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CURRENT COLLECTORS FOR ELECTRIC VEHICLES

Filed Aug. 21, 1941

Serial No.
407,804

3 Sheets-Sheet 1

Fig. 1

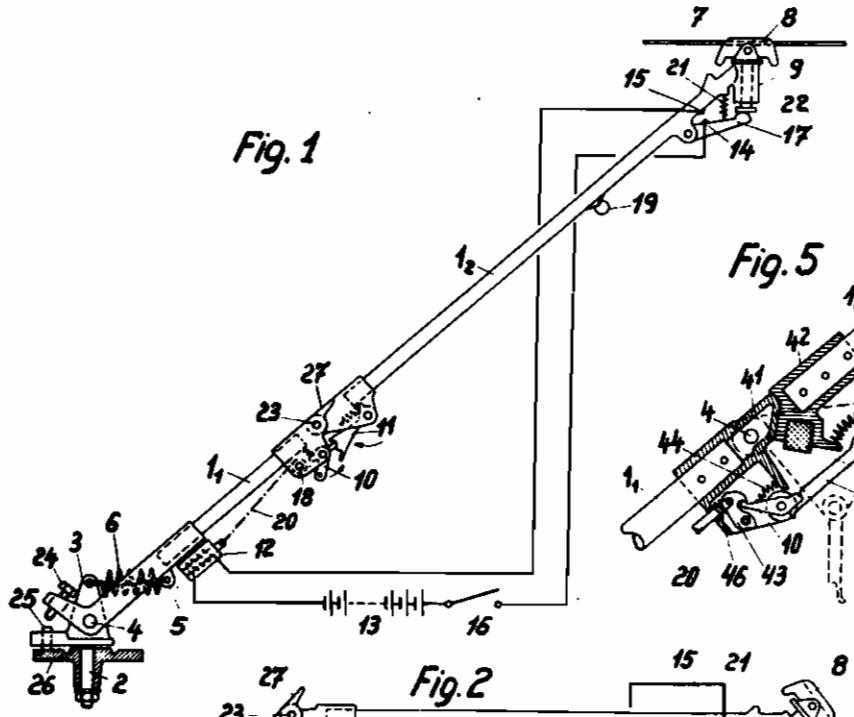

Fig. 5

Fig. 2

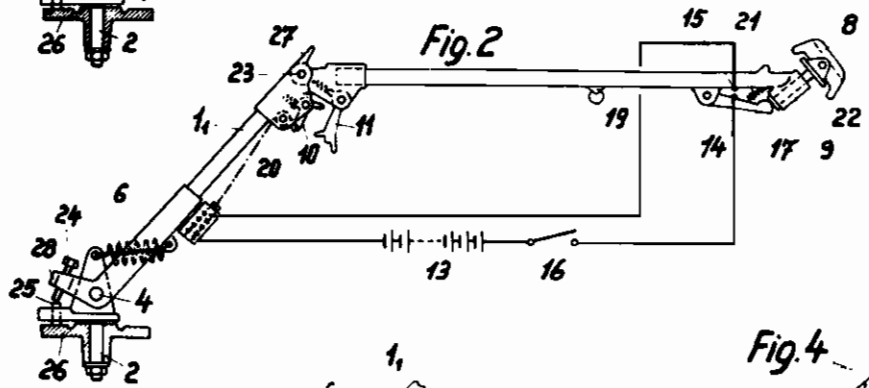

Fig. 3

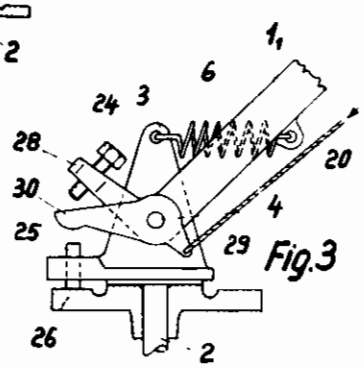

Fig. 4

