

(No Model.)

3 Sheets—Sheet 1.

H. A. F. PETERSEN.

CLOSED CONDUIT SYSTEM FOR ELECTRIC RAILWAYS.

No. 540,187.

Patented May 28, 1895.

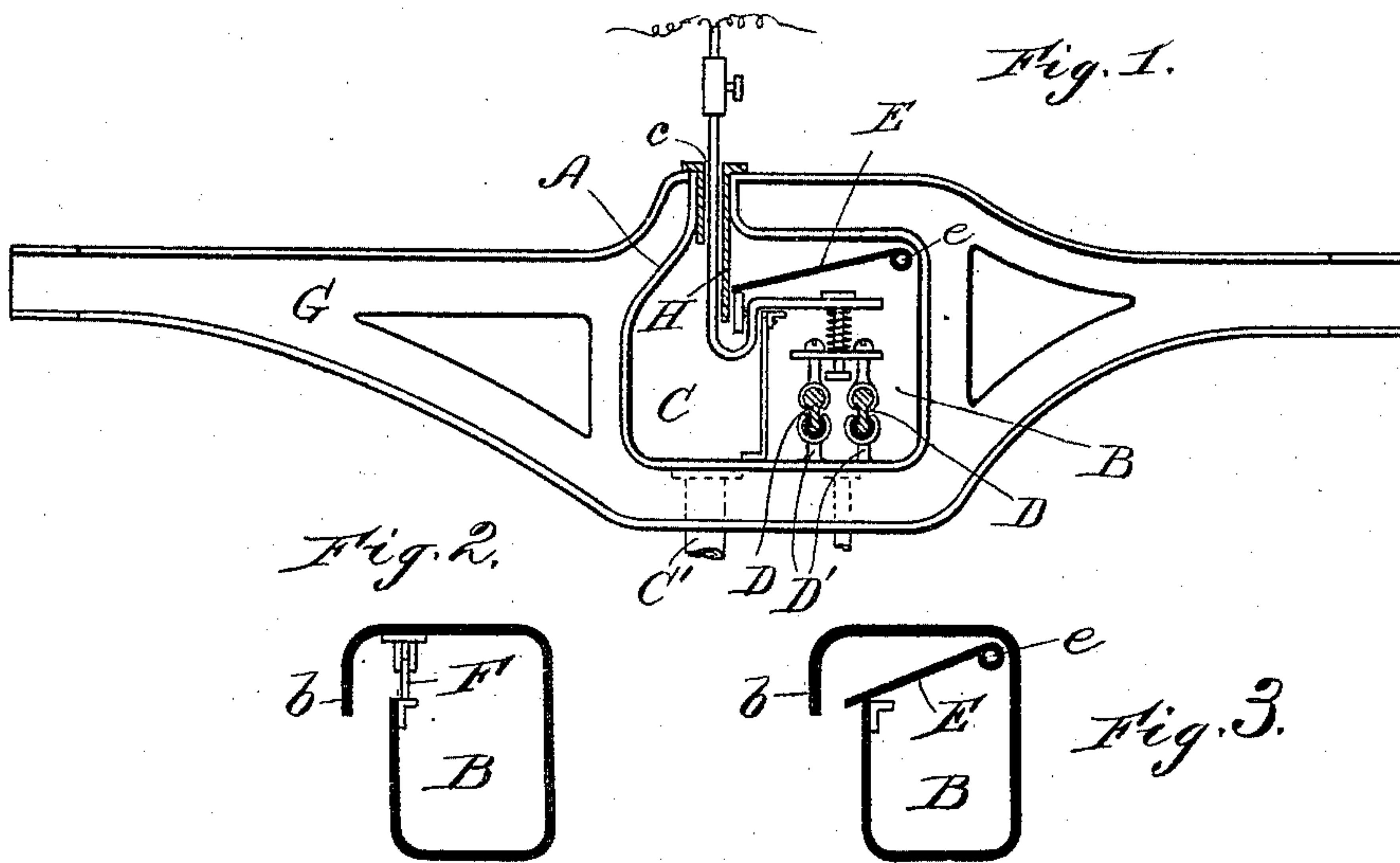


Fig. 2.

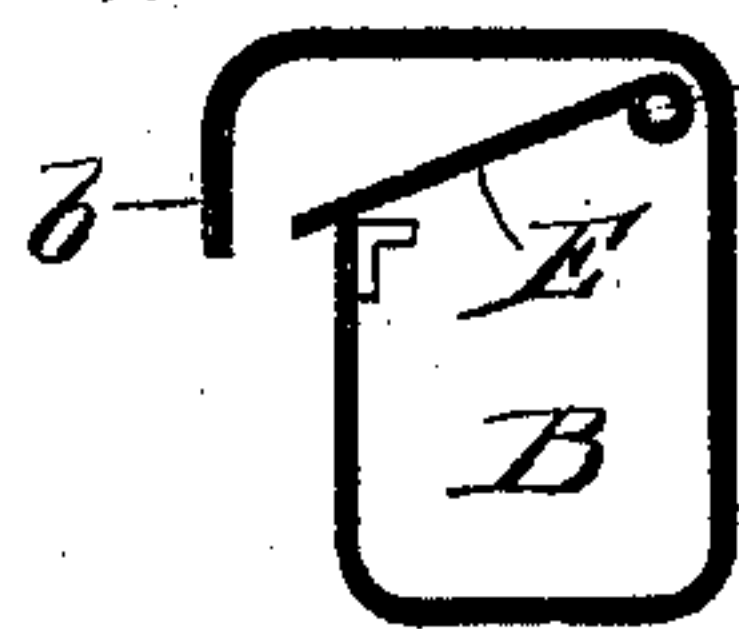
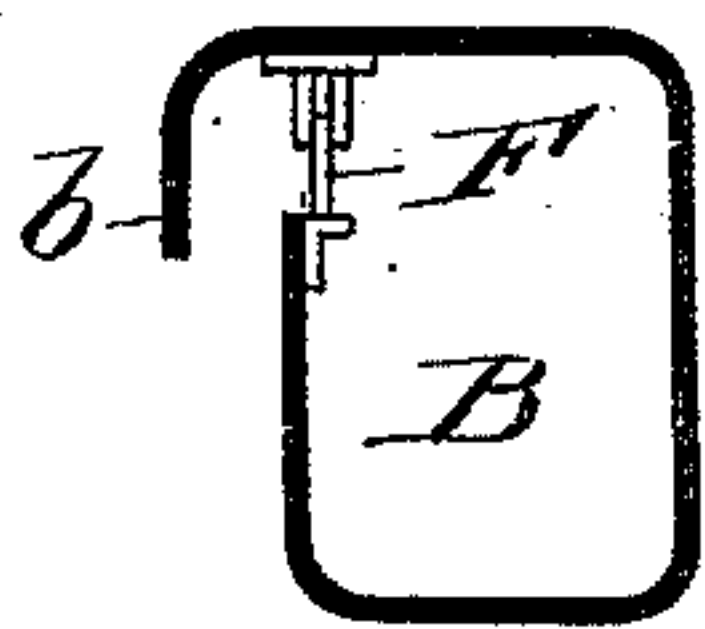


Fig. 3.

Fig. 4.

