Sept. 29, 1931. J. A. CLARKE, JR 1,824,871

PANTOGRAPH

Filed Dec. 6, 1927

Fig. 1.

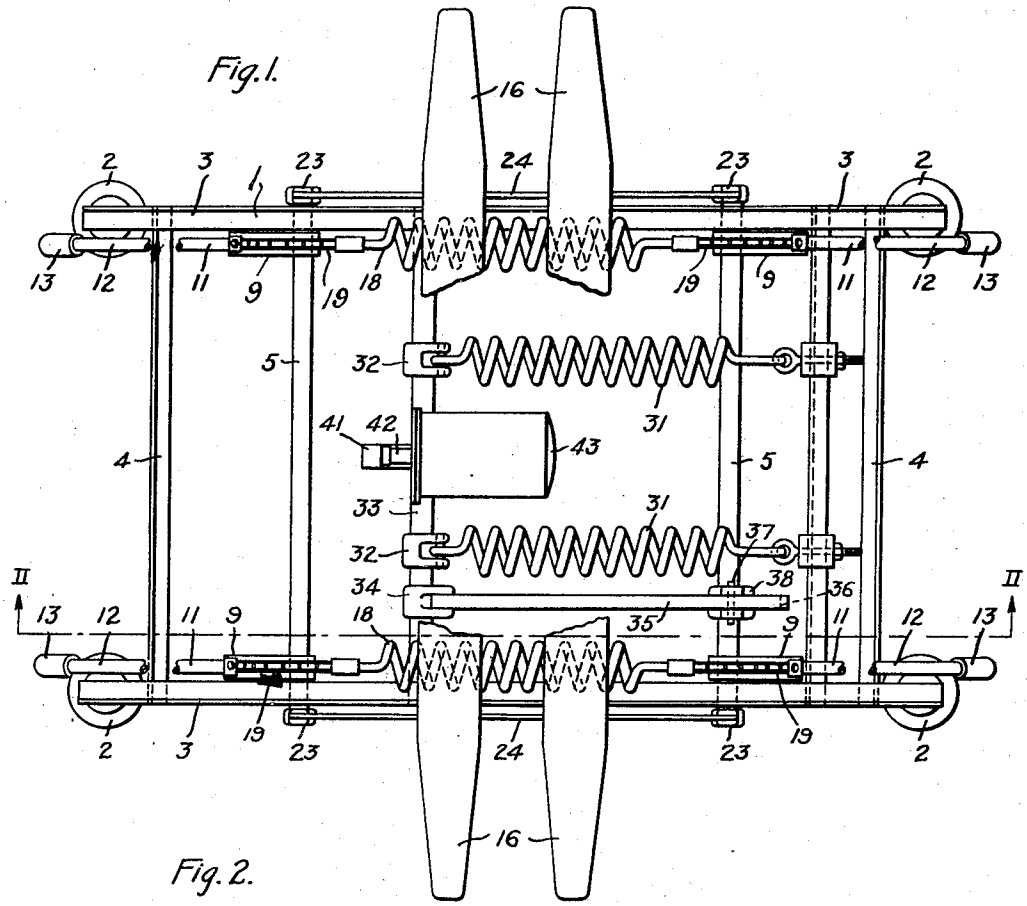
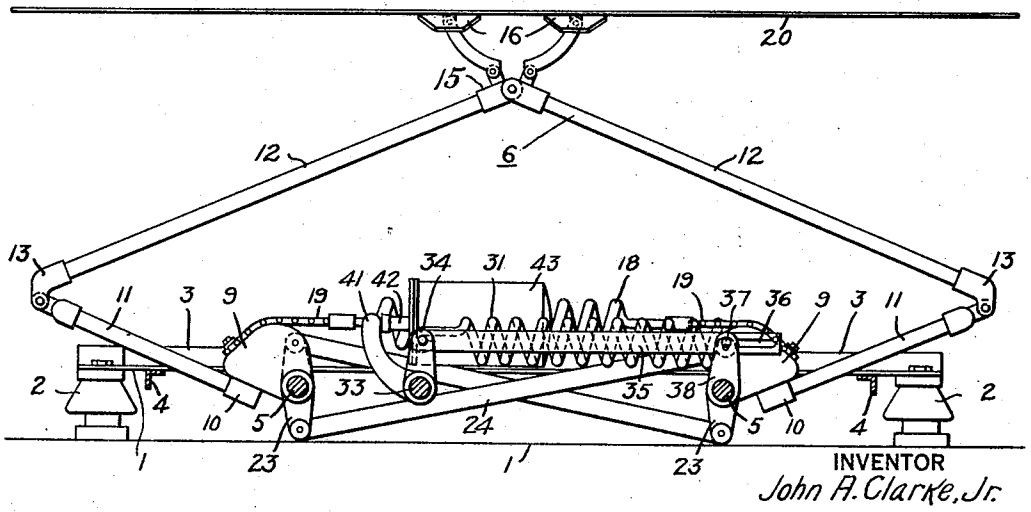


