Aug. 6, 1935. C. CHRISTENSEN 2,010,533

SWITCH

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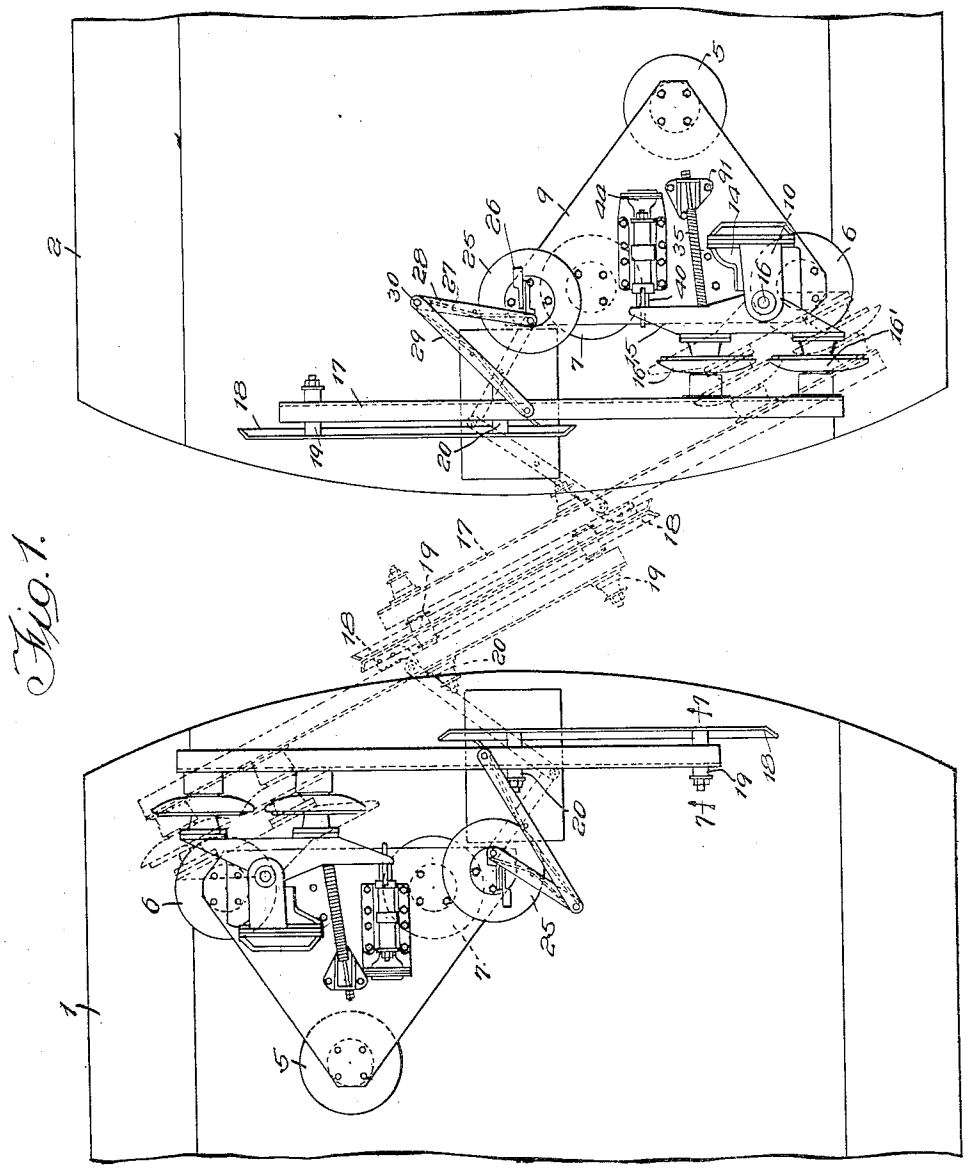

Fig. 1.

Witness:
William R. Kilroy

Inventor:
Christen Christensen
By Brown Jackson Boettcher & Dremmer.
Attys.

Aug. 6, 1935. C. CHRISTENSEN 2,010,533

SWITCH

Filed Dec. 24, 1930 10 Sheets-Sheet 2

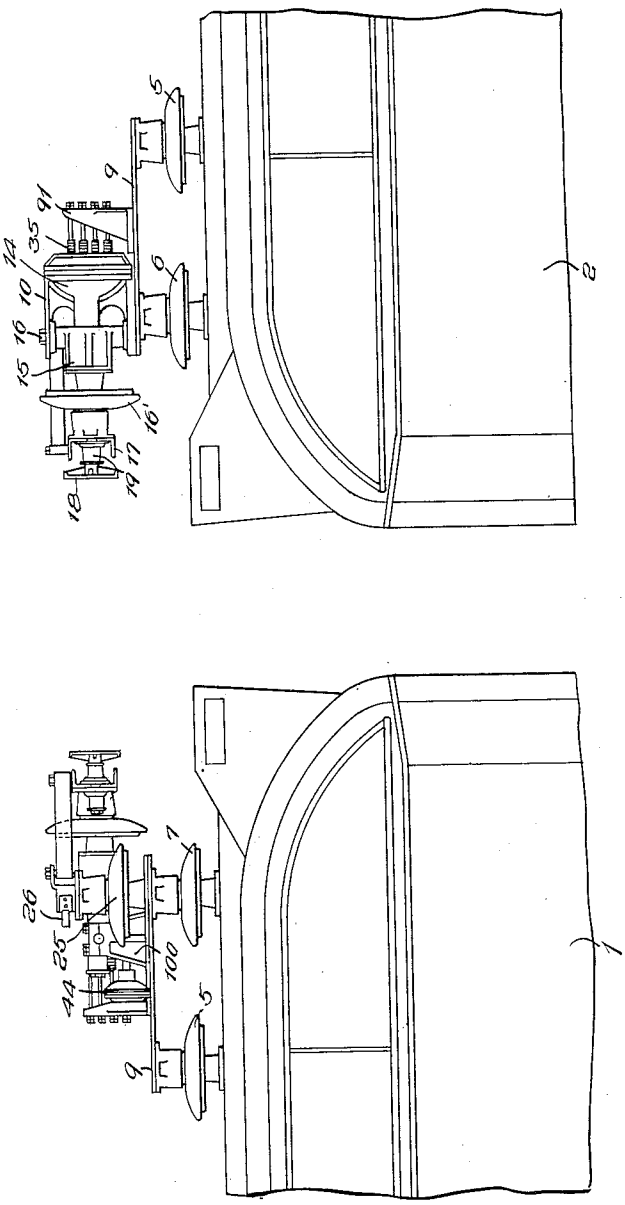

Fig. 2.

Witness:
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Aug. 6, 1935. C. CHRISTENSEN 2,010,533

SWITCH

Filed Dec. 24, 1930 10 Sheets-Sheet 3

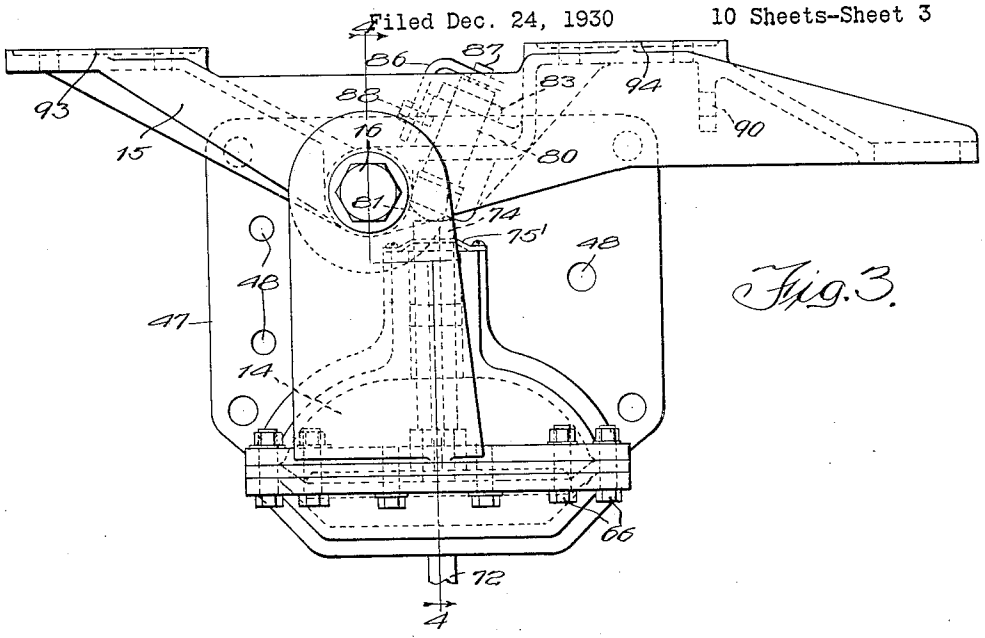


Fig. 3.

Fig. 6.

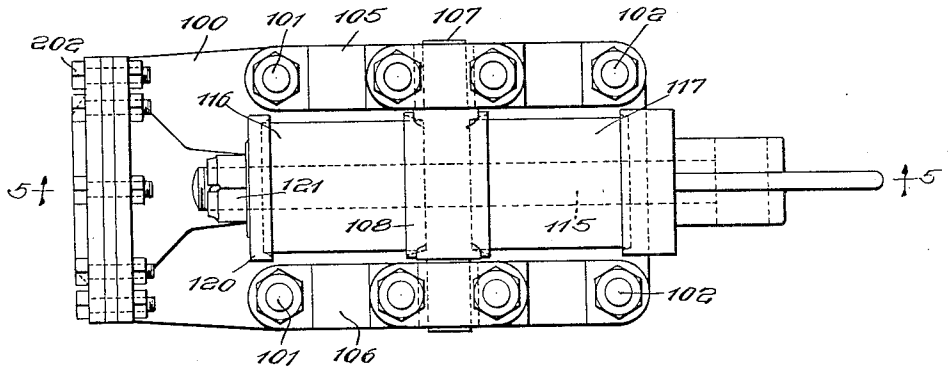
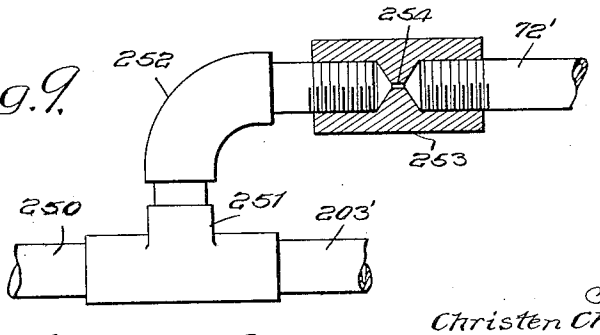


Fig. 9.



Witness:
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Aug. 6, 1935. C. CHRISTENSEN 2,010,533

SWITCH

Filed Dec. 24, 1930 10 Sheets-Sheet 4

Fig. 8.