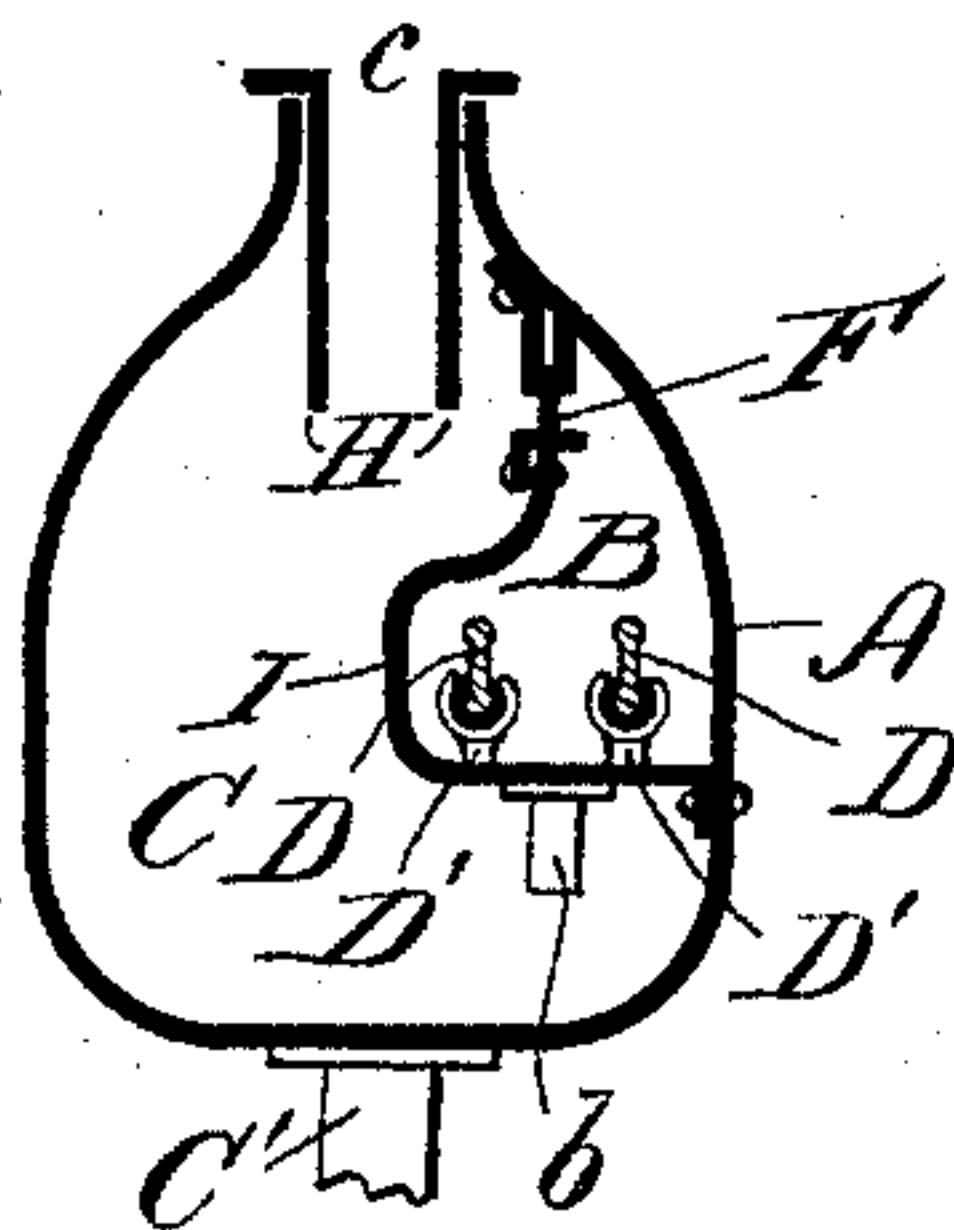


Fig. 5.

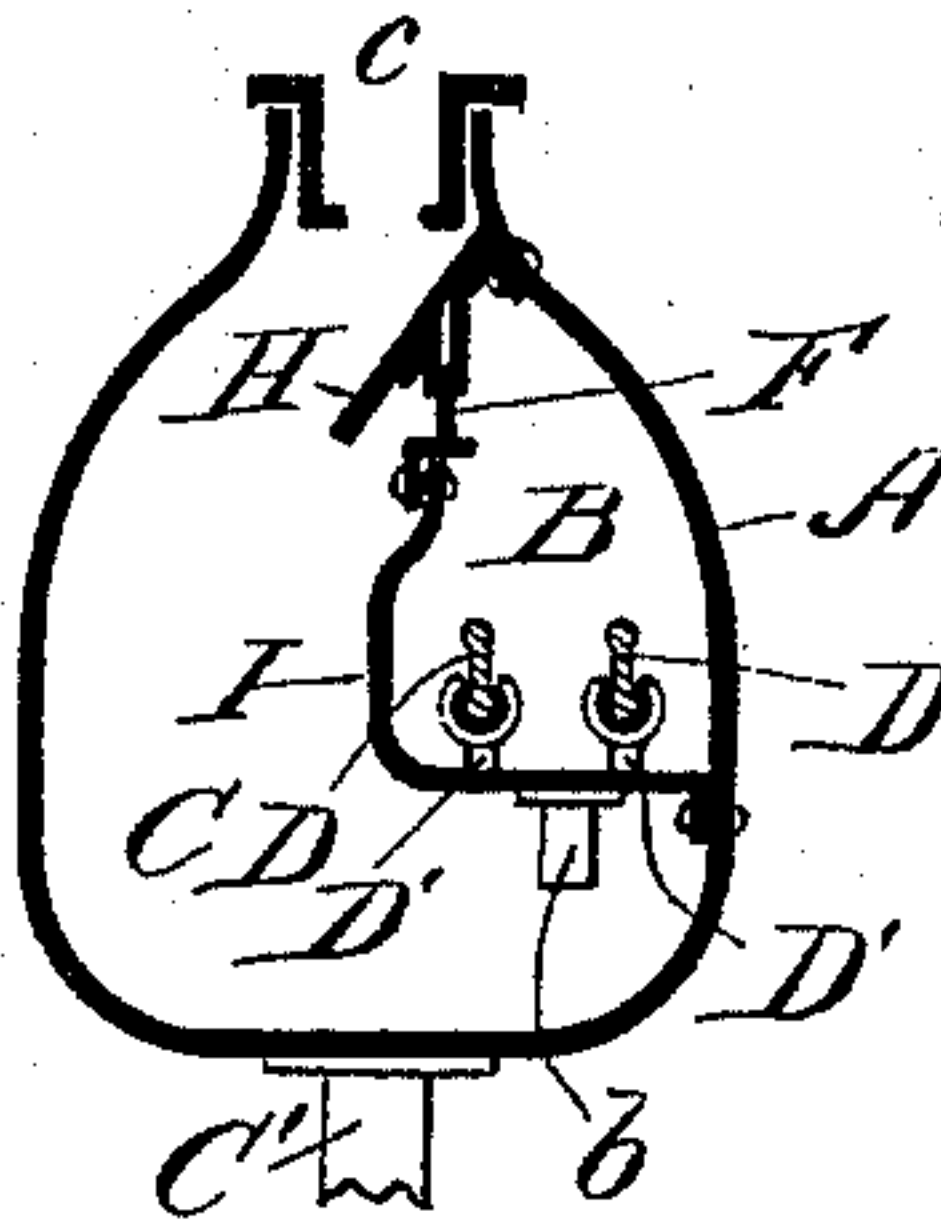


Fig. 6.

