

Oct. 17, 1933.

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1,930,722

RAILWAY SWITCH OPERATING APPARATUS

Filed Nov. 24, 1931

3 Sheets-Sheet 1

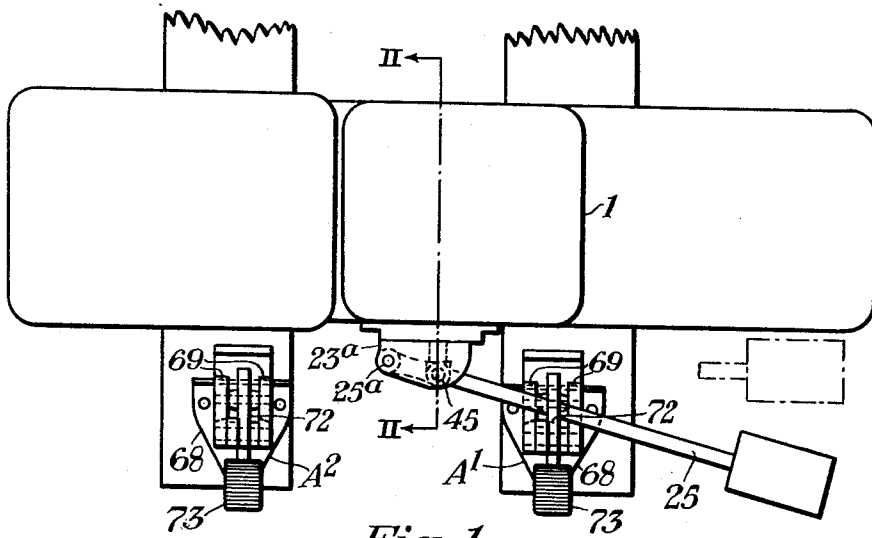


Fig. 1.

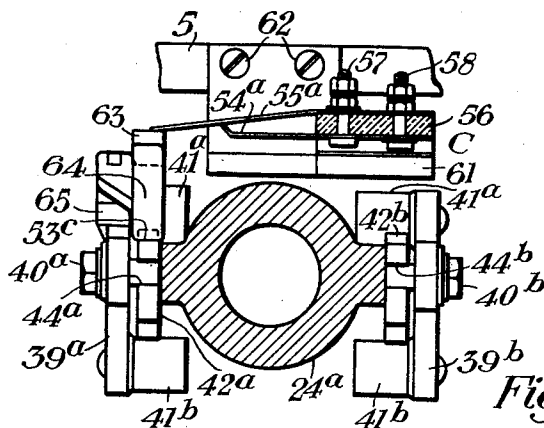


Fig. 4.

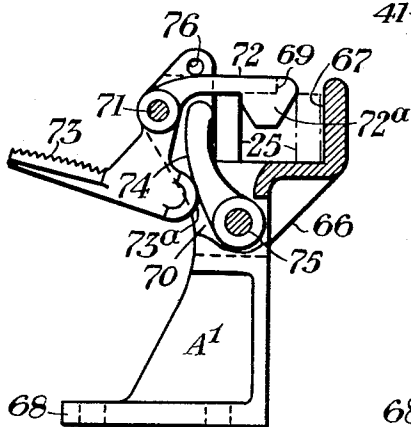


Fig. 12.

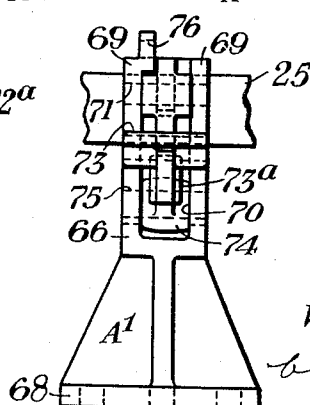


Fig. 13.

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3 Sheets-Sheet 2

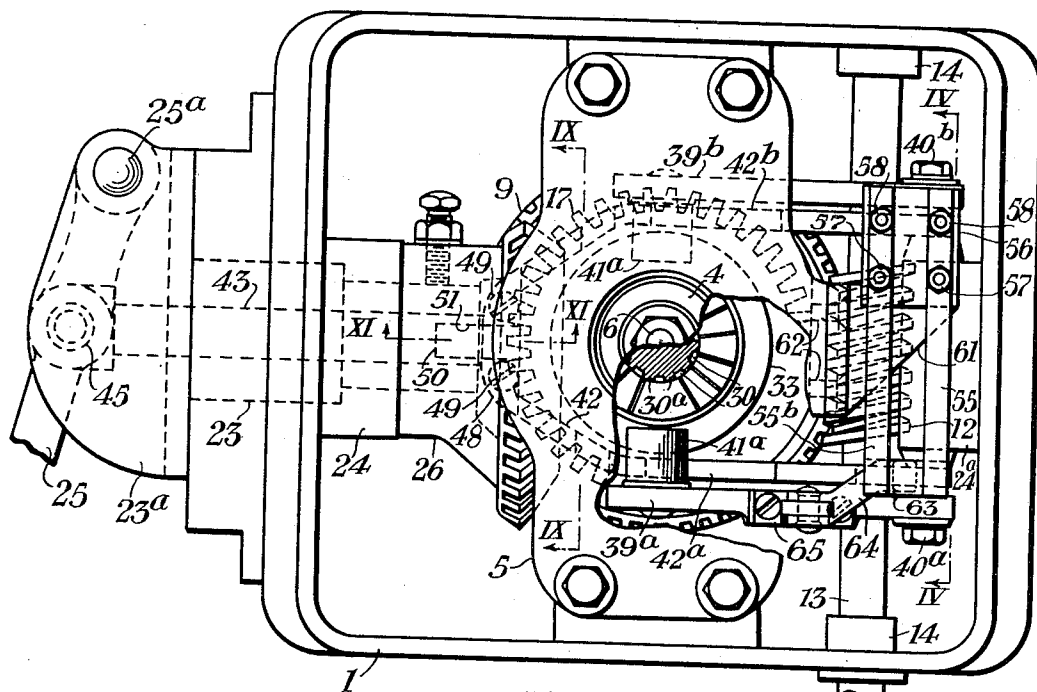


Fig. 3.

