Jan. 3, 1933. C. J. WAY 1,893,383

CURRENT COLLECTOR

Filed Jan. 12, 1931

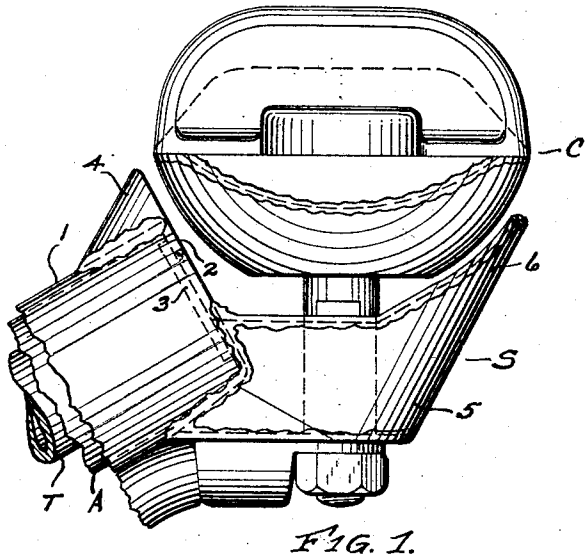


FIG. 1.

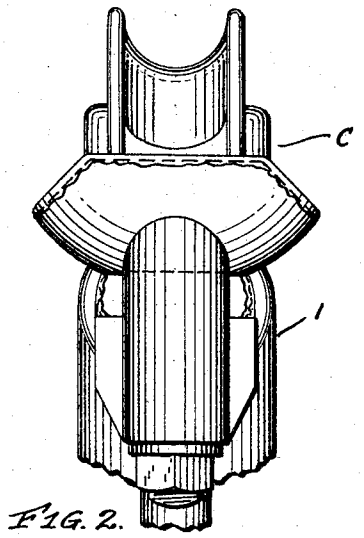


FIG. 2.

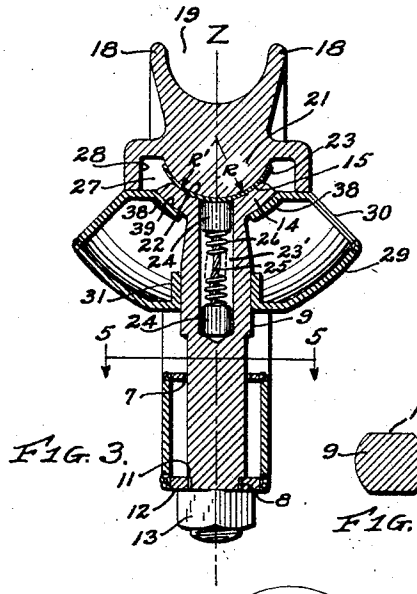


FIG. 3.

FIG. 5.

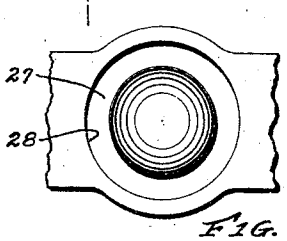


FIG. 6.

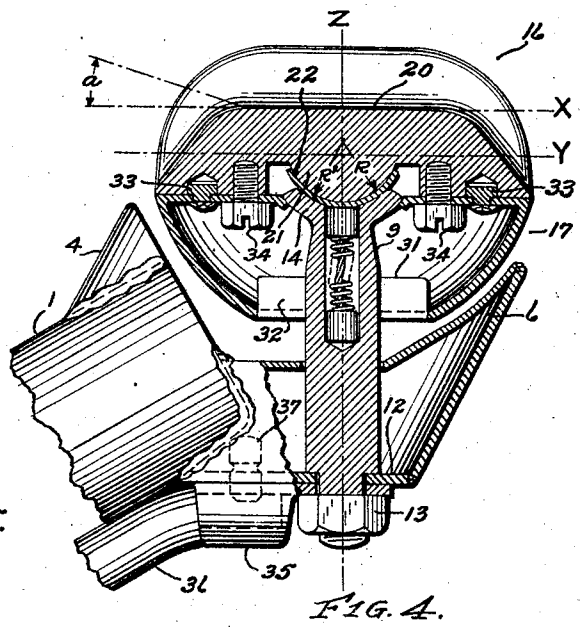


FIG. 4.

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By

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Patented Jan. 3, 1933 1,893,383

UNITED STATES PATENT OFFICE

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CURRENT COLLECTOR

Application filed January 12, 1931. Serial No. 508,090.

