

E. A. MITCHELL.
 SURFACE CONTACT ELECTRIC TRACTION SYSTEM.
 APPLICATION FILED MAY 19, 1908.

1,050,223.

Patented Jan. 14, 1913.

5 SHEETS—SHEET 1.

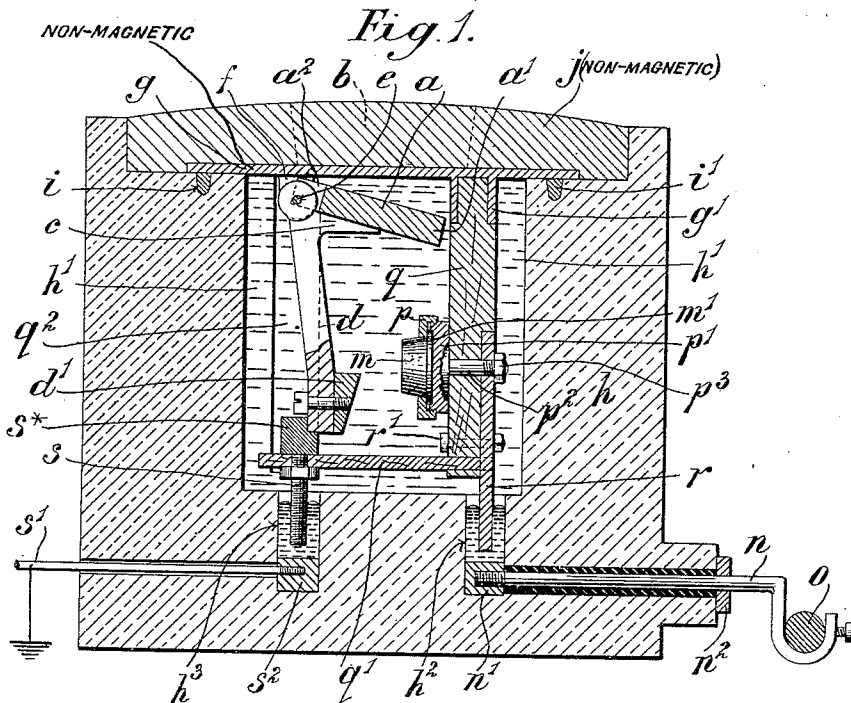
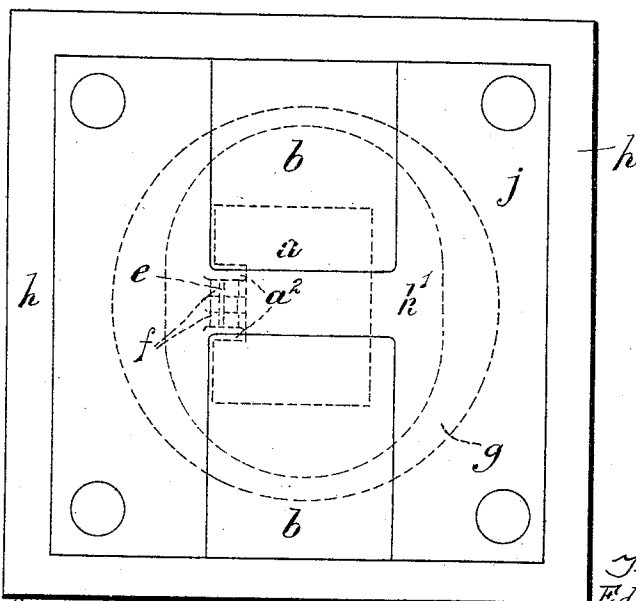


Fig. 2.