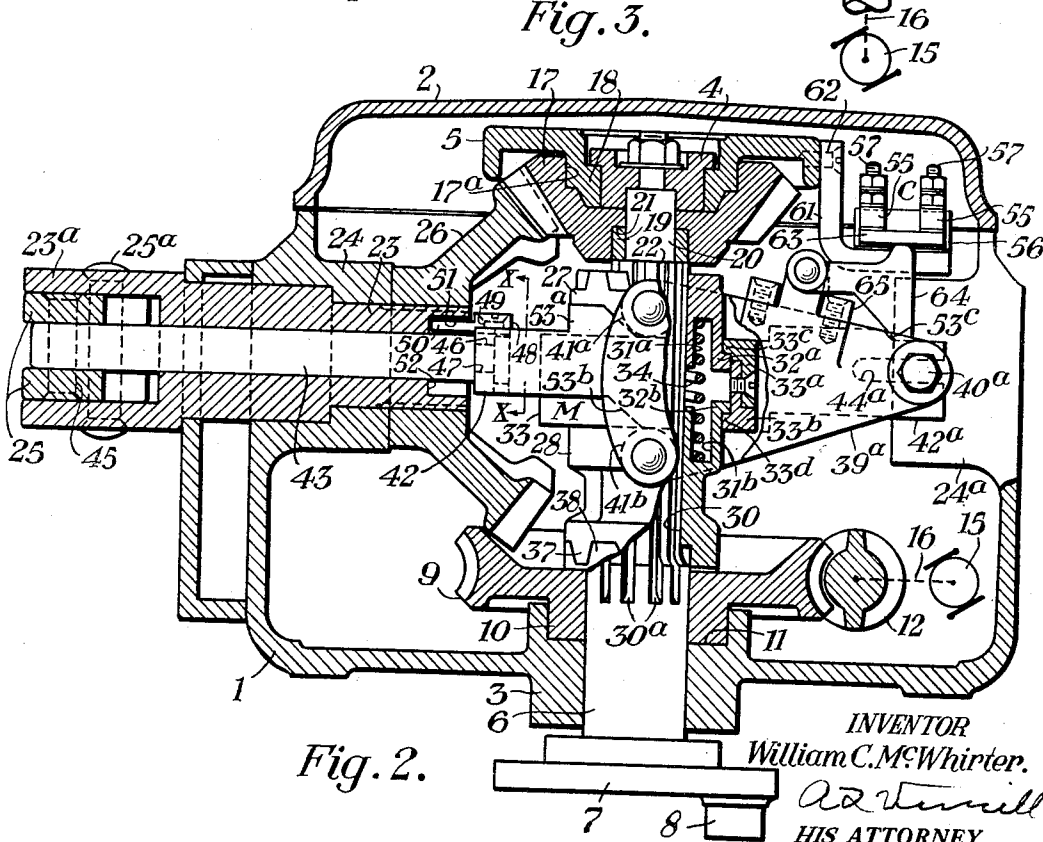


Fig. 2.

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RAILWAY SWITCH-OPERATING APPARATUS.

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3 Sheets-Sheet 3

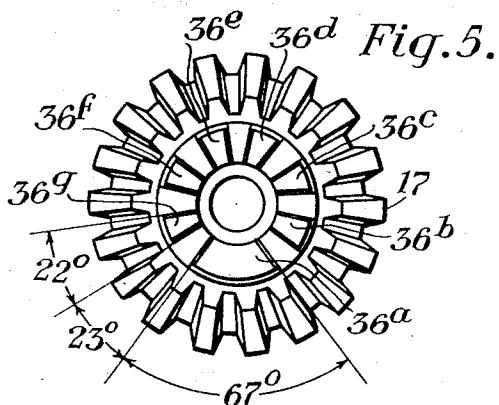
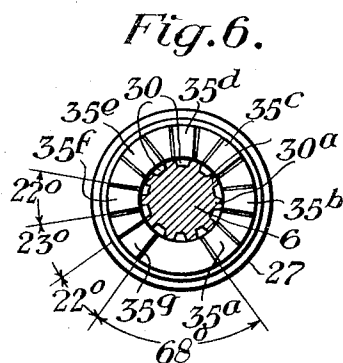
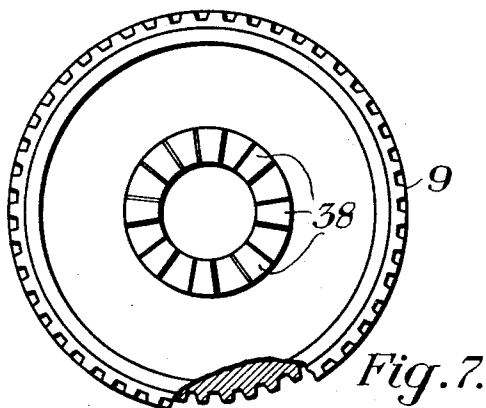
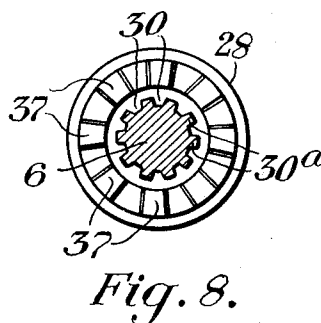
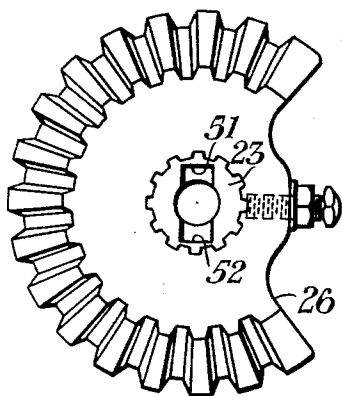
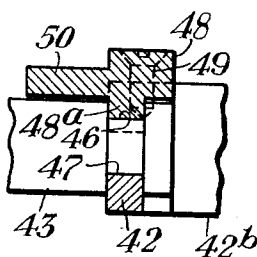
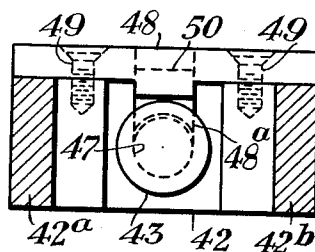


Fig. 9.

