft 6. As best seen in Fig. 3, the motor P comprises a fluid chamber 9, which may be cast integrally with housing 1, or which may be mounted securely thereon. Chamber 9 is preferably arcuate shaped, and is provided with a fluid operable piston 10 affixed to, and rotatable with, switch actuating shaft 6. The fluid operable piston 10 comprises piston rod 10*a*, one end of which is splined to shaft 6, the other end of which is provided with piston heads 11*n* and 11*r*. In the normal position of piston 10, as illustrated in Fig. 3, piston head 11*n* operates within a cylinder 12*n* disposed in the upper left-hand portion of the chamber 9, as viewed in Fig. 3, by-pass ports 13*a* and 13*b* provided in chamber 9 by-passing piston arm 10*a* only in this normal position of the piston. In the reverse position of piston 10, piston head 11*r* operates within cylinder 12*r* disposed at the upper right-hand portion of chamber 9, by-pass ports 14*a* and 14*b* provided for chamber 9 by-passing piston arm 10*a* only in this reverse position of the piston. Fluid is admitted to, or withdrawn from, chamber 9 through pipe 15*n* communicating with cylinder 12*n* and pipe 15*r* communicating with cylinder 12*r*.

The operation of the fluid motor is as follows: If fluid under pressure is admitted through pipe 15*n* to cylinder 12*n* when the piston 10 is in its normal position, as shown in Fig. 3, the fluid operates on piston head 11*n*, forcing the piston head out of cylinder 12*n*, the piston arm 10*a* being by-passed by by-pass ports 13*a* and 13*b* so that the fluid pressure on either side of the piston arm 10*a* is equalized. The actuation of piston 10 forces the fluid within chamber 9 out of the chamber through pipe 15*r*, and also rotates the switch actuating shaft 6. When piston head 11*n* emerges from cylinder 12*n*, the piston arm 10*a* is no longer by-passed by the ports 13*a* and 13*b* with the result that the fluid now operates against piston head 11*n* and piston arm 10*a*, thereby increasing the torque exerted by piston

10 upon shaft 6. When the piston is operated so that piston head 11*r* enters cylinder 12*r*, the ports 14*a* and 14*b* by-pass piston arm 10*a* with the result that the force exerted by piston 10 upon shaft 6 is decreased, the force now being only that exerted upon piston head 11*n* by the fluid. When the piston reaches the end of its stroke to assume its reverse position, the supply of fluid is cut off, as will be explained hereinafter, and the operation of motor P is terminated.

The operation of motor P from the reverse position of piston 10 back to the normal position of the piston is substantially the reverse of the operation just described, as will be readily apparent from an inspection of Fig. 3, and it is thought, therefore, that further detailed description is unnecessary.

It should be noted that in the extreme positions of piston 10 of motor P, the torque exerted upon shaft 6 by piston 10 is considerably lessened, so that at the start and termination of the rotation of shaft 6, the shaft exerts but little force upon the actuating mechanism for the switch. This feature is desirable, since, in accordance with the usual practice, shaft 6 first unlocks the switch points, then operates the switch points to a new position, and then locks the switch points in the new position, the locking and unlocking of the switch points requiring considerably less force than the operation of the switch points.

One advantage of apparatus embodying my invention is the provision of novel and improved power actuating means for a switch actuating shaft wherewith the torque applied to the shaft is proportioned in accordance with the force required to be exerted by the shaft in operating the switch locking and switch actuating means.