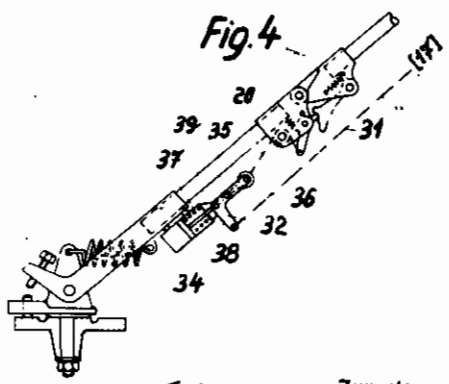

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Fig.8

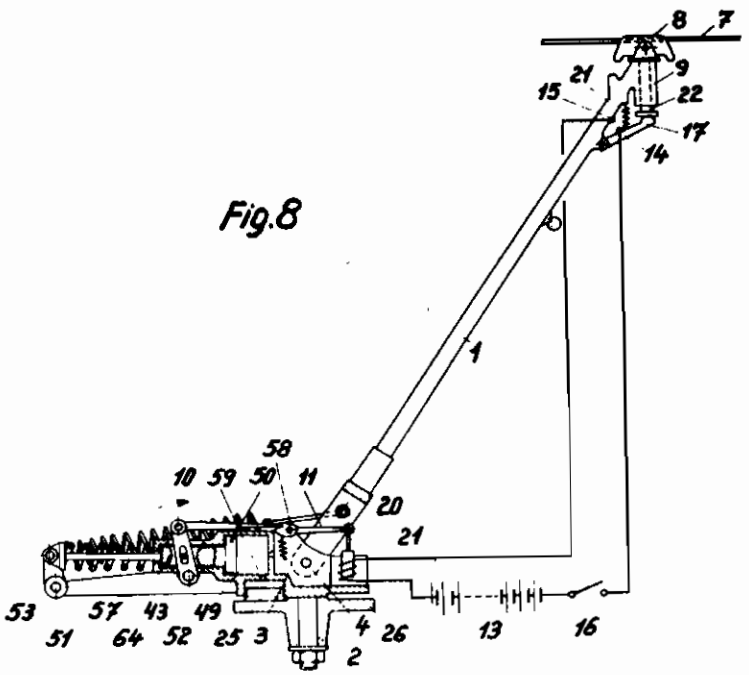

Fig.9

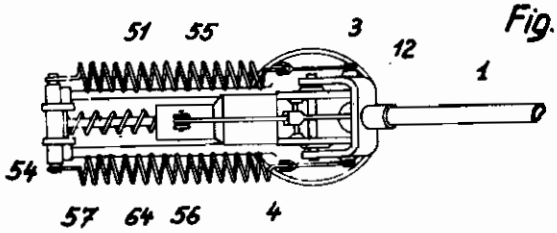

Fig.6

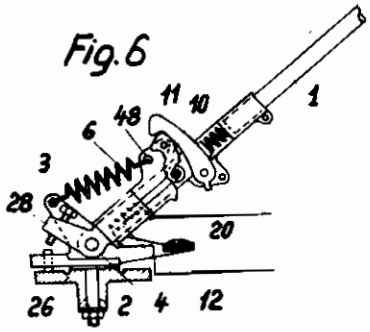

Fig.7

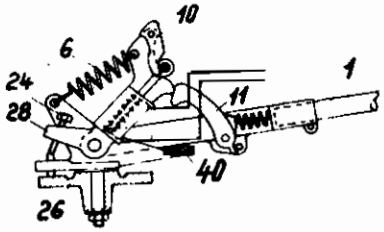

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Fig. 10.

