(No Model.)

F. VON HEFNER-ALTENECK.

RAIL CIRCUIT CLOSING CONTACT.

No. 495,674. Patented Apr. 18, 1893.

Fig: 1.

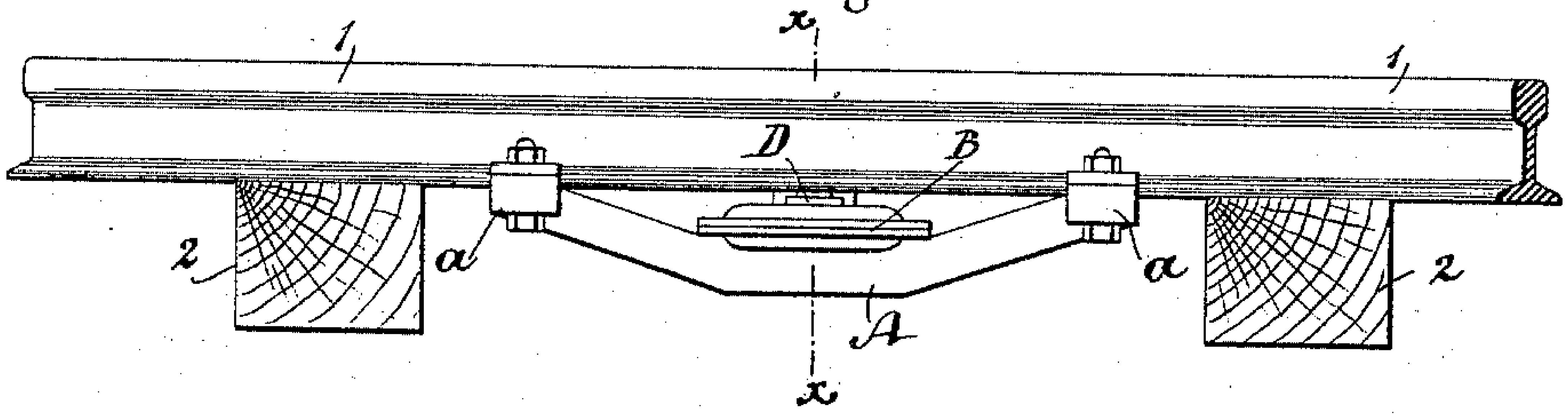


Fig: 2.