Fig. 11.

Fig. 10.

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UNITED STATES PATENT OFFICE

1,930,722

RAILWAY SWITCH OPERATING APPARATUS

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Application November 24, 1931

Serial No. 577,039

26 Claims. (Cl. 246—242)

My invention relates to railway switch operating apparatus, and has for an object the provision of novel and improved means for permitting manual operation of a power operated switch.

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

In the accompanying drawings, Fig. 1 is a top plan view showing one form of apparatus embodying my invention. Fig. 2 is an enlarged sectional view taken on the line II—II of Fig. 1. Fig. 3 is a top plan view of the apparatus shown in Fig. 2, with the cover of the housing removed, and with certain parts omitted or broken away to more clearly illustrate the construction thereof. Fig. 4 is a sectional view taken substantially on the line IV—IV of Fig. 3. Fig. 5 is a bottom view of the bevel gear 17 forming part of the apparatus shown in Figs. 2 and 3. Fig. 6 is a top view of the sleeve 27 forming part of the clutch mechanism M for at times connecting the shaft 6 with the bevel gear 17 of the apparatus shown in Figs. 2 and 3. Fig. 7 is a detail view illustrating the worm wheel 9 forming part of the apparatus shown in Figs. 2 and 3. Fig. 8 is a bottom view of the sleeve 28 forming part of the clutch mechanism M for at times connecting the shaft 6 with the worm wheel 9 of the apparatus shown in Figs. 2 and 3. Fig. 9 is a right-hand end view of the sleeve 23 and segment gear 26 forming part of the apparatus illustrated in Figs. 2 and 3. Fig. 10 is a sectional view taken on the line X—X of Fig. 2. Fig. 11 is a sectional view taken on the line XI—XI of Fig. 3. Fig. 12 is a view partly in elevation, and partly in section, showing on an enlarged scale the lock stand A¹ forming part of the apparatus illustrated in Fig. 1. Fig. 13 is a view of the lock stand shown in Fig. 12, as it appears when viewed from the left in Fig. 12.

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

Referring first to Figs. 1 to 3, inclusive, 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, but which may, for example, be similar to that shown in Letters Patent of the United States No. 1,293,290, granted to William Zabel, on Feb. 4, 1917. In the said patent, the crank 55 and crank pin 58 correspond respectively to the crank 7 and crank pin 8 in the present disclosure.

A worm gear 9 is mounted for rotation coaxially with the shaft 6, and is formed with a hub 10 for seating engagement within a suitable step bearing 11 formed in the upper portion of the bearing 3. This gear is driven by a worm 12 fixed to a jackshaft 13 which is journaled in bearings 14 provided in the walls of the housing 1. The jackshaft 13 is operatively connected with suitable power driving means such as an electrical motor 15 through suitable reduction gearing indicated in the drawings by the dash lines 16.

A bevel gear 17 is also mounted for rotation coaxially with the shaft 6, and is provided in its upper face with an annular recess 17^a which cooperates with a thrust bearing 18 formed on the lower side of the bracket 5 to prevent vertical and axial displacement of the bevel gear. Vertical and axial displacement of the bevel gear is also prevented by a bushing 19 which is interposed between the bevel gear and the reduced upper end 20 of the shaft 6, and which cooperates at one end with a circular shoulder 21 formed integral with the bevel gear, and at the other end with a shoulder 22 formed at the bottom of the reduced upper end 20 of the shaft. The bevel gear 17 meshes with a segmental bevel gear 26 splined to the end of a horizontally extending sleeve 23 which is journaled in a bearing 24 formed in the side of the housing 1. The outer end of the sleeve 23 is provided with an integral channel shaped portion 23^a, and pivotally mounted in this channel shaped portion on a pin 25^a carried thereby, is a hand lever 25. This lever provides means for rotating the sleeve 23 in its bearing for purposes presently to be described.

The worm gear 9 and the bevel gear 17 are selectively connected with the shaft 6 by means of a clutch mechanism M comprising two sleeves 27 and 28 which are mounted on the shaft 6 for vertical sliding movement, but which are constrained to rotate with the shaft by means of integral internal splines 30 which cooperate with

corresponding splines 30^a formed on the shaft, as best seen in Figs. 3, 6 and 8. As shown in Fig. 2, the confronting ends of the sleeves 27 and 28 are formed with annular recesses 31^a and 31^b, respectively, and with circumferential flanges 32^a and 32^b. A clutch collar 33 comprising two cylindrical members 33^a and 33^b screwed together, surrounds the sleeves 27 and 28 at the flanges 32^a and 32^b with slight clearance, and is provided at its upper end with an inwardly extending circular shoulder 33^c which overlies the circular flange 32^a, and at its lower end, with a similar inwardly extending shoulder 33^d which underlies the circular flange 32^b. The sleeves are constantly urged apart by a coil spring 34, the upper and lower ends of which are located in the recesses 31^a and 31^b, respectively.

As best seen in Fig. 6, the upper end of the sleeve 27 is provided with teeth 35^a, 35^b, . . . 35^s. It will be noted that, as here shown, the angular distance between each two adjacent teeth 35 is 23° except that the angular distance between the teeth 35^a and 35^s is 68°. The angular length of each tooth 35, as here shown, is 22°. The lower face of the bevel gear 17 is likewise provided with teeth 36^a, 36^b, . . . 36^s, as shown in Fig. 5. Each of these latter teeth, as here shown, has an angular length of 22° with the exception of the tooth 36^a which has an angular length of 67°. The angular space between each two adjacent teeth 36, as here shown, is 23°. It follows that the teeth 35 on the sleeve 27 will fit between the teeth 36 on the gear 17 when and only when the space between the teeth 35^a and 35^s on the sleeve is opposite the tooth 36^a on the bevel gear. The parts are so proportioned that this relation will exist when and only when the hand lever 25 and the switch occupy corresponding relative positions.

Of course, the described dimensions of the teeth on the sleeve 27 and gear 17 are not essential, as any other proportioning of parts can be employed which will permit mating of the gear and sleeve when and only when the hand lever and the switch occupy the proper relative positions.