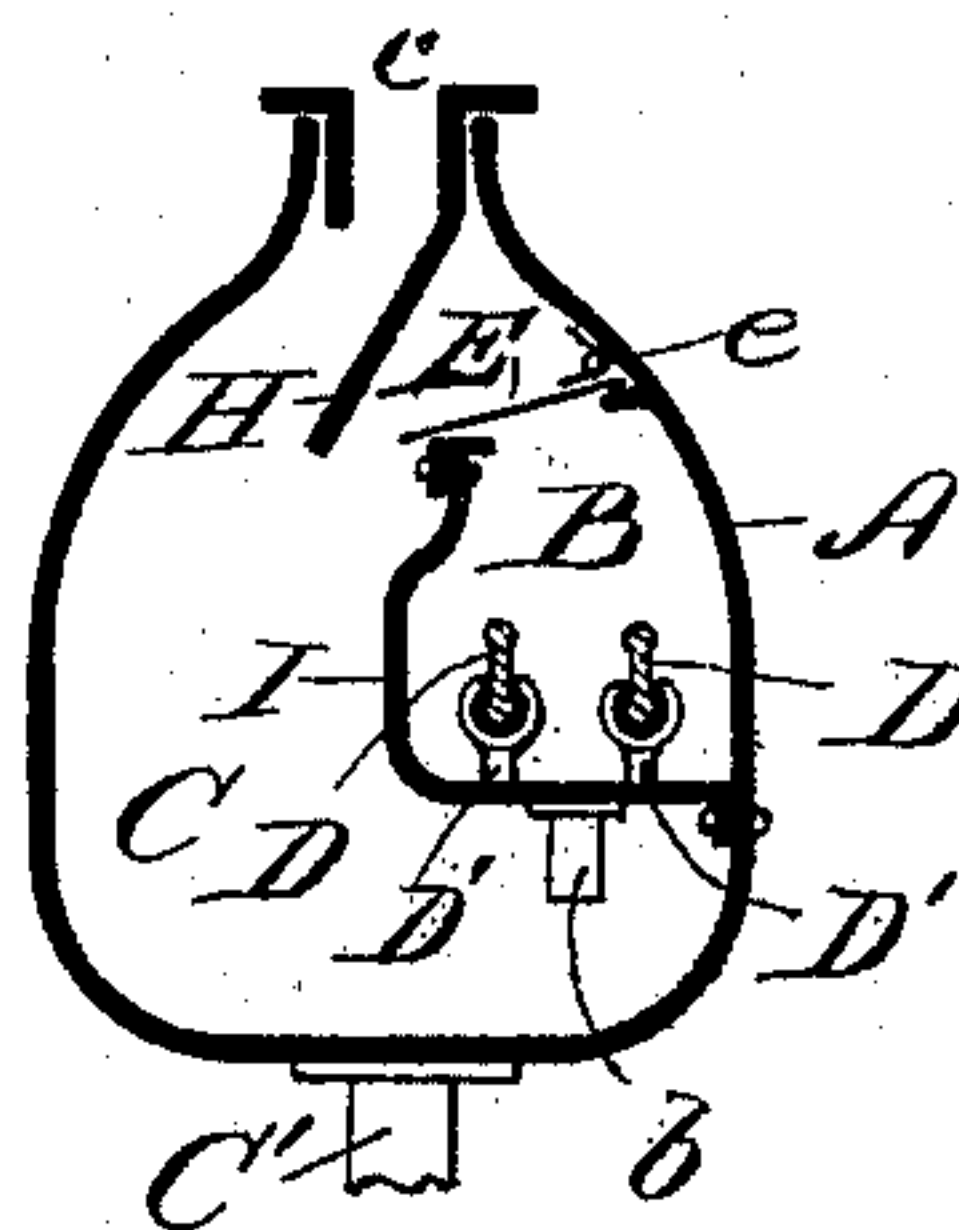
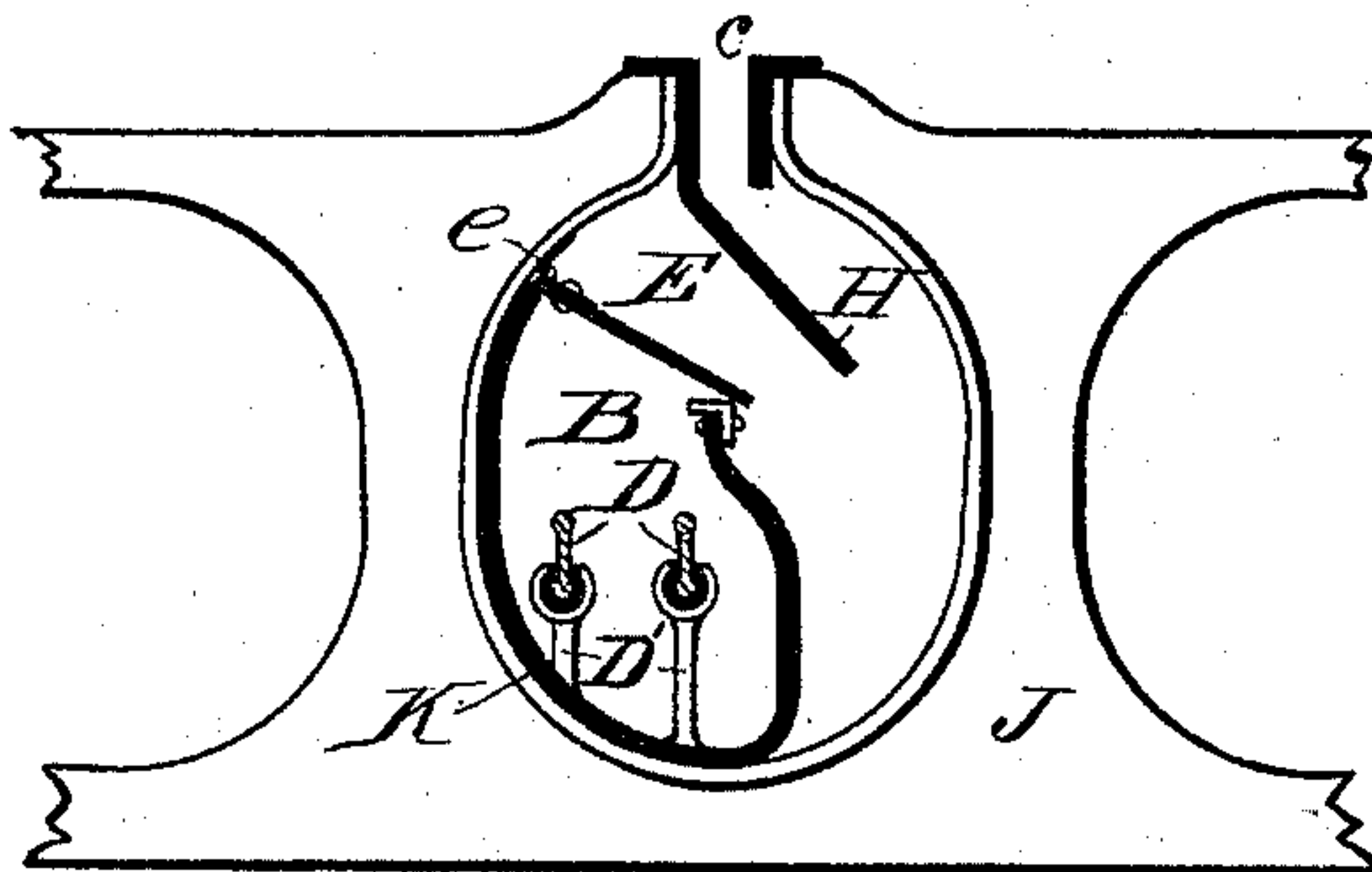


Fig. 7.



WITNESSES,

M. M. Wiles.
J. Leimbach.

INVENTOR.

