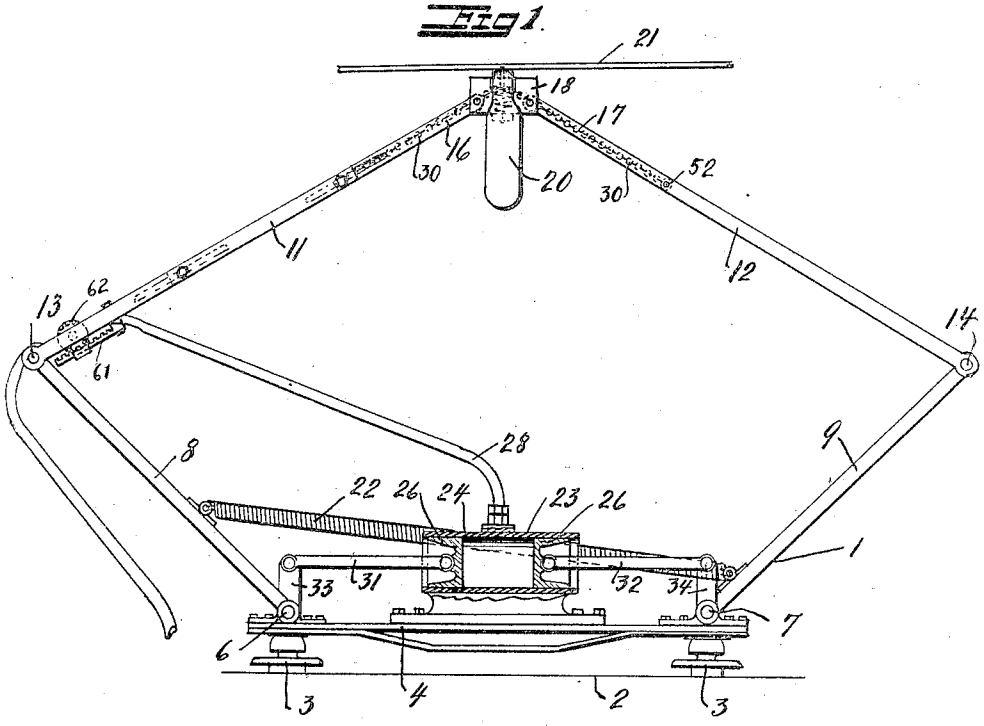
July 17, 1923. 1,461,988

R. B. SPIKES

PANTOGRAPH

Filed Nov. 27, 1922 2 Sheets-Sheet 1

Fig 1.



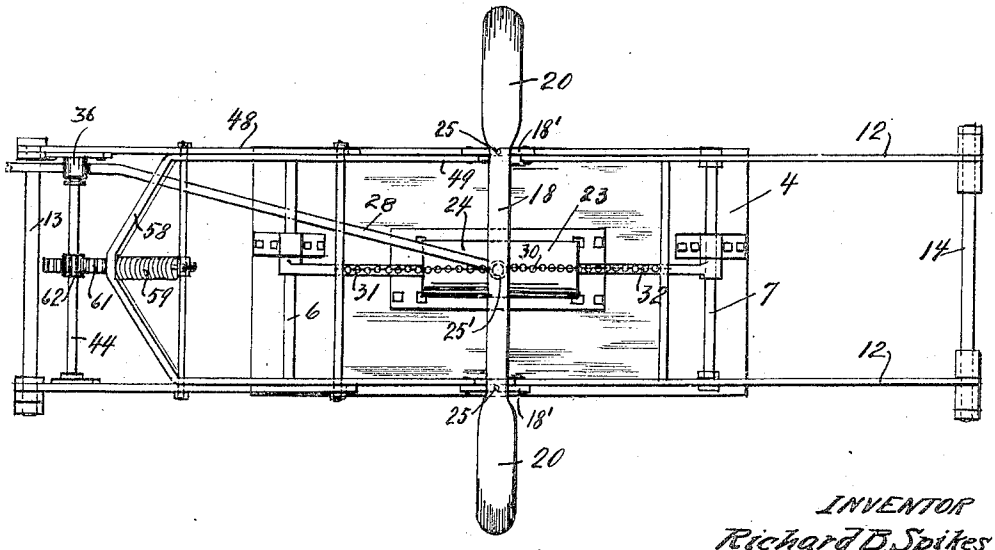


Fig 2

INVENTOR
Richard B. Spikes
By Munn & Co
ATTORNEYS.