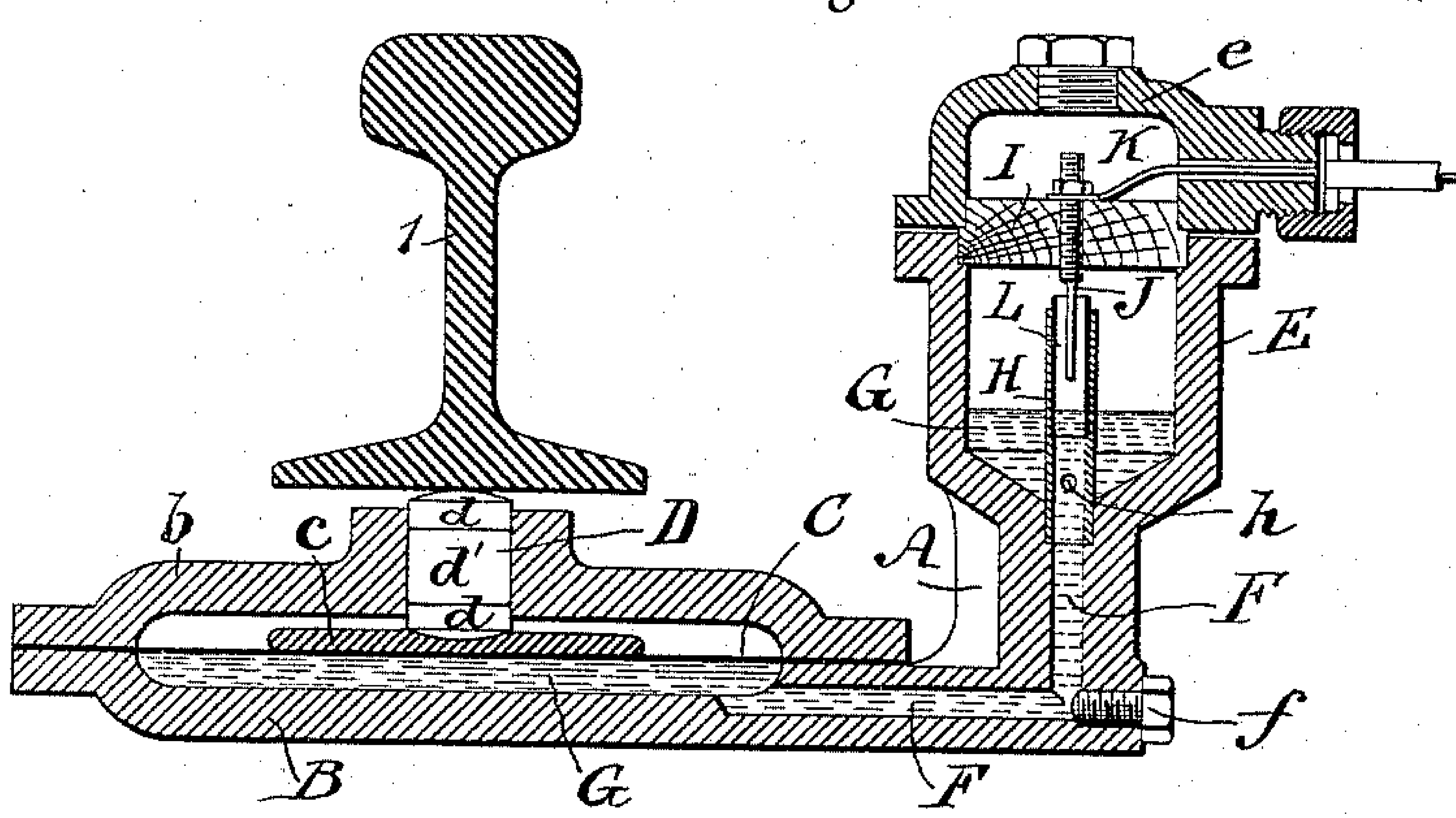


Fig: 3.