The lower end of the sleeve 28 is also formed with teeth 37. These teeth are evenly spaced about the end of the sleeve, as best seen in Fig. 8, and are arranged to cooperate with similar teeth 38 formed on the upper end of the worm wheel 9, as shown in Fig. 7.

It follows from the foregoing, that when the clutch mechanism M is in one longitudinal position on the shaft 6 the teeth on the lower end of the sleeve 28 connect the worm wheel 9 with the shaft 6, whereas, when the clutch mechanism M is in another longitudinal position on the shaft, the teeth on the upper end of the sleeve 27 connects the bevel gear 17 with the shaft 6.

The clutch mechanism M is moved longitudinally on the shaft 6 in order to effect the desired driving connection between the bevel gear 17 and the shaft, and between the worm wheel 9 and the shaft, by means of shifting mechanism embodying my present invention, which mechanism I will now describe. This mechanism, in the form here shown, comprises two shifter levers 39^a and 39^b which are pivotally mounted at one end on studs 40^a and 40^b threaded into the opposite sides of a boss 24^a formed on the side wall of the housing 1 (see Figs. 2, 3 and 4). The levers 39^a and 39^b extend inwardly

in substantially horizontal directions on opposite sides of the collar 33 to a position past the vertical axis of the collar, and are each provided at their inner ends with a pair of spaced rollers 41^a and 41^b which engage the upper and lower edges of the collar 33 at both sides of the collar. The shifting mechanism also comprises a substantially U-shaped shifter yoke 42 having two spaced horizontally extending arms 42^a and 42^b. The shifter yoke 42 is connected to one end of a shifter rod 43 in a manner to be described presently, and the one arm 42^a of the shifter yoke extends between the collar 33 and the lever 39^a, and is provided at its free end with an axial slot 44^a which receives the stud 40^a with slight clearance. The other arm 42^b of the shifter yoke 42 similarly extends between the collar 33 and the lever 39^b, and is provided at its free end with a slot 44^b (see Fig. 4) which receives the stud 40^b with slight clearance. The shifter rod 43 is mounted for axial sliding movement within the sleeve 23, and the outer end thereof is pivotally connected with the hand lever 25 by means of a pin 45.

For reasons which will appear hereinafter, it is necessary to connect the shifter rod 43 to the shifter yoke 42 in such manner that the shifter rod can rotate with respect to the shifter yoke, but that, axial movements of the shifter rod will cause corresponding horizontal movements of the shifter yoke. For this purpose, the shifter rod, as here shown, is provided at its inner end with an annular groove 46, and the shifter yoke 42 is provided with a recess 47 which receives the shifter rod at the groove 46 with slight clearance as shown in Figs. 10 and 11. The shifter rod 43 is held in place in the recess 47 by means of a bearing cap 48 which is fastened to the shifter yoke 42 adjacent the recess 47 by means of screws 49, and which is provided with a bearing member 48^a which extends into the upper end of the recess 47. The bearing cap 48 is also provided with a horizontally extending finger 50 which cooperates in a manner to be described hereinafter with two horizontally extending diametrically opposite slots 51 and 52 (see Figs. 2 and 9) formed on the inner end of the sleeve 23. The arms 42^a and 42^b of the shifter yoke 42 also extend between the rollers 41^a and 41^b carried by the adjacent levers 39^a and 39^b, and are each provided on their upper edges with a cam 53^a which cooperates with the adjacent roller 41^a, and on their lower edges, with a cam 53^b which cooperates with the adjacent roller 41^b.

The reference character C designates a circuit controller which, in the form here shown, comprises two sets of contact fingers, each set of which consists of a fixed contact finger 54 and a movable contact finger 55 which normally engages the fixed contact finger 54 to close a contact 54-55. The fixed contact finger 54 and movable contact finger 55 of each set are secured to the opposite sides of an insulating block 56 by means of two terminal posts 57 and 58. Each terminal post 57 is insulated from the associated finger 55, but is electrically connected with the associated finger 54, whereas, each terminal post 58 is insulated from the associated finger 54, but is electrically connected with the associated finger 55. The insulating block 56 is mounted on a bracket 61 which is secured to the side of the bracket 5 by means of screws 62. The free ends of the movable fingers 55 are engaged by an insulating block 63 which cooperates with a cam follower 64. The cam follower 64 is piv-

otally attached to a bracket 65 secured to the upper side of the lever 39^a, and is adapted to cooperate, in a manner to be described hereinafter, with a cam 53^a formed on the upper side of the arm 42^a of the shifter yoke 42 (see Fig. 2). The circuit controller C may, for example, be employed to control the supply of current to the electric motor 15.

Cooperating with the hand lever 25 on opposite sides of the sleeve 23 as shown in Fig. 1 are two lock stands A¹ and A². These lock stands are exactly alike, and a description of one will therefore suffice for both. Referring to the lock stand A¹, for example, illustrated in detail in Figs. 12 and 13, this lock stand, in the form here shown, comprises a jaw 66 formed on a suitable base 68 which may be secured to a railway tie as shown, or to any other convenient foundation or support. The jaw 66 is provided with an opening 67 which is adapted to receive the hand lever 25, this opening being made sufficiently wide as viewed in Fig. 12 so that when the hand lever is within the opening the lever may be swung through a considerable angle about its pivot 25^a in the horizontal plane. For reasons which will appear hereinafter, it is desirable to prevent the hand lever 25 from being inserted into, or removed from, the opening 67 except when the lever is at the extreme right-hand side of the opening, as viewed in Fig. 12, and for this purpose, the jaw 67 is provided with two spaced projections 69 which partially close the upper end of the opening 67 as best seen in Figs. 1 and 12. The jaw 66 is also provided at its left-hand side, as viewed in Fig. 12, with a slot 70 which communicates with the opening 67 between the spaced projections 69, and which extends at right angles to the plane in which the hand lever 25 must be rotated in order to insert it into, or remove it from, the opening 67. Pivotaly mounted within the slot 70 on a pin 71 carried by the jaw 66 is a locking member 72. The locking member 72 overlies the hand lever 25 when the hand lever occupies its extreme left-hand or full line position in the slot 67 as viewed in Fig. 12, and is provided at its right-hand end with a locking projection 72^a which cooperates with the hand lever 25 in such manner that the hand lever cannot be moved from its full line position to its dotted line position without first raising the locking member to a position in which the locking projection is out of the path of movement of the lever. In order to facilitate the raising of the locking member 72 to the position in which the locking projection 72^a is out of the path of movement of the hand lever, the locking member has secured thereto, or operatively connected therewith, a foot pedal 73. The foot pedal 73 also cooperates with a dog 74 which is pivoted within the slot 70 on a pin 75 carried by the jaw, in such manner that when the foot pedal is depressed, a rounded portion 73^a formed thereon will engage the dog 74 and will rotate it in a clockwise direction about the pin 75. The upper end of the dog 74 is adapted to cooperate with the left-hand side of the hand lever 25 to at times move the hand lever from the full line position shown in Fig. 12 to the dotted line position shown in this figure, in a manner which will be described more fully hereinafter. It will be noted from an inspection of Figs. 12 and 13 that one of the fingers 69 is provided with an eye 76 which is adapted to receive a padlock or other fastening