Fig. 2.



INVENTOR

John A. Clarke, Jr.

BY

Wesley G. Carr

ATTORNEY

Patented Sept. 29, 1931 1,824,871

UNITED STATES PATENT OFFICE

JOHN A. CLARKE, JR., OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO WESTINGHOUSE ELECTRIC & MANUFACTURING COMPANY, A CORPORATION OF PENNSYLVANIA

PANTOGRAPH

Application filed December 6, 1927. Serial No. 238,193.

My invention relates to current collectors and more particularly to mechanisms for actuating pantograph trolleys suitable for electrically driven railway vehicles.

In the devices of the prior art, it is common practice to provide an operating mechanism comprising a spring system for raising the pantograph trolley and for maintaining the proper contact pressure with the trolley conductor, a fluid-pressure cylinder for retracting the pantograph to its lowermost position and an automatically operable latch for locking it in its retracted position.

Another type of pantograph-operating mechanism that has been employed in the devices of the prior art comprises a pantograph frame biased in the upward direction by means of springs and provided with fluid-pressure cylinders for stretching the springs to increase their tension and complete the upward movement of the pantograph frame. This type of structure is objectionable in that the pantograph frame is caused to accelerate during its upward movement whereby the contact member approaches the trolley conductor at an excessive speed.

A further difficulty encountered with the devices of the prior art arises from the fact that the pantograph frame is accelerated during its downward movement and may strike the supporting frame or car roof a damaging blow unless cushioning means are provided.

It is an object of my invention to provide a pantograph-trolley-operating mechanism that will move the pantograph frame at a substantially uniform speed and thereby engage the contact member with the trolley conductor at a uniform speed and with a steady pressure.

Another object of my invention is to provide means for retracting the trolley contact member from the trolley conductor at a relatively high speed to quickly extinguish a possible arc.

A further object of my invention is to provide means for lowering the pantograph to its full retracted position at a progressively reduced speed, decreasing as it nears its lowermost position to provide buffing means for cushioning the trolley frame and for bringing it to its lowest position without shock.

In the accompanying drawings;

Figure 1 is a plan view of a pantograph-trolley structure embodying the principles of my invention, a portion of the contact member being broken away to more clearly show the operating mechanism.

Fig. 2 is a view, in side elevation, of the trolley structure shown, with a pantograph frame in a partially extended position.

Referring to the drawings, the pantograph-trolley structure therein illustrated comprises a supporting frame 1 that may be mounted on the roof of a railway vehicle by means of a plurality of insulators 2 that are disposed in pairs under its side members.

The supporting frame is composed of parallel longitudinally disposed members 3, preferably in the form of angle irons, that are mounted on the tops of the insulators 2. The longitudinally disposed members 3 are connected by means of transverse cross members 4 that are disposed to support the operating mechanism for raising or lowering the pantograph.

The longitudinal frame members 3 further serve as supports for pantograph shafts 5 that are journalled in spaced parallel relation transversely of the supporting frame. The pantograph shafts 5 serve to support the pantograph frame 6 in a manner well known in the art. Each of the pantograph shafts 5 is provided with two cams 9 that are secured near their ends to rotate with them. The cams 9 are provided with lugs 10 to which are secured the ends of tubes 11 that constitute the lower members of the pantograph frame 6. The lower members 11 are connected to upper members 12 by means of pivotal joints 13. The upper members 12 of the pantograph frame 6 are connected by means of joint members 15 that serve to strengthen the structure and also to pivotally support a pair of contact members 16.