The apparatus providing the operating fluid for motor P and the control apparatus therefor is shown diagrammatically in Fig. 4. Referring to Fig. 4, the reference character 18 designates a fluid pressure producing pump, here shown as a rotary gear pump operatively connected with an electric motor M. A suitable form of operating fluid, which is stored in a reservoir or sump 19, is drawn by pump 18 through the admission passage of the pump, and is forced through the delivery passage of the pump and through pump delivery pipe 20 to a four-way valve 17. The four-way valve 17 is connected with sump 19 by a fluid return pipe 21. At times, valve 17 is controlled, as will be explained hereinafter, to its left-hand position to connect pump delivery pipe 20 with pipe 15*n* communicating with cylinder 12*n* of motor P, fluid return pipe 21 being connected by valve 17 with pipe 15*r* communicating with cylinder 12*r* of motor P. At other times, valve 17 is controlled to its right-hand position, that is, the position shown in Fig. 4, to connect pump delivery pipe 20 with pipe 15*r*, fluid return pipe 21 being connected by valve 17 with pipe 15*n*. Interposed in the pump delivery pipe 20 is a non-return check valve 22 which permits pump 18 to supply fluid under pressure to valve 17, but which prevents fluid from returning from valve 17 to pump 18. Connected across pump delivery pipe 20 and fluid return pipe 21 is a pressure relief valve 23 which is arranged to open and by-pass valve 17 whenever the pressure in the pump delivery pipe rises above a predetermined level, thereby preventing excessive loading of motor M and pump 18 in the event that the switch points strike an obstruction. Connected across pipe 15*n* and pipe 15*r* is a by-pass valve 24, the valve being governed, as will be explained hereinafter, by the selector mechanism for permitting manual operation of the switch actuating mechanism.

Motor M and valve 17 are controlled by an electromagnetic circuit controller J. The circuit controller may take different forms and, as here shown (see Fig. 4), is of the type disclosed in United States Letters Patent No. 1,722,364, granted July 30, 1929, to Henry S. Young for Railway traffic controlling apparatus. This controller will be described in connection with the present description only insofar as seems necessary for a complete understanding of my invention.

The circuit controller J consists in its essential elements of a circuit controlling electromagnet K and a neutral magnet G. The circuit controlling electromagnet K comprises a magnet 25 made up of the two windings 25*a* and 25*b* and a polarized winding 26 which latter is preferably provided with a permanently magnetized core 27. Pivotally mounted on the core 27 is an armature 28, the arrangement being such that when electromagnet K is supplied with current of one polarity, the armature 28 is operated in a counter-clockwise direction to its normal position, that is, the position illustrated in Fig. 4, but that when current of the opposite polarity is supplied to the electromagnet K, the armature is swung in a clockwise direction to a reverse position. In either case energization of magnet 26 is effected during the operation of the armature 28 to strengthen the permanent magnetic flux. Two circuit controller contacts 29 and 30 and the four-way valve 17 are operatively connected with armature 28. It can be seen that when the armature 28 swings to its normal position the contacts 29 and 30 are operated to a right-hand position, as viewed in Fig. 4, to engage, respectively, contacts 31 and 32, and the four-way valve 17 is operated to its right-hand position, but that when the armature swings to its reverse position, contacts 29 and 30 are operated to a left-hand position, making engagements respectively with contacts 33 and 34, the four-way valve 17 also being operated to its left-hand position.

The neutral magnet G controls a pivoted armature 35, the lower end of which projects into the path of movement of a portion of armature 28 to prevent movement of armature 28 when neutral magnet G is deenergized. The armature 35 carries two contact fingers 36 and 37, which are insulated from each other in any suitable manner, and which are adapted to close contacts 38—39 and 40—41, respectively, when the magnet G is energized.

The reference characters 44 and 45 designate movable circuit controller contact members which are controlled, in accordance with usual practice, by the switch actuating shaft 6 acting through a suitable point detector mechanism, which is not shown on the drawings since it forms no part of my present invention, but which may be of the type disclosed in the copending application for Letters Patent, Serial No. 148,706, filed by William C. McWhirter and Edwin G. Little on June 17, 1937. Contact member 44 engages fixed contact member 46 at all times except when the switch is in its reverse position, and contact member 45 engages fixed contact member 47 at all times except when the switch is in its normal position.

The reference characters 48 and 49 designate

circuit controlling contacts governed, as will be explained hereinafter, by the selector mechanism for permitting manual operation of the switch operating mechanism.

The reference character E designates a pole changing switch control lever having a normal position N and a reverse position R, it being understood that when lever E is moved to its normal position, the armature 28 of circuit controller J is operated to its normal position by virtue of current of one polarity supplied to electromagnet K, but that when lever E is moved to its reverse position, the armature 28 of circuit controller J is operated to its reverse position by virtue of current of the other polarity being supplied to the electromagnet K.