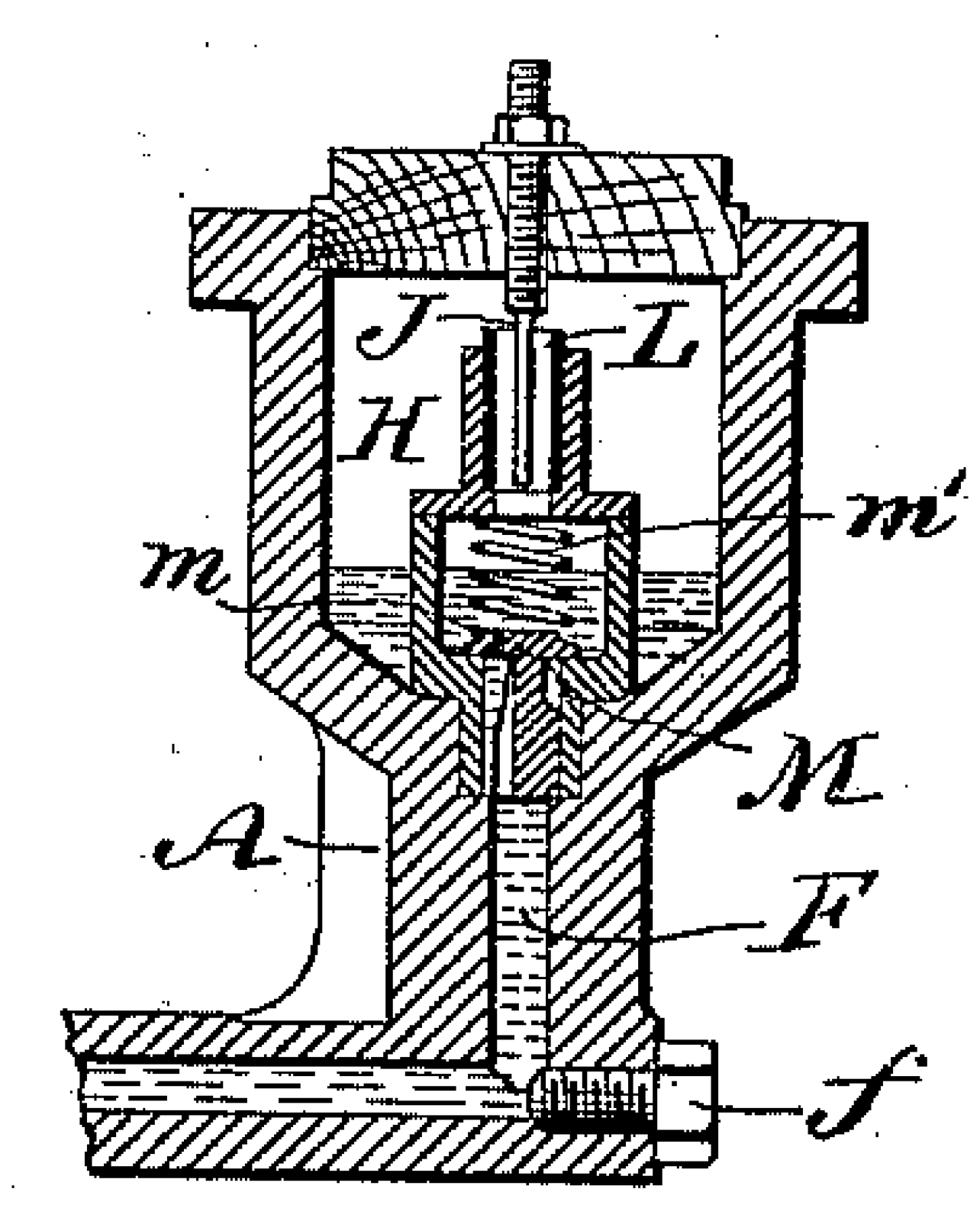


Fig: 4.