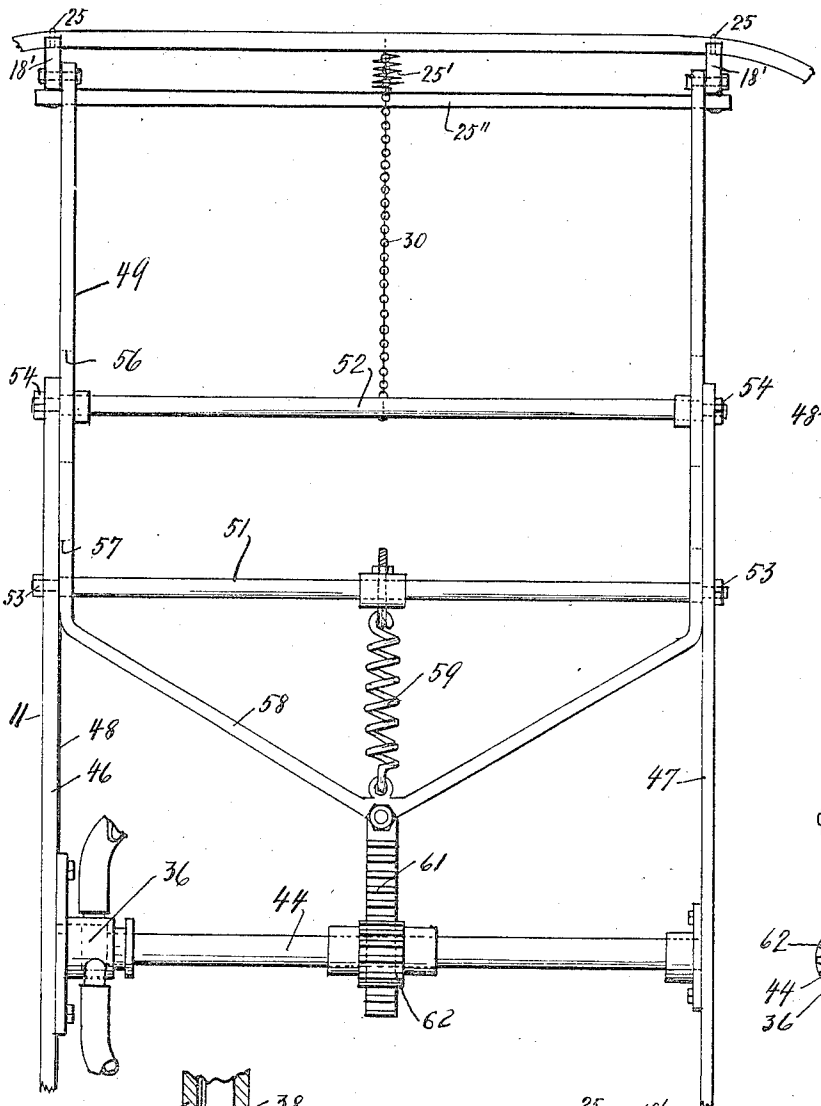
July 17, 1923. 1,461,988

R. B. SPIKES

PANTOGRAPH

Filed Nov. 27, 1922 2 Sheets-Sheet 2

Fig. 3.



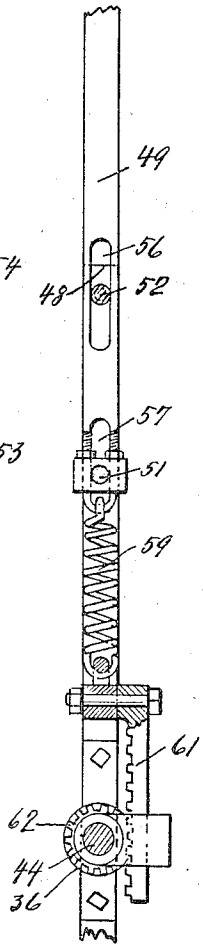


Fig. 4.

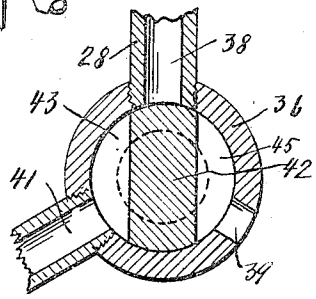


Fig. 5.