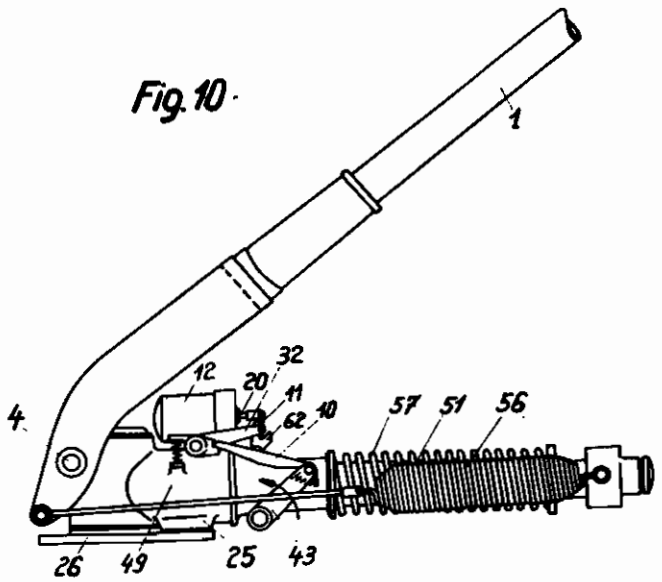


Fig. 11

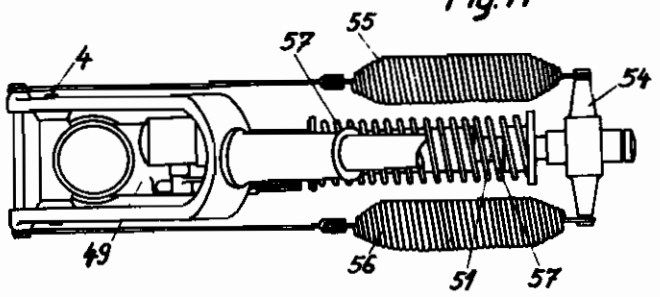
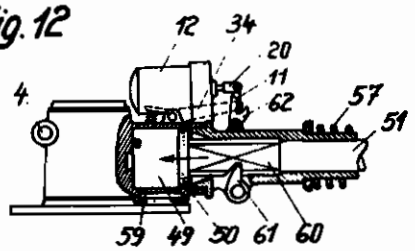


Fig. 12



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ALIEN PROPERTY CUSTODIAN

CURRENT COLLECTORS FOR ELECTRIC VEHICLES

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The sliding shoes or trolleys of the current collectors of the known types are liable to dewirement (to jump off the overhead wires) whilst running, in which case the spring urging the current collector against the overhead wires raises the current collector around the horizontal axis. This will cause the upper end of the current-collector pole to project above the overhead wire, in consequence whereof the trolley pole will seriously damage, any overhead wires getting into its way as well as any suspension wires of the overhead net. A further drawback is that the pole of the current collector which has dewired will swing out freely around the vertical axis of the trolley base and will perform a mowing-like motion, thus damaging any such wires or other subjects as may be situated sideways from the overhead wires. Any defects, thus arisen, can only be amended by means of lengthy and expensive repairs, whilst, high-tension wires crashing down also may cause a danger of life.

In order to eliminate the drawbacks enumerated, a device is provided on the current collector according to the invention wherein the trolley pole is propped in its working position, by a device being operated by an electric and/or mechanical apparatus and wherein further a pivot is provided on the trolley pole or on its support around which said pole will, as soon as the propping device is released, snap down to a level lower than that of the overhead wires.

In one embodiment of the invention, the pivot is provided on the lower end of the trolley pole and the pole is equipped with an intermediate carrying member by means of which the lifting spring is connected with the pole through the releasable propping member.

In another embodiment of the invention, the trolley pole is divided into sections by at least one pivot and the propping device keeps the sections of the divided pole in working position.

In a third embodiment of the invention, the lifting spring or springs of the current collector urging the trolley pole against the overhead wires are released by means of an oil or air dashpot and/or of a counter-spring, the operation of which being effected by means of an electromagnet and/or an electric motor and/or compressed air.

The re-setting of the released mechanism is effected by lifting the trolley pole above its highest working position, during which procedure the counterspring or some other pressure force overcomes the force of the lifting spring and pulls the pole into working position.

In addition hereto, it is the pressure of the oil or air-dashpot that is utilized also for braking the rotation of the trolley pole around a vertical axis, so as to prevent any damage which might be caused by the lateral movements of the trolley pole i. e. by the mowing-like motion.