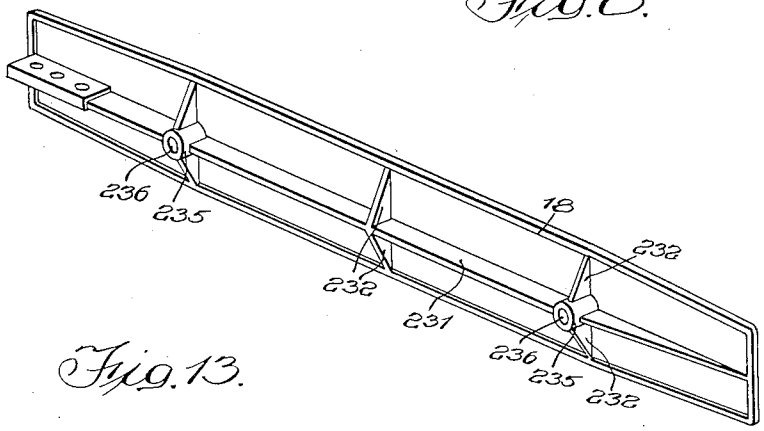


Fig. 13.

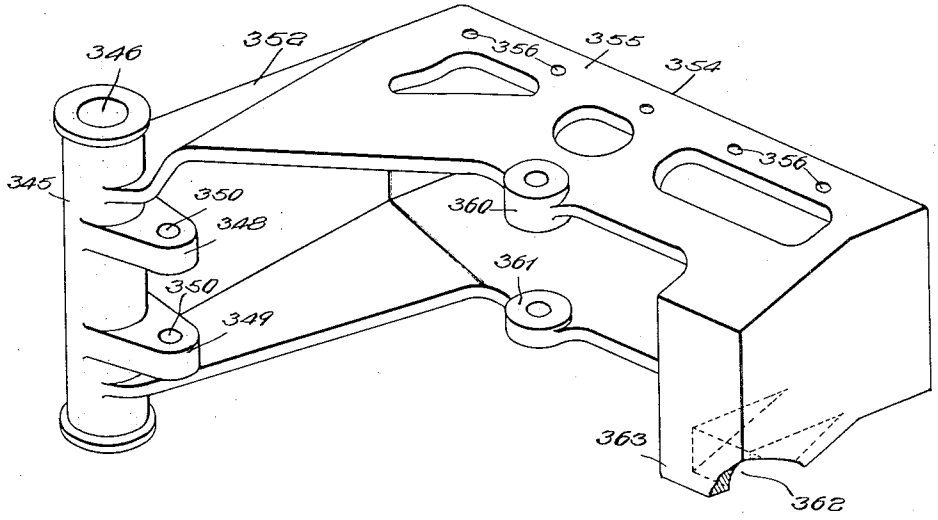
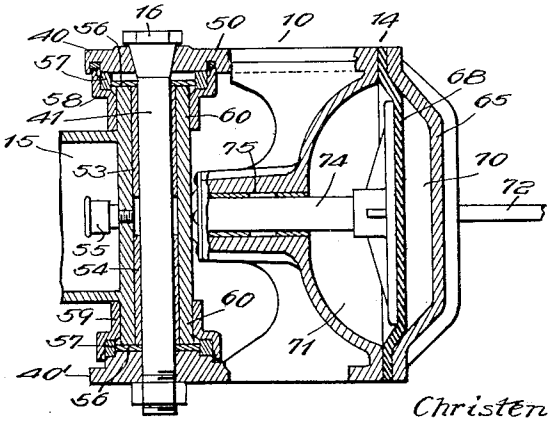


Fig. 4.



Witness:
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Aug. 6, 1935. C. CHRISTENSEN 2,010,533

SWITCH

Filed Dec. 24, 1930 10 Sheets-Sheet 5

Fig. 7.

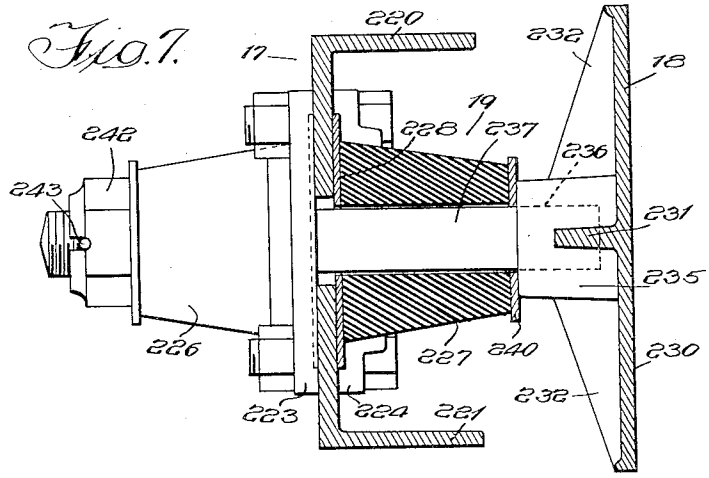
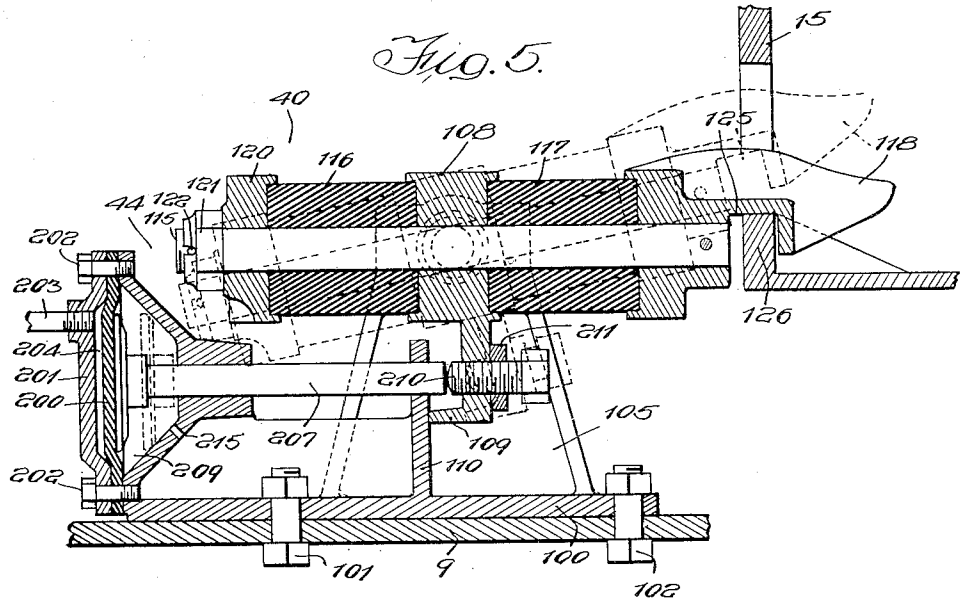


Fig. 5.



Witness:
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Aug. 6, 1935. C. CHRISTENSEN 2,010,533

SWITCH

Filed Dec. 24, 1930 10 Sheets-Sheet 6

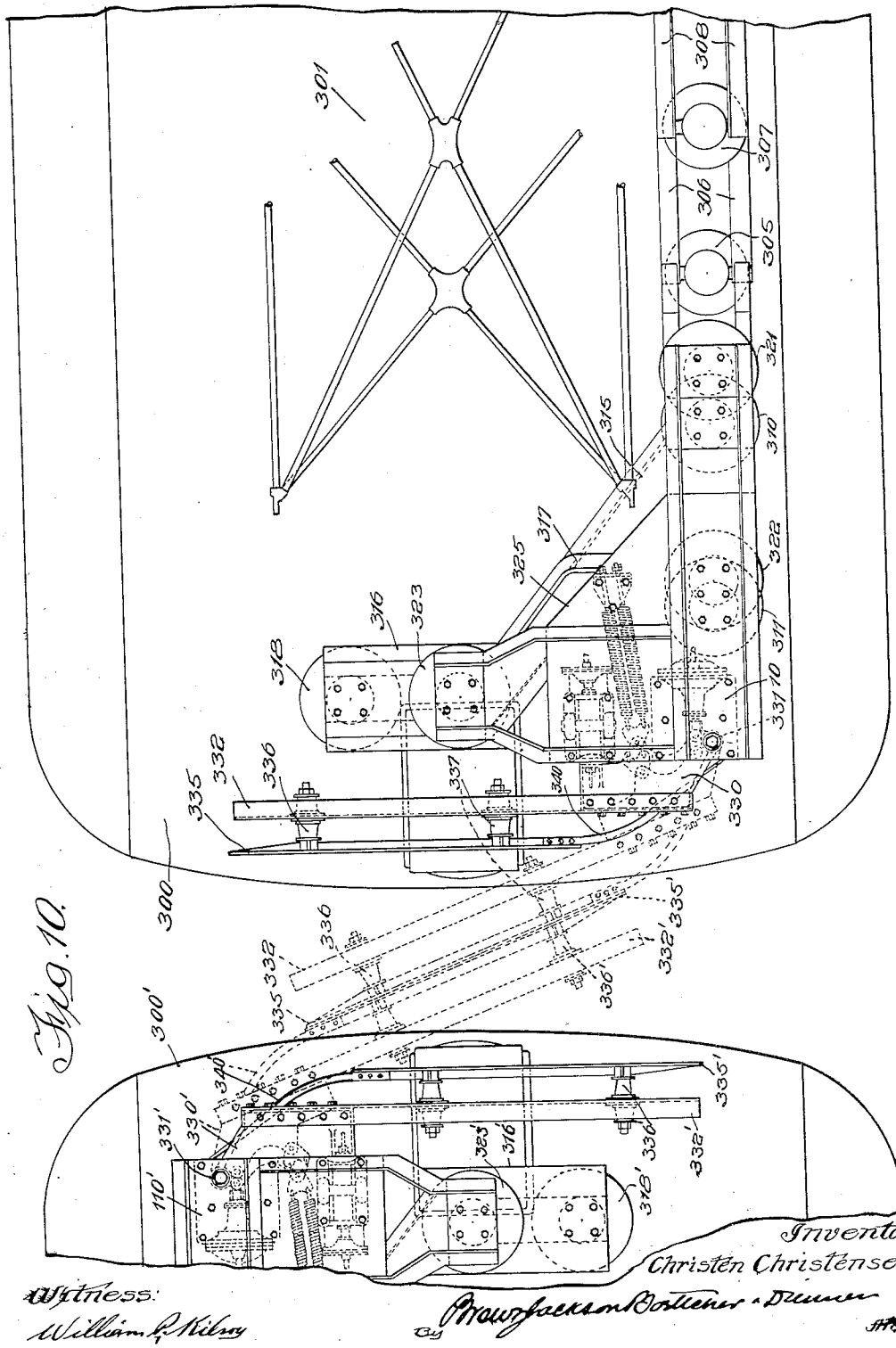

Fig. 10.