My invention relates to overhead current collecting devices for use on electrically operated vehicles and particularly to that type known as the trolley bus.

The trolley bus operates with an overhead wire or wires, but no track and is free to move laterally in either direction with respect to the trolley wires and for that reason the trolley poles and current collecting devices require special consideration as compared with those used on cars operating on a track.

The poles are extra long and therefore the momentum of the pole end is considerable therefore it is desirable to keep the weight as low as possible and this requires a small compact and lightly constructed current collecting device which has the necessary strength to withstand heavy abuse.

With these objects in mind I have also incorporated a construction in which the axis of or oscillation of the shoe portion which contacts with the wire will coincide approximately with the surface of contact between the shoe and the wire.

The shoe must rotate in a substantially horizontal plane about what may be termed a vertical axis as well as to pivot or oscillate in a vertical plane and this requires a device which will permit of these two motions singly or jointly and in my invention I have centered these two motions upon a single support and about a single point of movement and have done so by the use of spherical contacting surfaces amounting to a construction generally termed a universal joint.

By constructing the device to oscillate in a vertical plane upon an axis of oscillation coinciding approximately with the center line of contact between the shoe and trolley wire I eliminate the tendency for the front end of the shoe when traveling to pivot upwardly or as sometimes termed "nose upwardly", that is, for the shoe to pivot about its axis of oscillation in the same manner as a trolley wheel would rotate about its axis of rotation. The absence of a tendency to "nose" is due to the fact that the moment about the said axis of oscillation is made very small, in fact as small as possible and there is substantially no greater pressure between the nose of the shoe and the wire than there is at any other point of contact between the shoe and wire, thus producing a uniform amount of wear throughout the entire contact length of the shoe. When the center of R and R′ coincides with the center line of contact between the shoe and trolley wire, the moment about the axis of oscillation is zero.

By placing the center of movement as stated, there is less tendency for the shoe to leave the overhead due to the fact that there is less tendency for the shoe to pivot upon its bearing when it meets an obstruction along its path of travel as for instance trolley ears and other overhead devices.

In the accompanying drawing Fig. 1 is a side elevation of my invention.

Fig. 2 is a front elevation thereof.

Fig. 3 is a vertical section taken along the line Z of Fig. 4.

Fig. 4 is a vertical section taken along the line Z of Fig. 3.

Fig. 5 is a horizontal section taken along the line 5—5 of Fig. 3.

Fig. 6 is a partial plan view of the bottom of the contact shoe.

In the preferred embodiment of my invention shown in the accompanying drawing I provide a support S upon which is mounted the current collecting device C. The support S is shown as mounted on the end of the trolley pole T or other support with an interposed sleeve A of soft vulcanized rubber.

The support is constructed as far as possible of structural steel and by this term I mean such material as rolled sheets, drawn tubing of forgings and bar or rod materials. Such material is superior to castings in that it is dense and uniform and more reliable and its physical properties may be almost anything desired in the way of strength, elasticity, etc. By the use of structural steel I am able to make many of the parts of material no greater than substantially one sixteenth of an inch in thickness while if a casting they would be at least twice that if not more in thickness.

My support member S comprises a tubular member 1 with the end portion turned inwardly to produce a flange 2 and mounted within the member 1 and closing the end of the tube is a plate 3 welded to the parts 1 and 2. Projecting upwardly from the member 1 is a separately formed guard member 4 welded thereto as indicated (in the drawing the welds are indicated in the various figures in substantially the same manner by wavy lines). Projecting also from the member 1 is the hollow base member 5 having at its extreme end the upwardly projecting portion 6 acting as a guard similar to that as part 4. The member 5 is formed up of several pieces of sheet material and welded together and one end shaped to fit the portion 1 to which it is secured by welding. All welding may be done by means of the electric arc or oxy-acetylene flame, the use of which is known to those skilled in the art and therefore needs no explanation.

The base 5 has registering openings 7 and 8 in its upper and lower faces to receive the supporting pin 9. This pin has two flattened sides 10 corresponding with two flattened sides in the orifice 7 which lock the pin against rotation. The pin has a shoulder 11 at its lower end which seats upon the lower member 12 of the base 5 and is fixedly secured against displacement by the nut 13. The pin further has at its upper end a supporting portion 14 which has a spheric bearing surface 15, the radius of which is R'.

The collecting unit C comprises principally two parts, namely, the shoe 16 and the retaining and protecting member 17.