The invention will now be described by way of examples with reference to the accompanying drawing, in which:

Fig. 1 is one form of the current collector arrangement in accordance with the invention, in which the link divides the pole into two sections and in which the snapping down of the pole around the pivot is effected by electrical means.

Fig. 2 is the trolley pole as shown in Fig. 1 in its snapped down position.

Fig. 3 is a modified arrangement of the current collector shown in Fig. 1, in which the snapping down of the trolley pole around its pivot is effected by mechanical means, with the aid of a double-arm lever.

Fig. 4 is another modified arrangement of the current collector shown in Fig. 1, in which the snapping down of the pole around its pivot is likewise effected by mechanical means, notably by releasing a spring which is compressed in its working position.

Fig. 5 shows a further modification of the current collector arrangement according to Fig. 1 partly in section in which the lever system is composed of three members.

Fig. 6 is another embodiment of the current collector arrangement according to the invention, in which the pivot is arranged at the lower end of the pole and the snapping down of the pole around this pivot is effected by electrical means.

Fig. 7 shows trolley pole according to Fig. 6 in its snapped down position.

Fig. 8 is a side elevation, and partly a section of a third embodiment of the current collector according to the invention.

Fig. 9 is a plan view of the device according to Fig. 8.

Fig. 10 is a side elevation of a modification of the current collector according to Fig. 8.

Fig. 11 is a plan view of the device shown in Fig. 10.

Fig. 12 illustrates a detail of Fig. 10 in section.

The trolley pole 1 comprises a link 23 (Fig. 1), dividing the pole into two sections l_1 and l_2.

The sliding shoe 8 provided at the upper end of the upper pole section l_2 is rotatable around a vertical axis in the sleeve 9 of the pole section l_2.

A pawl 10 is journalled in the casing joining

on to the lower pole section l_1, whilst a lever 11 is journalled in the upper part of pole l_2. A lifting spring tends to keep pawl 10 and lever 11 in their working positions. Lever 11 is supported on pawl 10 at a point situated inside the line connecting the pivots of lever 11 and of pawl 10, so that thereby stable propping is assured in the operating position of the trolley pole. The magnet 12 fixed on pole section l_1 is fed by the source of current 13. The contacts 14, 15 and 16 are connected into the circuit of the magnet coil 12. Of these, contact 16 is provided at the upper end of pole section l_2, whilst contact 14 is provided on the lever 17 joining-on in an articulate manner to pole section l_2. The iron core of the magnet 12 is connected by means of the pulling member 20 guided around the roller 18 to the lower end of the pawl 10. In the working position of the current-collector pole the contacts 14, 15 are open, whereas contact 16 is closed. The free end of lever 17 is urged by spring 21 against the front face of pivot 22 of the sliding shoe 8 journalled in sleeve 9. By adjusting spring 21, it is possible to control the closing time of the contacts 14, 15.

The trolley pole reaches its snapped down position in the following manner according to Fig. 2:

If the sliding shoe 8 leaves the overhead wire 7, the pivot 22 of the sliding shoe 8 will, under the pulling action exerted by spring 21 on lever 17, close the contacts 14, 15. This will close the circuit of magnet 12, whereupon the pulling member 20 will draw-in the lower arm of pawl 10, whereas the upper arm of the pawl will jump out from the rest of lever 11, thereby releasing lever 11. This will result in the release of the propping device by which the pole sections l_1, l_2 are held together rigidly, in consequence whereof pole section l_2 will snap down around the pivot 23. (Fig. 2).

The brake shoe 25 cooperating with the stop 24 provided in the lever arm projecting beyond the horizontal pivot 4 of the lower pole section l_1 and the brake disc 26 arranged below the said brake shoe prevent the mowing like motion of the snapped trolley pole. Notably, when the trolley pole has left the overhead wire and spring 6 has swung the pole section l_2 in the upward direction, the adjustable stop 24 arranged in the bent-back end of the pole section will press brake shoe 25 against disc 26. Owing to this braking it will not be possible for any movement of the trolley pole.