Witness:
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Aug. 6, 1935. C. CHRISTENSEN 2,010,533

SWITCH

Filed Dec. 24, 1930 10 Sheets-Sheet 7

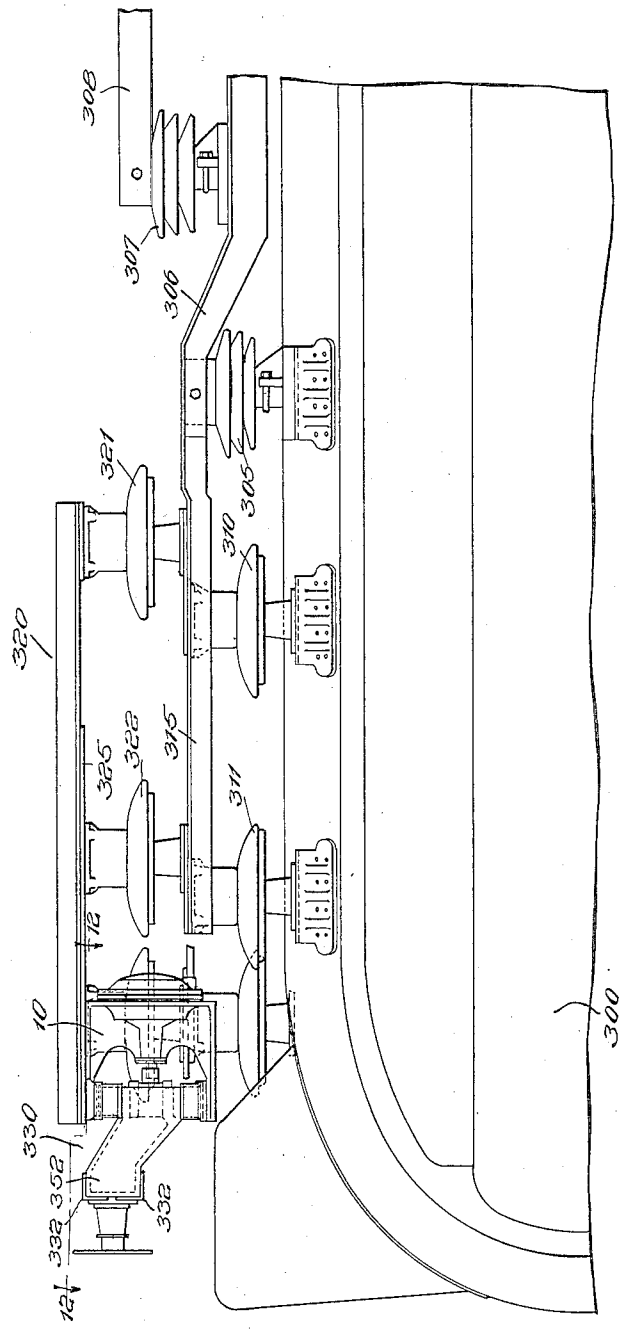

Fig. 11.

Witness:
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Inventor:
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Aug. 6, 1935. C. CHRISTENSEN 2,010,533

SWITCH

Filed Dec. 24, 1930 10 Sheets-Sheet 8

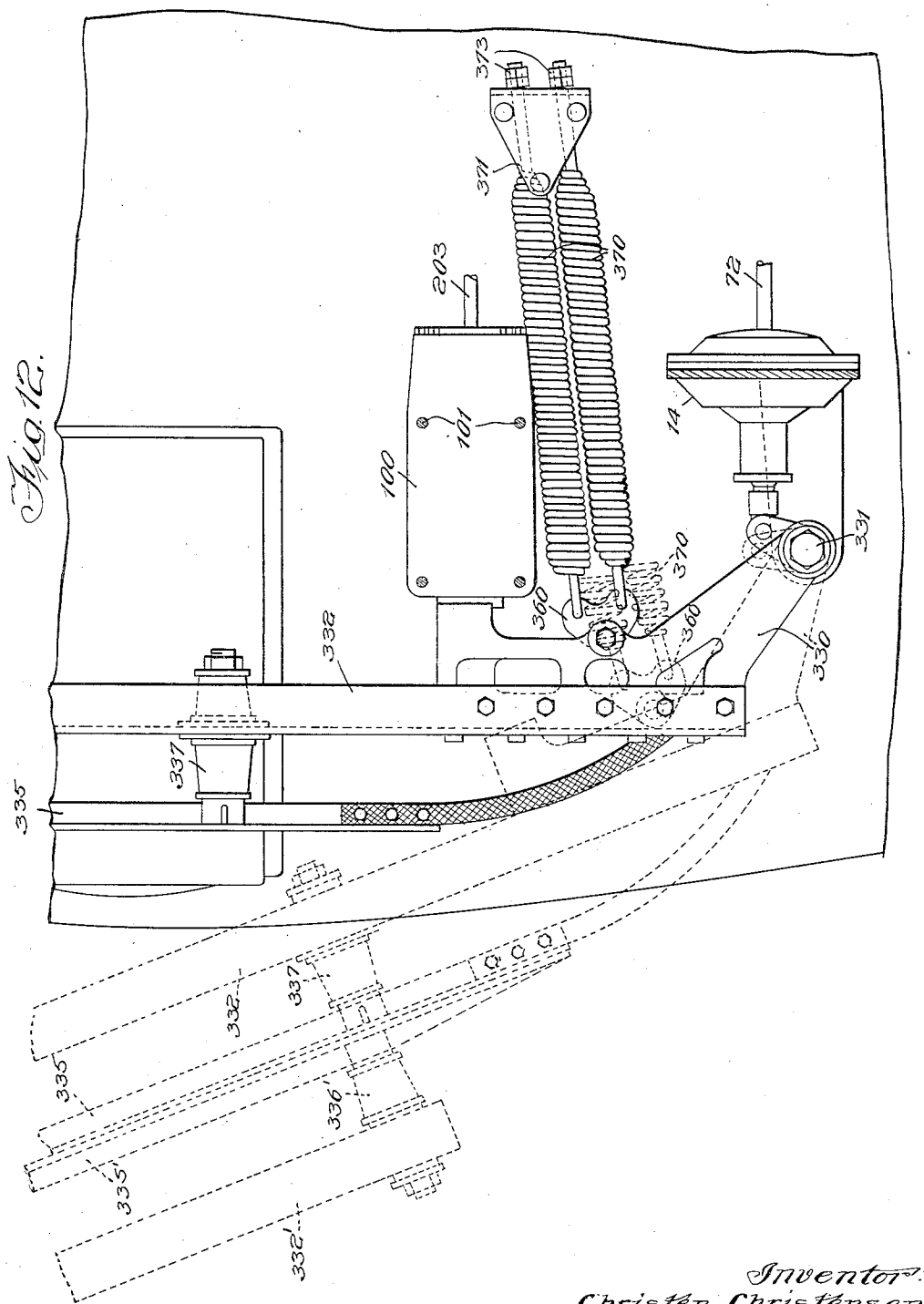

Fig. 12.

Witness:
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By Brown Jackson Boettcher & Dennis
Attys

Aug. 6, 1935. C. CHRISTENSEN 2,010,533

SWITCH

Filed Dec. 24, 1930 10 Sheets-Sheet 9

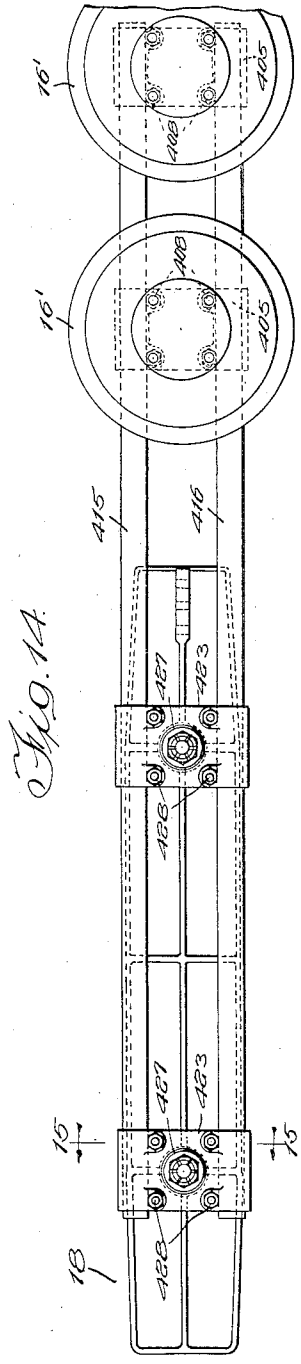

Fig. 14.

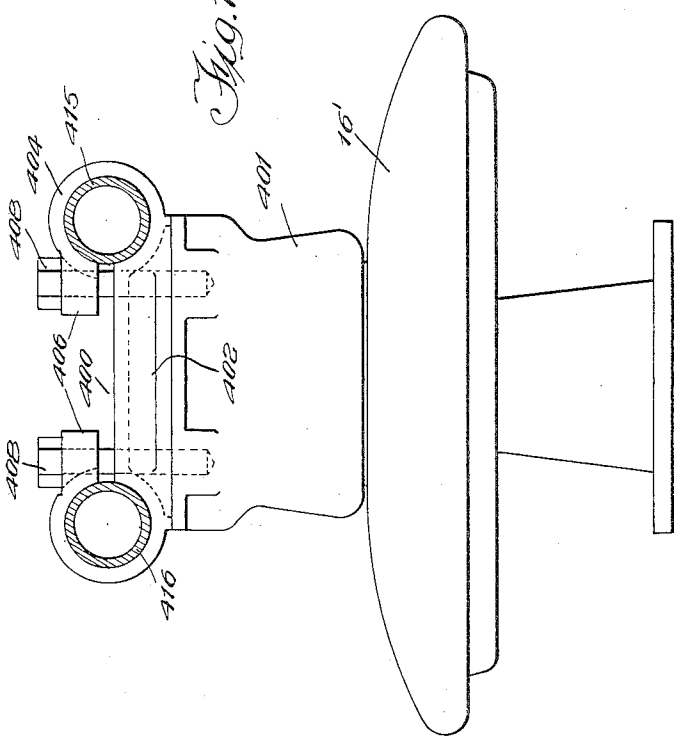

Fig. 16.

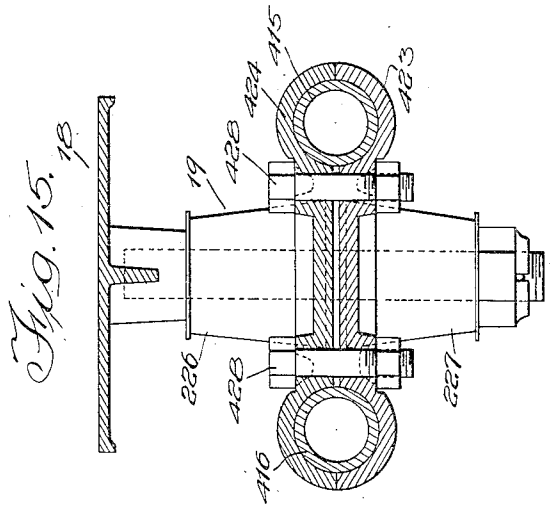

Fig. 15.