The shoe has upstanding flanges 18 which form the groove 19 having the elongated contact surface 20 normally in contact with the trolley wire when in operation. The shoe is provided with sufficient wearing material to give the shoe considerable life and this wearing material is represented by that portion between the lines X and Y. The line X may be said to represent the "longitudinal center line of contact" of the shoe with the trolley wire and approaches the line Y as the shoe wears. It will be noted that the center of the radius R' is positioned on the vertical axis Z of the pin 9 and between the lines X and Y or in other words, within the limits of wear of the shoe thereby bringing the center of radius R' as near to the said longitudinal center line of contact of the shoe with the trolley wire as is reasonably possible since this line of contact is changing constantly as the shoe wears. The shoe is provided with a bearing 21 having a spherical bearing surface 22, the radius of which is R and the center the same as that of R', that is, the common center F of R and R' is located on the vertical axis Z of the pin 9 and within the limits of wear of the contact surface of the shoe 16 and this center may be termed the "center of oscillation and rotation". The vertical axis Z and the longitudinal center line X of the groove 19 intersect and are positioned in a common substantially vertical plane.

I have used the term "axis of rotation" to designate the axis upon which the shoe rotates in a substantially horizontal plane, namely, the axis Z, and I use the term "axis of oscillation" as the axis upon which the shoe pivots in a substantially vertical plane. The perpendicularity of the axis Z will vary depending upon the relation of the axis Z to the axis of the pole and in turn upon the angularity of the pole axis to the horizontal, I refer to this axis Z however as the "vertical axis" or "vertical axis of the support".

Interposed between the surface 15 and the surface 22 is a contact member 23 which I prefer to construct of copper as it is softer than the steel of the members 14 and 21 and through relative movement of these parts it tends to wear itself to a surface with the members 14 and 21 which is of considerably greater efficiency than a direct contact between the members 14 and 21 which are preferably of steel and may be hardened. Unless the contact between the surfaces 15 and 22 is sufficient to carry the current from the shoe to the member 9 there is considerable heating and pitting which reduces the efficiency of the device.

To further overcome the heating and inefficiency of the bearing surfaces, I employ a conductor 23' which comprises terminal members 24 connected by means of a very flexible conductor 25 and biased to move apart by the interposed spring 26. The terminals 24 contact firmly with the adjacent surfaces and relative movement is permitted with increased efficiency of the contact.

With the surfaces 15 and 22 made sufficiently accurate the member 23 may be omitted and the parts 14 and 21 allowed to contact in which case the conductor 23' plays a very important part in conducting the current. The bearing 21 is positioned within a recess 27 and the wall 28 protects the member 21 from the weather and mechanical injury.

The member 17, as formed of sheet steel preferably, comprises the portion 29 and the portion 30 welded together as indicated.

The portion 29 has spaced flanges 31 forming an elongated slot 32 through which projects the pin 9 and permits pivotal or oscillating motion of the shoe in a vertical plane common to the lines X and Z, but prevents pivotal motion in a transverse direction thereto and also permits rotation about the axis Z.

The upper portion of the member 30 has secured therein spaced dowels 33 which register with openings in the lower face of the shoe 16. The shoe 16 and member 17 are se-

cured together by means of bolts or screws 34, the dowels insuring the parts against relative movement.

Interposed between the member 12 and the nut 13 is a projecting cable connector 35 having a passage therein to receive the end of the cable 36 and a projecting set screw 37 to secure the cable in place, although this may be done wholly or in addition thereto by means of solder or brazing. The set screw 37 passes through an opening in the member 12. This permits the under surface of the device to be substantially free from obstructions which tend to catch upon the overhead system if the collector leaves the wire. It is found that the set screw 37 is much superior to a headless or fillister headed screw which may be installed without projecting.

The member 30 is further provided with the inwardly projecting flanges 38 to engage the surface 39 of the member 14, thus securing the collector C to the support.

The operating characteristics of the collector C may be changed somewhat by positioning the center of the radii R and R' to the front or rear of the longitudinal center thereof.

In case of dewirement at speed there is less tendency for the pole to be bent when it strikes the overhead span or bracket supporting the wires due to the lighter weight in the collector head. The light weight of the collector portion and its free movement upon its support permits it to follow the trolley wire and overhead devices much more readily than a heavy device. The bearings upon the shoe and support are quite fully protected and the construction of the member 17 tends to guard the device against being caught in the overhead structure. The support S is also well protected by means of the guards 4 and 6 and the member 9 is easily renewable.