Witnesses

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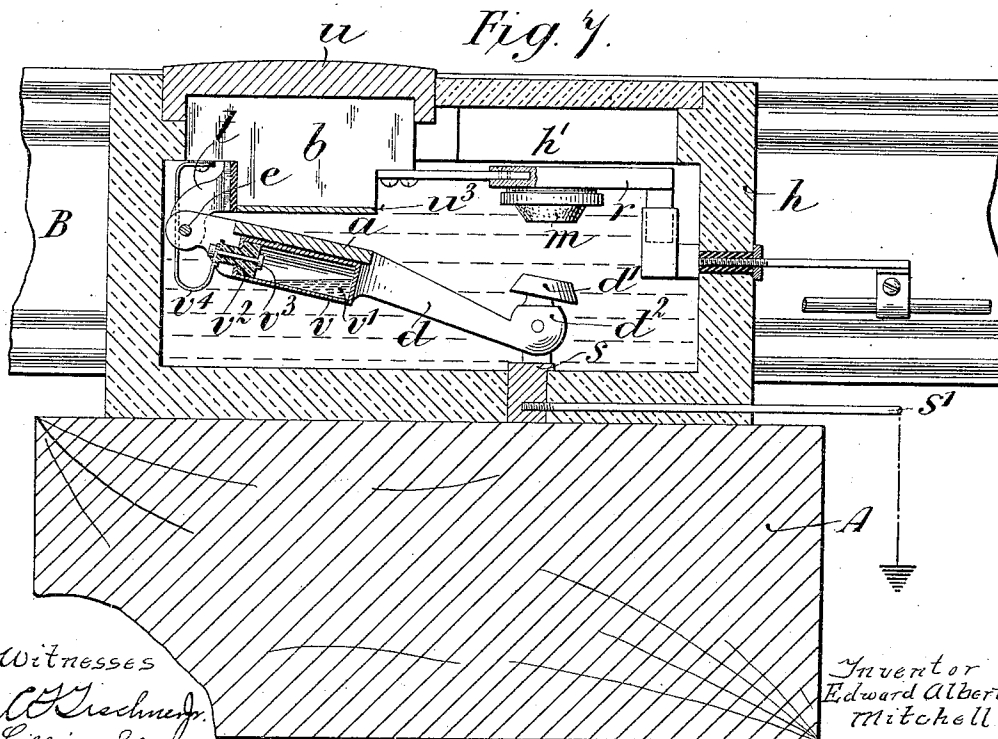
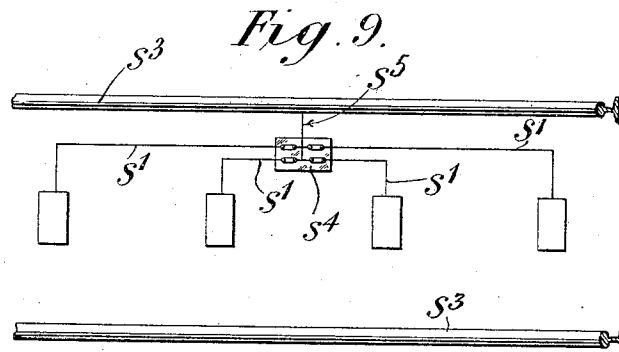
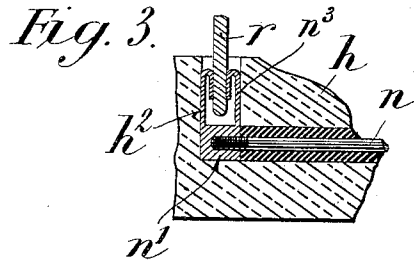
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5 SHEETS—SHEET 2.



Witnesses
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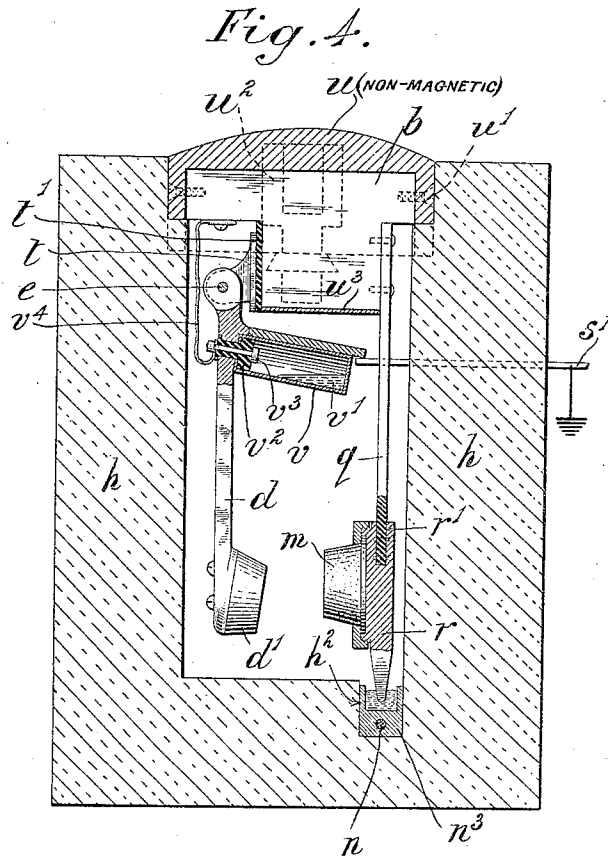
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5 SHEETS—SHEET 3.