In describing the operation of the control apparatus for motor P, I shall assume that the switch is in its normal position, and that the control apparatus is in its normal condition as shown in Fig. 4. I shall now assume that lever E is moved to its reverse position R, with the result that armature 28 of circuit controller J operates to its reverse position, thereby operating the four-way valve 17 to its reverse position, and completing a reverse circuit for motor M, which circuit may be traced from terminal B of a suitable source of current, such as a battery not shown, through bus wire 42, wire 50, wire 51, contact 29—33 of controller J, wire 52, contact 46—44 controlled by the point detector mechanism, wire 53, contact 48 controlled by the selector mechanism, the winding of motor M, contact 49 controlled by the selector mechanism, wire 54 and bus wire 43 to the other terminal C of the source of current. The energization of motor M actuates pump 18, which forces fluid through pipe 20, four-way valve 17, and pipe 15*n* to cylinder 12*n* of chamber 9, thereby operating piston 10 of motor P to its reverse position, switch actuating shaft 6 being rotated with the result that the switch is actuated to its reverse position. When the switch reaches its reverse position, contact 46—44 is opened with the result that motor M is deenergized so that pump 18 no longer supplies fluid to motor P, thereby terminating the operation of motor P.

When it is desired to return the switch to its normal position, lever E is first moved to its normal position with the result that armature 28 of circuit controller J is operated to its normal position, thereby closing contact 29—31 of controller J and operating valve 17 to its right-hand position. Motor M is now energized over a normal circuit passing from terminal B through bus wire 42, wire 50, wire 51, contact 29—31, wire 55, contact 47—45 controlled by the point detector mechanism, wire 53, contact 48 governed by the selector mechanism, the winding of motor M, contact 49 governed by the selector mechanism, wire 54 and bus wire 43 to terminal C. The operation of motor M actuates pump 18, and since valve 17 is in its right-hand position, fluid is forced by the pump through pipe 20, valve 17 and pipe 15*r* to cylinder 12*r* of the motor P, thereby operating piston 10 of motor P to its normal position. The operation of motor P rotates shaft 6 with the result that the switch is actuated to its normal position, and contact 45—47 is opened when the switch reaches its normal position to open the circuit for motor M with the result that pump 18 no longer supplies fluid to motor P, thereby terminating the operation of motor P.

It should be noted that reversible operation of motor P is effected solely by virtue of the four-way valve 17, so that pump 18 and motor M are operated in but one direction. One advantage of apparatus embodying my invention is the provision of means for reversibly operating a switch actuating shaft wherewith the actuating power element is required to be operated in but one direction.

Referring once more to Figs. 1 and 2, a bevel gear 56 (see Fig. 2) is mounted for rotation coaxially with shaft 6 and is provided on its upper face with a boss which cooperates with a thrust washer 57 to prevent vertical displacement of the bevel gear in an upward direction. Vertical displacement of the bevel gear 56 in the opposite direction is prevented by a bushing 58 which cooperates at its upper end with the underside of the bevel gear and at its lower end with the shoulder 6*a* formed on shaft 6. The bevel gear 56 meshes with a segmental gear 59 splined to the end of a horizontally extending sleeve 60, which sleeve is rotatably mounted in a ball bearing 61 and in a needle bushing 62 disposed in bearing recesses 63 and 64, respectively, provided in a bearing support 65. Secured to the outer end of the sleeve 60 is a hand lever 66 by means of which the sleeve 60 and hence the bevel gear 56 may at times be rotated between two extreme positions.

The bevel gear 56 is adapted to be operatively connected with the shaft 6 by means of a clutch member 67 which is mounted on the shaft 6 for vertical sliding movement but which is constrained to rotate the shaft by means of integral splines 67*a* (see Fig. 6) which cooperate with corresponding splines 6*b* formed on the shaft 6.

As best seen in Fig. 6, the upper end of the clutch member 67 is provided with a plurality of teeth, two of which 68*a* and 68*b* in the particular embodiment illustrated are 62° in length and are spaced 53° apart, and the remaining one of which 68*c* is 47° in length and is spaced 68° from each of the teeth 68*a* and 68*b*. The lower end of the bevel gear 56 is likewise provided with a plurality of teeth, two of which 69*a* and 69*b* (see Fig. 5) are 65° in length and are spaced 50° apart, and the remaining one of which 69*c* is 50° in length and is spaced 65° from the other two teeth 69*a* and 69*b*. It follows that the teeth 68 on clutch member 67 will fit between the teeth 69 on bevel gear 56 when and only when the space between the teeth 68*a* and 68*b* is opposite the tooth 69*c* of bevel gear 56. The parts are so proportioned that this relation will exist when and only when the hand lever 66 and the switch occupy corresponding relative positions.