Witness:
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Aug. 6, 1935. C. CHRISTENSEN 2,010,533

SWITCH

Filed Dec. 24, 1930 10 Sheets-Sheet 10

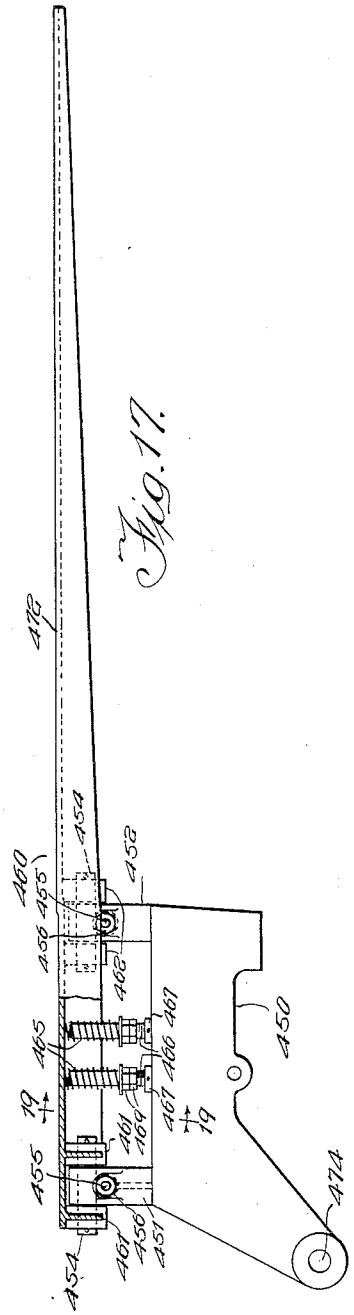

Fig. 17.

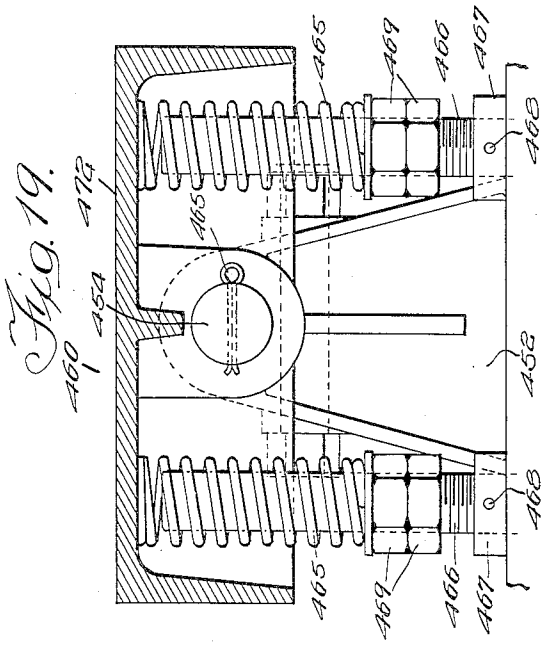

Fig. 19.

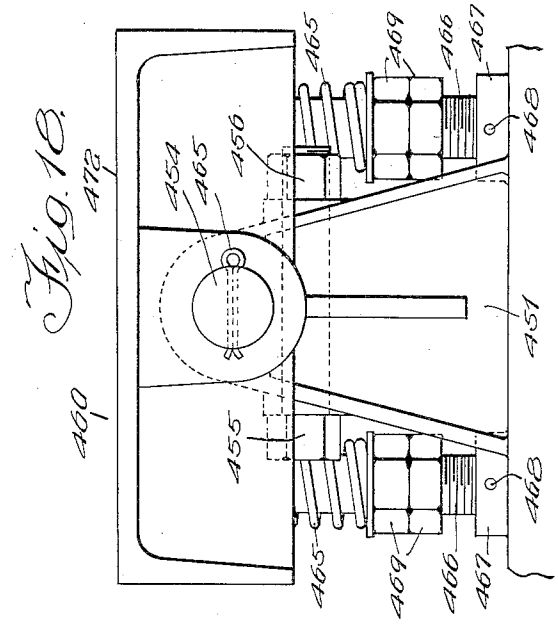

Fig. 18.

Witness:
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Attys

Patented Aug. 6, 1935

2,010,533

UNITED STATES PATENT OFFICE

2,010,533

SWITCH

Christen Christensen, Maywood, Ill., assignor to Electrical Engineers Equipment Co., a corporation of Illinois

Application December 24, 1930, Serial No. 504,502

30 Claims. (Cl. 173—332)

This invention relates in general to electric switching means and more particularly to switching means for electric power work as distinguished from the low current carrying switches used in signaling systems. The switches herein shown, for illustrative purposes, are particularly designed for performing switching operations between adjacent vehicles in a train of two or more coupled cars, especially railroad cars or the like.

It is one of the objects of the present invention to provide an improved switch which can be mounted on a railroad car adjacent one end thereof and which will cooperate with a similar switch similarly mounted on an adjacent car and maintain electrical connections while the train is in motion. Such a switch must satisfy certain rigorous requirements. It is of course apparent that two cars of a train do not travel as a rigidly connected body. There is a certain amount of side sway present and since the two cars do not necessarily sway in the same direction at the same time the distance between corresponding parts of the two cars is constantly varying. In addition there is a certain amount of give in the coupling means between the two cars so that the distance between the two cars constantly varies as the train accelerates or decelerates, starts or stops. In addition, and this is the greatest cause of variation in the distance between two adjacent cars of a train, there is the change that occurs as the train moves along a curve. If a switch is so designed that one part of the contact mechanism is mounted on one of the cars and the other part on the other car, then the construction of the switch must be such that contact is maintained while the train is in motion and the structures upon which the two contact making parts are mounted go through all the relative motions corresponding to the motions of their respective cars. This my switch accomplishes. In the form of my invention herein illustrated the two contact making portions engage one another along a planar surface the center line of which lies between the two coupled cars and at an angle to their longitudinal center lines. The contact making mechanisms are pivoted on their respective cars and yielding means is provided for constantly urging them to swing about their pivots in a direction towards one another. The two blade members make abutting contact with one another so that each blade limits the extent of swinging of the other about its pivot and each blade acts as a cushion stop for the swing of the other. Thus as the cars turn corners or otherwise move with respect to one another the two blade members slide along one another or swing about their pivots, always maintaining their position of contact along a line approximately joining their pivotal centers.

In addition, a switch of this type should be controllable from a remote point and should always be under the control of the operator. My switch is held in its closed position by a locking latch and is adapted to be moved to its open position by remotely controlled pneumatic means which serves to maintain the switch in the closed position as long as the pneumatic pressure is maintained. A spring means is provided for urging the switch to the open position and upon the release of the pneumatic pressure the spring means is effective to move the switch blade to its full open position where it is held by the latch. It is within the purview of the present invention to reverse the motive power for moving the blade to its open and closed positions. For instance, spring means may be relied upon to move the switch to its closed position and the pneumatic means for opening the switch. The converse is however preferable and therefore incorporated in the embodiments herein shown, as stated above.

As previously stated, the switch is held in its open position by a latch or the like and is moved to its closed position by the application of pressure to a pneumatic motor. The switch can of course be actuated only after the latch is released. It is another one of the objects of the present invention to provide improved means whereby a single actuation will result in the release of the latch and also in the actuation of the switch. If pressure is applied to actuate the switch before the latch has been fully released, a banging or hammering of the switch parts against the latch might result. This may even result, in some cases, in the wedging of the latch in the switch locking position thus preventing the actuation of the switch. My improved mechanism avoids this occurrence. I accomplish this by providing a restriction in the passageway communicating pressure to the switch actuating means whereas no such restriction is placed in the passageway communicating pressure to the latch releasing means. As a result of the restriction in the conduit there is a slight delay in the building up of the pressure in the switch operating motor. In the meantime the latch is released. A moment later the pressure in the switch operating motor has built up to the amount required to operate the same and the switch is actuated. The latch is biased to the locking position so that upon release of the pneumatic pressure it locks the switch when the switch reaches its full opening thereof under the action of the spring.

It is a further object of the present invention to provide an improved switch blade and blade support so that the blade will have a substantially universal motion with reference to its ultimate support, the railway car.

It is another object of the present invention to

provide an improved mounting for switches of the class described. Where the railway car has a pantograph mounted on the top thereof for contacting with the trolley some of the insulators supporting the pantograph may be utilized to help support the switch structure, which is also to be insulated from the railway car.

The attainment of the above and further objects of the present invention will be apparent from the following specification taken in conjunction with the accompanying drawings forming a part thereof.

In the drawings:

Figure 1 is a top view of the adjacent ends of two adjacent cars of a railway train, said cars being equipped with my improved switch, the closed position of the switch being indicated in dotted lines;

Figure 2 is a side view of the structure as shown in Figure 1;

Figure 3 is a top view of the blade carrier and pneumatic motor for operating the same;

Figure 4 is a sectional view taken along the line 4—4 of Figure 3 and looking in the direction of the arrows;

Figure 5 is a longitudinal sectional view of the bumper latch mechanism and the pneumatic motor for releasing the same, said view being taken along the line 5—5 of Figure 6 and looking in the direction of the arrows;

Figure 6 is a top view of the bumper latch mechanism and the pneumatic motor for operating the same;

Figure 7 is a fragmentary sectional view showing the manner of mounting the contact shoe upon the shoe holder, said view being taken along the line 7—7 of Figure 1 and looking in the direction of the arrows;

Figure 8 is a perspective view of the contact shoe;

Figure 9 is a fragmentary diagram showing a portion of the conduit for extending pneumatic pressure to the two pneumatic motors as shown in Figures 3 and 5 respectively;

Figure 10 is a top plan view of a modified form of switch mechanism, said view showing the manner of mounting the same upon the top of a railway car;

Figure 11 is a side view of the structure shown in Figure 10;

Figure 12 is an enlarged fragmentary view of a portion of this switch mechanism, said view being taken along the line 12—12 of Figure 11 and looking in the direction of the arrows;

Figure 13 is a perspective view of the blade carrier of the switch shown in Figures 10 and 11;

Figure 14 shows an alternate form of blade holding means for a switch such as is shown in Figures 1 and 2;

Figure 15 is a sectional view taken along the line 15—15 of Figure 14;

Figure 16 is a view showing the manner of mounting the blade means of Figure 14 upon its supporting insulator;

Figure 17 shows a modified form of blade mounting means for a switch such as is shown in Figures 10 and 11;

Figure 18 is an end view thereof; and

Figure 19 is a fragmentary sectional view taken along the line 19—19 of Figure 17.

Reference may now be had more particularly to Figures 1 and 2 wherein I show, in diagrammatic form, the adjacent ends of two coupled railway cars and my improved switching mechanism mounted on top of the cars. The railway cars are indicated at 1 and 2 and may be coupled together in any preferred form. Since the coupling means between the railway cars constitutes no part of my invention this has been omitted from the drawings. Three insulators indicated at 5, 6, and 7 are mounted upon the top of the railway car in any preferred manner, said insulators being arranged in the form of a triangle. A triangular plate 9 is bolted or otherwise suitably secured to the insulator caps of the three insulators and supports the switch mechanism, to be presently described, in insulated relationship to the railway car.

A member 10 having a pair of spaced horizontal arms is mounted upon the plate 9 and constitutes a support for a blade carrier 15 which is pivoted between the arms by means of a pivot pin 16. The member 10 also constitutes a support for a pneumatic motor 14 for swinging the blade carrier 15 about its pivot. This motor will be described as the description proceeds.