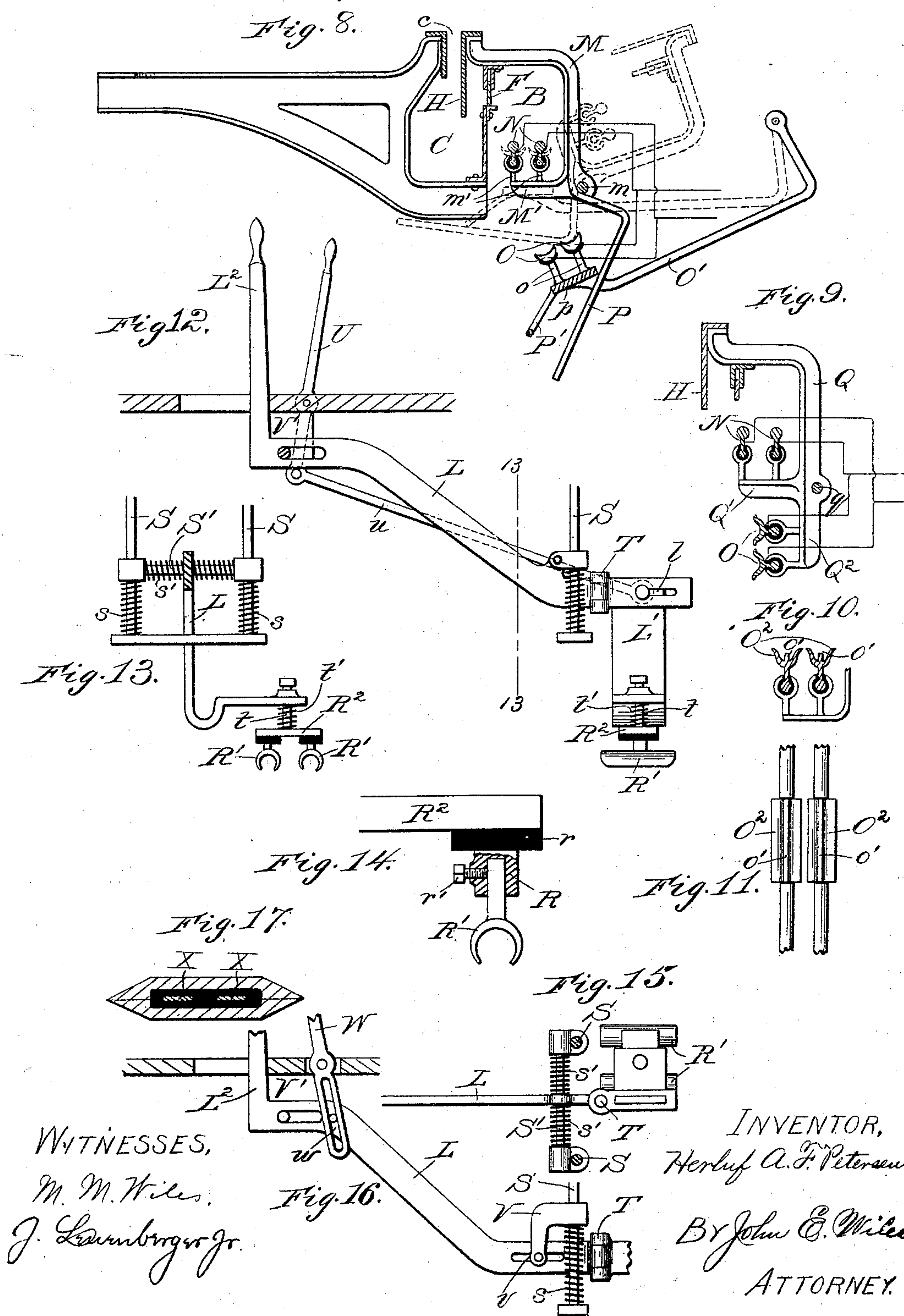
Herluf A. F. Petersen,
By John E. Wiles,
ATTORNEY.

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WITNESSES,
M. M. Wiles.
J. L. Lumborg Jr.

INVENTOR,
Herluf A. F. Petersen.
BY John E. Wiles.
ATTORNEY.

(No Model.)