In order to cause the trolley pole to come back to its working position, the contact 16 is interrupted and the pulling effect exerted by the pulling member 20 on the pawl 10 will cease. The pole section l_2 is brought into alignment with pole section l_1, whereupon pawl 10 will catch into the rest of lever 11 and the trolley pole will regain its propped condition.

When placing the trolley pole on the overhead wire 7, it is necessary that the pole will be pulled downwards in consequence whereof the effect exerted by the adjusting screw on brake shoe 25 will cease and the whole trolley pole will become freely rotatable around the vertical pivot.

In Fig. 3 the releasing device is relayed by a double-arm lever 29 journalled on the shaft 4, the end 30 of the said lever falling within the range of operation of stop 24. At the moment when shoe 8 has left the overhead wire 7, the stop 24 will make impact by its lower end against the end 30 of the lever 29, and will press this end against brake shoe 25, whereupon brake shoe 25 will become pressed against disc 26 and will thereby prevent any rotation of the whole mechanism around pivot 2. Concurrently with the downward deflection of arm 30 of lever 29, however, the pulling member 20 will also become displaced in the direction of the arrow according to Fig. 3, and will deflect the lower arm of the pawl 10, until the upper arm of the latter will rise from the rest of lever 11 and pole section l_2 will reach the snapped down position shown on Fig. 2.

Relaying by mechanical means can, however, as shown in Fig. 4, also be effected in a different manner. The lever 17 (Fig. 1) subject to the action of the spring 21 is, through pulling member 31 (Fig. 4) acting on arm 33 of the double-arm lever 32. The lever 32 is journalled on the cylinder 34 and its arm 35 engages through link 36 with piston-rod 39 of the piston 38 subject, in cylinder 34, to the action of spring 37. The free end of the piston rod 39 is connected with the pawl 10 by means of the pulling member 20. In the rest position of the apparatus the spring 37 is compressed, in which case the arm 35 of the double-arm lever 32 and the link 36 are in alignment with the piston rod 39.

If the shoe 8 leaves the overhead wire 7, the lever 17 will, under the action of the spring 21, pull the pulling member 31, whereupon the lever 32 will become deflected, whilst at the same time it will, together with the articulation member 36, leave the centre line of the piston rod 39, and the action exerted by the spring 37 on the piston 39 will become effective. Under the action of the spring 37, the piston 38 will, together with the piston rod 39, become displaced in such a manner that it will, through the pulling member 20, deflect the pawl 10, and will lift out the upper leg of the said pawl from the rest of the lever 11. Thereby the end 12 of the trolley pole will snap down around the pivot 23. When bringing the current-collector pole into its working position the spring 37 has, of course to be re-compressed.

The embodiment represented in Fig. 5 shows a modification of the lever system of the trolley pole illustrated in Figs. 1 to 4. In this embodiment, the lever system, in addition to the pawl 10 journalled in the sleeve 41 which is fitted with an extension piece and is arranged on the propping section l_1, notably at its upper end, and the lever 11 journalled in the sleeve 42 which is fitted with an extension piece and is journalled on the propped section l_2, notably at its lower end, also contains the locking bolt 43. Preferably, the pawl 10 likewise is journalled in the extension piece of the sleeve 41, and in the propped position of the pole section l_2 one of the arms of the said pawl lays itself into the groove of the locking bolt 43, whereas on the other arm of the said pawl the lever 11 finds support by its rest. The levers 10 and 11 as well as the locking bolt 43 are subject to the action of the springs 44, 45, 46.

In this embodiment, the design of the pawl 10 and of the levers 11 is such as to ensure that in the working position of the trolley pole they should be in an unstable position promoting release; accordingly, if the pawl 10 were not kept in a fixed position by the locking bolt 43, the lever 11 would, in consequence of the pressure exerted in an eccentric direction by the lever 11 slide off immediately from the pawl 10 and the pole section l_2 would snap down. This object is achieved by placing the point of attack of the lever 11 on the pawl 10 outside the line connecting the pivots of the pawl 10 and of the lever 11.