A blade holder 17 is mounted upon the carrier member by means of a pair of insulators 16'—16' which rigidly support the blade holder 17 in position upon the carrier so that upon movement of the carrier the blade holder is moved. The blade holder is relatively long and narrow and, when the switch is in its open position, it extends transversely of the railway car as is indicated in the full lines in Figure 1. A relatively long and narrow contact shoe 18 is resiliently mounted upon the blade holder 17 by means of a set of resilient supports 19 and 20. The construction of the contact shoe 18 and the manner of mounting the same upon the blade holder 17 will be more fully set forth as the description proceeds. For the present it may suffice to say that the contact shoe is mounted to have a limited amount of universal motion with reference to the blade holder 17.

An insulator 25 is mounted upon the top of the plate 9 and supports a terminal lug 26 at the top thereof. A conductor for extending the circuit to or from the switch extends to the terminal lug, and from the terminal lug the circuit is extended by means of a flexible braided conductor 27 (Figure 1) which extends from the terminal lug 26 along a pair of split links 28 and 29 which are pivoted together at 30, one end of the link 29 being pivoted to the blade holder 17 and one end of the link 28 being pivoted to the insulator 25. The flexible conductor 27 extends along the two links and is connected at its remote ends to the contact shoe 18.

The switch is adapted to be actuated from its open position as shown in full lines in Figure 1 to its switch closed position as is shown in dotted lines in this figure. This movement is accomplished by applying pneumatic pressure to the pneumatic motor 14 which thereby causes the blade carrier 15 to swing about its pivot 16 in a counter-clockwise direction as seen in Figure 1. It is to be noted that the cooperating switch members on the two railway cars 1 and 2 are mounted upon opposite sides of the longitudinal center lines of the railway cars. As a result, when the blade carriers 15 of the two switches are swung in a counter-clockwise direction, the contact shoes 18 of the two switches approach one another and finally come into engagement. The pneumatic pressure is maintained upon the motor 14 during the entire time that the switch is in its closed position, that is in the position shown in dotted lines in Figure 1. It is to be noted that the switch blades of the two switches mounted upon the respective cars each limit the

extent of counter-clockwise rotation of the other about its pivot 16. Since the pneumatic pressure is being constantly maintained it is evident that the contact shoes of the two switching members will be maintained in engagement even though the two railway cars move laterally with respect to one another. Such motion of course takes place to a pronounced degree when the train is traveling around a curve. It is also to be noted that the two cars of a train have a limited amount of vertical motion relative to one another. In order to prevent the contact shoes of the cooperating switching members from coming out of engagement with one another due to this vertical motion, the shoes 18 are made of appreciable width in their vertical direction, as seen in Figure 2, whereby contact is maintained within the limit of vertical motion of the two railway cars relative to one another. There is also a limited amount of rocking motion, vertically, of the two railway cars with reference to one another. To take care of this rocking motion there is provided the resilient supports 19 and 20 for the contact shoes. As a result the two cooperating contact shoes always maintain their faces in engagement with one another regardless of the relative motion of the two railway cars with respect to one another.

A spring 35 is provided for moving the blade carrier from the dotted line position shown in Figure 1 to the full open position as shown in full lines in that figure. The pressure applied by the pneumatic motor 14 is normally in excess of the pull upon the blade carrier 15 by the spring 35. To move the switch to the open position it is merely necessary to release the pressure upon the motor 14 whereupon the spring 35 retracts the blade carrier and with it the blade holder member. When the carrier member 15 reaches its full line position as seen in Figure 1 it is latched in this position by means of the latch 40 thereby preventing movement of the switch member with reference to its supporting railway car due to the motion of the railway car. The latch member is adapted to be pneumatically controlled by means of a pneumatic motor 44 when it is desired to release the latch to permit swinging movement of the blade carrier 15 under the action of the pneumatic motor 14. The construction of this latch and the manner of operating the same will be more fully set forth as the description proceeds. It may be sufficient to here state that when pneumatic pressure is applied to the motor 14, for swinging the blade carrier, pressure is also simultaneously applied to the motor 44, the arrangement being such that the pressure builds up faster in the motor 44 than it does in the motor 14, thus releasing the latch 40 somewhat before the motor 14 has become effective to move the blade carrier.

Reference may now be had to Figure 3 which shows the pneumatic motor for operating the blade carrier. In this connection reference may also be had to Figure 4 showing a sectional view of this motor. The U-shaped frame member 10 comprises a bearing for the blade carrier 15 and an air pressure chamber for the pneumatic motor 14 as previously stated. The blade carrier 15 is pivoted between the arms 40 and 40' of the member 10 by means of a king bolt 41 that extends through aligned openings in the arms 40 and 40' and through a cylindrical bore in the blade carrier. Cylindrical anti-friction members 53 and 54 are interposed between the king bolt and the walls of the bore in the member 15 and means comprising an oil cup 55 is provided for facilitating the lubricating of the bearing surfaces. Fibre discs 56—56 are located above and below the bearing and suitable stuffing glands 57—57 are interposed between the arms 40 and 40' and the rotatable members. Dust caps 58 and 59 are provided for preventing the entrance of moisture or other foreign matter into the bearing. Each of these dust caps 58—59 comprises a split collar member the two split portions being adapted to be clamped about the tubular portion 60—60 of the blade carrier.

The base 47 of the bearing and air pressure member 10 is adapted to be bolted or otherwise suitably secured to the top of the plate like member 9 by means of suitable bolts passing through the openings 48—48 in the base of the member 10 and through suitable bolt holes in the plate member 9.

The air chamber is provided with a cover member 65 which is bolted or otherwise secured to the member 10 by means of bolts 66 which also serve to secure a diaphragm 68 in place. The diaphragm 68 divides the air chamber into two compartments 70 and 71. The compartment 70 is adapted to have air or other pneumatic pressure applied thereto by way of a conduit 72 whereas the compartment 71 is closed off from the compartment 70 and may be open to the atmosphere.

The diaphragm 68 is adapted to move an actuating piston rod 74 which moves through a bore 75 in the air chamber, said bore being provided with a suitable anti-friction member as well as with means for providing lubrication for the piston rod 74. The piston rod 74 moves outwardly of a cover 75' provided for the air chamber and is adapted to exert a pushing force upon the blade carrier 15 to swing the same about its pivot bolt 16. To facilitate this action the blade carrier is provided with a bolt member 80 having a spherical head 81 against which the piston rod 74 abuts. This bolt member 80 is threaded to the blade carrier and is adapted to be locked in adjusted position by means of a nut 83. By adjusting the position of this bolt member the position at which the piston rod 74 engages the bolt 80 may be adjusted thereby adjusting the extent of permissible movement of the piston rod 74, and therefore the diaphragm 68, before it engages the bolt 80.

An L-shaped bracket member 85 is provided at one end with a square opening for receiving a square projecting portion 87 of the bolt 80. The other end of the L-shaped bracket may be removably secured to the blade carrier by means of a bolt 92. This bracket additionally prevents turning of the bolt 80 and therefore serves to insure the holding of this bolt in its adjusted position. To adjust the bolt 80 it is first necessary to remove the L-shaped bracket 86 and then by loosening the nut 83 the bolt 80 may be adjusted.

It is to be noted that the axis of the bolt 80 is directed at an angle to the axis of the piston rod 74. When the switch is operated to its closed position the blade carrier 15 swings about the center of the bolt 16 in a counter-clockwise direction through such an angle as to bring the center line of the bolt 80 substantially in line with the center line of the piston rod 74. Of course this varies somewhat during the motion of the railway car but, in general, and when the two coupled railway cars are traveling over a straight portion of the track, the blade carrier,

when in the position shown in dotted lines in Figure 1, is at such an angle that the bolt 80 is directly in line with the piston rod 74. It is to be remembered that the switch is maintained in its switch closed position by the continued application of pressure to the pneumatic motor whereby the piston rod 74 is maintained extended. The piston rod continually exerts its force upon the bolt 80 and since this force is transmitted to the bolt 80 along a line extending through the bolt and axially of the rod 74 there is substantially no side thrust upon the rod 74 during the time that the switch is in its closed position, which represents substantially the only time that the piston rod is extended.

As previously stated, the switch is returned to its open position, upon the cutting off of pneumatic pressure to the motor 14, by means of the spring indicated at 35 in Figure 1. One end of the spring is connected to a projecting portion 90 in the blade carrier, said projecting portion having an opening therein for receiving the end of the spring. The opposite end of the spring is connected to a spring support as shown in Figure 1.

The forward end of the blade carrier 15 is provided with flat surfaces as indicated at 93 and 94, said surfaces being provided with suitable bolt holes for securing the insulators 16'—16' of Figure 1 thereto.

When the switch is returned to its full open position by the action of the springs 35 it is held in place by means of a latch as previously stated. This latch is shown more particularly in Figures 5 and 6 to which reference may now be had. The latch 40 is swiveled in a casting 100 which is bolted or otherwise suitably secured to the plate 9 by means of bolts as indicated at 101 and 102. The casting 100 comprises a bearing support for the latch and also an air pressure chamber for the pneumatic motor 44 that actuates the latch to its released position. The base casting 100 has a pair of arms 105 and 106 extending upwardly therefrom on the opposite sides thereof and supporting suitable journal bearings in which is journaled a shaft 107. This shaft member is capable of swinging or rocking movement within the bearings through a limited angle. A collar member 108 is suitably secured to the shaft 107 to swing therewith, and is provided with a projecting portion 109 which is adapted to abut against an arm 110 in the base 100 for limiting the extent of turning of the shaft 107 in a clockwise direction as seen in Figure 5. A bolt 115 extends through the collar member 109 and the shaft 107, this bolt passing through rubber shock absorbing members 116 and 117 and serving to secure the hook portion 118 to the rockshaft 107, so that upon rocking of the collar member 108 the hook portion 118 is turned. A cap 120 is provided at the other end of the assembly, the whole assembly being held together by means of a castellated nut 121 which threads about the bolt 115 and is held in position by means of a pin 122.