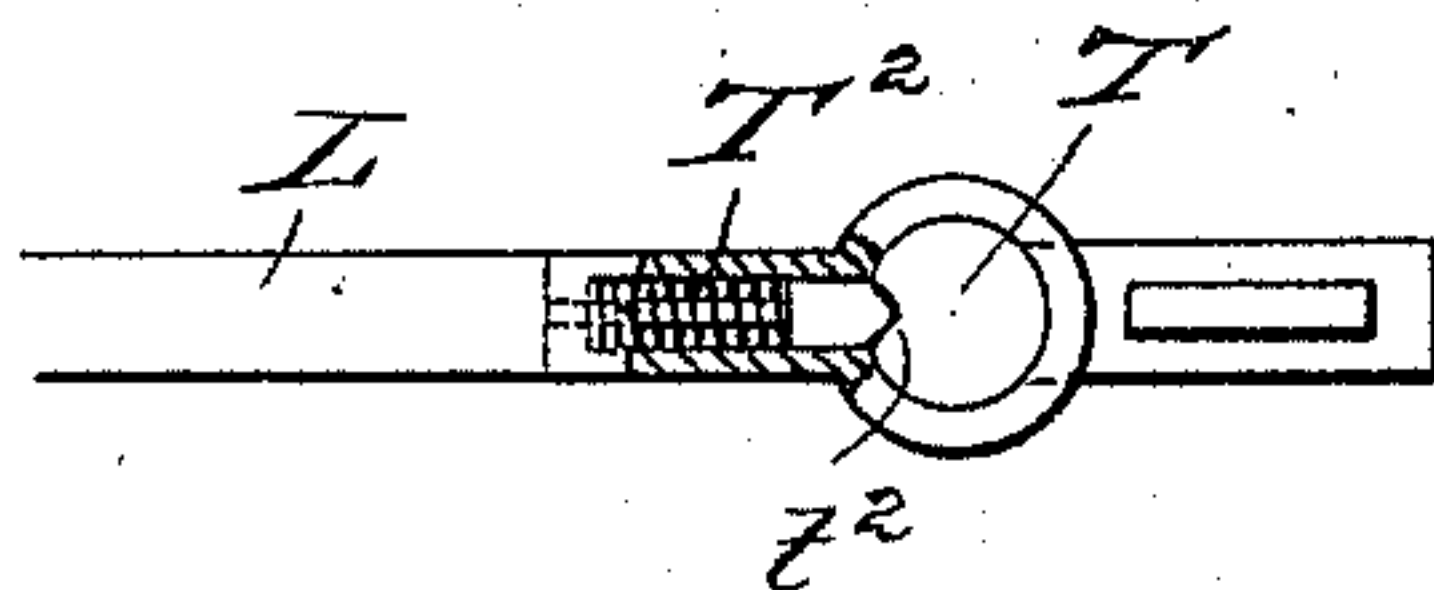
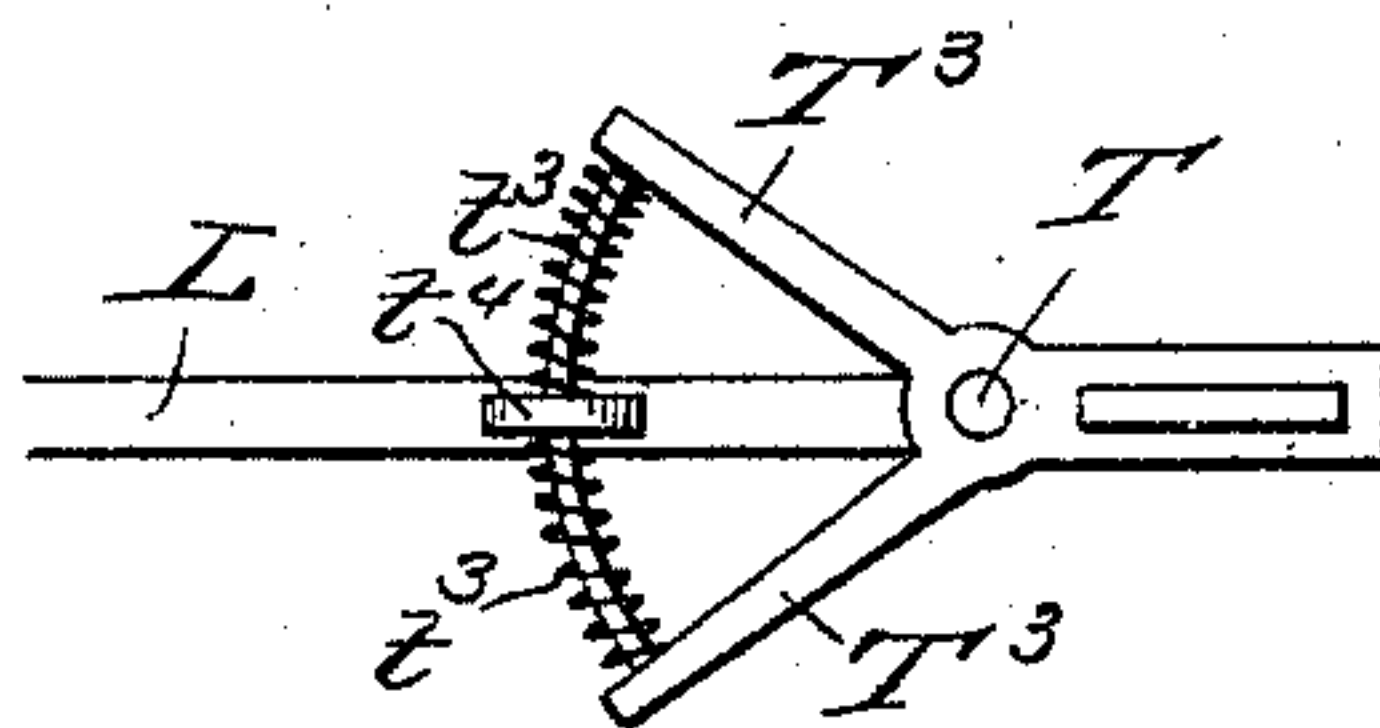
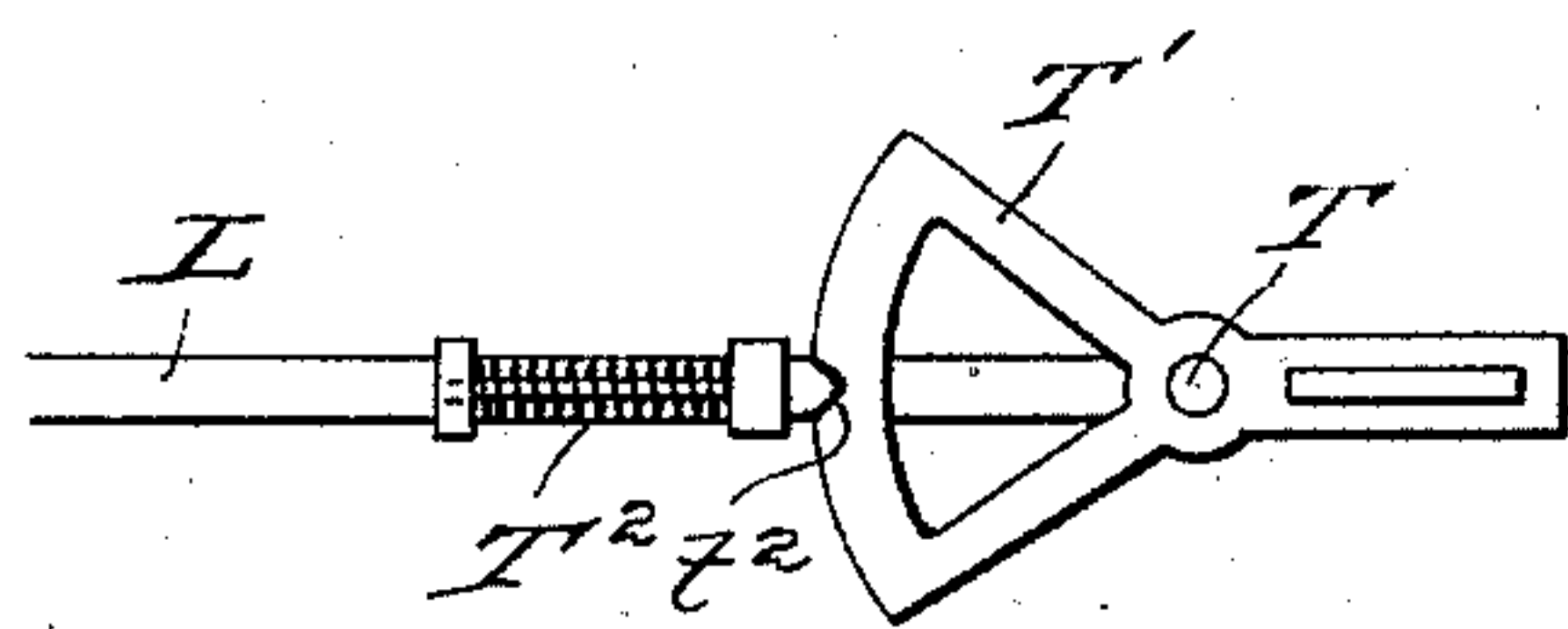
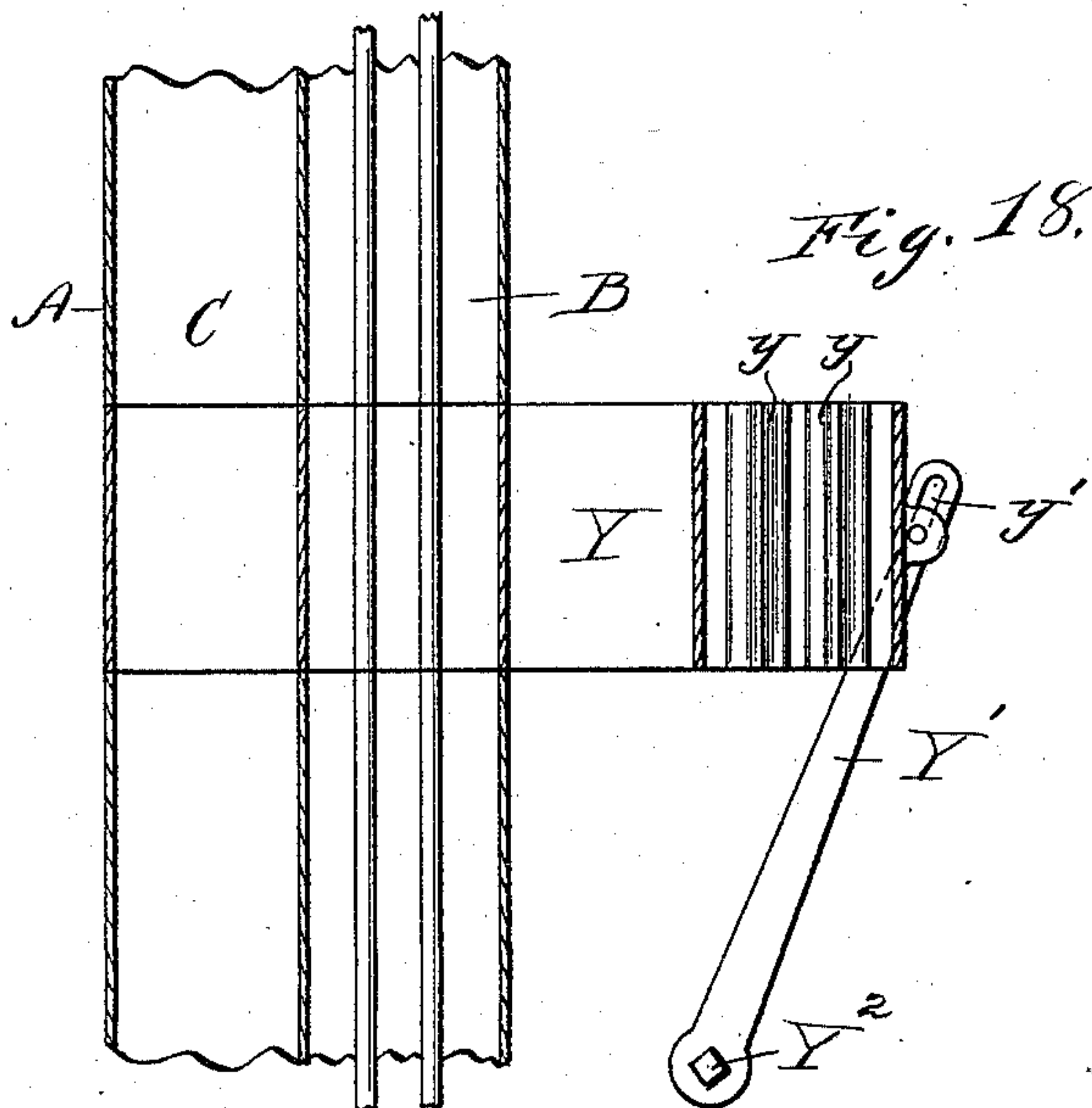
3 Sheets—Sheet 3.