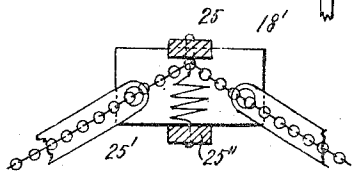


Fig. 6.

INVENTOR
Richard B. Spikes
By
ATTORNEYS

Patented July 17, 1923. 1,461,988

UNITED STATES PATENT OFFICE.

RICHARD B. SPIKES, OF SAN FRANCISCO, CALIFORNIA, ASSIGNOR TO S. D. S. EXPERIMENTAL LABORATORIES COMPANY, OF SAN FRANCISCO, CALIFORNIA, A CORPORATION OF CALIFORNIA.

PANTOGRAPH.

Application filed November 27, 1922. Serial No. 603,679.

To all whom it may concern:

Be it known that I, RICHARD B. SPIKES, a citizen of the United States, and a resident of San Francisco, county of San Francisco, State of California, have invented a new and useful Pantograph, of which the following is a specification.

The present invention relates to a device commonly known as a pantograph and used in connection with electric railroad cars for establishing an electrical connection with a wire supported above the car. Pantographs of this character have to be constructed with sufficient flexibility to allow them to adjust themselves to the height as well as the tension of the wire so that a firm contact is maintained at all times no matter whether the wire is stretched tightly or depends loosely from its supports. To obtain an ideal condition for maintaining the contact between the pantograph and the wire it is necessary to provide means in connection with the pantograph that will automatically adjust the same to suit conditions. Assuming for instance that the wire is stretched tightly and rather high above the car the contact member of the pantograph should automatically rise to maintain the contact.

If on the other hand the wire is stretched tightly rather close to the car the contact member should automatically descend to meet this condition so that no undue strain may be put on the wire. It is therefore of importance to provide control means for the pantograph that will answer the pressure exerted upon the contact member by the wire and will cause the contact member to rise and descend to meet any situation that may arise.

The pantograph as such is old and the present invention is principally confined to the control means for the same.

The preferred form of my invention is illustrated in the accompanying drawing in which Figure 1 shows a side view of my pantograph, Figure 2 a top plan view of the same, Figure 3 a plan view of an extensible frame used in my device, Figure 4 a vertical section through the same, Figure 5 a sectional detail view of a valve used for the control of my device, and Figure 6 a vertical section through a shoe engaging the trolley wire. While I have shown only the preferred form of the invention it should be understood that various changes or modifications may be made within the scope of the claims hereto attached without departing from the spirit of the invention.

My pantograph (1) is supported on the top of an electric car indicated by the line (2) in any suitable manner by means of the standards (3). It comprises a base member (4) to the two ends of which are pivoted, as shown at (6) and (7), two frames (8) and (9) preferably rectangular in form. The latter two frames are joined together by two other frames (11) and (12) pivoted to the same as shown at (13) and (14) and pivotally connected at their free ends (16) and (17) by means of two grooved members (18′) adapted to support a transverse bar (18) forming the shoe of my pantograph. The shoe which corresponds in length to the widths of the frames is preferably provided with a wing (20) at either end which slopes downwardly and prevents the control wire from catching underneath the shoe under certain conditions. The shoe which rests in the grooves of the members (18′) is held against transverse motion by vertical pins (25) extending upwardly from the bottom of the grooves. The pins, however, do not hold the shoe against vertical motion and allow the shoe to be torn away from the pantograph in case the shoe is caught by some obstacle in the wire. The shoe is normally held in place by a spring (25′) connecting the same with a parallel transverse bar (25″) engaging the under surfaces of the members (18′) and also by light chains (30) connecting a central portion of the shoe with transverse rods (52) within the upper frames. Both spring and chains are constructed to break when the shoe is caught.

The four frames (8), (9), (11) and (12) are thus arranged to form a figure resembling a parallelogram with the shoe (18) supported transversely over the electric car substantially in central relation to the pantograph. It will be seen that the pivotal connections between the frames allow the parallelogram to be compressed and expand vertically so as to allow the shoe which is designed to engage the trolley wire (21) to rise and fall.