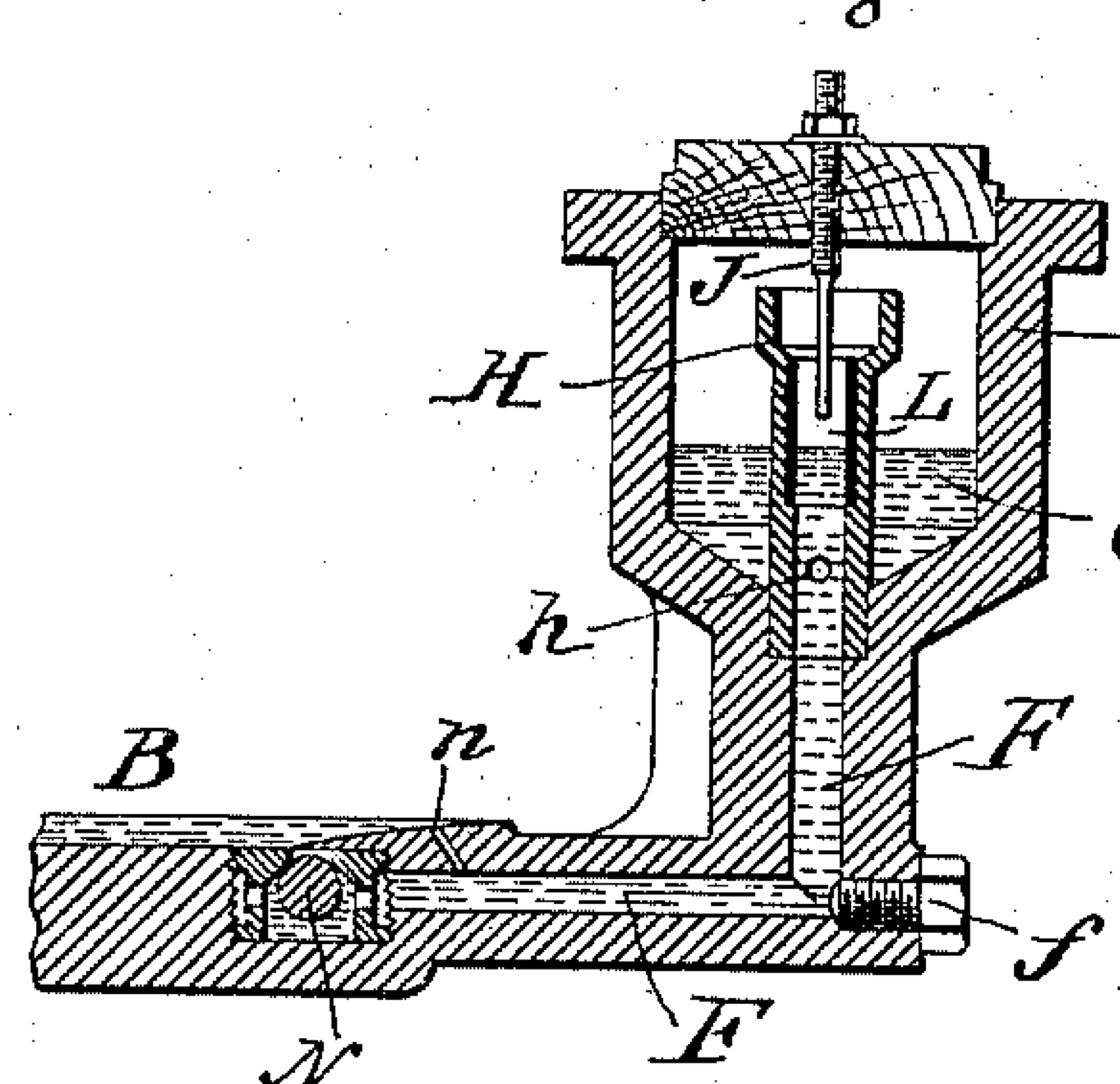


Fig: 5.