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M. M. Wiles.

J. L. Lumberger Jr.

INVENTOR,

Herluf A. F. Petersen,

By John E. Wiles

ATTORNEY.

UNITED STATES PATENT OFFICE.

HERLUF A. F. PETERSEN, OF MILWAUKEE, WISCONSIN.

CLOSED-CONDUIT SYSTEM FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 540,187, dated May 28, 1895.

Application filed March 26, 1894. Serial No. 505,209. (No model.)

To all whom it may concern:

Be it known that I, HERLUF A. F. PETERSEN, a citizen of the United States, residing at Milwaukee, county of Milwaukee, State of Wisconsin, have invented a certain new and useful Improvement in Underground Conduit Systems; and I declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it pertains to make and use the same, reference being had to the accompanying drawings, which form a part of this specification.

My invention relates to new and useful improvements in underground conduit systems for electric railways and consists in the matters hereinafter described and pointed out in the appended claims.

In the accompanying drawings, illustrating my invention, Figure 1 is a view of one form of my improved conduit, showing a contact device which is carried by a car in operative engagement with the conductors in said conduit. Fig. 2 is a detail sectional view illustrating a somewhat different form of construction, in which the compartment which contains the conductors is formed from a single sheet or plate of metal bent into the desired form. Fig. 3 is a similar view, but illustrates a different form of closing device. Figs. 4, 5, and 6 are transverse vertical sectional views illustrating my improved construction as applied to existing form of underground cable-conduits. Fig. 7 is a similar view illustrating one form of my improvement as applied to underground cable-conduits in which no casing is provided for the cable-conduit, but yokes are arranged transversely within an underground passage or chamber for the support of the cable mechanism, this particular form of my improvement consisting in the arrangement of a longitudinal casing for holding the electric conductors so as to extend through the openings in said yokes. Fig. 8 is a transverse sectional view illustrating the arrangement of a movable frame as applied to the form of conduit shown in Fig. 1 for opening the conduit at a desired point for the removal of the contact devices therefrom. Fig. 9 is a detail view of a somewhat different form of the movable frame and the connected sections of the conductor. Figs. 10 and 11

illustrate a modification of the conductors designed to be located at the end of the track and arranged to permit the contact devices to be raised. Fig. 12 is a side elevation of the contact-carrier. Fig. 13 is a vertical sectional view of the same on line 13 13 of Fig. 12. Fig. 14 is a detail view of one of the removable shoes. Fig. 15 is a top plan view of a part of the carrier-arm with the contact devices. Fig. 16 is a side elevation illustrating a different form of adjusting mechanism. Fig. 17 is a transverse sectional view of one form of my improved contact carrier-arm. Fig. 18 illustrates still another form of the movable frame carrying short sections of the conductors. Figs. 19, 20, and 21 are detail views of different forms of devices for normally holding the movable end of the arm in alignment.

Referring by letter to said drawings, A designates as a whole a longitudinal casing or conduit which may be made of any desired or suitable construction either from a single casting or from a single plate or sheet of metal, bent to the required shape or form a number of sections cast so as to fit snugly together at their abutting edges.

Where I form the entire casing to be placed beneath the surface of the ground, I construct the same in any suitable manner so as to afford two longitudinal compartments or passages B C the former of which is arranged to contain the electric conductors and the latter being provided in its upper wall with a suitable slot *c* for the admission of a contact carrier, and provided at suitable intervals with connections leading to and arranged to discharge into a sewer.

The conductors D D are conveniently supported upon suitable brackets D' D' but insulated therefrom in the manner shown in the drawings, and so arranged as to expose their upper sides or edges for electrical contact with the contact shoes or analogous devices carried by the contact carrier arm.

Any suitable form of device may be employed for normally closing the compartment or passage B such for instance as either one of the forms of closure illustrated in my prior application for patent, Serial No. 490,354, filed November 8, 1893, or my prior patent, No. 516,876, granted March 20, 1894. The particular closing device illustrated in Figs. 1,

3, 6, and 7 comprises a longitudinal plate E, hinged or pivotally supported at one side as at *e* to the wall of the conduit and adapted to engage at its free edge with the upper edge of the division wall between the two compartments of the conduit, while the form of closing device illustrated in Figs. 2, 4, 5, and 8 comprises a vertically movable strip F arranged to engage at its lower edge with the upper edge of the division wall between the two compartments or passages of the conduit and engaged between suitable depending flanges secured to the casing in any convenient manner.

Both forms of closing device are adapted for engagement at their free edges by the advancing contact carrier arm so as to open as the arm passes and to close immediately after the arm has passed a certain point. In the particular form of construction shown in Fig. 1 yokes G G are arranged transversely at suitable intervals along the line of the track, these yokes being provided with central openings and the casing of the conduit is secured in any suitable manner around the sides of said openings. In the forms of construction shown in Figs. 2 and 3, the compartment B is formed by simply bending a plate or sheet of metal to the desired shape with one edge *b* arranged to extend downward past the opening into the compartment so as to form a flange to convey water which might find its way along the outside of said casing downward past the opening therein. This form of casing or compartment B might be independently secured to the yokes G in substantially the same manner as shown in Fig. 7 instead of providing a complete casing having the two compartments or passages B C. In every case, I arrange at one side of the slot, a suitable slot rail or plate provided with a depending flange, H, which extends down in such a manner within the compartment as to conduct water which may enter the slot *c* past the opening leading into the compartment B.

In the forms of conduits shown in Figs. 4, 5 and 6, I have illustrated my improvement as adapted to existing forms of cable conduit by simply securing to one wall of the main conduit, a suitably shaped partition I, provided upon its upper side with the supporting brackets D' D' upon which the insulated conductors are held. In the particular construction illustrated in Fig. 4, the vertically movable closing device F is secured to the oblique wall of the conduit itself, and in the particular form shown in Fig. 5, said closing device is secured to the under side of the oblique wall H, while in the form shown in Fig. 6, the closing device E is secured by suitable hinges to the inside of the main casing A, and is arranged to normally rest at its free edge upon the upper edge of the division wall I.

As shown in Figs. 1, 4, 5 and 6, I arrange at suitable intervals in the lower side of the compartment C, suitable pipes C' C' which are arranged to discharge in any desired manner

into a sewer. Furthermore, if desired, I may provide in the lower part of the compartment B at suitable intervals along the line of the conduit, discharge spouts or connections *b b*, which may if desired be provided with traps or valves, arranged to permit a free downward passage of water therethrough, but to prevent any upward passage of water into said compartment.

In the particular form of construction illustrated in Fig. 7, my improvement is adapted for use in connection with underground cable conduit systems such as are in use in some cities, in which a passage or tunnel is formed beneath the surface of the street and transverse yokes J J extend across said passage or tunnel beneath the slot *c*, for supporting the rope carrying pulleys, and in this form of my device I simply provide a casing K which is suitably shaped to form the compartment B, and arranged to conform at its outside to the contour of the openings in the yokes J J within which said casing is secured. In this form of device the chamber or passage beneath the street takes the place of the compartment C of my other forms of construction.