The action of the parallelogram is controlled by two factors, the spring (22) con-

necting the two lower frames (8) and (9) and tending to draw the same together whereby the parallelogram is expanded vertically and a pressure means (23) adapted to force the two frames (8) and (9) away from each other whereby the parallelogram is contracted vertically. The latter means comprises preferably a cylinder (24) disposed horizontally on the base member (4) having two pistons (26) and (27) reciprocating therein. A pressure medium such as compressed air may enter the central portion of the cylinder through the tube (28) and tends to force the pistons toward the ends of the cylinder in opposite directions, the motion of the pistons being transferred to the frames (8) and (9) by means of connecting rods (31) and (32) engaging arms (33) and (34) fixed to the pivots (6) and (7) respectively. The pressure medium within the cylinder exhausts through the same tube (28) through which it enters and is controlled by means of a valve (36).

The operation of the valve (36) constitutes the principal feature of the present invention. The valve is shown in detail in Figure 5 and comprises a valve housing (37) having three peripheral ports (38), (39) and (41) therein, port (38) communicating through the tube (28) with the central portion of the cylinder (24), port (41) communicating with a suitable source of pressure such as a pressure tank not shown in the drawing and port (39) discharging into the atmosphere. A rotary valve (42) is mounted in this housing and provided with two peripheral grooves (43) and (45) on opposite sides of the valve. When the valve is in the position shown in Figure 5 it closes the port (38) and disconnects the intake and exhaust ports from one another and from the port (38) so that it may be considered to be in a neutral position. It will be noted that a slight turn of the valve to the right, as viewed in Figure 5, connects the intake (41) with the port (38) through the groove (43), and a slight turn to the left connects the exhaust port (39) with the cylinder through the groove (45) while a more intense turn to the left connects the intake with the cylinder through the groove (45). The rotary valve forms an integral part of a shaft (44) rotatably supported between the lateral members (46) and (47) of one of the upper frames as for instance the frame (11).

The latter frame differs from the other three frames in so far as it is made of two sections (48) and (49) slidably engaging each other by means of two transverse rods (51) and (52) secured in the frame section (48) as shown at (53) and (54) and riding in slots (56) and (57) of the section (49). The latter section which is the upper one and connects with the shoe (18) terminates at its lower end in a yoke (58) secured to the rod (51) supported in the lower section (48) by means of a spring (59) tending to force the upper section upwardly. Thus the frame (11) is constructed extensible, the spring (59) tending to maintain the member in its most extended position. The yoke (58) which preferably comes to a point in the center of the frame is provided with a downwardly extending rack (61) engaging a pinion (62) on the shaft (44) previously mentioned.

The operation of the device is as follows: Normally the spring (22) acting on the two frame members (8) and (9) draws the same together and tends to expand the parallelogram vertically. The spring member (59) within the frame (11) normally tends to expand the same frame until prevented from doing so by the tension of the trolley wire. Assuming that the pantograph has adjusted itself to a definite position so that its shoe (18) contacts with the trolley wire the valve (36) is adjusted to be closed, that is, substantially in the position shown in Figure 5. This situation remains unchanged until a change occurs in the tension or the height of the trolley wire. If the latter becomes lower it will exert additional pressure on the shoe (18) which pressure will first be felt by the spring (59). The latter is expanded and allows the expanded frame member (11) to contract. This again causes the rack (61) to ride downwardly on the pinion (62) and to turn the same to the right, establishing a communication between the air intake port (41) and the tube (28). Air or whatever pressure medium is used is forced into the central portion of the cylinder (24) causing the two pistons (26) to move outwardly and to thereby force apart the two frames (8) and (9) whereby the height of the pantograph is reduced. As soon as the height of the latter has become adjusted to that of the trolley wire the tension on the spring (59) will cease and the latter returns to a normal position causing the pinion (62) and the valve (42) to return to a normal or inoperative position.

Assuming now that the electric car passes to a place where the trolley wire is higher the spring (59) of the extensible frame (11) which under normal conditions is always slightly expanded is allowed to contract and to move the upper frame section (49) upwardly since the pressure of the trolley wire has ceased. This causes the rack (61) to revolve the pinion (62) in the opposite direction and the valve (42) is now rotated to the left into a position where the groove (45) registers with the tube (28) and the exhaust port (39) thereby allowing the compressed air within the cylinder (24) to escape and allowing the main spring (22) to draw the two frame members (8) and

(9) together whereby the parallelogram is vertically expanded until it again makes contact with the trolley wire.