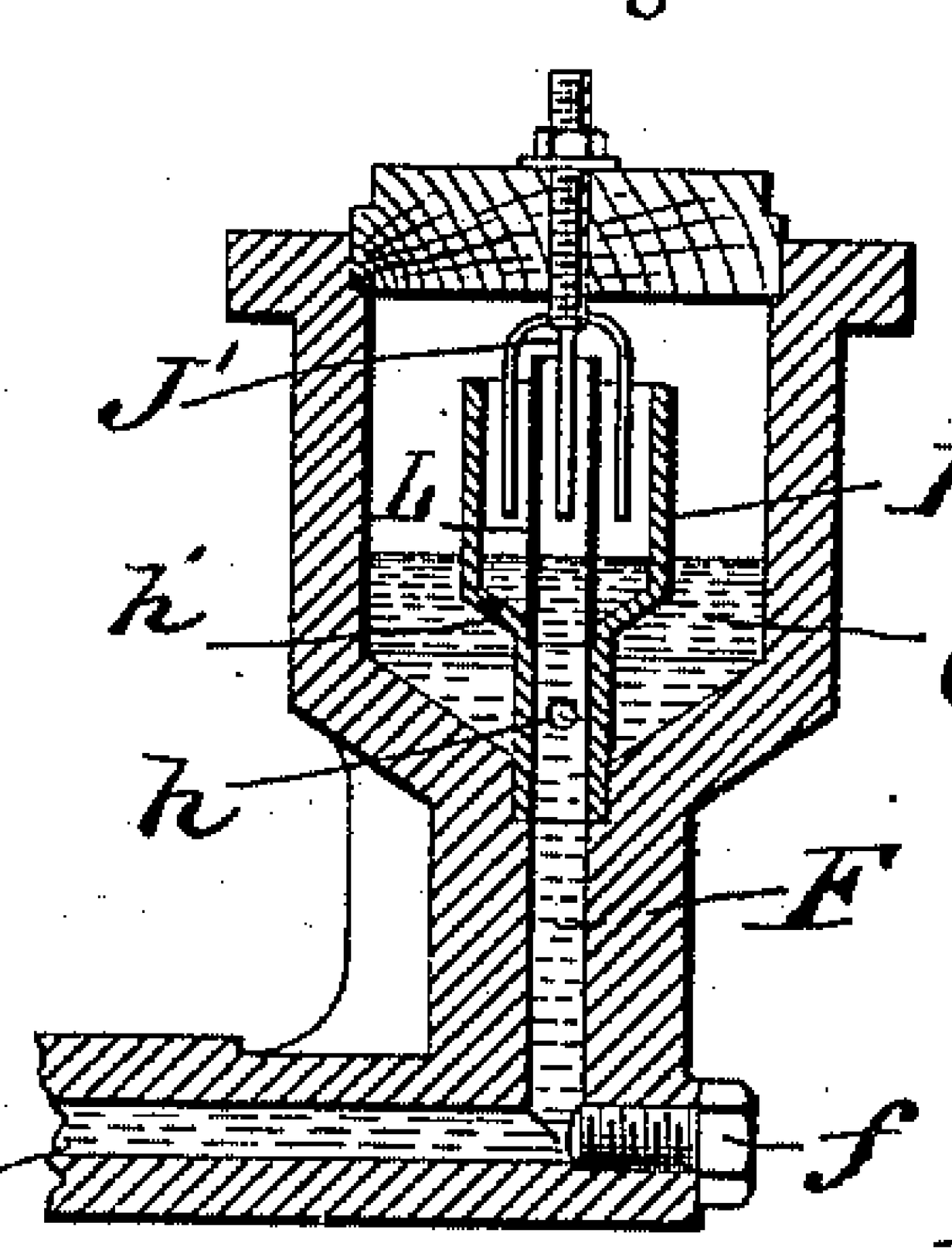


Fig: 6.