The contact carrier arm L may be of any desired or convenient shape to enable it to extend downwardly through the slot and laterally so as to enter the compartment B. In the particular construction illustrated in the drawings, I have shown the contact carrier arm L as movably supported beneath the car, and adapted to be raised or lowered about its support so as to remove the arm from the conduit or place it in engagement with the conductors therein.

In order to permit the ready removal of the contact carrier arm from the conduit, it becomes necessary that at certain points along the line of the conduit suitable movable covers or sections may be provided for opening the conduit so as to enable the arm with the contact devices carried thereby to be lifted bodily from the conduit. To this end I may provide simply removable manhole covers if desired, by the removal of which that part of the conduit in which the contact carrier with its contact devices travels, may be opened, or I may provide means similar to those shown in Figs. 8 and 9.

The particular form of device shown in Fig. 8 comprises a suitable section M at one side of the conduit pivoted at *m* and adapted to be thrown back in the position indicated in the dotted line. An arm M' extends horizontally from the lower end of this pivoted section, and is provided with supporting brackets *m' m'* in which are supported suitable insulated sections N N of the conductors, which are moved by the movement of the pivoted section M out of line of the contact devices, and into the position indicated by the dotted lines in Fig. 8, so that when the contact devices reach this point in the conduit they will be freed from engagement with the conductors proper. I prefer to provide at this point in the

line of the conduit suitable concave conductor sections O O, which are arranged to take the places of the movable sections N N of the conductors proper, as indicated by the dotted lines in Fig. 8 and these concave conductor sections O O are arranged upon suitable supporting brackets o o, carried at the free end of a pivoted arm O' and arranged to be simultaneously moved into the position shown by the dotted lines as the pivoted section M of the conduit or casing is moved back. I also prefer to provide a suitable arm P which is secured to the lower part of the pivoted section m and arranged to extend downward in the manner shown in the drawings and to engage with a suitable cross-piece or plate p upon the end of the arm O', as shown so that as the pivoted section M is thrown back to the position shown in the dotted lines, this arm P will serve to elevate the free end of the arm O' with the sections O O thereon into position for permitting the engagement of the contact shoes with said concave sections O O. I also find it convenient to provide an angularly projecting bail or loop P' at the side of a cross piece p which is engaged by the arm P toward the completion of its movement and by means of which the pivoted arm O' with the conducting sections O O is sustained in operative position. The contact shoes are preferably made of such shape as to embrace the conductors during the longitudinal movement of the contact devices along the conduit and under ordinary circumstances the contact devices will pass freely along the upper sides of the conductors, and the movable sections N N the arrangement of the shoes to embrace the conductors serving to retain the shoes in engagement with the conductors throughout the entire length of the latter and preventing the accidental displacement of said shoes.

When it is desired to remove the contact carrier from the conduit, one of the movable sections M is thrown back to the position indicated in the dotted lines, thereby bringing the concave conductor sections O O into position for engagement with the contact shoes when said shoes will obviously be freed, so as to enable them to be readily lifted, from the conduit.

In Fig. 9, I have shown a slightly different form of construction, in which a section Q of the conduit is pivotally supported as at q and provided with a horizontally extending arm Q' upon which conductor sections N N are supported as before, and with a downwardly extending arm Q² upon which are suitably supported concave conductor sections O O in the manner before described. By this construction, the movable section Q may be readily swung upon its pivotal support q so as to carry the movable sections N N of the conductors out of the line of the contact devices and to bring the concave conductor sections O O into a corresponding position. These concave conductor sections may be of any de-

sired or convenient form, either such as shown in Fig. 8 or in Fig. 9 or as an additional precaution against lateral movement of the contact devices, suitable central ribs o' o' may be provided in the manner shown in Figs. 10 and 11 for engagement with the inner faces of the shoes.

As shown in Figs. 12, 13, 15 and 16, I prefer to provide suitable means upon the contact carrier arm for permitting a lateral movement of the arm in either direction, or a vertical up or down movement thereof, or for permitting the portion of the arm with which the contact shoes are directly connected to have an independent lateral movement of its own so as to enable the contact carrier arm and the contact devices thereon to automatically adjust themselves to the position of the conductors and the slot in the conduit as the car goes around curves or turns in the track, and to this end I prefer to provide substantially the form of supports for the carrier arm as are shown in said figures of the drawings. In this form of construction I provide suitable hangers S S which are arranged to extend downwardly for a suitable distance beneath the truck and a cross piece S' is movably engaged with said hangers and yieldingly supported thereon by springs s s, while the arm L has a laterally movable engagement with said cross piece, and springs s' s' are engaged with opposite sides of the arm L and serve to normally hold said arm centrally between the hangers S S.

As shown more particularly in Figs. 13, 15, and 16, the part of the arm to which the contact shoes are directly connected, is movably engaged with the main part of the arm, by a suitable hinge T, so as to enable this part of the arm to swing upon the main part of the arm L in an obvious manner.

As shown more particularly in Fig. 14, I prefer to provide suitable sockets R R, with which the shanks of the contact shoes R' R' may be removably engaged by means of set screws r' r', so as to enable the contact shoes to be readily removed and replaced by new ones when they become worn.

The sockets R R for the shanks of the contact shoes R' R' will of course be insulated from the supporting cross-piece R². The cross-piece R² may be supported in any suitable or desired manner from the end of the carrier arm as for instance in the manner shown in Figs. 12 and 13 of the drawings, in which a vertical supporting pin or post t is provided upon the upper side of said cross-piece R² and arranged in a bearing in the end of the arm L, and a spring t' is arranged to normally hold said cross-piece down, but to permit a vertical upward yielding of said cross piece in an obvious manner.

By the described construction of the contact carrier arm with its connections, it will be seen that ample provision is made for a free movement of said arm in any direction and also for the free movement of the contact

shoes upon the conductors so as to enable the shoes to follow any unevenness in the conductors without danger of straining any of the parts, or of breaking the contact between the shoes and the conductors.

It may be necessary under some circumstances to effect a slight longitudinal adjustment upon the conductors in order to move the same off from insulated joints in the conductors in case the car has stopped with the shoes resting on such joints, so as to enable current to pass from the charged conductors to the motor and to this end, I may provide any desired form of adjusting devices.

In Fig. 12 of the drawings, I have illustrated one form of adjusting devices, the same consisting of a lever U, pivoted upon the platform of the car and arranged to project somewhat below the level of the platform and operatively connected by means of a pitman *u* with a movable part L' of the carrier arm which part L' is arranged within a suitable yoke at the end of the main part of the arm in which is provided suitable slots *l* for permitting a longitudinal movement of the part L' of the arm by adjusting the lever U in an obvious manner. The movable part L' of the carrier arm may be adjusted sufficiently to move the shoes R' R' upon the conductors so as to bring said shoes into electrical contact with a charged portion of the conductors. If desired however, the entire arm may be arranged to be adjusted longitudinally as in the form of construction illustrated in Fig. 16. In this particular form of construction, the arm has a slotted engagement at its lower end with a bracket V supported upon the hangers S S, and another slotted engagement at its upper end with a suitable hanger V'. A lever W is pivotally supported upon the platform of the car and extends somewhat below the lower side of the platform and has a slotted engagement as at *w* with the arm L whereby an adjustment of said lever upon its pivotal support will effect a longitudinal adjustment of the arm L together with the contact shoes carried thereby.

As shown more particularly in Figs. 12 and 16 of the drawings, I prefer to provide another lever L², upon the upper end of the arm L which lever is adapted for operation to elevate the rear end of the carrier arm with the contact devices thereon. By the operation of the lever L² the arm L with the contact devices may be adjusted in an obvious manner so as to lift the rear end of said arm out of the conduit and by the arrangement of the vertical hangers S S with which said arm is engaged by means of the cross-piece, S' a rectilinear movement of the rear end of the arm will be insured while by the slotted engagement between the front end of the arm and the hanger V' the arm will be permitted to move longitudinally to some extent upon said pivotal connection in an obvious manner.