The device just described has the advantages over others now on the market in that it is considerably lighter in weight thus requiring less tension from the trolley pole to maintain it in contact with the trolley wire. The momentum at the end of the pole is less, thus reducing the tendency for the end of the pole to be thrown out of alinement with the wire. Due to lighter pole tension the friction and hence the wear is less on both the shoe and the trolley wire.

Having shown and described my invention, I claim:

1. A current collecting device comprising a support having a cup shaped receptacle with a spherical surface, a contact member having a part mounted upon the said spherical surface and having a spherical surface corresponding substantially with that of the support, a member interposed between the said spherical surfaces of a softer material than that of the shoe and support and means to secure the contact member to the support in movable relation relative to the support.

2. A current collecting device comprising a support having a cup shaped receptacle with a spherical contact surface, a contact member having an elongated contact surface to engage a trolley wire and having also a part with a spherical surface mounted within the receptacle, the radii of the surfaces having a common center coinciding approximately with the elongated contact surface and means to secure the contact member and support together in movable relation to each other.

3. A current collector comprising a contact member having an elongated contact surface to engage a conductor and subject to wear and having also a part with a spherical surface, a support for the contact member having a receptacle with a spherical surface to receive the said part, the contact member and support oscillating relative to each other in a vertical plane and about a vertical axis and the axis of oscillation falling within the limits of wear of the contact surface on the contact member.

4. A current collector comprising a support with a receptacle having a concave spherical surface, a contact member having an elongated contact surface to engage a conductor and subject to wear and having also a part mounted within the receptacle and free to oscillate relative thereto, the axis of oscillation falling within the limits of wear of the contact surface on the contact member and along the length of the contact member and means to hold the contact member and support in assembled relation.

5. A sliding contact shoe having a grooved elongated contact surface on one side to engage a conductor and having also a part with a convex spherical bearing surface positioned on the side opposite the contact surface.

6. A sliding contact shoe having an elongated grooved contact surface on one side to engage a conductor and having also a part with a convex spherical bearing surface surrounded by a channel and positioned on the side of the shoe opposite the contact surface.

7. A sliding contact shoe having a groove with an elongated contact surface subject to wear and located on one side of the shoe and having also a part with a convex spherical surface, the center of the radii of the spherical surface located within the limits of wear of the contact surface and within the length of the shoe.

8. A current collector comprising a head composed of a plurality of parts formed of structural metal and secured together, one part having a receptacle with a concave spherical bearing surface opening upwardly, a contact shoe with an elongated contact sur-

face subject to wear and means with a convex spherical bearing surface positioned within the receptacle to support the shoe, the shoe and said means arranged to oscillate relative to the support simultaneously in two different planes, one of which is angularly disposed to a vertical axis passing through the spherical bearing surfaces.

9. A current collector comprising a support having a recess with a concave spherical bearing surface, a contact shoe having a part with a convex spherical bearing surface mounted in the said recess to oscillate relative to the support, an auxiliary recess in the support, a connector within the recess having a part pressing against the bearing surface on the contact shoe and means to hold the shoe and support assembled.

10. A current collector comprising a support member having a receptacle with a concave spherical bearing surface, a contact member having means with a convex spherical bearing surface mounted in the receptacle to oscillate on the bearing surfaces relative to the support and support the contact member, a recess in one of the members, a yielding connector within the recess and having a part pressing against the bearing surface on the other part and means to maintain the members in assembled movable relation.

11. A current collector comprising a head having a part to secure the head to a support and an auxiliary supporting member detachably secured to the head and having means co-operating with means on the head to prevent rotation of the auxiliary supporting member about its vertical axis, the auxiliary supporting member having a cup shaped receptacle, a contact shoe rotatably and pivotally mounted thereon and having a part positioned within the receptacle and means to hold the auxiliary supporting member and contact shoe assembled.

12. A trolley device comprising a head having a part to be secured to a support, a hollow part projecting from said first part, an auxiliary supporting member separately formed and detachably secured to the projecting part and having a bearing surface formed upon its upper end, a contact shoe having a bearing surface mounted on the auxiliary supporting member with the bearing surfaces engaging in movable relation and means to secure the contact shoe and auxiliary supporting member together in movable relation.

13. A trolley device comprising a head having a part formed of structural steel to attach to a support, a second part projecting from the first part and welded thereto and formed of a plurality of members of structural steel welded together to form a hollow part, registering openings in the upper and lower sides of said second part, a supporting member formed of structural metal and detachably mounted within said openings, means to prevent rotation of the supporting member, a contact shoe mounted upon the upper end of the support member, a universal joint between the shoe and supporting member and means to hold the shoe and supporting member assembled.

