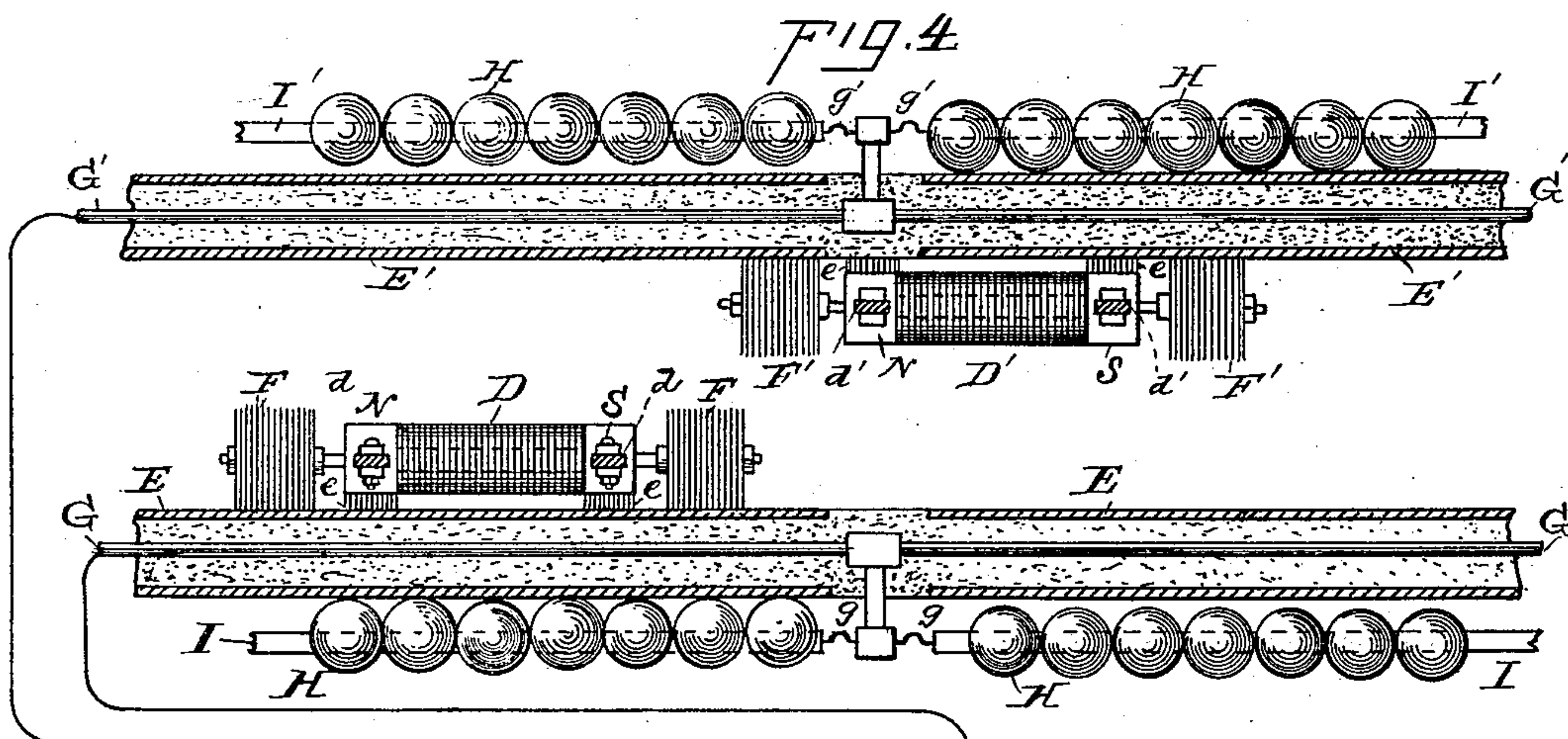