The latch assembly is not balanced about the shaft 107 but is heavier on the right hand side as seen in Figure 5 than on the left hand side. Due to this fact the latch is biased by gravity to the position shown in full lines in Figure 5. As the blade carrier 15 is moved to its full line position of Figure 1, under the action of the spring means 35, a portion of the carrier having an opening therein rides into a position such that the nose portion of the hook 118 enters the opening. The lower surface of the opening causes the latch assembly to rock about the shaft 107 for a limited degree. A moment later the blade carrier rides into the position shown in Figure 5 whereupon the hook portion 118 of the latch assembly again swings to its normal position as shown in the full line of Figure 5 so that the portion 126 of the blade carrier lies within the notch in the hook portion 118 as shown in Figure 5. The latch now holds the blade carrier against outward movement. In order to permit the actuation of the switch it is necessary to first release the latch and this may be accomplished by swinging the latch to its dotted position as shown in Figure 5. A pneumatic motor 44 is provided for doing this. The motor comprises an air chamber which is divided into two compartments as by means of a diaphragm 200. The motor is provided with a cover plate member 201 which is bolted to the open front face of the air chamber of the motor by means of suitable bolts 202—202 which also serve to secure the diaphragm 200 in place. A conduit 203 supplies air pressure to the compartment 204 for moving the diaphragm 200 to the right as seen in Figure 5. The diaphragm 200, acted upon by the pressure in the chamber 204, is adapted to actuate a piston rod 207 which in turn is adapted to bear against a bolt 210 which is threaded into the collar member 196 and locked in its adjusted position by means of a suitable lock nut as indicated at 211. By adjusting the bolt 210 an adjustment may be provided for adjusting the extent of permissible movement of the piston rod 207 before it abuts against the bolt 210 to swing the latch member to the dotted line position. The compartment 209 of the pneumatic motor is open to atmosphere by means of an opening 215 whereby one side of the diaphragm is constantly subjected to atmospheric pressure. Upon releasing the pressure in the compartment 204 the diaphragm 200 returns to the position as shown in Figure 5 due to its own resiliency. This may be accelerated if desired, by means of a spring or by applying negative pressure to the conduit 203.

A description will now be given of the manner of mounting the contact shoe 18 upon the blade 17, and for this purpose reference may be had more particularly to Figure 7 which is a section taken along the line 7—7 of Figure 1 and looking in the direction of the arrows. The blade or contact shoe holder comprises a pair of angle iron members 220 and 221 which extend parallel and adjacent one another for their full length. The angle iron members are slightly spaced from one another and are secured at one end to the caps upon the insulators 16'—16'. A pair of bumper supports 223 and 224 are bolted together on the opposite sides of the members 223 and 224 by means of suitable bolts which extend through the bumper supports 223 and 224 and also through the members 220 and 221. The bumper supports therefore also serve to secure the channel members 220 and 221 together in desired spaced relationship. The bumper supports may comprise merely flat plates of a generally square shape and having a central opening therein. The bumper plates serve to secure rubber bumpers 226 and 227 to the contact shoe holder 17. It is to be noted that these rubber bumpers are of a generally circular cross-section and of a generally conical shape. A disc member 228, which may comprise merely a plurality of layers of canvas, is interposed between each of the rubber bumpers 226—227 and the angle members 220—221.

The contact shoe 18 is made of copper or other

suitable material of high electrical conductivity and comprises a substantially flat contacting face portion 230 which is suitably reenforced at the rear by means of a reenforcing web 231 which extends lengthwise of the contact shoe and suitable webs 232 which extend transversely thereof. The reenforcing webs are formed integrally with the rest of the contact shoe. A plurality of such webs 232—232 are provided in spaced relationship lengthwise of the contact shoe to suitably strengthen the same. At each of the bumpers such as 19 and 20 of Figure 1 the contact shoe is provided, at its rear, with a boss 235 which is internally threaded as indicated at 236. A bolt 237 is threaded into the contact shoe 18 and is extended through openings in the rubber bumpers 226 and 227. A suitable disc 240, which may also be made of a plurality of layers of canvas, is interposed between the boss 235 and the bumper 227. At its other end the bolt 237 is threaded and the contact shoe 18 is locked in position by means of a castellated nut 242, which may be held in place by means of a pin 243. It is to be noted that the space between the vertical flanges of the angle member 220 and the member 221 is appreciably more than the diameter of the bolt 237. As a result it is possible for the contact shoe 18 to adjust itself with reference to its holder 17 so as to maintain proper contact with the cooperating contact shoe on the switch of the adjacent railway car. To do this it may be necessary for the contact shoe to move angularly in a clockwise or counterclockwise direction as seen in Figure 7 due to the fact that one or the other of the two coupled cars have a limited amount of motion in a vertical direction with reference to one another. The rubber bumper arrangement permits a limited amount of universal motion of the contact shoe 18 with respect to its supporting blade holder 17.

In order to operate the switch to its closed position air pressure is applied to the pneumatic motor 14 and at the same time air pressure is applied to the pneumatic motor 44 for releasing the latch 40. In order to obtain the best results it is advisable to release the latch before a considerable force is applied to the blade carrier 15 for if a considerable force were applied by the pneumatic motor 14 to the blade carrier 15 at a time when the blade carrier is held in its locked position by the latch mechanism 40 there is a possibility that the carrier might wedge against the latch mechanism and prevent release of the latch mechanism by the pneumatic motor 44. This might require the use of two control levers, one for the latch motor and the other for the motor 14. However, I accomplish this result by the application of air pressure to a single conduit and providing means for delaying the building up of pressure in the operating motor 14. This is accomplished by the arrangement shown diagrammatically in Figure 9. Air for operating the two pneumatic motors is supplied under pressure from the conduit 250, the outlet of which is connected to a T-pipe having two branches. One of the branches extends by way of the conduit 203' to the conduit 203 of Figure 5, for operating the pneumatic motor 44. The other branch of the T extends by way of an elbow 252 and a nipple 253 to a conduit 72' which connects with the conduit 72 of Figure 4 for operating the pneumatic motor 14. The nipple 253 is provided with a restricted orifice 254 for restricting the rate of air flow. No such restriction is provided in the connection to the pneumatic motor 44 for operating the releasing and holding latch. When air pressure is applied to the conduit 250 for operating both of the motors to actuate the switch to its closed position the air pressure builds up quickly in the motor 44, due to the fact that there is no restriction to the air flowing through the pipe 203'. As a result the latch is immediately operated to its releasing position shown in dotted lines in Figure 5. At the same time air pressure is applied by way of the conduit 72' for operating the pneumatic motor 14. However, due to the restricted orifice 254, there is a momentary delay in the building up of the air pressure in the operating chamber of the pneumatic motor 14 with the result that there is a delay in the operation of the piston that actuates the blade carrier 15. A moment later, the latch 40 having already been released, the air pressure will build up in the motor 14 with the result that the piston rod operated by this motor will actuate the blade carrier to the position shown in the dotted lines in Figure 1. Since the air pressure is maintained during the entire time that the switch is to be kept in its closed position it is apparent that the motor 14 maintains the switch in the position shown in dotted lines in Figure 1.

The restricted orifice 254 (Figure 9) not only delays the initiation of the switch closing movement but also checks the rate of movement of the switch in its closing direction since the rate of movement is determined by the rate of fluid flow through the restricted orifice. Hence the orifice prevents violent slamming or banging of the switch in its closing movement. In a like manner, during the switch opening movement, fluid from the chamber 70 (Figure 4) must escape through the restricted orifice 254 (Figure 9). The rate of escape of fluid from the chamber 70 will determine the rate of movement of the switch in its opening direction under the action of the retracting spring 35. The orifice 254 limits the rate of escape of fluid from the chamber 70 and thus cushions the return movement of the switch blade.

Reference may now be had to Figures 10, 11 and 12 showing a switch of a somewhat modified form of construction. In these figures I show only the top portion of a railway car upon which my switch is mounted. The railway car is indicated at 300 and has mounted on the top thereof a number of insulators for supporting the usual pantograph structure 301 that rides along the overhead trolley. The pantograph supporting structure may be of a kind well known in the art and only a portion thereof is here shown. This portion includes an insulator 305 which is mounted on top of the railway car and supports, together with other insulators not shown, a member 306 whereon are supported a number of insulators, one of which is indicated at 307, for supporting the pantograph support 308. As previously stated, the insulator 305 is provided on top of railway cars of the kind herein contemplated regardless of whether or not the car is provided with my improved switch. I contemplate utilizing this insulator to help support my switching structure and thus reduce, by at least one, the number of insulators that might be otherwise required to support the switch. Two insulators 310 and 311 are mounted upon the railway car and support an angle iron frame member 315. This frame member extends beyond the insulator 310 and is supported at its extended end by the insulator 305. The frame 315 constitutes a sub frame and extends length-

wise of the top of the car and along the side thereof for a short distance. This frame is provided with a portion indicated at 316 which extends transversely of the railway car and is joined to the longitudinally extending portion by means of a portion 317. The portion 316 of the frame 315 is supported by an insulator 318 which is mounted upon the top of the railway car.

The sub base 315 supports an upper base 320 by means of three insulators indicated at 321, 322 and 323. This upper base 320 comprises an angle iron frame having a plate-like member 325 secured to the lower side of the angle frame. The switch and the various operating means therefor are suspended from the lower side of the plate member 325. A frame member 10 which constitutes a bearing for the blade carrier and an air pressure chamber for the pneumatic motor for operating the switch is mounted on the lower side of the plate 325. The member 10 is of a construction such as has been previously described in connection with the switch mechanism shown in Figures 1 and 2 and need not be further described herein. A blade carrier 330 is pivoted in the frame member 10 in substantially the same manner as is the blade carrier 15 of the switch previously described. The blade carrier is adapted to swing about its pivot which is indicated at 331 in Figure 10. In this form of my invention a contact shoe holder 332 is bolted or otherwise rigidly secured to the blade carrier 330 to swing therewith as an integral unit. The blade or contact shoe holder 332 may be of a construction substantially identical to the construction of the blade holder 17 of the switch previously described, and it supports a contact shoe 335 by means of a pair of spaced resilient bumper supports 336 and 337. The contact shoe and the manner of mounting the same upon the blade holder 332 may be of a construction substantially the same as the contact shoe 18 and the bumper supports 19 and 20 of the switch shown in Figure 1 and which has been previously described. A flexible braided copper conductor 340 is secured to the contact shoe 335 for extending the electrical circuit thereto. It is to be noted that in this form of switch the blade holding member 332 is mounted directly upon the blade carrier 330 whereas in the form of switch previously described a set of insulators is interposed between the corresponding member 17 and the corresponding blade carrier 15. As a result of the present arrangement the various actuating means such as the pneumatic motors and the like are not insulated from the switch blade. Hence the conduit supplying air to the pneumatic motors must include a section of insulation.

Reference may now be had to Figure 13 showing a perspective view of the blade carrier 330 of the switch shown in Figures 10 and 11. The blade carrier is provided with a cylindrical portion 345 having a central bore 346 through which the mounting bolt 331 (Figure 10) extends. The cylindrical portion is provided with a pair of arms 348 and 349 having aligned openings therein as indicated at 350—350. A bolt is extended through these aligned openings and constitutes a bearing surface against which the piston rod 74 (Figures 3 and 4) of the pneumatic motor bears. An arm 352 extends forward and upwardly from the cylindrical portion 345 and terminates at a front wall 354 which extends at right angles thereto and transversely of the railway car. This portion of the blade carrier is provided with a flat portion 355 and a similar portion at the lower end thereof. These flat surfaces are provided with a plurality of bolt holes indicated at 356. The angle members 332 of the switch are adapted to be bolted to the carrier member 330 by means of bolts that extend through the opening 356.

The blade carrier 330 is provided with a pair of lugs 360 and 361 having central aligned openings therein for receiving a mounting pin. A spring swivel is pivoted about this pin and provides a support for one end of a spring which is provided for returning the switch blade to its open position as shown in full lines in Figures 10, 11 and 12. This swivel is indicated at 360 in Figure 12. At its bottom portion the blade carrier is provided with a projecting end 362 which is adapted to ride over the locking portion of a locking latch such as the lock portion 118 of the locking member shown in Figure 5, and be thereby held in place.