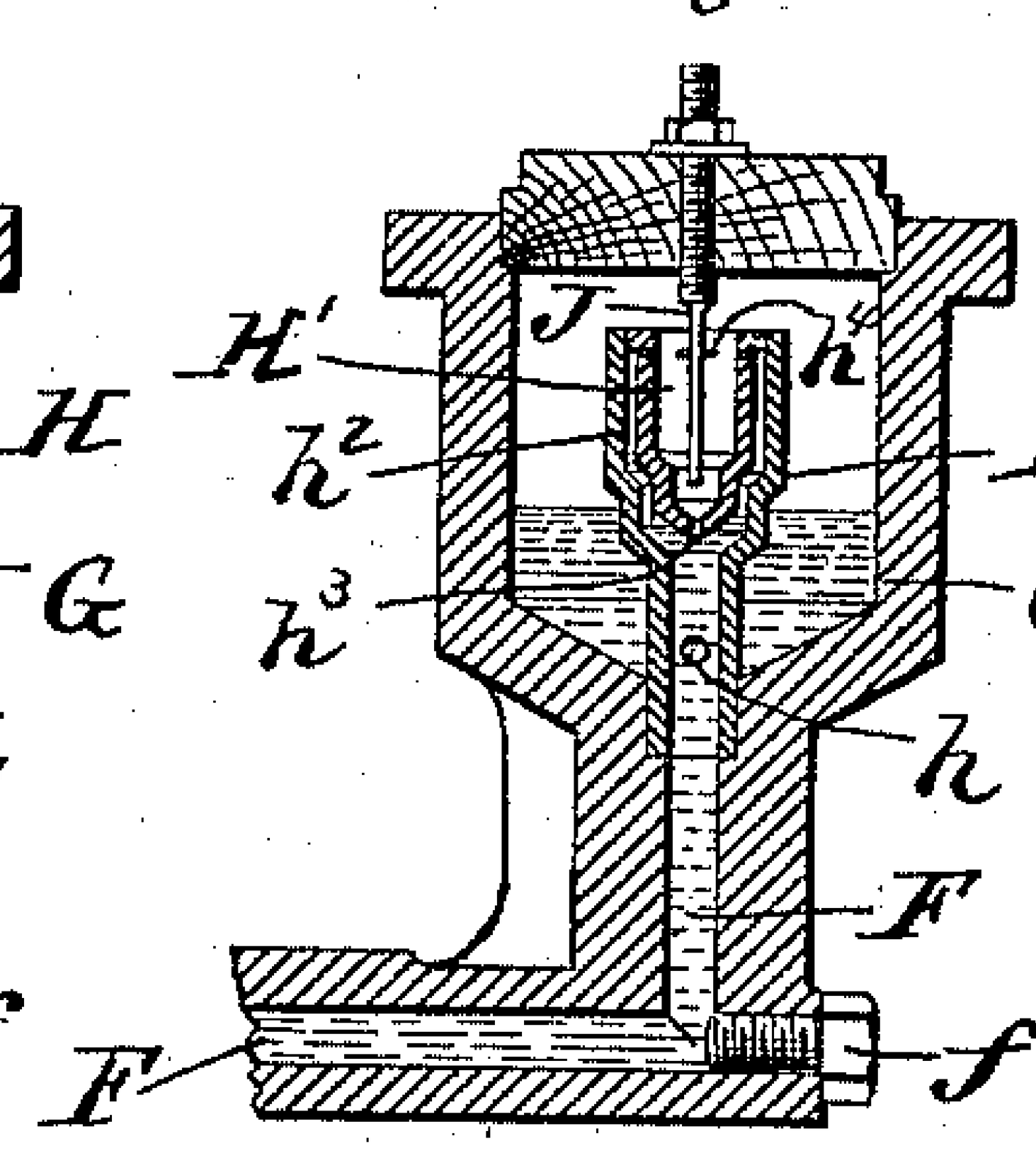
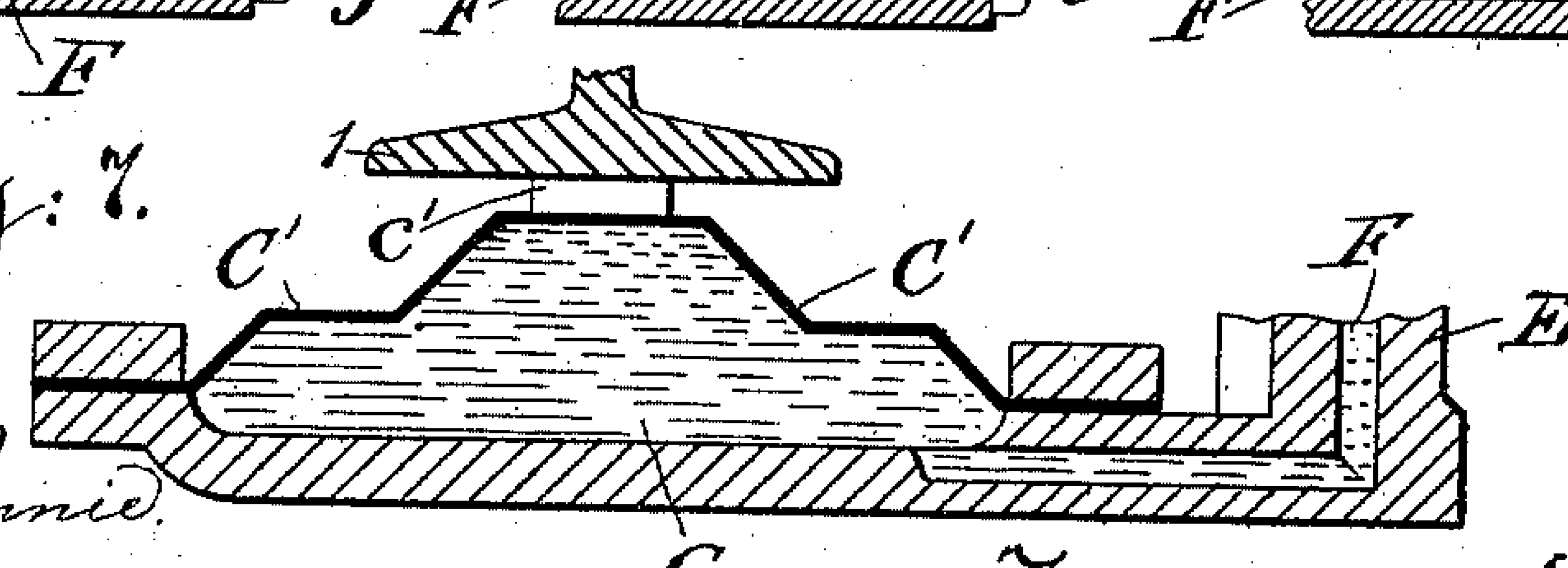