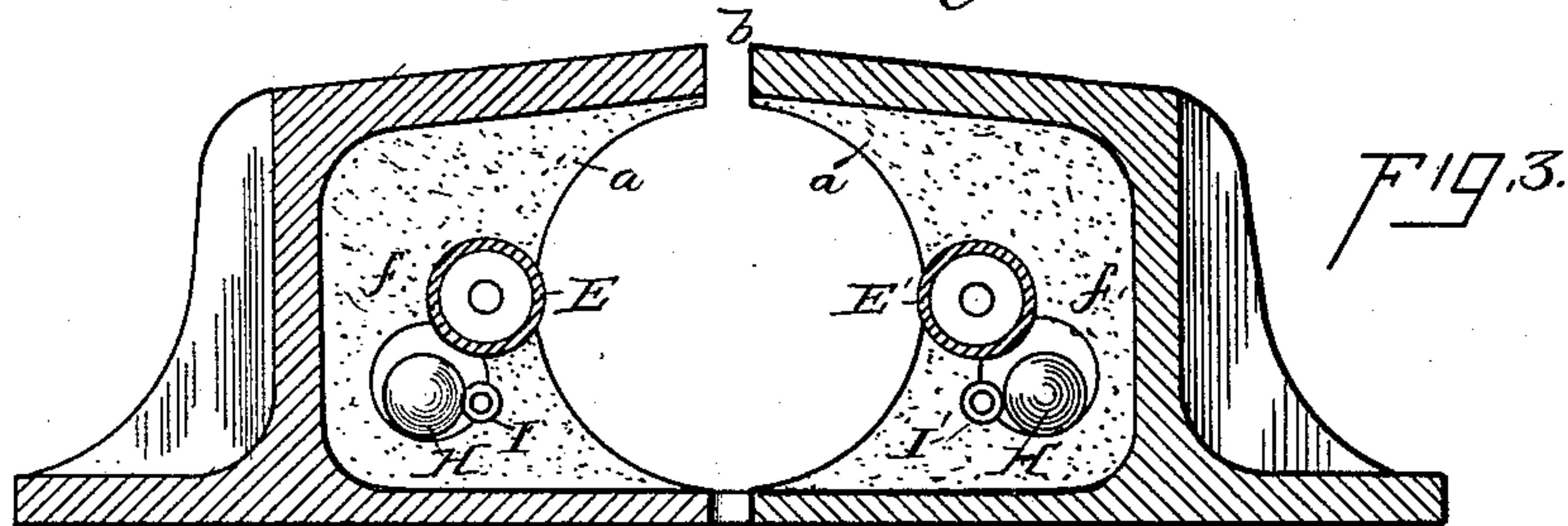
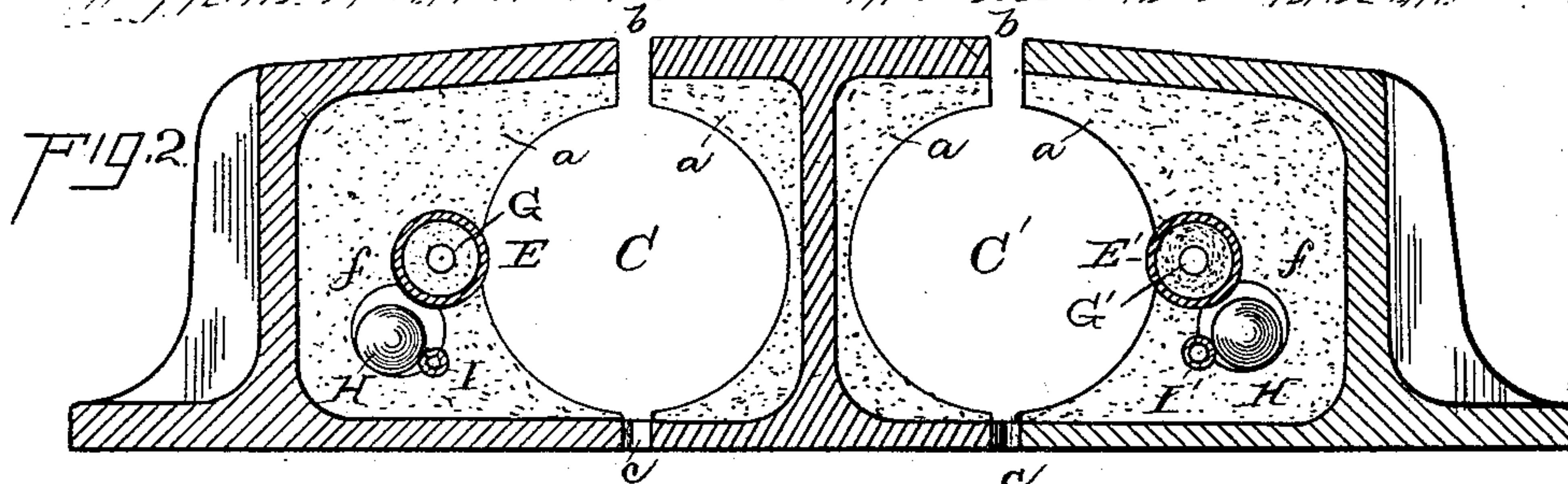