The locking latch shown in Figures 4 and 5 is secured in inverted position, to the underside of the upper plate 325 and is so arranged that when the blade carrier is swung to the position shown in full lines in Figure 10 the hook member 118 is forced downwardly by the wall portion 363 (Figure 13) of the blade carrier until this wall portion reaches the portion 125 of the locking latch shown in Figure 5. In view of the fact that the locking latch is here mounted in its inverted position it is necessary to provide a counterweight on the side of the locking latch adjacent the cap 128 (Figure 5) in order to bias the locking member to the position as shown in full lines in Figure 5. In the absence of such a counterweight if the mechanism as shown in Figure 5 were inverted then the apparatus would assume the position as shown in the dotted lines of this figure.

A set of springs 370 (Figure 12) are connected at one end to the spring swivel 360 and at their other end to a spring support 371 which is secured to the lower side of the plate member 325. Means comprising a set of bolts and nuts as indicated at 373 is provided for permitting the adjustment of the tension of the springs 370. These springs normally bias the switch to the position shown in full lines in Figure 12 and are adapted to return the switch to this position upon the cut off of the air pressure in the motor 14. When the spring brings the blade carrier to the full line position as shown in Figure 12 the latch or hook member 118 locks it in position.

In Figure 10 I have shown a portion of a railway car which is coupled to the railway car 300' and is provided with a switch such as the switch shown as mounted upon the car 300. The switch mounted upon the car shown in fragmentary form at the left-hand side of the sheet of drawings is of a construction identical to that shown on the car 300 and only a portion of this structure has been shown. Similar parts of this switch are indicated by the same reference numerals as were used in connection with the switch as shown mounted upon the car 300, these reference numerals being primed.

Reference may now be had more particularly to Figures 14, 15, and 16 wherein I show a somewhat modified form of blade holder. Whereas in the modifications previously described the blade holder comprised a pair of angle iron members, the blade holder shown in these figures comprises a set of spaced tubular members. In Figure 14 I show a pair of insulators 16'—16' which are the insulators shown in Figure 1 and which

are mounted upon the blade carrier 15 of Figure 1. A clamping member 400 is suitably secured to the insulator cap 401 and comprises a flat portion 402 which seats upon the insulator cap. The clamping member 400 is provided with a pair of cylindrical grooves each formed by a portion 404 which is integral with the base 402 of the clamping member and extends therefrom sidewise, upward and back as indicated, said member 404 forming a cylindrical socket for receiving the tubes 415 or 416. The member 404 is provided with a lug portion 406 which is adapted to be clamped toward the portion 402 of the frame 400 by means of the bolt 408 which passes through an opening in the lug 406 and through an aligned opening in the member 400 and threads into a tapped opening in the insulator cap 401. The blade or contact shoe holder comprises a pair of tubular members 415 and 416 which are inserted into the sockets formed by the member 404 of the support 400 and are clamped in place by means of the bolts 408.

The contact shoe 18 is mounted upon a rubber bumper 19 which is of a construction substantially the same as the bumper member 10 of the switch as shown in Figure 1. This bumper is however mounted upon the tubular members 415 and 416 in a different manner. I provide a pair of plate-like clamp members indicated at 423 and 424 each of which is provided with a pair of semi-cylindrical grooves which are adapted to embrace the two pipe members 415 and 416. The two plate members are provided with central openings into which the rubber bumpers 226 and 227 may extend in the same manner as those bumpers extend through the plate members 223 and 224 of Figure 7. The clamping members 423 and 424 are adapted to be clamped together by means of four sets of bolts and nuts indicated at 428. These clamp members are bolted tightly to the pipe members 415 and 416 and thus rigidly support the rubber bumper upon which the contact shoe 18 is mounted so that the contact shoe has a limited amount of universal movement with respect to the supporting pipes or tubes 415 and 416. The clamp members 423 and 424 also hold the ends of the pipes or tubes 415—416 against spreading.

In Figures 17, 18 and 19 I show another form of contact shoe and mounting means therefor. This form of contact shoe is adapted to be mounted upon a blade carrier 14 which may be of a construction similar to the blade carrier 330 of the switch shown in Figures 10, 11 and 12, or of a construction similar to that of the blade carrier 15 of the switch shown in Figures 1 and 2. The blade carrier is provided with a pair of supporting brackets 451 and 452 each of which is split longitudinally and adapted to be clamped in embracing relationship to a stud pin or shaft 454 by means of a bolt 455 and a nut 456. The contact shoe 460 is provided, at its rear side, with a set of arms 461—461 which are adapted to embrace the supporting arm 451, and another set of arms 462—462 which are adapted to embrace the arm 452. The pins or studs 454 extend through aligned openings in the set of arms on the contact shoe 460 and the corresponding arms on the blade carrier 450 and are held in place by means of cotter pins or the like 465. The blade carrier is thus capable of oscillating about the center of the pins 454 as an axis.

Sets of springs 465 are provided for biasing the blade carrier 450 to the position as shown in the drawings with reference to the blade carrier 450. For this purpose the blade carrier is provided with bosses 467, said bosses being formed integrally with the blade carrier. The bosses are provided with tapped openings into which are threaded studs 466, the studs being locked in position by means of pins 468 that extend through the bosses and into the studs. The studs 466 extend up to within a short distance of the inner side of the contact shoe 460 and constitute a guiding means for the springs 465. A set of adjustable lock nuts 469 is provided for adjusting the compression upon the springs 465. The springs 465 are located two on each side of the longitudinal center line of the contact shoe 460 and therefore resiliently hold the contact shoe in the position shown in the drawings.

The contact shoe 460 is provided with a relatively long contact surface 472 which is adapted to cooperate with the corresponding surface of another contact shoe of identical construction in a manner which will be apparent from the description thus far given. Since the contact shoe 460 is capable of swiveling about the pins 454 and these pins are mounted upon a blade carrier 450 which is in turn capable of swinging about the pivot 474 it is apparent that the contact shoe 460 has universal motion with reference to its ultimate support, the axis 474 about which the blade carrier 450 pivots.

While I have herein shown the contact shoe 460 mounted upon the blade carrier 450 without the interposition of insulators between the two it is apparent that such insulators may be provided, in which event the insulators would be mounted upon the blade carrier, the contact shoe together with its swiveling apparatus being mounted upon the insulator.

In compliance with the requirements of the patent statutes I have herein shown and described a few preferred embodiments of my invention. It is however to be understood that the invention is not limited to the precise constructions herein shown, the same being merely illustrative of the invention. What I consider new and desire to secure by Letters Patent is:

1. In combination, two tandem connected railway cars, switching means pivotally mounted for rotation in the same plane at the adjacent ends of the two cars at opposite sides of the longitudinal center lines of the two cars, and actuating means for rotating the switching means in the same direction about their pivots into abutting engagement in said horizontal plane with one another and maintaining engagement while the cars move with respect to one another, the switching means engaging one another along a line extending diagonally between the two cars when the cars are in alignment.

2. In combination two vehicles coupled together in tandem, switching means pivotally mounted at the adjacent ends of the respective vehicles about vertical pivots spaced from the longitudinal center of the vehicles, each of said switching means comprising a switch blade member and means for swinging the same about its pivot into a position between the vehicles and into engagement with the switching means on the other vehicle along a line disposed angularly to the longitudinal center line of the vehicle, and each switching means including yielding means urging it about its vertical pivot into engagement with the other switching means and maintaining a pressure contact between the two switching means.

3. A railway vehicle having a top, an electric switch member pivotally mounted on the top of

the vehicle adjacent one end thereof, means for swinging the same about its pivot in a generally horizontal direction beyond the body of the vehicle for establishing an electric circuit connection with another switch member on another vehicle, and means for retracting the switch member to interrupt the circuit connection, said switch member, when in its extended position having a substantially great freedom of angular motion in a horizontal direction with reference to the vehicle and having a substantially lesser but distinct freedom of angular motion in the vertical direction, and yielding means constantly urging the switch horizontally towards its extreme limiting position in one direction when the switch is extended.

4. An electric switch including a switch blade carrier pivotally mounted, a switch blade member mounted on the carrier and swingable therewith, a relatively long and narrow contact shoe mounted on the blade member with its longitudinal axis extending lengthwise of the blade member, yielding means constantly effective while the switch is in its closed position for urging the blade carrier to swing about its pivot in the switch closing direction, and additional means constantly urging the blade carrier, and with it the blade, to the switch open position, said yielding means predominating over said additional means, said switch being opened by said additional means upon the yielding means becoming ineffective.

5. An electric switch including a switch blade carrier pivotally mounted, an insulator rigidly mounted on the carrier with its axis extending at right angles to the pivotal axis of the carrier, a switch blade member mounted on the insulator and swingable therewith, a relatively long and narrow contact shoe mounted on the blade member with its longitudinal axis extending lengthwise of the blade member, yielding means constantly effective while the switch is in its closed position for urging the blade carrier to swing about its pivot in the switch closing direction, and means for swinging the blade carrier, and with it the blade, to the switch open position.

6. An electric switch including a switch blade carrier pivotally mounted, an insulator rigidly mounted on the carrier with its axis extending at right angles to the pivotal axis of the carrier, a switch blade member mounted on the insulator and swingable therewith, a relatively long and narrow contact shoe mounted on the blade member with its longitudinal axis extending lengthwise of the blade member, yielding means constantly effective while the switch is in its closed position for urging the blade carrier to swing about its pivot in the switch closing direction, and additional means for constantly urging the blade carrier, and with it the blade, to the switch open position, said yielding means normally predominating over said additional means and being rendered ineffective to permit opening movement of the switch under the action of said additional means.

7. An electric switch including a plurality of spaced insulators rigidly mounted, a supporting base rigidly supported on the insulators, a switch blade carrier pivotally mounted on the base, an insulator rigidly mounted on the carrier with its axis extending at right angles to the pivotal axis of the carrier, a switch blade member mounted on the insulator and swingable therewith, a relatively long and narrow contact shoe mounted on the blade member with its longitudinal axis extending lengthwise of the blade member, yielding means constantly effective while the switch is in its closed position for urging the blade carrier to swing about its pivot in the switch closing direction, and additional means for constantly urging the blade carrier, and with it the blade, to the switch open position, said yielding means normally predominating over said additional means and being rendered ineffective to permit opening movement of the switch under the action of said additional means.

8. An electric switch including a plurality of spaced insulators rigidly mounted, a supporting base rigidly supported on the insulators, a switch blade carrier pivotally mounted on the base, a switch blade member mounted on the carrier and swingable therewith, a relatively long and narrow contact shoe mounted on the blade member with its longitudinal axis extending lengthwise of the blade member, yielding means constantly effective while the switch is in its closed position for urging the blade carrier to swing about its pivot in the switch closing direction, and means for swinging the blade carrier, and with it the blade, to the switch open position.