device not shown in the drawings. The function of the eye 76 will be made clear presently.

The operation of the lock stand is as follows: When the parts occupy the positions in which they are illustrated in the drawings, that is, with the hand lever 26 resting in the opening 67 at the extreme left-hand end of the opening, and with the locking member 72 in the position to which it is biased, if a locking device such as a padlock is placed in the eye 76, rotation of the locking member 72 will be prevented, and the hand lever 25 will therefore be held in the position shown by the locking projection 72^a. When the eye 76 is unoccupied by a locking device under the above conditions, however, the locking member is free to rotate, and if the foot pedal 73 is then depressed, the locking member 72 will be rotated upwardly to a position in which the locking projection 72^a is out of the path of movement of the hand lever. At the same time, the dog 74 will be rotated in a clockwise direction about its pivot 75, and during this rotation, the upper end of the dog will engage the left-hand side of the lever as viewed in Fig. 12, and will move the lever from its full line position to its dotted line position. When the lever has reached its dotted line position, the foot pedal may be released, and the locking member 72 will return by gravity to the position shown. With the parts in these latter positions, the hand lever 75 may be removed from the opening 67 in the lock stand at the will of the operator.

If, after the parts have been moved to the positions last described, it is desired to return the parts to the positions shown, it is only necessary to swing the hand lever in the horizontal plane about its pivot 25^a toward the left as viewed in Fig. 12. When this is done, due to the shape of the locking projection 72^a, the dog will first be automatically raised as the lever moves past the dog, and will then return by gravity to the position shown.

The parts of the locking stand may be proportioned in any suitable manner, but as here shown, they are so proportioned that when the lever is resting in the opening 67 in its dotted line position, it will be substantially horizontal and will lie in a plane which is perpendicular to the axis of rotation of the sleeve 23, but that, when the lever occupies its full line position in Fig. 12, it will still be substantially horizontal but will lie in a plane which is disposed at an angle of approximately 15° with the axis of rotation of the sleeve 23.

The operation of the apparatus, as a whole is as follows: When the hand lever 25 occupies its extreme left-hand position in the opening 67 in the switch stand A¹, as shown in the drawings, the shifter yoke 42 is held in its extreme left-hand position as viewed in Figs. 2 and 3 by the shifter rod 43, and the finger 50 on the bearing cap 48 occupies the slot 51 in the sleeve 23. With the shifter yoke in this position, each roller 41^b rides on top of the associated cam 53^b, and each roller 41^a is out of engagement with the associated cam 53^a. As a result, the levers 39^a and 39^b are rotated to their lowermost positions, and due to the engagement of the rollers 41^a with the upper edge of the collar 33, a downward force is exerted on the collar which is transmitted through the shoulder 33^c, flange 32^a and coiled spring 34 to the lower sleeve 28, thereby holding this sleeve in the position in which the teeth 37 on the sleeve mesh with the teeth 38 on the worm wheel 9. The worm wheel is there-

fore operatively connected with the switch actuating shaft 6, so that the apparatus is in condition for operation of the switch by the electric motor 15. At such times, the clutch 33 is disconnected from bevel gear 17 so that the clutch and shaft are free to rotate with respect to the bevel gear, and the hand lever is therefore disconnected from the switch.

I will now assume that it is desired to disconnect the motor 15 from the switch, and to connect the hand lever 25 with the switch. To do this, the operator depresses the foot pedal 73 of the lock stand A¹, thus moving the hand lever 25 from its full line position shown in Figs. 1 and 2, to its dotted line position, in the manner previously described. This movement of the hand lever moves the shifter rod 43, and hence the shifter yoke 42 to the right, as viewed in Figs. 2 and 3, from the position shown, to the position in which the rollers 41^b are out of engagement with the associated cams 53^b, and the rollers 41^a are riding on the associated cams 41^b. As a result, the levers 39^a and 39^b are rotated upwardly about the studs 40^a and 40^b to their uppermost positions, and since the rollers 41^b carried by these levers engage the underside of the collar 33 it will be seen that the collar 33 is likewise moved to its uppermost position. Furthermore, as a result of the movement of the shifter yoke toward the right, the finger 50 carried by the bearing cap 48 is withdrawn from the slot 51 in the sleeve 23 so that the sleeve 23 is now free to rotate with respect to the shifter yoke. During the movement of the collar 33 to its uppermost position, its lower shoulder 33^d engages the flange 32^b on the sleeve 28, thereby positively moving the sleeve 28 upwardly to a position in which the teeth 37 on the sleeve are disengaged from the teeth 38 on the worm wheel, so that the shaft is then free to rotate with respect to the worm wheel. Furthermore, during the movement of the collar 33 to its uppermost position, the sleeve 27 is moved upwardly by virtue of the force transmitted by the spring 34, and if the position of the switch and hand lever then correspond, so that the long tooth 36^a on the bevel gear 17 is opposite the long space between the teeth 35^a and 35^b on the sleeve 27, the teeth on the sleeve and the teeth on the bevel gear will mesh. The bevel gear 17 will then be connected with the shaft 6 so that the switch may be operated by swinging the hand lever from one extreme position to the other in a plane perpendicular to the axis of rotation of the sleeve 23 and shifter rod 29, to rotate the segment gear 26. If, however, the position of the switch and the hand lever do not correspond when the collar is being moved upwardly, so that the long tooth 36^a on the bevel gear 17 is not opposite the long space between the teeth 35^a and 35^b on the sleeve 27, then when the collar has moved upwardly a comparatively short distance, the flat ends of the teeth 35 on the sleeve 27 will engage the flat ends of the teeth 36 on the bevel gear 17, and during the remainder of the upward movement of the collar 33, spring 34 will become compressed. It will be apparent, therefore, that under these conditions, the hand lever will not become connected with the switch until the hand lever is moved to the position corresponding to the position of the switch, at which time, the energy stored in the spring 34 will complete the upward movement of the spring 24, thereby causing the teeth on the sleeve to mesh with