Of course, the prescribed dimensions of the teeth on the clutch member 67 and the bevel gear 56 are not essential and any other proportioning of the parts can be employed which will permit mating of the gear and the clutch member when and only when the hand lever 66 and the switch occupy corresponding relative positions.

It can be seen from the foregoing that when the clutch member 67 is in its one longitudinal position on shaft 6, the teeth on the upper end of the clutch member will connect bevel gear 56 with the shaft 6, but that when the clutch member is in its other longitudinal position on shaft 6, the bevel gear 56 is disconnected from the shaft. The clutch member 67 is moved longitudinally on the shaft 6 in order to effect the desired connection between the bevel gear 56 and the shaft 6 by means of a shifting mechanism.

The shifting mechanism may take different forms and as here shown is of the type disclosed in the copending application for Letters Patent,

Serial No. 148,706, filed June 17, 1937 by William C. McWhirter and Edwin G. Little. This shifting mechanism will be described in connection with the present description only insofar as seems necessary for a complete understanding of my invention.

The shifting mechanism (see Figs. 1 and 2) comprises in its essential element a shaft **70** provided at one end with a selector lever **71** by means of which the shaft may be at times oscillated and a shifter yoke **72** operatively connected with the inner end of the shaft **70**. The shifter yoke **72** is operatively connected with the clutch member **67** by means of a pair of rollers **73** extending into and cooperating with an annular groove **67***b* formed in the clutch member for operating the clutch member between its two extreme longitudinal positions in response to movement of the selector lever between its extreme positions.

The shaft **70** extends through, and is rotatably mounted in, the sleeve **60**, and is provided at its inner end with a rounded pin **74** formed in eccentric relation with respect to the axis of the shaft. The pin **74** cooperates with an elongated slot **72***c* formed in the right-hand end of the shifter yoke **72**, as viewed in Fig. 2, for actuating the yoke. The left-hand end of the shifter yoke **72** is attached to a floating fulcrum block **76**, which is pivotally attached to the housing **1**, and which is biased by means of a spring **77** to a mid position, that is, a position corresponding to a mid position of the clutch member **67** wherein the bevel gear **56** is disconnected from the shaft **6**.

The operation of the shifting mechanism is as follows: Normally, the selector lever **71** occupies the extreme position in which it is shown in the drawings, which is the position for motor operation, and under these conditions the pin **74** is at its lowest point in the path of its movement. With the pin in this position, the shifter yoke **72** and the clutch member **67** are in their extreme lowermost positions so that bevel gear **56** is disconnected from the shaft **6**. In order to connect bevel gear **56** to shaft **6**, and thereby permit manual operation of the switch, the selector lever **71** is rotated through an angle of approximately 210° from the position shown, thereby rotating the pin **74** through a corresponding angle. This rotation of pin **74** rotates the shifter yoke **72** and thereby causes the clutch member **67** to move upwardly on shaft **6**. When the clutch member is moved upwardly, under these conditions, if the position of the switch and the hand lever **66** correspond, so that the teeth **68** of the clutch member align with the spaces between the teeth **69** on the bevel gear **56**, the clutch member will be moved to its extreme upper position in which the teeth on the clutch member and the teeth on the bevel gear mesh. The bevel gear **56** will then be connected with the shaft **6**, with the result that the switch may be operated between its two extreme positions by swinging the hand lever **66** between its two extreme positions. If, however, the position of the switch and the hand lever **66** do not correspond when the lever **71** is rotated to the hand throw position, so that when clutch member **67** is moved upwardly, the teeth of the clutch member **67** do not mesh with the teeth of bevel gear **56**, the spring **77** provided for the fulcrum block **76** is compressed. It can be seen, therefore, that under this latter condition, when the hand lever **66** is moved to a position corresponding to the position of the switch, the energy stored in the spring **77** will complete the upward movement of the clutch member, thereby causing the teeth on the clutch member to mesh with the teeth of the bevel gear **56**, and thereby permitting manual operation of the switch in the manner previously described.