If the shoe, through some accident, catches in the trolley wire or the members supporting the same, it is torn off the pantograph due to the momentum of the car, the spring (25') and the chains (30) yielding to the pressure. The resulting reaction of the spring (59) is the same as in the second case, only in an intensified form and the valve (42), instead of turning slightly to the left so as to connect cylinder and exhaust revolves sufficiently far to the left to connect the intake and the cylinder through the groove (45), whereby the opposite result is obtained. That is, the whole frame work contracts vertically and takes the upper members out of the reach of the overhead wires.

I claim:

1. A self-adjusting contact-maintaining device for an electric car having a wire suspended thereover, comprising a plurality of frames linked together to substantially form a paralellogram adapted to be secured to the top of the car so as to touch the wire, spring means and pressure means co-operating in affecting the height of the parallelogram in opposite senses, a valve control for the pressure means and means actuated by the tension of the wire controlling the valve so as to adjust the height of the parallelogram to the height of the wire.

2. A self-adjusting contact-maintaining device for an electric car having a wire suspended thereover, comprising a plurality of frames linked together to substantially form a parallelogram adapted to be secured to the top of the car so as to touch the wire, spring means and pressure means cooperating in affecting the height of the parallelogram in opposite senses, a valve control for the pressure means and means actuated by the tension of the wire controlling the valve so as to adjust the height of the parallelogram to the height of the wire, said means comprising a sliding arrangement in one of the frames rendering one member of the same extensible, yielding means tending to extend the same in opposition to the tension of the wire and an operative connection between the extensible frame member and the valve allowing the latter to be controlled by the oscillations of the frame member.

3. A self-adjusting contact-maintaining device for an electric car having a wire suspended thereover, comprising a plurality of frames linked together to substantially form a parallelogram adapted to be secured to the top of the car so as to touch the wire, spring means and pressure means cooperating in affecting the height of the parallelogram in opposite senses, a valve control for the pressure means and means actuated by the tension of the wire controlling the valve so as to adjust the height of the parallelogram to the height of the wire, said means comprising a sliding arrangement in one of the frames rendering one member of the same extensible, yielding means tending to extend the same in opposition to the tension of the wire, a pinion associated with the valve and a rack connected with the extensible frame member engaging the pinion for controlling the valve in accordance with the oscillations of the frame member.

4. A valve control for a device of the character described comprising a frame having a sliding arrangement therein whereby one frame member is rendered extensible, yielding means tending to extend said frame member, a variable tension bearing on the frame member opposing the action of said yielding means whereby the frame member is caused to oscillate and an operative connection between the valve and the frame member allowing the former to be controlled by the oscillations of the latter.

5. A valve control for a device of the character described comprising a frame having a sliding arrangement therein whereby one frame member is rendered extensible, yielding means tending to extend said frame member, a variable tension bearing on the frame member opposing the action of said yielding means whereby the frame member is caused to oscillate and an operative connection between the valve and the frame member allowing the former to be controlled by the oscillations of the latter, comprising a pinion associated with the valve and a rack connected with the frame member engaging the pinion.

6. A self-adjusting contact-maintaining device for an electric car having a wire suspended thereover, comprising a plurality of frames linked together to substantially form a parallelogram adapted to be secured to the top of the car having a top member touching the wire, spring means and pressure means cooperating in affecting the height of the parallelogram in opposite senses, a valve control for the pressure means and means actuated by the tension of the wire controlling the valve so as to adjust the height of the parallelogram to the height of the wire having means associated therewith for vertically contracting the frame when the wire engaging member tears loose.

7. In a device of the character described, a vertically expansible frame, spring means tending to expand the same into contact with an overhead wire of variable tension, pressure means adapted to contract the frame having a control valve associated therewith and means actuated by the tension of the wire for controlling the valve to relieve the pressure when the tension is re-

duced and to apply the pressure when the tension is increased.

8. In a device of the character described, a vertically expansible frame, spring means tending to expand the same into contact with an overhead wire of variable tension, pressure means adapted to contract the frame having a control valve associated therewith and means actuated by the tension of the wire for controlling the valve to relieve the pressure when the tension is reduced and to apply the pressure when the tension is increased, said valve being so constructed as to also apply the pressure when the tension is removed altogether.

9. In a device of the character described, a control valve for a pressure medium comprising a housing having an intake port, an exhaust port and a discharge port therein and a valve rotatable in the housing having two grooves on opposite sides adapted to establish communications between the discharge and the intake and between the discharge and the exhaust on a slight right and left hand turn respectively and also a communication between the discharge and the intake on a more pronounced left hand turn.

RICHARD B. SPIKES.