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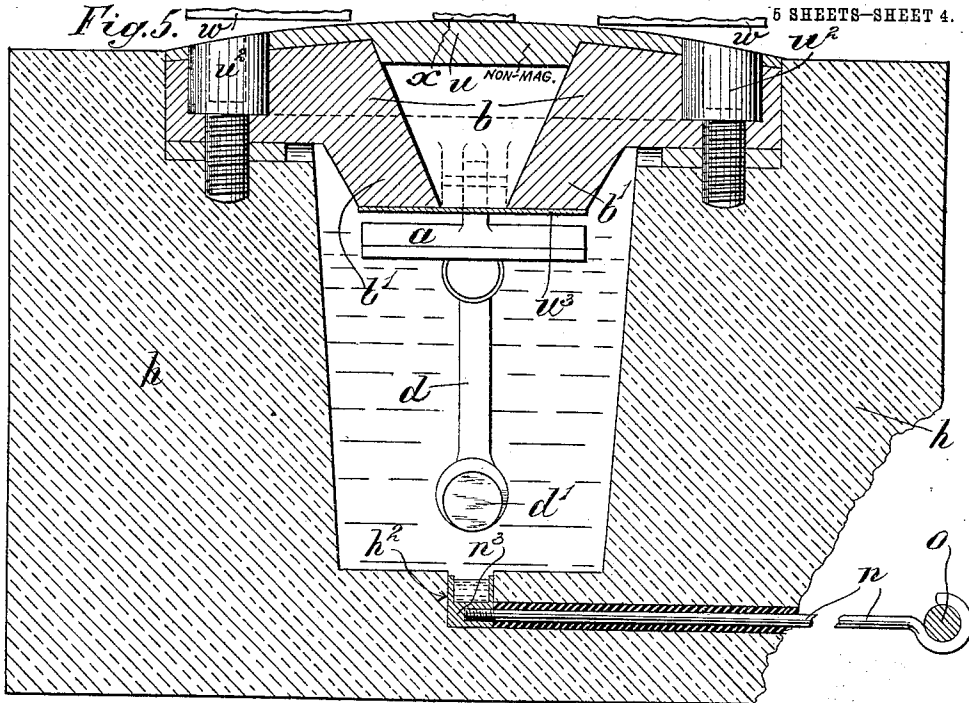
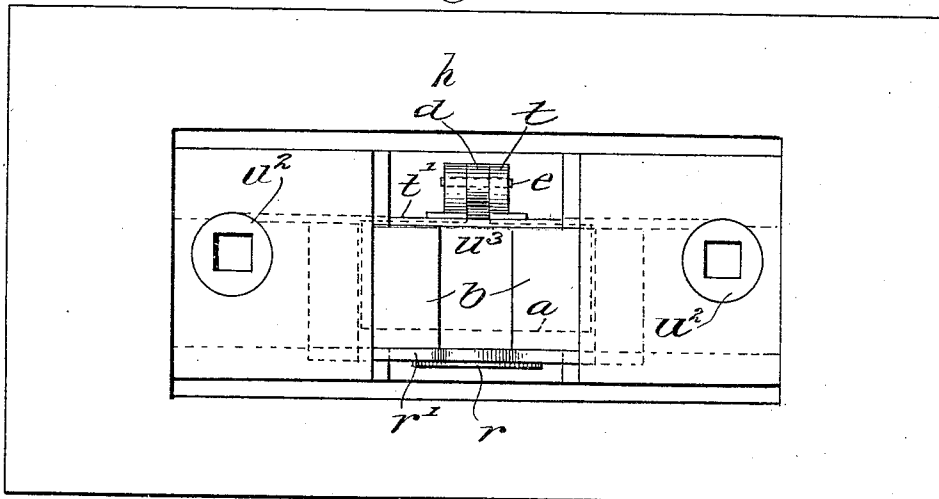


Fig. 6.