the teeth on the bevel gear, and hence permitting manual operation of the switch in the manner previously described. The movement of the shifter yoke 42 toward the right caused by the inward movement of the hand lever 25 about its pivot 22 also causes the cam follower 64 to ride up onto the cam 53^c, thus raising the movable contact fingers 55 out of engagement with the fixed contact fingers 54, and hence opening the contacts 54—55. When these contacts are open, the motor is disconnected from its source of current, and it will be seen, therefore, that operation of the worm wheel 9 is prevented while the apparatus is in condition for manual operation of the switch.

When it is desired to restore the apparatus to condition for operation by the motor, the hand lever is first rotated to the position in which it enters the opening 67 in either the lock stand A¹ or A², and is then swung outwardly about its pivot to its extreme outer position in the opening. The operation of the apparatus, under these conditions, is just the reverse of that described hereinbefore and will be readily understood without describing it in detail. It should be noted, however, that since the teeth on the sleeve 28 and the teeth on the worm wheel 9 are evenly spaced, these teeth will mesh except when the ends of the teeth are directly opposite each other, at which time, they will mesh as soon as the motor operates the worm wheel to an angle corresponding to the width of one tooth. It should be pointed out, that due to the finger 50 carried by the bearing cap 48, the hand lever 25 cannot be swung outwardly about its pivot to disconnect the hand lever from the switch and to connect the motor with the switch except when the parts are in the relative positions in which the finger is opposite either the slot 51 or the slot 52 in the sleeve 23. The parts are so proportioned that this condition will exist when and only when the hand lever is within the opening 67 in either the lock stand A¹ or the lock stand A².

If the hand lever is disconnected from the switch by swinging it about its pivot to its extreme outer position when the hand lever is in the opening 67 in the lock stand A², and it is subsequently desired to again connect the hand lever with the switch, this may be done by depressing the foot pedal of the lock stand A². The operation of the apparatus under these conditions will be substantially the same as that previously described when the parts were in the positions shown, and will be readily understood without further description.

Although I have herein shown and described only one form of railway 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 switch operating apparatus comprising a switch actuating shaft, a plurality of gear wheels mounted for rotation adjacent said shaft, clutch mechanism for selectively connecting said gear wheels with said shaft, a motor for rotating one of said gear wheels, a rotatable sleeve operatively connected with another of said gear wheels for rotating the same, a pivotally mounted lever for operating said clutch mechanism, a shifter yoke for operating said lever, a

shifter rod mounted for longitudinal sliding movement in said sleeve for operating said shifter yoke, and a manually operable lever pivotally connected with both said sleeve and

5 said rod for rotating said sleeve and for moving said rod longitudinally therein.

2. Railway switch operating apparatus comprising a switch actuating shaft, a plurality of gear wheels mounted for rotation adjacent said shaft, clutch mechanism for selectively connecting said gear wheels with said shaft, a motor for rotating one of said gear wheels, a rotatable sleeve operatively connected with another of said gear wheels for rotating the same, a shifter rod mounted for longitudinal sliding movement within said sleeve, a shifter yoke operatively connected with said shifter rod in such manner that said shifter rod is free to rotate with respect to said shifter yoke but that said shifter yoke is constrained to move in response to longitudinal movements of said shifter rod, means controlled by said shifter yoke for operating said clutch mechanism, and manually operable means for rotating said sleeve and for sliding said rod within said sleeve.

10 3. Railway switch operating apparatus comprising a switch actuating shaft, a plurality of gear wheels mounted for rotation adjacent said shaft, clutch mechanism for selectively connecting said gear wheels with said shaft, a motor for rotating one of said gear wheels, a rotatable sleeve operatively connected with another of said gear wheels for rotating the same, a shifter rod mounted for longitudinal sliding movement within said sleeve, a shifter yoke operatively connected with said shifter rod in such manner that said shifter rod is free to rotate with respect to said shifter yoke but that said shifter yoke is constrained to move in response to longitudinal movements of said shifter rod, a shifter lever operated by said shifter yoke for operating said clutch mechanism, and singly manually operable means for rotating said sleeve and for sliding said rod within said sleeve.

15 4. Railway switch operating apparatus comprising a switch actuating shaft, a plurality of gear wheels mounted for rotation adjacent said shaft, clutch mechanism for selectively connecting said gear wheels with said shaft, a motor for rotating one of said gear wheels, a rotatable sleeve operatively connected with another of said gear wheels and provided with a slot, a shifter rod mounted for axial sliding movement within said sleeve, a member operatively connected with said shifter rod in such manner that said shifter rod is free to rotate with respect to said member but that said member is constrained to move longitudinally in response to longitudinal movements of said shifter rod, means responsive to longitudinal movements of said member for operating said clutch mechanism, a single lever operatively connected with both said sleeve and said rod for rotating said sleeve and for sliding said rod within said sleeve, and a finger secured to said member and cooperating with the slot in said sleeve in such manner that said shifter rod can be operated to slide said shifter rod within said sleeve when and only when said sleeve has been rotated by said rod to the position in which said finger is opposite said slot.