9. An electric switch including a plurality of spaced insulators rigidly mounted, a supporting base rigidly supported on the insulators, a switch blade carrier pivotally mounted on the base, a switch blade member mounted on the carrier and swingable therewith, a relatively long and narrow contact shoe mounted on the blade member with its longitudinal axis extending lengthwise of the blade member, yielding means constantly effective while the switch is in its closed position for urging the blade carrier to swing about its pivot in the switch closing direction, means for swinging the blade carrier, and with it the blade, to the switch open position, locking means effective responsive to the switch reaching its full open position for locking it in position, and means effective responsive to the initiation of the switch opening operation for releasing the locking means.

10. An electric switch including a plurality of spaced insulators rigidly mounted, a supporting base rigidly supported on the insulators, a switch blade carrier pivotally mounted on the base, an insulator rigidly mounted on the carrier with its axis extending at right angles to the pivotal axis of the carrier, a switch blade member mounted on the insulator and swingable therewith, a relatively long and narrow contact shoe mounted on the blade member with its longitudinal axis extending lengthwise of the blade member, yielding means constantly effective while the switch is in its closed position for urging the blade carrier to swing about its pivot in the switch closing direction, means for swinging the blade carrier, and with it the blade, to the switch open position, and locking means effective responsive to the switch reaching its full open position for locking it in position.

11. An electric switch including a plurality of spaced insulators rigidly mounted, a supporting base rigidly supported on the insulators, a switch blade carrier pivotally mounted on the base, an insulator rigidly mounted on the carrier with its axis extending at right angles to the pivotal axis of the carrier, a switch blade member mounted on the insulator and swingable therewith, a relatively long and narrow contact shoe mounted on the blade member with its longitudinal axis extending lengthwise of the blade member, yielding means constantly effective while the switch is in its closed position for urging the blade carrier to swing about its pivot in the switch closing direc-

tion, means for swinging the blade carrier, and with it the blade, to the switch open position, locking means effective responsive to the switch reaching its full open position for locking it in position, and means effective responsive to the initiation of the switch opening operation for releasing the locking means.

12. A switch comprising a pair of spaced relatively movable vertical pivots, a pair of cooperating switch blades mounted for swinging movement about the respective pivots into and out of engagement with one another, said blades being horizontally displaced in opposite directions from the plane determined by both pivots, and yielding means for moving said blades about their pivots into abutting engagement with one another and urging them beyond their position of engagement for maintaining a yielding pressure engagement between them as the pivots move relative to one another.

13. An electric switch including a pair of cooperating contact making members pivotally mounted and swingable about their pivots into and out of engagement, the pivotal supports of each of the contact making members being movable in a direction having a component at an angle to the line joining the pivots, said contact making members being swingable about their pivots when in the switch closed position, and yielding means for constantly urging said contact making members about their pivots and towards one another when the switch is in the closed position, whereby they are maintained in engagement while the relative positions of the two pivot points shift.

14. An electric switch including a pair of spaced vertical pivots, a pair of contact making members adapted to be swung about the pivots into engagement with one another, yielding means constantly urging the contact making members to swing about their pivots towards one another when they are in engagement, said pivots being movable and said contact making members being freely swingable about their respective pivots under the action of the yielding means.

15. In combination, a switch member, means for holding the member in a given position, pneumatic means for controlling the release of the first named means, pneumatic means for moving the switch member to a second position, both of said pneumatic means being arranged to have pressure simultaneously applied thereto, and means for delaying the effect of the pressure on the second named pneumatic means until the holding means has been released.

16. In combination, a switch member, means for holding the member in a given position, pneumatic means for controlling the release of the first named means, pneumatic means for moving the switch member to a second position, both of said pneumatic means being arranged to have pressure simultaneously applied thereto, and means for restricting the rate of fluid flow to the second named pneumatic means as compared to the rate of flow to the first named pneumatic means, thereby delaying the effect of the pressure on the second named pneumatic means until the holding means has been released.

17. In combination, two vehicles coupled together in tandem and, at the adjacent ends of the vehicles, a switching member pivoted on one vehicle at a substantial distance to one side of the longitudinal center of the vehicles, a cooperating switch member pivoted to the other vehicle at a substantial distance to the other side of the longitudinal center of the vehicles about a pivot parallel to the first pivot, both of the switching members having a contacting surface defined by the locus of a straight line at right angles to the axes of the pivots moving parallel to itself, and means for swinging both switching members about their respective pivots and in directions towards one another to bring the members into engagement along a line extending diagonally between the two vehicles.

18. In combination, two vehicles coupled together in tandem and, at the adjacent ends of the vehicles, a switching member pivoted on one vehicle at a substantial distance to one side of the longitudinal center of the vehicles, a cooperating switch member pivoted to the other vehicle at a substantial distance to the other side of the longitudinal center of the vehicles, each of said members having a horizontally extending flat contacting surface, means for locking the respective members in their switch open position, means for releasing the locking means, and means for swinging both switching members about their respective pivots and in directions towards one another to bring the members into engagement along a line extending diagonally between the two vehicles.

19. In combination with a railway car, switching means mounted thereon adjacent one end thereof and including a blade carrier pivotally mounted for movement in a generally horizontal plane, insulators mounted on the blade carrier, a blade mounted on the insulators and movable by the blade carrier horizontally beyond the body of the railway car, motor means mounted on top of the railway car and connected to said carrier adjacent the pivot thereof for actuating the blade carrier, said motor means being insulated from the blade by said insulators, and means normally tending to resist movement of said carrier by said motor means.

20. A switch including blade supporting means, a resilient insulating tubular member on one side of the supporting means, another resilient tubular member on the other side of said means, a bolt passing through said two tubular members and through a hole in the blade supporting means and out of contact with the blade supporting means, said bolt serving to secure the insulating members to the blade supporting means, and a switch blade carried by the supporting means through the tubular insulating members.

21. A switch including a pair of cooperating switch blades adapted to be mounted on adjacent vehicles of a train of vehicles, vertical pivots for the blades, said pivots being movable towards and away from one another as the adjacent vehicles move with respect to one another, yielding means for swinging said blades about their pivots from their normal switch open position to their normal switch closed position in abutting engagement with one another, each blade having a contacting surface which is a straight line in horizontal section whereby the blades engage along a horizontal line lying between the pivots, said yielding means maintaining a force constantly urging the blades in their switch closing direction beyond their position of abutment to maintain a pressure engagement between the blades.

22. In a train comprising a pair of tandem connected vehicles, a switch including a pair of cooperating switch blades, one on each vehicle, vertical pivots for the blades, said pivots being relatively movable with said vehicles, yielding means for swinging said blades about their pivots from

their normal switch open position to their normal switch closed position in abutting engagement with one another, each blade having a contacting surface which is a straight line in horizontal section whereby the blades engage along a horizontal line lying between the pivots, said yielding means maintaining a force constantly urging the blades in their switch closing direction beyond their position of abutment to maintain a pressure engagement between the blades, said pivots being located at adjacent ends of the two vehicles and on the opposite sides of the longitudinal center line thereof.

23. In a train of coupled vehicles, a switch comprising one switching member pivoted about a vertical pivot on the roof of one vehicle adjacent the end thereof and spaced from the longitudinal center line thereof, a cooperating switching member pivoted about a vertical pivot on the roof and at the adjacent end of the adjacent vehicle, said second pivot being spaced on the opposite side of the longitudinal center line of the vehicle, and yielding means for swinging the switching members about their respective pivots in a horizontal plane from their normal switch open position to their normal switch closed position in abutting engagement with one another, said yielding means maintaining a force constantly urging said switching members beyond their position of abutment in said horizontal plane to maintain a pressure engagement between them.

24. In a train of coupled vehicles, a switch comprising one switching member pivoted about a vertical pivot on the roof of one vehicle adjacent the end thereof and spaced from the longitudinal center line thereof, a cooperating switching member pivoted about a vertical pivot on the roof and at the adjacent end of the adjacent vehicle, said second pivot being spaced on the opposite side of the longitudinal center line of the vehicle, each of the switching members having a contacting surface defined along a major portion of its length by the locus of a horizontal straight line moving parallel to itself, and yielding means for swinging the switching members about their respective pivots from their normal switch open position to their normal switch closed position in abutting engagement with one another, said yielding means maintaining a force constantly urging said switching members about said pivots beyond their position of abutment to maintain a pressure engagement between them.

25. Electric switching means including a pair of switch blade carriers pivotally mounted about spaced pivots that are movable toward and away from one another, contacting means supported by the respective carriers and each including a relatively long and narrow contact making portion, said blade carriers being swingable about their pivots to bring the two contact making portions into and out of engagement with one another, yielding means constantly effective while the switching means is in its closed position for urging the blade carriers to swing about their pivots towards engagement with one another for maintaining engagement of the contact making portions as the pivots move with respect to one another, and means for swinging the blade carriers about the pivots to their switch open positions.

26. In a train of tandem connected vehicles, switching means for establishing circuit connections between adjacent vehicles comprising, on each of two adjacent vehicles, a comparatively long switch blade extending transversely of the vehicle when in its open position and movable into a position extending diagonally in the space between the vehicles, said two blades being pivoted about vertical pivots located on opposite sides of the longitudinal center line of the train, and means for swinging the blades toward one another about their vertical pivots and continuously maintaining a yielding pressure engagement between them, said blades being movable about their vertical pivots under the action of the yielding pressure maintaining means for maintaining engagement of the blades as the vehicles and the associated blade pivots move with respect to one another.

27. In a train of tandem connected vehicles, switching means for establishing circuit connections between adjacent vehicles comprising, on each of two adjacent vehicles, a comparatively long switch blade extending transversely of the vehicle when in its open position and movable into a position extending diagonally in the space between the vehicles, said two blades being pivoted about vertical pivots located on opposite sides of the longitudinal center line of the train, means for swinging the respective blades to their switch open position, and means for holding the blades in the open position.

28. In combination with a railway car, switching means thereon adjacent one end of said car and including a blade carrier pivotally mounted for movement in a horizontal plane, motor means connected to said carrier for moving the carrier in one direction about said pivot, resilient means for resisting movement of said carrier by said motor means and moving said carrier in the opposite direction upon deenergization of said motor means, and means for cushioning the blade carrier in its movement in said opposite direction.

29. In combination with a railway car, switching means thereon adjacent one end of said car and including a blade carrier pivotally mounted for movement in a horizontal plane, motor means connected to said carrier for moving the carrier in one direction about said pivot, resilient means resisting movement of said carrier by said motor means and moving said carrier in the opposite direction upon deenergization of said motor means, and means for cushioning the blade carrier in its movement in said opposite direction and for introducing a relatively small delay in the initial movement of said carrier upon actuation of said motor means.

30. In combination, a switch comprising a switch blade pivotally mounted for rotation in a horizontal plane from switch open to switch closed position, spring means for moving said switch blade into switch open position, motor means having abutting engagement with said blade for moving said blade into switch closed position and for storing energy in said spring means, means associated with said motor means for cushioning said switch blade adjacent its switch opened position against the movement imparted thereto by said spring means, and means for controlling the angular rotational movement imparted to said switch blade by said motor means.

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