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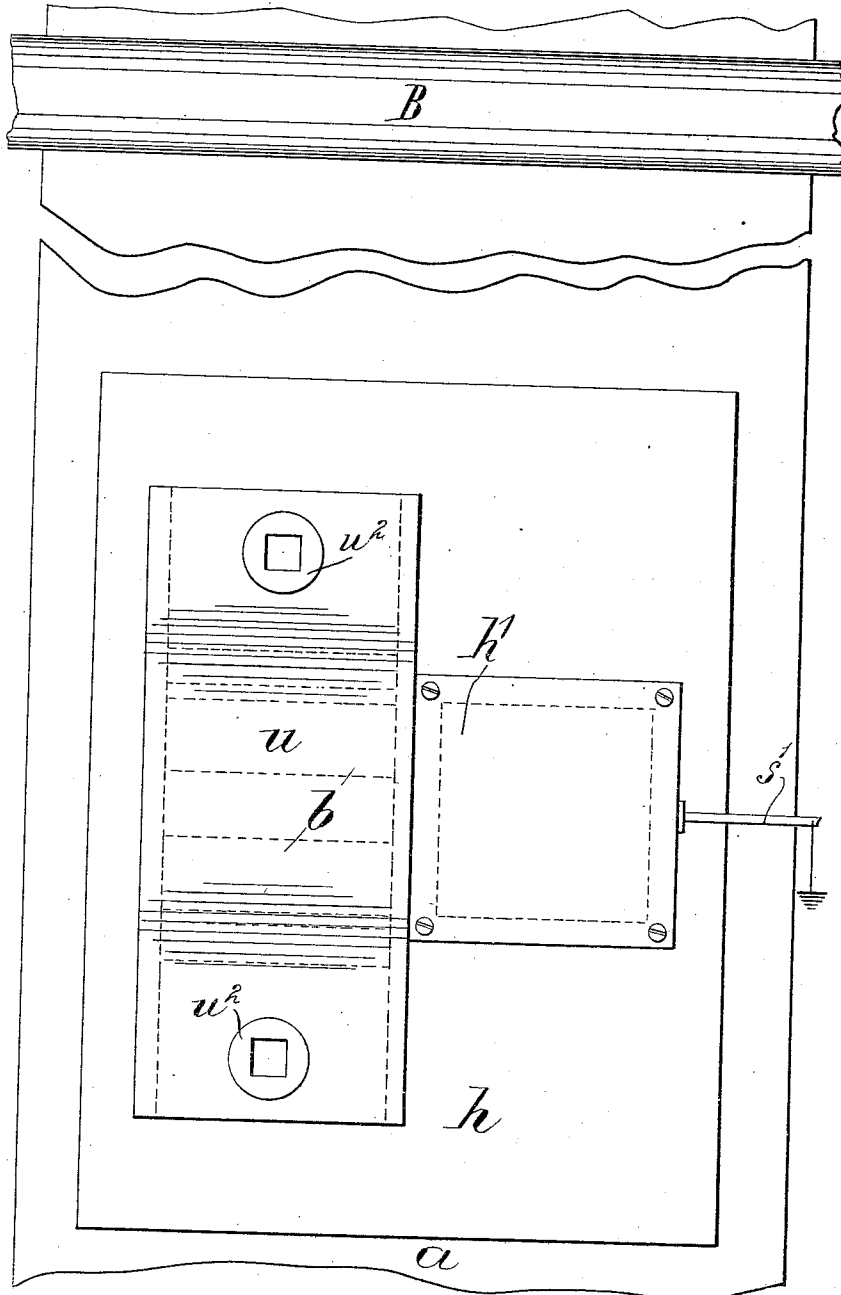
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5 SHEETS—SHEET 5.

Fig. 8.



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UNITED STATES PATENT OFFICE.