80 5. Railway switch operating apparatus comprising a switch actuating shaft, a plurality of gear wheels mounted for rotation adjacent said shaft, clutch mechanism for selectively connecting one of said elements or the other with said member, power means for operating one of said elements, a rotatable sleeve operatively connected with the other element for operating the same and provided at one end with two slots, two levers pivotally mounted at one end in fixed studs and each provided at their free ends with a pair of rollers which engage both edges of said clutch collar at both sides of the collar,

85 6. Railway switch operating apparatus comprising a switch actuating shaft, a plurality of gear wheels mounted for rotation adjacent said shaft, clutch mechanism for selectively connecting said gear wheels with said shaft, a motor for rotating one of said gear wheels, a rotatable sleeve operatively connected with another of said gear wheels and provided with a slot, a shifter rod mounted for axial sliding movement within said sleeve, a member operatively connected with said shifter rod in such manner that said shifter rod is free to rotate with respect to said member but that said member is constrained to move longitudinally in response to longitudinal movements of said shifter rod, means responsive to longitudinal movements of said member for operating said clutch mechanism, a single lever operatively connected with both said sleeve and said rod for rotating said sleeve and for sliding said rod within said sleeve, and a finger secured to said member and cooperating with the slot in said sleeve in such manner that said shifter rod can be operated to slide said shifter rod within said sleeve when and only when said sleeve has been rotated by said rod to the position in which said finger is opposite said slot.

90 7. Railway switch operating apparatus comprising a switch actuating shaft, a plurality of gear wheels mounted for rotation adjacent said shaft, clutch mechanism for selectively connecting one of said elements or the other with said member, power means for operating one of said elements, a rotatable sleeve operatively connected with the other element for operating the same and provided at one end with two slots, two levers pivotally mounted at one end in fixed studs and each provided at their free ends with a pair of rollers which engage both edges of said clutch collar at both sides of the collar,

45 8. Railway switch operating apparatus comprising a switch actuating shaft, a plurality of gear wheels mounted for rotation adjacent said shaft, clutch mechanism for selectively connecting said gear wheels with said shaft, a motor for rotating one of said gear wheels, a rotatable sleeve operatively connected with another of said gear wheels for rotating the same, a shifter rod mounted for longitudinal sliding movement within said sleeve, a shifter yoke operatively connected with said shifter rod in such manner that said shifter rod is free to rotate with respect to said shifter yoke but that said shifter yoke is constrained to move longitudinally in response to longitudinal movements of said shifter rod, a cam on said shifter yoke, a pivoted shifter lever operated by said cam for operating said clutch mechanism in response to longitudinal movement of said shifter yoke, and a single manually operable lever for rotating said sleeve and for sliding said rod within said sleeve.

50 9. Railway switch operating apparatus comprising a switch actuating shaft, a plurality of gear wheels mounted for rotation adjacent said shaft, clutch mechanism for selectively connecting said gear wheels with said shaft, a motor for rotating one of said gear wheels, a rotatable sleeve operatively connected with another of said gear wheels, a shifter rod mounted for longitudinal sliding movement within said sleeve, a single manually operable lever operatively con-

a shifter yoke having two arms one of which extends between the rollers on one of said levers and is provided at its free end with a slot which slidably receives one of said studs and the other of which extends between the rollers on the other of said levers and is provided at its free end with a slot which slidably receives the other of said studs, a recess in said shifter yoke, a shifter rod mounted for longitudinal sliding movement within said sleeve and provided at one end with an annular groove which fits into the recess in said shifter yoke, a bearing cap secured to said yoke and provided with a bearing member which fits into the recess in said shifter yoke above said shifter rod to hold said shifter rod in place, said bearing cap also being provided with a finger adapted to enter one slot in said sleeve when and only when said sleeve has been rotated to one position and adapted to enter the other slot in said sleeve when and only when said sleeve has been rotated to another position, cams on both said arms of said shifter yoke and cooperating with the adjacent rollers on said levers for operating said levers, a channel shaped portion secured to one end of said sleeve, and a hand lever pivotally attached to said sleeve within said channel shaped portion for rotating said sleeve and to the free end of said shifter rod for sliding said rod within said sleeve.

9. Railway switch operating apparatus comprising a switch actuating shaft, a manually operable lever movable in two planes, power means for at times operating said shaft, means responsive to movement of said lever in one plane for disconnecting said power means from said shaft and for connecting said lever with said shaft to permit operation of said shaft by movement of said lever in the other plane, a foot pedal, a locking member controlled by said foot pedal and effective for at times preventing movement of said lever when said lever is disconnected from said shaft, and means controlled by said foot pedal and effective when said foot pedal is operated to release said locking member and to move said lever in said one plane in such manner that said power means becomes disconnected from said shaft and said hand lever becomes connected with said shaft.

10. The combination with railway switch operating apparatus of the type in which a switch actuating shaft is adapted to be operated manually by swinging a hand operated lever in one plane and to be transferred from manual operation by said lever to condition for operation by power means by swinging said hand lever in another plane, of a switch stand having an opening adapted to receive said lever when said lever is in one position in said one plane and to permit movement of said lever in said other plane within said opening through a sufficient angle to transfer said switch actuating shaft from the condition for operation by said lever to the condition for operation by said power means or vice versa, a locking member pivotally attached to said stand and having a locking projection extending into the path of movement of said lever within said opening, a foot pedal operatively connected with said locking member for at times moving said lever to the position in which said locking projection is out of the path of movement of said lever within said opening, and means controlled by said foot pedal and effective when said locking member is moved to the position in which said locking

projection is out of the path of movement of said lever for at times moving said lever within said opening from the position which said switch actuating shaft is in condition for power operation to the position in which said lever is in condition for manual operation by said lever.

11. The combination with a lever which is movable in two planes for controlling a railway switch, of a jaw having an opening which is adapted to receive said lever when and only when said lever is in one of said planes and which is sufficiently wide to permit considerable movement of said lever in the other plane within said opening, a locking member pivotally attached to said jaw and having a locking projection which extends into the path of movement of said lever in said opening for at times locking said lever in one position in said opening, a foot pedal for controlling said locking projection, and means controlled by said foot pedal for moving said lever from said one position to the position which said lever occupies when it is in a position common to both planes.