Fig: 7.



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UNITED STATES PATENT OFFICE.

FRIEDRICH VON HEFNER-ALTENECK, OF BERLIN, GERMANY, ASSIGNOR TO SIEMENS & HALSKE, OF SAME PLACE.

RAIL-CIRCUIT-CLOSING CONTACT.

SPECIFICATION forming part of Letters Patent No. 495,674, dated April 18, 1893.

Application filed January 18, 1893. Serial No. 458,815. (No model.) Patented in Germany July 23, 1885, No. 35,222; in Belgium August 10, 1885, No. 69,870; in France August 11, 1885, No. 170,587; in Russia August 16, 1885, No. 10,605; in Austria-Hungary September 4, 1885, No. 28,014 and No. 63,346; in Italy March 24, 1886, No. 19,735, and in England May 10, 1886, No. 9,568.

To all whom it may concern:

Be it known that I, FRIEDRICH VON HEFNER-ALTENECK, a subject of the King of Bavaria, residing in the city of Berlin, in the German Empire, have invented new and useful Improvements in Rail-Circuit-Closing Contacts, (patented in Germany July 23, 1885, No. 35,222; in France August 11, 1885, No. 170,587; in Belgium August 10, 1885, No. 69,870; in Austria-Hungary September 4, 1885, No. 28,014 and No. 63,346; in Italy March 24, 1886, No. 19,735; in England May 10, 1886, No. 9,568, and in Russia August 16, 1885, 10,605,) of which the following is a specification.

This invention relates to a device for closing an electric circuit from a railway rail, and by the agency of the downward deflection of a small portion of the rail by the weight of a passing engine or train.

In carrying out the invention, I make use of two communicating mercury or fluid charged chambers or vessels, one preferably having relatively larger area than the other, and a wire or contact in one vessel which the mercury touches to close an electrical circuit when pressure is brought upon the mercury in the other vessel. I may also at times make use of means to prolong the closed circuit when this is desirable or necessary.

The invention will first be described and then will be particularly defined in claims hereinafter set forth.

Reference is to be had to the accompanying drawings, forming a part of this specification, and in which similar letters and figures of reference indicate corresponding parts in all the views.