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SURFACE-CONTACT ELECTRIC TRACTION SYSTEM.

1,050,223.

Specification of Letters Patent.

Patented Jan. 14, 1913.

Application filed May 19, 1908. Serial No. 433,643.

To all whom it may concern:

Be it known that I, EDWARD ALBERT MITCHELL, a subject of the King of Great Britain and Ireland, residing at Carshalton, in the county of Surrey, England, have invented Improvements in or Relating to Surface-Contact Electric Traction Systems, of which the following is a specification.

This invention relates to improvements in surface contact electric traction systems of the kind in which switches arranged in boxes embedded in the roadway, or located on the track, are closed by the action of a magnetic device located on the propelled vehicle, as the latter passes over contact studs in the road, for the purpose of temporarily connecting such studs with the source of current supply and enabling current to pass to the motor or motors on the vehicle either through the magnetic device, or through a separate non-magnetic collector or skate, the switches being opened when the magnetic device passes beyond the studs.

The present invention has for object to provide a switch wherein the magnetizable device shall be arranged below both of the road studs in such a manner that one end portion thereof will be at all times near to and practically equally distant from both studs so that the air gaps between the two studs and the one end portion of the magnetizable device will be quite short and the studs, when magnetized, will act equally and strongly on the said device and cause it to turn toward them so as to gradually and rapidly reduce the length of the gaps between the studs and those parts of the magnetizable device that extends away from the end portion thereof nearest to the studs.

Another object of the invention is to provide means whereby, when current is not being collected by the vehicle, a break can be secured in such a portion of the circuit and in such a way that there is little or no possibility of the same being accidentally closed through the formation of an electric arc, water flooding, the accumulation of carbon particles, if one or other of the contacts be of such material, or other cause, the said means serving either as an auxiliary device to a switch of the kind referred to, so that in effect a double break switch is obtained,

or as the main switch for electrically disconnecting the road studs from the source of current supply.

Further objects of the invention are to simply and otherwise improve the construction and working of surface contact electric traction systems.

To attain these objects the invention consists in various novel features of construction and in various combinations and arrangements of parts, all as hereinafter described and pointed out in the claims.

In the accompanying illustrative drawings, Figure 1 is a central vertical section, taken longitudinally of the track, of the general arrangement of parts, of one construction of apparatus embodying the invention, and Fig. 2 is a plan of the same. Fig. 3 is a detail view showing a modification. Figs. 4, 5 and 6 show another arrangement of apparatus according to the invention, Fig. 4 being a view similar to Fig. 1, Fig. 5 a sectional elevation taken transversely of the track, and Fig. 6 a plan of Figs. 4 and 5 with a part removed. Figs. 7 and 8 are similar views to Figs. 5 and 6 showing another arrangement. Fig. 9 is a diagram of part of the track with the invention applied thereto.

Referring to Figs. 1 and 2, the magnetizable device here shown may advantageously be made as a soft iron plate a (hereinafter called the armature) made, it may be as wide as the studs b , or even wider, and mounted to turn with the switch lever d about an axis e parallel to a transverse line joining the two road studs b constituting a pair, instead of about an axis at right angles to such a line, so that when the studs b are magnetized, the unpivoted end portion a^1 of the armature, which is equally distant from both studs, will turn and approach both studs at the same rate. By this means a magnetic switch operating device of less magnetic strength than heretofore usual can be used. Further, there will be less magnetic density between the studs b and the armature a owing to the comparatively large area of the latter and to the same extending under a considerable portion of the two studs. Furthermore, by the arrangement described, the studs b in each pair thereof can be arranged at a greater

distance apart than usual, so as to avoid direct magnetic leakage between them and thus induce a greater magnetic flux between them and the armature a . The armature a may conveniently be attached to an arm or extension c on the upper pivoted end of the switch lever d and the combined armature and lever are pivoted to a lug f on the bottom of a cover plate g which is arranged to rest upon and close the top of the switch box h and come between the same and the road studs b . The lug f may be fork shaped to receive the upper end of the switch lever d , which is pivoted to it, and the adjacent portion of the armature a is notched, as at a^2 , to accommodate the lug. The cover plate g and lug f are preferably of non-magnetic material, for example brass.