12. The combination with a lever which is movable in two planes for controlling a railway switch, of a jaw having an opening which receives said lever at one end of its stroke in one of said planes and which is wide enough to permit movement of said lever within said opening in the other plane from the one extreme position which it occupies when it is inserted into the opening to another extreme position, a locking member pivotally attached to said jaw and having a locking projection which extends into said opening for at times locking said lever in said other extreme position, and a single manually operable device for operating said locking member to unlock said lever and for moving said lever from said other extreme position to said one extreme position.

13. The combination with a lever which is movable in two planes for controlling a railway switch, of a jaw having an opening which receives said lever at one end of its stroke in one of said planes and which is wide enough to permit movement of said lever within said opening in the other plane from the one extreme position which it occupies when it is inserted into the opening to another extreme position, a locking member pivotally attached to said jaw and having a locking projection which extends into said opening for at times locking said lever in said other extreme position, a foot pedal for controlling said locking member, and means controlled by said foot pedal for moving said locking member from said other extreme position to said one extreme position.

14. The combination with a lever which is movable in two planes for controlling a railway switch, of a jaw having an opening which receives said lever at one end of its stroke in one of said planes and which is wide enough to permit movement of said lever within said opening in the other plane from the one extreme position which it occupies when it is inserted into the opening to another extreme position, a locking member pivotally attached to said jaw and having a locking projection which extends into said opening for at times locking said lever in said other extreme position, a foot pedal for controlling said locking member, and a pivoted dog actuated by said foot pedal for moving said locking member from said other extreme position to said one extreme position.

15. The combination with a lever which is

movable in two planes for controlling a railway switch, of a jaw having an opening which is adapted to receive said lever and which is sufficiently wide to permit movement of said lever

5 within said opening from one end of its stroke to the other end of its stroke in one of said planes, two spaced projections secured to said lever and partially closing said opening in such manner that said lever can be inserted into or
10 removed from said opening when and only when said lever is in the other plane, said jaw also being provided with a slot which communicates with said opening between said projections and which extends substantially at right angles to
15 said other plane, a locking member pivotally attached to said jaw within said opening and provided with a locking projection which extends into the path of movement of said lever in said one plane within said opening for at times
20 preventing movement of said lever in said one plane from said other end of its stroke to said one end of its stroke, a foot pedal for operating said locking member to withdraw said locking projection from the path of movement of said
25 lever within said opening, and a dog pivotally attached to said jaw within said opening and co-operating with said foot pedal and said lever in such manner that when said foot pedal is operated to unlock said lever said lever is automatically moved by said dog from said other end
30 of its stroke in said one plane to said one end of its stroke.

16. Railway switch operating apparatus comprising a switch actuating shaft, a gear wheel
35 mounted for rotation adjacent said shaft, a rotatable sleeve operatively connected with said gear wheel for at times rotating said gear wheel, a shifter rod mounted for longitudinal sliding movement within said sleeve, a shifter yoke
40 operatively connected with said shifter rod in such manner that said shifter rod is free to rotate with respect to said shifter yoke but that said shifter yoke is constrained to move longitudinally in response to longitudinal movements
45 of said shifter rod, a single manually operable lever for rotating said sleeve and for sliding said shifter rod within said sleeve, and means controlled by said shifter yoke for at times connecting said gear wheel with said switch actuating
50 shaft.

17. Railway switch operating apparatus comprising a switch actuating shaft, a gear wheel
55 mounted for rotation adjacent said shaft, a rotatable sleeve operatively connected with said gear wheel for at times rotating said gear wheel, a shifter rod mounted for longitudinal sliding movement within said sleeve, a shifter yoke operatively connected with said shifter rod in such manner that said shifter rod is free to rotate
60 with respect to said shifter yoke but that said shifter yoke is constrained to move longitudinally in response to longitudinal movements of said shifter rod, a single manually operable lever for rotating said sleeve and for sliding said rod
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within said sleeve, means controlled by said shifter yoke for at times connecting said gear wheel with said switch actuating shaft, and a contact operated by said shifter yoke.

18. Railway switch operating apparatus comprising a switch actuating shaft, a gear wheel
80 mounted for rotation adjacent said shaft, a rotatable sleeve operatively connected with said gear wheel for at times rotating said gear wheel, a shifter rod mounted for longitudinal sliding movement within said sleeve, a shifter yoke operatively connected with said shifter rod in such manner that said shifter rod is free to rotate
85 with respect to said shifter yoke but that said shifter yoke is constrained to move longitudinally in response to longitudinal movements of said shifter rod, a shifter lever operated by said shifter yoke, means controlled by said shifter lever for at times connecting said gear wheel with said switch actuating shaft, and a single manually operable lever for rotating said sleeve and for
90 sliding said rod within said sleeve.

19. Railway switch operating apparatus comprising a switch actuating shaft, a gear wheel
100 mounted for rotation adjacent said shaft, a rotatable sleeve operatively connected with said gear wheel for at times rotating said gear wheel, a shifter rod mounted for longitudinal sliding movement within said sleeve, a shifter yoke operatively connected with said shifter rod in such manner that said shifter rod is free to rotate
105 with respect to said shifter yoke but that said shifter yoke is constrained to move longitudinally in response to longitudinal movements of said shifter rod, a pair of shifter levers operated by said shifter yoke, means controlled by said shifter levers for at times connecting said gear wheel with said switch actuating shaft, a cam on said shifter yoke, a cam follower pivoted to one of said shifter levers and cooperating with
110 said cam, and a contact controlled by said cam follower.

20. Railway switch operating apparatus comprising a switch actuating shaft, a gear wheel
120 mounted for rotation adjacent said shaft, a rotatable sleeve operatively connected with said gear wheel for at times rotating said gear wheel, a shifter rod mounted for longitudinal sliding movement within said sleeve, a shifter yoke operatively connected with said shifter rod in such manner that said shifter rod is free to rotate
125 with respect to said shifter yoke but that said shifter yoke is constrained to move longitudinally in response to longitudinal movements of said shifter rod, means controlled by said shifter yoke for at times connecting said gear wheel with said switch actuating shaft, a single manually operable lever for rotating said sleeve and for sliding said shifter rod within said sleeve, and means for preventing sliding movements of
130 said shifter rod by said lever except when said lever occupies a predetermined position.

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