In order to provide the necessary force for raising the pantograph, relatively heavy springs 18 are disposed at the sides of the

structure in longitudinal alinement with the cams 9. The ends of the springs 18 are operatively connected to the cams 9 by means of chains 19 that are disposed to wind upon the curved surfaces of the cams 9 in such manner that the contact members 16 are caused to exert a substantially constant pressure against a trolley conductor 20 at any position within the limits of its vertical operating range. The ends of the shafts 5 are provided with crank arms 23 that are interconnected by means of equalizer bars 24 to provide a parallel-motion device that is disposed to limit the movement of the contact members 16 to a substantially vertical direction.

For the purpose of lowering the pantograph frame 6, a mechanism comprising a set of lowering springs 31 is provided. The springs 31 are disposed between the springs 18 and parallel thereto. One end of each spring 31 is secured to the pantograph supporting frame and its other end is pivotally connected to a crank arm 32 that is securely mounted on a shaft 33. The shaft 33 is rotatably mounted on the longitudinal frame members 3 and is disposed parallel to the pantograph shafts 5. In order to operatively connect the shaft 33 to the pantograph shaft 5, a crank arm 34 is securely fastened to the shaft 33 and is pivotally connected to one end of a link 35. The other end of the link 35 is provided with a slot 36 for engaging a pin 37 that is mounted in the end of a crank arm 38. The crank arm 38 is securely mounted on one of the pantograph shafts 5 in longitudinal alinement with the crank arm 34 on the shaft 33.

Referring to Fig. 2, the springs 31 exert a force upon the crank arms 32 that tends to rotate the shaft 33 clockwise. It will be seen that the link 35 will be forced to the right by the crank arm 34 and when the lost motion permitted by the slot 36 is taken up, the link will engage the pin 37 in the crank arm 38 to bias the pantograph shaft 5 in the clockwise direction and thereby retract the pantograph frame 6. The springs 31 are so adjusted that, when the pantograph frame 6 is in the fully retracted position, they exert a force that is sufficient to overcome the tendency of the springs 18 to raise the pantograph frame 6.

With a view to providing means for controlling the position of the pantograph frame 6, a crank arm 41 is securely attached to the shaft 33 at substantially the transverse center of the pantograph structure. The end of the crank arm 41 is engaged by a piston rod 42 that extends from a fluid pressure cylinder 43. When it is desired to raise the pantograph to its operating position, fluid is admitted, at a predetermined relatively slow rate, to the cylinder 43 through a pipe that is connected to a source of fluid pressure and controlled by means of the usual valve mechanism (not shown).

The fluid pressure within the cylinder 43 causes the piston rod 42 to be moved to the left, as viewed in the drawings, and thereby rotates the shaft 33 counterclockwise by means of the crank arm 41. When the shaft 33 is so rotated, the link 35 is moved to the left by means of the crank arm 34, thereby permitting the crank arm 38 on the shaft 5 to move to the left and the pantograph frame 6 to be extended under the influence of the raising springs 18.

After the pantograph frame 6 has been extended sufficiently to engage the contact members 16 with the trolley conductor 20, the pantograph frame 6 comes to rest. As additional fluid is admitted to the cylinder 43, the link 35 is moved further to the left, thereby removing all pressure from the pin 37 of the crank arm 38. When the piston rod 42 has been actuated to the limit of its movement to the left, the link 35 will be in such position that the pin 37 will not engage either end of the slot 36. Under these conditions, the pantograph frame 6 is biased in the upward direction by means of the springs 18 only, and the frame is free to move vertically to compensate for variations in the height of the trolley conductor 20 by virtue of the lost-motion connection between the link 35 and the crank arm 38.

When the pantograph is in its raised position, it is disposed to exert a substantially constant upward force against the trolley conductor 20, as hereinbefore explained, and, inasmuch as the lowering springs 31 and the mechanism connected thereto, are entirely disengaged from the pantograph frame 6, the remaining mechanism, comprising the parallel-motion device and the pantograph frame 6, is of relatively light weight and disposed to sensitively and quickly follow irregularities in the trolley conductor 20.

During the normal operation of the pantograph, the lowering springs 31 are stressed to their full extent by the action of the fluid pressure in the cylinder 43. To retract the pantograph frame 6 to its lowered position, it is merely necessary to exhaust the fluid from the cylinder 43, thereby permitting the full tension of the springs 31 to force the link 35 to the right and turn the crank arm 38 clockwise.