The switch box h is made of a block of hard resisting material that is a non-conductor or bad conductor of electricity, for example porcelain or granite, having a chamber or cavity h^1 formed therein for the reception of the switch device. The top of the block is or may be formed with one or more grooves i , one is shown, to receive a packing piece i^1 , or pieces, for preventing or retarding the passage of water between the block h and cover g to the switch chamber h^1 . The packing piece i , or pieces, may be of metal and be formed in one piece with and depend from the underside of the cover plate g . Above the block h and cover plate g is a chair or cover j of hard wear resisting non-magnetic material, for example manganese steel, which may rest partly upon the cover plate and partly direct on the block and may surround the upper portion of the latter, or, as shown, be held within a recess therein.

The switch device comprises, as usual, a movable contact d^1 , preferably of copper, carried by the lower end of the switch lever d , and a fixed contact m of carbon. In the constructions of switch boxes and switches heretofore used, the stationary switch contact m has been fixed in the box h so that it has not been possible to simultaneously examine the two contacts from time to time to ascertain whether they were in proper working order. In order to obviate this disadvantage, the stationary contact m is, according to the present invention, carried by but insulated from the cover plate g and adapted to be readily placed in connection, through a conductor n , with the main supply conductor o , so that upon removing the cover g from the switch box h , both the movable and stationary switch contacts d^1 m will be removed therewith and the condition and working thereof can be readily ascertained. In the arrangement illustrated for this purpose in Fig. 1, the stationary contact m , which may consist of a circular block

of carbon having a flanged base m^1 , is secured by a detachable screw ring p to a metal block p^1 that is formed with a screw threaded shank p^2 by means of which and a nut p^3 , it can be fixed to a depending rod q or other support of insulating material, for example, lignum vitæ, that is secured, as by a socket piece g^1 to the underside of the cover plate g . To the shank p^2 is fixed, as by the nut p^3 that secures it to the rod q , a metal tongue or switch piece r that may be further fixed to the rod q by one or more additional bolts r^1 and depends into mercury that is held in a pocket h^2 formed in the lower portion of the block h . The mercury is in contact with a metal block n^1 in the bottom of the pocket h^2 and to which is connected, as by screwing, a metal rod constituting the conductor n which extends laterally through a hole in the block h to one side thereof and which may be formed with a flange or collar n^2 to close the outer end of the hole. The rod n may be coated with material such as bitumen to insure closure of the said hole. The outer end of the rod n is connected in any convenient manner to the main conductor o which is arranged at one side of the block h . Instead of a mercury contact, the metal block n^1 , or its equivalent, may, as shown in Fig. 3, be provided with metal spring contacts n^3 between which the metal tongue or switch piece r can be forced and which are in connection with the main conductor o through the said rod n . The depending rod q of insulating material may be connected, as by one or more horizontal rods q^1 , to other depending rods q^2 of like material which, or some of which, may, as shown be utilized to limit the opening movement of the switch lever d .

With a view of preventing water entering the switch box, the latter may, as heretofore, be filled with oil having a greater specific gravity than ordinary or sea water.

While, with the arrangement described, the liquid tightness of the switch box is effectually secured at the time the electric contact system is installed, it may happen that, as the result of wear or accident, some part or other may become deranged and permit water to enter the switch box. Means are therefore provided whereby, even if such leakage should take place, the contact studs in the roadway will be dead, or practically so, when the switch is open. For this purpose it is arranged that so long as the switch in a switch box remains open, the movable switch element a , c , d , d^1 will be in contact with a conductor leading to earth, part of the said conductor being so located with reference to the switch box that should water accumulate therein to a sufficient height to place the fixed and movable switch contacts in electrical connection, the current which,

in the absence of the earth connection, would ordinarily flow through the road contact studs if touched, will be shunted to earth.