When it is desired to restore the apparatus to condition for operation by the motor, the selector lever **71** is restored to its normal position in which it is shown in the drawings. The operation of the apparatus under these conditions is the reverse of that just described, as will be readily understood from an inspection of the drawings without further detailed explanation.

The selector lever **71** also provides means, previously referred to, for automatically rendering the fluid pressure motor P and the power element, motor M, for motor P ineffective to operate the switch whenever the selector lever is moved away from the motor operating position. As here shown, the means for controlling by-pass valve **24**, whereby motor P is rendered ineffective to actuate shaft **6**, comprises a crank arm **80** operatively connected with the by-pass valve **24** by means of a pin **81**, the crank arm **80** being secured to a rockshaft **82**. The rockshaft **82** extends transversely of the switch machine (see Fig. 1), and is journaled in suitable lugs formed in the bearing plate **83**, and is provided on one end with an arm **84** provided with a cam follower **84***a* which cooperates with a cam **85**. The cam **85** is journaled on the hub of segmental gear **59** and has formed integral therewith a gear wheel **87** which meshes with a pinion **88** mounted on one end of a jackshaft **89**. The jackshaft **89** is journaled in a bearing **90** secured to the hub of the segmental gear **59**, and is provided at the end opposite to the pinion **88** with a similar pinion **91** which meshes with a gear wheel **92** formed on the inner end of the shaft **70**.

In operation, when the selector lever **71** is rotated away from the position shown, the rotation of the lever will act through shaft **70**, gear wheel **92**, pinion **91**, shaft **89**, pinion **88**, and gear **87** to cause cam **85** to rotate in unison with the selector lever, and as soon as the cam has been rotated through a relatively small angle, the high portion of the cam will move into engagement with the cam follower **84***a*. This will cause the cam follower, and hence the cam arm **84**, to rotate and hence act through the rockshaft **82**, the crank arm **80** and the pin **81**, to open the valve **24**. The valve will then be held in its opened position until the selector lever is subsequently restored to the position shown. Valve **24** in its opened position by-passes the piston **10** of motor P, thereby rendering motor P ineffective to operate the switch actuating shaft, and also permitting piston **10** of motor P to rotate freely in accordance with a rotation of the switch actuating shaft. It can be seen, therefore, that manual operation of the switch may be effected without disconnecting the fluid operable piston from the switch actuating shaft.

The means for rendering inoperative the power element, motor M, for the switch mechanism comprises a crank arm **93** secured to one end of the rockshaft **94** extending longitudinally of the switch machine (see Fig. 1), the crank arm **93** being operatively connected by means of a vertical connecting rod **98** which actuates a member **99** connected with contacts **48** and **49** interposed, as was explained hereinbefore, in the motor circuit for motor M. The other end of rockshaft **94** is provided with a crank arm **95** connected

through a vertical connecting rod 96 with a crank arm 97 provided on rockshaft 82.

The control of the contacts 48 and 49 by the selector lever is similar to the control of by-pass valve 24, the rotation of selector lever 71 being transferred, as hereinbefore described, to rockshaft 82 and then through crank arm 97, connecting rod 96, crank arm 95, rockshaft 94, crank arm 93, connecting rod 98 and member 99 to open the contacts 48 and 49 when the selector lever is moved from its motor position, the contacts remaining open until the selector lever is returned to its motor position.

It is apparent from the foregoing that manual operation of the switch mechanism may be effected without disconnecting piston 10 of motor P from the switch actuating shaft 6. It is further apparent that, when the switch mechanism is conditioned for hand operation, control of the power actuating element, motor M, for the switch actuating shaft cannot be established. One advantage of apparatus embodying my invention is the provision of novel and improved means permitting manual operation of a switch actuating shaft without requiring disconnection of the power actuated piston of the power actuating means from the switch actuating shaft.

Although I have herein shown and described only one form of railway track switch operating 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 track switch operating apparatus comprising a rotatable shaft adapted to be operatively connected with the switch, a fluid pressure motor having an arcuate shaped fluid chamber provided at one end with a first cylinder and at the other end with a second cylinder, a fluid operable piston arm operating within said chamber and affixed to said shaft for rotation therewith, said piston arm being provided at its outer end with a first piston head cooperating with said first cylinder and with a second piston head cooperating with said second cylinder, by-pass ports disposed within said chamber for by-passing the fluid around said piston arm when said first or said second piston operates within said first or said second cylinder, and means for at times supplying fluid to said motor for reversibly operating said piston.