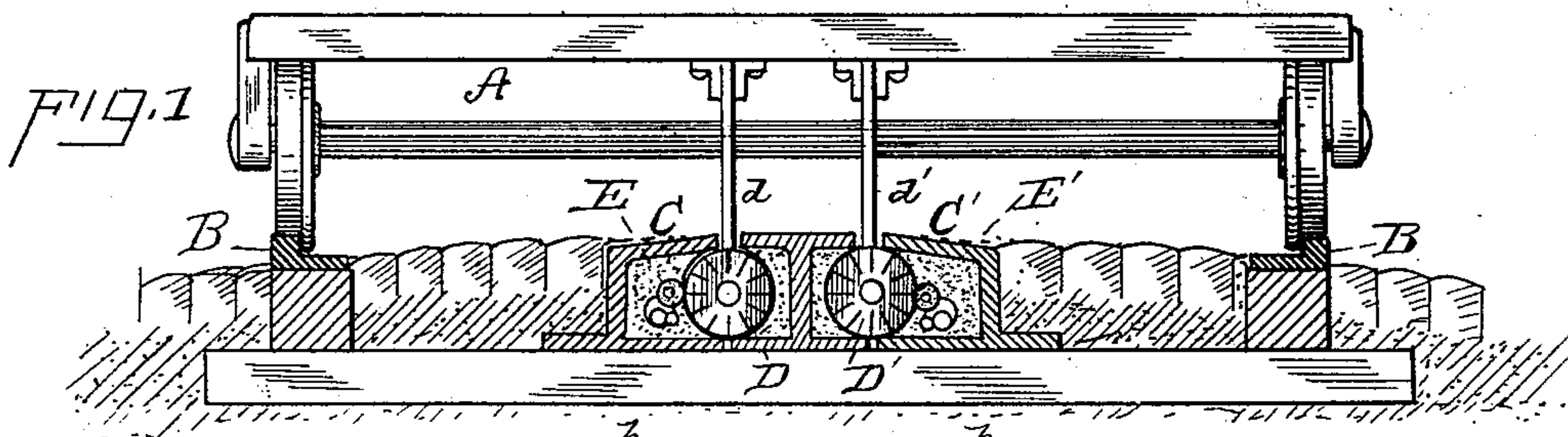