If a pulling effect is exerted in the direction of the arrow on the drawbar 28 connected electri-

cally or mechanically to the locking bolt 43, the locking bolt 43 will become deflected around its pivot and release the lower arm of the pawl 10, so that this pawl, becoming displaced, in consequence of the pressure of the lever 11, against the action of the spring 44, from its unstable position, will throw off the lever 11 supported on its upper arm. In consequence hereof the section l_2 of the trolley pole will, together with the part 42, snap down into the position shown in dotted lines.

In order to reduce the strong impact made by the pole section l_2 when clashing against the pole section l_1, notably against the sleeve 41 fitted with an extension piece, a rubber cushion 47 or a gas- or liquid-dashpot is provided in the extension piece of the sleeve 42.

In other respects the operation of the propping device is entirely similar to the operation of the devices employed in the embodiment described by way of above examples.

In Figs. 6 and 7, it is on the lower end of the current-collector pole that the articulation 4 is provided, whilst the intermediate carrying member 46 is arranged on one side of the pole 1 or between its forked lower legs. This intermediate carrying member is a bell-crank lever, to one end of which there joins on the spring 6 pressing the trolley pole against the overhead wire, whilst its other end contains the stop 24 which effects the braking of the pole. The pivot of the intermediate carrying member 46 coincides with the pivot 4 of the current-collector pole 1 and in its arm subject to the action of the tensioning spring 6 there is journalled a pawl 10 engaging with the lever 11 which is arranged on the current-collector pole 1 and is subject to the action of a spring. The lower leg of the pawl 10 is connected by means of the pulling member 20 with the iron core of the magnet 12.

If the shoe 8 leaves the overhead wire 7, the contacts 14, 15 are closed, the pawl 10 will become deflected in such a manner that the lever 11 will leave its rest, and the trolley pole 1 will snap down around the pivot 4 and will lay itself in its position shown in Fig. 2, on the cushion 40. The trolley pole is brought into its working position. For this purpose, the contact 16 is interrupted, whereupon the nose of the pawl 10 will again catch into the rest of the lever 11 subject to spring action.

In the case of the embodiment according to Figs. 8–9, a dashpot 49 joins on sideways to the frame 3. The rod 51 of the piston 50 moving in this dashpot joins on articulately to the arms 53 journalled at the end of the arm 52 projecting from the frame 3. The arms 53 are journalling the transverse pivot 54 (Fig. 9). One end of each of the lifting springs 55 and 56, respectively, is fastened to the two ends of this pivot, whilst the other ends of the said springs urge against the forked end of the trolley pole 1 in the vicinity of the pivot 4. The piston rod 51 is surrounded by the counter-spring 57, which is supported, on the one hand, on the pivot 54, and on the other hand, on the casing of the dashpot 49. In the working positions of the trolley pole, the action of the counterspring is weaker than the resultant of the springs 55, 56; notably, it may, amount to, say, between one-tenth and five-tenths of the latter.

The working point of the lifting springs 55, 56 on the trolley pole 1 is determined by the overhead wire pressure, from the pivot 4 of the pole, and accordingly, when the trolley pole approaches the vertical position, the strength of the springs diminishes. Accordingly, it will be possible to provide for the counter-spring 57 to overcome the lifting force of the springs 55, 56 in the highest working position of the trolley pole, in order to render the release of the lifting spring by means of pivot 54 and of piston rod 51 possible.

The lever 43 journalled on the base 3 passes through the port 64 out into the thicker part of the piston rod 51. The lever 10 connected articulately to the upper end of the lever 43 catches into the rest of the pawl 11 pivotable around the pivot 58, on the opposite end of which pawl the armature 20 of the electro-magnet 12 attacks. The operation of the electro-magnet 12 is effected in the manner described above.