It has been found that the resistance offered by water in the switch box is sufficiently high to, in any case, reduce the potential difference between the road studs and the earth to an extent that will not seriously affect the supply system so that it will be seen the earth connection provided, while causing the studs to become practically "dead" when the switch is open, will not cause the whole track or section of track to become inoperative should leakage of water into one, or it might be more than one, switch box take place. In applying such an earthed connection to the form of switch box hereinbefore described, a metal rod or plate s may, for example, be arranged within the lower portion of the switch box h , such rod or plate being adapted, in conjunction with the attached earth connection, which may be a wire s^1 conveniently passed through and molded in the wall of the switch box, to offer a path of lesser resistance to the flow of current to earth than that afforded by the movable switch element. The said rod or plate s may be so fashioned or shaped at the part s^* where the movable switch member engages it, that sufficient area of contact between the two is secured. The metal rod or plate s may, as shown, conveniently be fixed to the insulating frame formed by the rods q , q^1 , q^2 of insulating material and dip into mercury held in another pocket h^3 formed in the insulating block h , so that it will be removed with the cover plate g and switch when the cover plate is removed. The mercury rests upon a metal block s^2 held in the bottom of the pocket and fixed to the earthed connection s^1 . An earth connection such as described, will also serve to divert current from the corresponding road contact stud or studs should an arc be formed between the fixed and movable switch contacts m , d^1 when the switch is opened. It will also serve to direct from the road contact studs any current leaking from the fixed switch contact m , due to the presence of carbon dust, or carbonized oil, if oil be used, in the switch box.

The earthed rods or plates in a number of switch boxes may, as shown in Fig. 9, be connected together as a group and be connected by a conductor s^3 common to them, to an earth connection, such as one or both of the track rails s^3 , preferably through a disconnecting link box s^4 , so that tests can be easily made from time to time for leakage between the earth rods or plates s and earth. Or each earth rod or plate may be separately connected through such a disconnecting box to one or both of the track rails.

In the example shown in Figs. 4, 5 and 6 the details of constructions are considerably simplified, the cover plate g (Fig. 1) being dispensed with and the switch lever d attached to a hinge t carried from the road studs b by an insulating plate t^1 , the pivotal axis being disposed transversely of the track as in Figs. 1 and 2. The upper sides of the studs b also are covered with a top plate u of non-magnetic material, such as manganese steel, shaped as shown and attached to the said studs, as by screws u^1 , so that it is removable, the retention of both the studs b and top plate u upon the switch box h being effected by means of bolts u^2 (Fig. 5) or the like. By the use of the top plate u , the drag upon the vehicle skate is considerably reduced. The studs b are each made of the obtuse angular shape shown more particularly in Fig. 5, that is to say, they each have a horizontal piece b and a downwardly inclined polar piece b^1 , the upper horizontal portion b being of greater cross section than the downwardly inclined portion b^1 . The two studs constituting a pair are arranged, as shown, so that their polar extensions b^1 incline downwardly and toward one another so as to form between them a truncated V-shaped space that extends from the top of the studs to the lower horizontal faces b^2 thereof, whereby, when the studs are magnetized, the flux density becomes greatest at the lower ends of the polar pieces b^1 where the greatest attraction is desired, namely in the neighborhood of the armature a of the movable switch element d . By this means the magnetic switch operating device w on the vehicle need not be so strongly magnetized as heretofore, and it can be supported a short distance above and clear of the studs b so as to eliminate frictional drag between these parts, the current being collected from the studs by a non-magnetic skate or collector x . Means, as for example a sheet u^3 of brass or other non-magnetic material may be arranged between the studs b and the armature a to prevent direct contact between these parts after considerable wear of the carbon contact m .

The metal tongue or switch piece r directly carries the stationary contact m and is socketed, as at r^1 , to the insulating rod q , while the mercury into which it depends is confined within the cup n^3 connected to the conductor n which is passed through the switch box h and rendered liquid tight by the employment of any suitable sealing composition, as in the arrangement shown in Fig. 1.

The earth wire s^1 is arranged to be engaged by the armature a of the apparatus when the switch is open.

The switch lever d instead of being ar-

ranged to hang in a more or less vertical position, as in the arrangements shown in Figs. 1 to 6 inclusive, may, as in the modified arrangement shown in Figs. 7 and 8, be arranged to extend in a more or less horizontal position, the stationary contact m being in this case arranged above the movable contact d^1 . The switch box h may be provided with a removable cover plate h^1 to admit of ready access being gained to the switch. This modified arrangement is specially applicable in cases, such as electric railways, where it is desired to employ a shallow switch box and to support the same upon the sleepers A carrying the rails B .