(No Model.)

E. H. JOHNSON.  
CLOSED CONDUIT FOR ELECTRIC RAILWAYS.

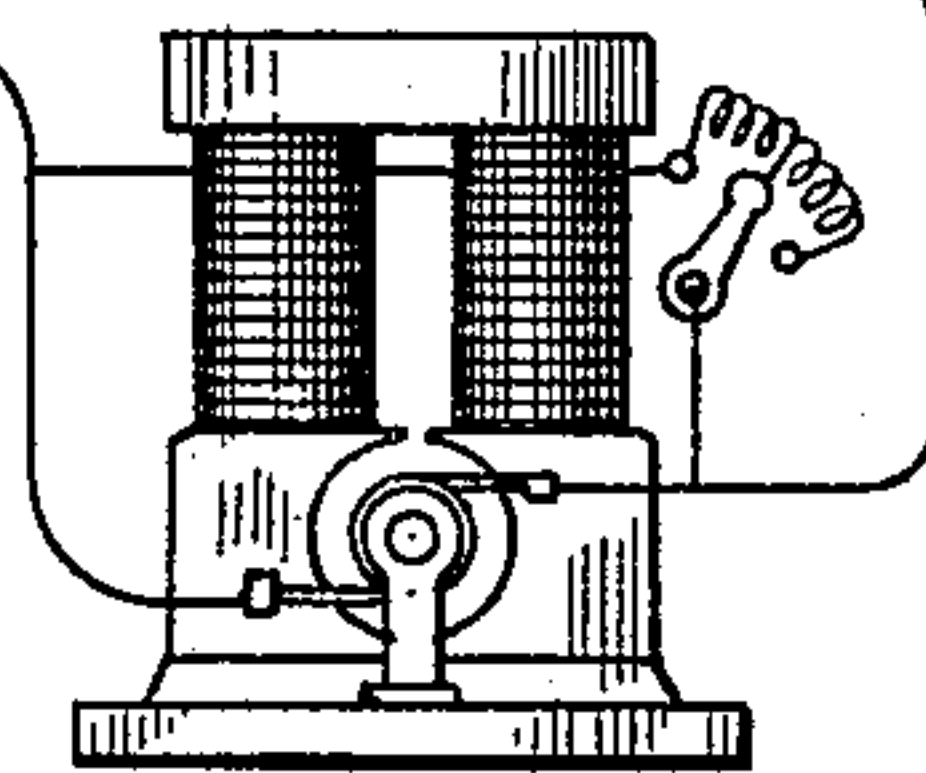
No. 479,809.

Patented Aug. 2, 1892.



ATTEST:  
E. H. Johnson,  
Inventor

FIG. 5  
H



INVENTOR.  
Edward H. Johnson,  
By S. J. & S. L. S. Attys.



# UNITED STATES PATENT OFFICE.

EDWARD H. JOHNSON, OF NEW YORK, N. Y., ASSIGNOR TO THE SPRAGUE  
ELECTRIC RAILWAY AND MOTOR COMPANY, OF SAME PLACE.

## CLOSED CONDUIT FOR ELECTRIC RAILWAYS.

SPECIFICATION forming part of Letters Patent No. 479,809, dated August 2, 1892.

Application filed February 10, 1887. Serial No. 227,139. (No model.)

*To all whom it may concern:*

Be it known that I, EDWARD H. JOHNSON, of New York city, in the county and State of New York, have invented a certain new and useful Improvement in Electric Railways, of which the following is a specification.

The object I have in view is to produce an arrangement, construction, and combination of the main and working conductors, the traveling contacts, and other parts associated therewith in the constitution of an electric railway, whereby leakages of the current and the various ills arising therefrom will be to a great extent eliminated and a simple, efficient, and durable apparatus will be produced, making the application of electricity to the propulsion of cars upon the surface railways of cities and towns entirely feasible.

My invention consists in the use of separate conduits for the working conductors, in means whereby the working conductors can be divided into short sections, upon each of which there will be no current except as a car is passing over it, in a peculiar arrangement of the main and working conductors, in the peculiar construction of the contact-carriers, and in various combinations of parts and details of construction and arrangement, all as more fully hereinafter explained, and pointed out by the claims.

In the accompanying drawings, forming a part hereof, Figure 1 is a sectional view showing the employment of separate conduits for the working conductors; Fig. 2, a sectional view, on a larger scale, of the two conduits; Fig. 3, a view similar to Fig. 2, showing both working conductors in one conduit; Fig. 4, a view, partly in diagram, illustrating the connections of the several sets of conductors; and Fig. 5, a sectional view of one of the magnetic balls used in the apparatus.

The car (represented at A) travels upon the rails B, between which and resting upon the ties are the two conduits C C'. Each is an iron box made in sections and filled with concrete  $\alpha$ , having a continuous slot  $b$  at the top, as usual, and at the bottom lugs  $c$  at intervals on the opposite parts to keep the sides of the conduit the proper distance apart and at the same time to permit the escape of water and dirt from the conduit. Contact-carriers D D'

travel one in each conduit, making contact with the working conductors E E', one of which is also supported in each conduit. From the carriers D D' arms  $d d'$  extend upwardly through the slots  $b$  to the car. By having separate conduits for the working conductors leakages between such conductors, due to water in the conduits or from other causes, and short-circuits through the contact-carriers are in a great measure avoided. The conduits, whether one is used or two are employed, are preferably on their interior of circular or other rounded form in cross-section. The contact-carriers have a central body carrying contact-brushes  $e$ , while beyond such brushes the carriers terminate in plungers F F', which completely fill the conduit, and are made of any suitable flexible insulating material, such as wood splints; but it is evident that when there is a separate conduit for each working conductor the plunger may be composed of iron wires. They serve principally to guide the contact-carrier in the conduit, keeping it central therein, and they also keep the conduit clear.