2. A fluid pressure motor comprising an arcuate shaped fluid chamber provided at one end with a first cylinder and at the other end with a second cylinder, a fluid operable piston operating within said chamber and affixed to a rotatable shaft for rotating said shaft, a first piston head provided at the outer end of said piston for cooperating with said first cylinder, a second piston head provided on the outer end of said piston for cooperating with said second cylinder, and means disposed within said chamber effective when said first piston head operates within said first cylinder or when said second piston head operates within said second cylinder for reducing the torque exerted upon said shaft by said piston.

3. A fluid pressure motor comprising an arcuate shaped fluid chamber provided at one end with a first cylinder and at the other end with a second cylinder, a fluid operable piston operating within said chamber and affixed to a rotatable shaft for rotating said shaft, a first piston head provided at the outer end of said piston for cooperating with said first cylinder, a second piston head provided at the outer end of said piston for cooperating with said second cylinder, and by-pass ports disposed within said fluid chamber for by-passing the fluid around said piston whenever said first piston head operates within said first cylinder or whenever said second piston head operates within said second cylinder.

4. A fluid pressure motor comprising, in combination, an arcuate shaped fluid chamber, said chamber having two cylinders one disposed at each end of said chamber, a rotatable shaft, a piston arm secured to said shaft and rotatable about the axis of said shaft between two extreme angular positions, a piston head carried by said piston arm, said head cooperating with one or the other of said two cylinders according as said piston arm is in its respective one or another of said two extreme positions, and means for supplying fluid to said chamber effective whenever said piston head cooperates with said cylinders for exerting fluid pressure only upon said head and effective at other times to exert fluid pressure upon both said piston head and said piston arm.

5. Railway track switch operating apparatus comprising a rotatable shaft adapted to be operatively connected with the switch, and fluid pressure responsive motor means for rotating said shaft between two extreme angular positions, said motor means having a fluid operable piston which is affixed to said shaft and which rotates about the axis of said shaft to thereby rotate said shaft, and said motor means being characterized by the fact that the force exerted by the operating fluid upon said piston is proportioned in accordance with the torque required to be exerted by said motor means upon said shaft.

6. Railway track switch operating apparatus comprising a rotatable shaft adapted to be operatively connected with the switch, a fluid pressure motor comprising a chamber containing a reciprocable piston, said piston being affixed to said shaft and rotatable about the axis of said shaft to thereby rotate said shaft, and means provided in said chamber and controlled by the position of said piston in said chamber for controlling the force exerted by the operating fluid upon said piston, whereby said piston exerts different torques upon said shaft at different positions of said piston in said chamber.

7. In a railway track switch operating mechanism of the class having a rotatable shaft adapted to be operatively connected with the switch and wherein the shaft is operatively connected to or disconnected from manual operating means according as a selector mechanism is in its respective manual or power operating position, the combination with said rotatable shaft of fluid pressure responsive motor means comprising a chamber containing a reciprocable piston affixed to and rotatable about the axis of said shaft and said chamber being provided with means controlled by the position of said piston for controlling the force exerted by the operating fluid on the piston whereby to cause said piston to exert different torques upon said shaft at different positions of said piston in said chamber, and means controlled by said selector mechanism when in its manual operating position for by-passing the operating fluid in said chamber around said piston to permit manual operation of said shaft.

8. In a dual-control railway track switch operating mechanism of the class having a rotatable shaft adapted to be operatively connected with the switch and wherein the shaft is conditioned for rotation by power operating means or by manual operating means according as a selector mechanism is in its power or its manual operating position, the combination with said rotatable shaft of a fluid operable piston affixed to and rotatable about said shaft and operating in a chamber to which operating fluid is at times supplied for reversibly operating said piston, said chamber being provided with means responsive to the position of said piston in the chamber for varying the force exerted by the operating fluid on said piston, and means controlled by said selector mechanism when in its manual operating position for by-passing fluid in said chamber around said piston for permitting manual operation of said shaft.

JOHN W. LOGAN, JR.