The movable contact d^1 may, in each case, be jointed to the switch lever d , as by a ball and socket joint d^2 (see Fig. 7), so that it can automatically take an even bearing against the stationary contact m .

For the purpose of securing a double break when the switch is open, as herein previously referred to, a portion of the circuit conductor is mechanically interrupted and the severed portions led to within a receptacle containing mercury in such a manner that by moving the said receptacle in one way, the said portion of the circuit is rendered conductive through the mercury, while movement in another way serves to remove the mercury out of circuit, the receptacle being either hermetically sealed or not as desired. For example, as shown in Figs. 4 and 7, a metal tube v carried by and in electrical connection with the switch lever d , may be arranged beneath the armature a and contain mercury v^1 as shown. The end of the tube which is at the higher level when the switch is open (see Figs. 4 and 7), is closed by an insulating plug v^2 carrying a conducting plate and stem v^3 connected by a flexible lead v^4 to the road studs b . When therefore the armature a becomes attracted and the tube v tilted, it will be seen that the mercury will complete the electric circuit which, at this part, is normally open.

The details of construction can be variously modified.

What I claim is:—

1. In a track unit for a surface contact electric traction system, a pair of road studs formed of magnetic material and from one to the other of which a magnetic circuit is to be completed said studs comprising horizontal portions and downwardly extending polar extensions that are inclined one toward the other and terminate in lower substantially horizontal surfaces so as to form between them a truncated V shaped space that extends from the top of the studs to the lower faces thereof, a cover or top of non-magnetic material arranged to completely cover and in close proximity to the horizontal portions of said studs, and a switch

the movable member of which carries an armature arranged directly below the polar extensions aforesaid, said switch member being mounted to turn about an axis parallel to a transverse line joining the two studs, so as to form, when the switch is open, two air gaps of equal length each gradually decreasing toward the axis aforesaid.

2. In a track unit for a surface contact electric traction system, a pair of road studs formed of magnetic material and from one to the other of which a magnetic circuit is to be completed, said studs comprising horizontal portions and downwardly extending polar extensions that are inclined one toward the other and terminate in lower substantially horizontal surfaces so as to form between them a truncated V shaped space that extends from the top of the studs to the lower faces thereof, a cover or top of non-magnetic material arranged to completely cover said studs and directly secured thereto, and a switch the movable member of which carries an armature arranged directly below the polar extensions aforesaid, said switch member being mounted to turn about an axis parallel to a transverse line joining the two studs, so as to form, when the switch is open, two air gaps of equal length each gradually decreasing toward the axis aforesaid.

3. In a surface contact electric traction system, a hollow chair or support, a pair of road studs having downwardly converging polar extensions, a cap of non-magnetic material to the underside of which the road studs are secured and which is removably attached to the chair or support, a stationary switch element, an insulating support carrying said switch element from the studs and a movable switch element similarly carried, a cup of mercury into which the stationary switch element dips, a supply conductor, a connection from the latter to the mercury cup, a receptacle attached to the movable switch element and containing mercury, a flexible conductor attached to the road studs and to an insulated pin extending into the receptacle, a magnetizable armature attached to the said movable switch element and movable about an axis parallel to a line joining both road studs and an earthed conductor engaging the movable switch element when the switch is open.

4. In a surface contact electric traction system, a hollow chair or support, a pair of road studs having downwardly converging polar extensions, a cap of non-magnetic material to the underside of which the road studs are secured and which is removably attached to the chair or support, a stationary switch element, an insulating support carrying said switch element from the studs and a movable switch element similarly carried,

a cup of mercury into which the stationary switch element dips, a supply conductor, a connection from the latter to the mercury cup, a receptacle attached to the movable switch element and containing mercury, a flexible conductor attached to the road studs and to an insulated pin extending into the receptacle, and a magnetizable armature attached to the said movable switch element and movable about an axis parallel to a line 10 joining both road studs.

Signed at London, England, this first day of May 1908.

EDWARD ALBERT MITCHELL.

Witnesses:

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Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents
Washington, D. C."