The working conductors E E' are iron pipes embedded in the concrete  $\alpha$  and projecting into the conduit, the exposed surfaces being rubbed by the contact-brushes. The main conductors G G' are copper rods inclosed within the pipes E E' and insulated therefrom. This arrangement of the main conductors within the working conductor is an exceedingly compact and simple one and furnishes a good protection and insulation for such main conductors.

Beneath each working conductor and running parallel therewith is a chamber  $f$  in the concrete, in which are located iron balls or rollers H. These rest normally on the bottom of the chamber  $f$  and against a conductor I or I', which may be an iron pipe, but just out of contact with the working conductor. The chamber  $f$  is filled with the balls H and runs the length of each section of the conduit, at the ends of which it is closed airtight. The working conductors terminate at the ends of the sections. Between the sections of the conduit and of the working conductors the main conductors, which are continuous, are connected with the auxiliary



main conductors I I' through safety-catches *g g'*, so that such conductors I I' are constantly connected with the main conductors when the safety-catches are intact.

5 The contact-carriers D D' are composed each of a horizontal electro-magnet, and the contact-brushes *e* project from the poles N S of such magnet, between which poles the magnet-winding is carried, as shown. The contact-brushes *e* are preferably of iron, and the  
10 electro-magnetic contact-carrier magnetizes the sections of the iron-pipe working conductor E or E' as it passes over them. As each section of the working conductor becomes magnetic, it attracts the iron balls H,  
15 which roll up against it, connecting that section with the conductor I or I', and thence with the working conductor G or G', and thus completing the circuit to the contact-carrier.  
20 In this way the sections of the working conductor are brought successively into circuit, and since this connection is made at every point it will be seen that the sections of the working conductor can be made as short as  
25 desired.

In Fig. 4 the contact-carriers are shown separated laterally as they would be when two conduits are used; but if one conduit is used the two contact-carriers would be placed one  
30 in advance of the other.

The iron balls H are cast hollow, as shown in Fig. 5, to make them as light as possible. They may be electroplated with copper, as may also the pipes E E' and I I' where the  
35 balls touch them in order to make better contact.

What I claim is—

1. In an electric railway, the combination, with a car, of two contact-carriers carried  
40 thereby, two separate conduits in which such carriers travel, and a working conductor in each of such conduits, substantially as set forth.

2. In an electric railway, the combination,  
45 with the working conductors normally dis-

connected from the source of electrical energy, of iron balls or rollers and a magnet on the car moving such balls or rollers by magnetic attraction into position to connect the working conductors in circuit as it passes over  
50 them, substantially as set forth.

3. In an electric railway, the combination, with the working conductors, of the main conductors, the auxiliary main conductors, and the magnetic balls, substantially as set forth. 55

4. In an electric railway, the combination, with the working conductors, of the main conductors, the auxiliary main conductors connected with the main conductors through safety-catches, and the magnetic balls, sub-  
60 stantially as set forth.

5. In an electric railway, the combination, with a hollow working conductor, of a main conductor inclosed thereby, substantially as  
65 set forth.

6. In an electric railway, the combination, with a hollow sectional working conductor, of a continuous main conductor inclosed thereby, substantially as set forth.

7. In an electric railway, the combination, 70 with a conduit, of a contact-carrier traveling therein and plungers of insulating material forming part of such carrier, said plungers bearing on all sides in the conduit and keeping the carrier central therein, substantially  
75 as set forth.

8. In an electric railway, the combination, with the conduit and the working conductors, of the electro-magnetic contact-carriers having contact-brushes bearing on such working  
80 conductors and the plungers maintaining the central position of such contact-carriers, substantially as set forth.

This specification signed and witnessed this 9th day of February, 1887.

EDWARD H. JOHNSON.

Witnesses:

WM. PELZER,  
E. C. ROWLAND.