14. A current collector comprising a support having a receptacle with a concave spherical bearing surface, a contact shoe having a contact groove with an elongated contact surface, a part with a convex spherical bearing surface to support the shoe and mounted within the receptacle, the spherical surfaces contacting and permitting the shoe and said part to pivot and to rotate relative to the support about a common center coinciding approximately with the longitudinal center line of contact of the shoe.

15. A trolley head comprising a support having a concave spherical surface and a convex spherical surface and the radii of the two surfaces having a common center, a current collecting device having an elongated groove and a concave spherical surface and a convex spherical surface whose radii have a common center and the same length as the first said radii, the convex and concave surfaces on the collecting device cooperating with the concave and convex surfaces respectively on the support and permitting the collecting device to oscillate in a vertical plane relative to the support and rotate about a vertical axis relative to the support, means on the collecting device cooperating with means on the support to limit the oscillating movement of the collecting device and present movement of the collecting device in a plane transversely disposed to the groove, one pair of cooperating spherical surfaces supporting the collecting device and the other pair maintaining the first pair in contact and means on the support to receive a support for the head.

16. A trolley head comprising a support having a concave spherical surface and a convex spherical surface spaced from the first said surface and the radii of the two surfaces having a common center, a current collecting device having an elongated groove to engage a trolley wire and a concave spherical surface and a convex spherical surface spaced from the first said surface and whose radii have a common center and the same length as the first said radii, the concave and convex surfaces on the collecting device cooperating with the convex and concave surfaces respectively on the support and permitting the collecting device to oscillate and rotate relatively to the support, one pair of cooperating spherical surfaces supporting the collecting device and the other pair maintaining the first pair in operative relation.

17. A current collector head comprising a support having a concave spherical bearing surface, a shoe mounted in the support and upon the said bearing surface to oscillate and rotate relative to the bearing surface on the support, the shoe having an elongated contact surface to engage a trolley wire, the center of rotation and oscillation of the shoe coinciding approximately with the longitudinal center line of contact between the shoe and trolley wire and having its engagement with the support spaced from the center of rotation and oscillation, the support provided with means to receive a main support and a member of deformable vulcanized rubber interposed between the said means and main support to hold the said means and support in insulated relation.

18. A current collecting device comprising a part having an elongated contact groove, a second part secured to the first part and having a portion with a concave spherical retaining surface, an elongated slot in said second part and one of the said parts having a convex spherical supporting surface.

19. A current collector comprising a support having a cup-shaped receptacle, a sliding collecting device having a groove with an elongated contact surface and a member mounted on the support, the said cup-shaped receptacle and member having engaging spherical bearing surfaces upon which the collecting device oscillates and rotates relative to the support and means to maintain the said surfaces in contact, the center of radius of the said spherical surfaces falling within the limits of wear of the collecting device between the ends of the shoe and means to mount the collector on a pole.

20. A current collector comprising a main support with means to mount the collector on a pole, an auxiliary support projecting from the main support and having a cup-shaped receptacle at its free end; a shoe having a groove with an elongated contact surface, the auxiliary support and the shoe having engaging spherical bearing surfaces upon which the shoe pivots and rotates about a common center and a part depending from the shoe enclosing the bearing portions of the shoe and auxiliary support.

21. A current collector comprising a support member having a cup-shaped receptacle and a shoe having a groove with an elongated contact surface to engage a trolley wire, means positioned on the opposite side of the shoe from the groove to support the shoe, the said cup-shaped receptacle of the support and the said means having engaging spherical bearing surfaces upon which they oscillate in a vertical plane and rotate about a vertical axis relative to each other, means to prevent movement of the shoe and the first said means in a vertical plane transverse to the longitudinal center line of the groove and means to mount the collector on a pole.

22. In a current collecting device, in combination, a swivel having a convex spherical bearing surface to engage a support the center of curvature of which is located along the vertical axis of the swivel, and a slider shoe disposed to be carried by the swivel, said slider shoe being provided with a groove having an elongated contact surface.

23. In a current collecting device, in combination, a slider shoe having an elongated contact surface for engaging a trolley conductor, and a swivel for carrying the slider shoe, said swivel being provided with a spherical bearing surface to engage a support, the center of curvature of which is located on the conductor side of said contact surface.

In testimony whereof I affix my signature.

CLARENCE J. WAY.