The connections between the contact devices and the motor may be established in

any suitable manner such for instance as illustrated in my prior patent aforesaid, in which the wires are carried along the arm in grooves at the side of the arm, or as shown in Fig. 17 of the drawings, the arm may be made hollow conveniently in two sections fitted together, and the conductors X X arranged to extend upwardly through the hollow of the arm, being of course surrounded by suitable insulating material as shown. In thus arranging the conductors to extend through the interior of the arm, it will be preferable to make the conductors flat instead of round, so as to take up as little space as possible, and avoid any unnecessary thickening of the arm.

Instead of the adjusting mechanism for moving the short sections of the conductors shown in Figs. 8 and 9 of the drawings, I may if desired, employ substantially the form of construction employed in Fig. 18, in which a transversely movable frame Y is provided at one side of the conduit and is arranged to normally support short sections of the conductors in line with the main conductors, as shown in the drawings. Suitable concave sections *y y* of the conductors are located upon said frame, as shown in the drawings and the frame has an operative engagement as at *y'* with a suitable lever mechanism Y' which may be operated in any suitable or desired manner, the particular form shown in the drawings being provided with an angular head Y² adjacent to its pivotal support for engagement with a wrench or lever.

The particular construction illustrated in Figs. 10 and 11, is designed more particularly for use at the end of the track, where it becomes necessary to remove the contact devices and in such locations the sections O² O² of the conductors will be permanently secured in position in line with the main conductors, so as to permit the contact devices to pass into engagement with the upper faces of said sections O² O² when they may be readily lifted out of contact therewith as before described.

I may employ in connection with the two-part carrier arm suitable means for normally holding the rear end of the arm in alignment so as to normally hold the shoes carried thereby in proper engagement with the conductors. The particular device illustrated in Fig. 19 comprises arms T' T' secured to the pivoted rear end of the arm, and provided with a connecting arc-shaped connecting piece, provided with a central notch *t*², with which notch a spring bolt or detent D² is arranged to normally engage. By this arrangement, the two parts of the arm will be normally held in alignment but in case of an unusual strain upon the movable part of the arm, said movable part will be permitted to yield upon its support so as to prevent breakage or undue strain upon any of the parts. In the form shown in Fig. 20, arms T³ T³ are secured as before to the pivoted part of the arm and are connected together by an arc shaped rod upon which are located springs *t*³ *t*³ arranged to engage at

their adjacent ends with a central stop or shoulder ^t upon the main part of the arm. Instead of either of these forms of devices, the particular form shown in Fig. 21 may be employed in which the pivotal support T for the movable part of the arm is made of considerable diameter and provided in one side with a notch ² with which a spring plug or detent T² is arranged to engage as in the device shown in Fig. 19. The operation of either of these forms of construction, is substantially the same in that the movable part of the arm is permitted to yield without breaking or straining any of the parts.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent of the United States, is—

1. The combination with an underground conduit for electric railways and conductors arranged to extend lengthwise therethrough, of a section or cover at one side of the conduit, supported upon suitable pivotal connections and carrying short sections of the conductors and adapted to be swung back into a position to simultaneously open the conduit for the removal of the contact devices and move said short sections of the conductors out of the line of movement of the contact devices, substantially as described.

2. The combination with an underground conduit for electric railways and the contained conductors of a section or cover at one side of the conduit, supported upon suitable pivotal connections and carrying short conductor sections normally in line with the main conductors, and adapted to be swung back into position to simultaneously open the conduit casing for the removal of contact devices and carry said conductor sections out of the line of movement of said contact devices, and other conductor sections, carried by said movable part and adapted to be moved by the adjustment of the latter, into line with the main conductors, substantially as described.

3. The combination with the conduit casing the contained conductors and contact devices carried by a car and adapted to normally embrace the conductors, of a movable section pivotally supported at one side of the conduit casing, and provided with a lateral arm, carrying short conductor sections normally in line with the main conductors, and having operative engagement with a suitable support carrying concave conductor sections, said movable part being adapted to be swung upon its pivotal supports so as to simultaneously open the conduit, remove the short conductor sections from the line of the main conductors and move the concave conductor sections into line with said main conductors substantially as and for the purpose described.

4. The combination with an underground conduit and its contained conductors, of a contact carrier arm, movably supported upon a car, and arranged to extend through a slot in the conduit casing and carrying at its free end a pair of contact shoes for engagement

with said conductors, and suitable spring connections between said contact carrier arm and the car for permitting lateral and up and down movements of said arm, while said shoes are in engagement with the conductors, and a spring connection between said contact shoes and said arm, substantially as described.

5. The combination with an underground conduit and the contained conductors of a contact carrier arm arranged to normally extend into said conduit and carrying contact shoes for engagement with said conductors, a universally adjustable spring connection between said arm and its support upon the car, and a lever extending above the platform of the car and operatively engaged with said arm and adapted for operation to elevate the rear end of said arm, so as to raise the shoes out of engagement with the conductors, substantially as described.

6. The combination with an underground conduit and its contained conductors of a contact carrier arm arranged to normally extend into said conduit and carrying contact shoes for engagement with said conductors, a movable connection between the upper end of the arm and its support upon a car and hangers supported beneath the car and having spring connections with said arm for permitting vertical and lateral movements of said arm substantially as described.

7. The combination with an underground conduit and its contained conductors of a contact carrier arm arranged to normally extend into said conduit and carrying contact shoes for engagement with said conductors, spring supports at the free end of said arm for the contact shoes and hangers beneath the car having spring connections with said arm and arranged so as to permit a vertical or lateral yielding movement of said arm, substantially as described.

8. The combination with the contact carrier arm having a universally movable spring support beneath a car, and carrying shoes at its free end for electrical engagement with the conductors, of suitable means movably engaged with said arm and adapted for operation from the platform of the car so as to adjust said arm longitudinally, substantially as described.

9. The combination with the two-part contact carrier arm having a universally movable spring support beneath a car of a pivoted lever secured to a support upon the car platform and operatively connected with the part of the carrier arm with which the contact shoes are directly engaged and adapted for operation to adjust said part of the carrier arm longitudinally, substantially as and for the purpose described.

10. The combination with the contact carrier arm, adapted to extend into an underground conduit and provided with contact shoes for electrical engagement with the conductors within said conduit, suitable means for raising and lowering said arm, suitable

means for permitting lateral or up and down movement of said arm, and other means having operative connections with said arm and adapted to adjust the same longitudinally so as to shift the positions of the contact shoes upon the conductors, substantially as described.

11. The combination with an underground conduit for electric railways and its contained conductor, of a movable frame located at one side of the conduit and carrying short sections of the conductors normally in line with the main conductors, and also carrying other short conductor sections and suitable means operatively connected with said frame and adapted to be operated to adjust the same so as to carry said first-mentioned conductor sections out of line and to simultaneously move said other conductor sections into line with the main conductors, substantially as described.

12. The combination with an underground conduit for electric railways and its contained conductors of a movable frame located at one side of the conduit, and carrying short conductor sections normally in line with the main conductors and also carrying short conductor sections concave upon their upper sides, and

suitable lever mechanism having operative connection with said movable frame, for adjusting the same, so as to simultaneously move the first mentioned conductor sections out of line and the concave conductor sections into line with the main conductors, substantially as described.

13. The combination with the two-part carrier arm, the main part being adjustably supported upon a car, and the other part being movably engaged with the lower end thereof, by means of a vertical pivot, and carrying contact shoes for engagement with the conductors, of an arc-shaped piece upon the movable part of the arm, and spring-controlled mechanism upon the main part of the arm adapted for operative engagement with said arc-shaped piece, so as to normally hold the two parts of the arm in alignment, but to permit said movable part to yield laterally when under strain, substantially as described.

In testimony whereof I sign this specification in the presence of two witnesses.

HERLUF A. F. PETERSEN.

Witnesses:

JOHN E. WILES,
M. M. WILES.