The fluid may be exhausted from the cylinder at a predetermined rate in order that the piston rod 42 may be quickly forced to the right by the springs 31 and the contact members 16 be thereby rapidly drawn away from the trolley conductor 20.

It is desirable to quickly retract the contact member 16 to avoid drawing a destructive arc between it and the trolley conductor 20. Further, in case the trolley encounters

a damaged portion of the conductor 20, the operator may quickly retract it to avoid entangling it with the damaged conductor.

During the retracting operation, the springs 31 contract to such an extent that their tension is greatly reduced, as the pantograph frame 6 approaches its lowered position.

Inasmuch as the upward biasing force of the springs 18 remains substantially constant, due to the varying moment through the cam, the speed of the downwardly moving pantograph frame may be progressively reduced, and the frame 6 be thereby slowly brought to rest at its fully retracted position and without striking the supporting frame or other portions of the pantograph mechanism a destructive blow.

It is, therefore, apparent that a pantograph-trolley-operating mechanism embodying the features of the invention may be utilized to extend a pantograph frame at a substantially constant relatively slow speed and engage a contact member with the trolley conductor steadily and without subjecting the latter to a destructive blow.

Further, the operating mechanism is adapted to maintain a constant pressure between the contact member and the trolley conductor and to quickly adjust the contact member to any irregularities in that conductor. The lowering mechanism that constitutes a part of this invention is adapted to quickly retract the contact member from the trolley conductor and lower it at a progressively decreasing speed, thereby bringing it to rest in the fully retracted position without shock.

Although I have described and illustrated only one embodiment of my invention, it will be obvious to those skilled in the art that various modifications may be made in the details of the construction and in the general arrangement of the various operating linkages without departing from the spirit and scope of the invention as defined in the appended claims.

I claim as my invention:

1. A pantograph-trolley structure comprising an extensible pantograph frame, a contact member carried by the frame and means for retracting the pantograph frame at a uniformly progressive decelerating speed.

2. A pantograph trolley comprising an extensible pantograph frame, means for extending and retracting the frame at predetermined speeds and means for uniformly reducing the retracting speed as the frame approaches its retracted position.

3. A pantograph trolley comprising an extensible pantograph frame, means for extending the frame at a predetermined substantially constant speed, and means for retracting the frame at a uniformly progressive decreasing speed.

4. In a pantograph trolley, the combination with an extensible frame and a contact member supported thereby of means for exerting a substantially constant upward pressure upon the contact member, means for exerting a uniformly progressive decreasing downward force upon the frame for retracting the contact member, means for counteracting the retracting force, and means for controlling the counteracting means to thereby regulate the position and movement of the trolley.

5. In a pantograph trolley, in combination, an extensible pantograph frame, means for extending the frame at a predetermined speed, means for retracting the frame at a relatively great speed, and means for uniformly reducing the retracting speed during the movement of the frame.

6. In a pantograph trolley, in combination, an extensible pantograph frame, means for extending the frame at a predetermined speed, means for retracting the frame at a relatively great speed, and means for uniformly reducing the retracting speed before the frame reaches its limiting position.

7. A pantograph-trolley structure comprising an extensible pantograph frame, spring means connected to the frame for biasing it in the upward direction, said spring means being disposed to exert a substantially constant force upon the frame in all positions, a second spring for biasing the frame in the downward direction, said second spring being disposed to exert its greatest force when the frame is at its highest position and fluid-pressure means for opposing the force of the second spring to control the position of the frame.

8. In a pantograph trolley, an extensible pantograph frame, a contact shoe mounted on the frame, shafts for supporting the frame, said shafts being disposed to extend the frame when rotated, cams mounted on the shaft, resilient means connected to the cams and under tension to extend the frame, a lost-motion mechanism connected to one of the shafts, spring means connected to the lost-motion mechanism for retracting the trolley, and fluid-pressure means for opposing the spring means to permit the trolley to be extended under the influence of the first-named resilient means only by virtue of the lost-motion mechanism.

9. A pantograph trolley comprising, in combination, an extensible pantograph frame structure, springs for raising the pantograph frame, springs for lowering the pantograph frame, the raising and lowering springs being disposed in parallel relation to pull directly against one another with varying degrees of unbalance, said lowering

springs being the stronger, and controlled means for supplementing the force of the raising springs to raise the pantograph frame structure.

In testimony whereof, I have hereunto subscribed my name this fourth day of November, 1927.

JOHN A. CLARKE, JR.