The trolley pole snaps down in the following manner:

If the sliding shoe or trolley leaves the overhead wire, the electro-magnet 12 will draw-in its armature 20, which latter pull down and/or strikes the longer arm of the pawl 11, whilst the shorter arm of the pawl 11 thrusts the lever 10 from its rest.

The release of the lever 10 relays the propping lever 43, whereupon the lifting springs 55, 56 are thrusting the piston rod 51, and, together with it, the piston 50 and the pivot 54 towards the axis 4, i. e. towards the right. After this motion has been braked by the counter-spring 57 and by the dashpot 49, it is only gradually that the lifting springs 55, 56 will become released, and thus the trolley pole 1 will not drop freely, but will first sink rapidly below the level of the contact wire, following which it is by gradual deceleration that it will reach its horizontal position.

The mowing-like motion of the trolley pole which has jumped off the overhead wire is prevented by the brake piston 25 moving in the cavity of base 3 fitted with pivot 2. Whilst piston 50 compresses the medium contained in dashpot 49, the air gets through the aperture 59 into the space behind the brake piston 25, and presses the latter against the base-plate 26.

If the trolley pole which has jumped off is to be replaced to the overhead wire it is first necessary to make the electro-magnet 12 currentless, whereupon the pulling action exerted by the armature 20 on pawl 11 will cease and pawl 11 will, under spring action, return into its rest position. The lever 10 is brought by lever 43 into the rest of pawl 11, whereupon the piston rod 51 is pressed back by the spring 57, in which action the spring is aided either by raising the trolley pole 1 or by passing compressed air or liquid into the dashpot 49. It follows from this that as soon as the trolley pole is replaced on the overhead wire, the whole operating device together with the springs are rebrought automatically in their initial positions.

The modification represented in Figs. 10–12 differs only from the embodiment shown in Figs. 8 and 9 in that the operating device and springs are arranged behind the pivot when viewed in the running direction of the car and not in front of it.

The springs 55, 56 act on the section situated below the axis 4 of the trolley pole 1. The opposite ends of these springs are journalled on the pivot 54 arranged on the end of the piston rod 51. The springs 55, 56 are holding trolley pole 1 in its operative position and are drawing pivot 54 towards axis 4. (Figs. 10 and 11). This is prevented by the tooth or toothed wheel 61 journalled on the pivot of lever 43 and engaging with the end 60 of piston rod 51 (Fig. 5). Accordingly,

the lever 43 tends to turn in the direction of the arrow indicated on Fig. 10, but this is prevented by lever 10 connected into the rest of pawl 63 subject to spring action. The pawl 63 is deflected against spring action by lever 32, with the co-operation of the levers 11 and 17 operated by the armature 20 of magnet 12.

Notably, as soon as the shoe of the trolley pole 1 has left the overhead wire the magnet 12 will deflect lever 62 on the axle of lever 11 (Fig. 12), whereupon the lever 32 becomes released from lever 62 and the pawl 63 will, in consequence of the pressure of the pole 10, become deflected in a counter-clockwise sense. In the meantime lever 10 jumps out from the rest of pawl 63, and lever 43 will, together with tooth 61 mounted on the common axle, turn in the direction of the arrow shown in Fig. 10 and release piston rod 54. Under the action of the springs 55, 56, the piston 50 will become displaced in the direction of the arrow shown in Fig. 12. This motion is resisted by the counter-spring 57 and by the medium compressed in the dashpot 49.

In other respects the device according to Figs. 10–12, is similar to the current-collector releasing and braking device shown in Figs. 8 and 9.

Magnet 12 should preferably be constructed in such a manner as to ensure that lever 11 should exert a striking effect so that the engagement between levers 32 and 62 is released with greater safety.

For releasing the levers 32, 62 it is also possible to employ, instead of a magnet, a number of turns of a small electric motor.

Instead of the contact switch arranged on the trolley pole, it is also possible to employ a pneumatic valve, whilst instead of the electro-magnet it is also possible to employ a compressed air cylinder.

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