Figure 1 is a side elevation of a portion of a railway rail and cross-section of two adjacent ties between which and to the rail my improved circuit closing device is applied. Fig. 2 is an enlarged detail vertical transverse section, taken on the line *x*, *x*, in Fig. 1, and Figs. 3 to 7 inclusive, are sectional views showing modifications of the device, hereinafter described.

To the base or bottom of a railway rail 1, and between two adjacent ties or sleepers 2, 2, of the road-bed, are securely bolted the opposite ends *a*, *a*, of a longitudinally ranging bar or girder A, at the central depressed part of which is sustained a mercury holding chamber or vessel B, which projects laterally beneath the rail 1, and in part, is preferably formed or cast in one piece with the girder. The cap or cover *b*, confines a flexible diaphragm C, at the upper face of which may be sustained or attached a suitable plate *c*, which affords a bearing for the lower end of a vertically movable plug or piston D, which is fitted in the cap *b*, and projects above it to allow depression of the plug and diaphragm by a slight downward deflection of that portion of the rail 1, lying between the fixed ends *a*, *a*, of the girder. When the rail 1, is heavy and its downward flexure between the girder ends *a*, *a*, by the weight of a passing engine is consequently slight, the plug piston D, may be made of any non-compressible metal or material, but when the rail 1, is light and its downward flexure is therefore considerably greater, I make the piston D, compressible or elastic or resilient, so that it may take up in itself some of the motion of the rail, and thus prevent excessive flexure and strain of the diaphragm C, to prevent its buckling or breaking and maintain its sensitiveness to the required degree.

Fig. 2, of the drawings shows the piston D, made with metal facings *d*, *d*, at opposite ends and an intermediate rubber or other elastic middle part or core *d'*, which gives the requisite elasticity. Any other suitable yielding piston may however be employed.

A vessel E, preferably having considerably smaller horizontal sectional area than the main mercury chamber B, is also sustained by or from the girder A, and is in part preferably formed or cast in one piece therewith, and projects upward at the inside of the rail 1. This vessel E, has communication by a passage F, with that portion of the main chamber B, below the diaphragm C, thereby allowing more or less free flow of mercury G, between the chamber and vessel. A plug *f*, allows charging and discharging of the mercury to or from the device.

To the bottom of the vessel E, at the passage F, is held a stand-pipe H, which has near its

lower end a drainage orifice *h*, which allows back-flow to the passage F, and main chamber B, of excess of mercury which may at times overflow the top of the pipe H, into the vessel E. Into a non-conducting support I, confined between the main body of the vessel E, and its cap *e*, is fixed any suitable metallic contact piece J, which is shown as a screw having a reduced lower end which the rising column of mercury touches to complete an electrical circuit anywhere along the line of railway, and by means of a wire K, which as shown, is carried suitably through the cap *e*, and is connected to the contact J.

The simple and effective operation of this device is as follows: By the passage of an engine or train along the rail 1, that portion of the rail between the rigid end connections *a*, *a*, of the girder A, will be deflected downward sufficiently to cause depression of the piston D, and diaphragm C, whereby considerable displacement of mercury from the large chamber B, through the passage F, into the vessel E, of smaller area, will take place and the column of mercury thus caused to rise in the pipe H, will touch the contact J, and close the circuit. Excess of mercury overflowing the top of pipe H, will run back from the vessel E, through the pipe orifice *h*, into the passage F, and thence to or toward the main mercury chamber B.

In order to prevent undesired conductivity or closure of the electric circuit through the wire K, after the column of mercury in the stand-pipe H, has fallen below the contact J, I have provided the pipe with an interior non-conducting wall or lining which may be a tube L, of glass or ebonite which will not conduct the electric current should any drops or particles of the mercury lodge between the contact J, and the adjacent wall of the tube. This non-conducting lining thus is important, because without it drops of mercury lodged on the contact J, within the tube H, would close a circuit through said tube after the subsidence of the main column of mercury below the contact.

I specially mention the support of the entire device operating as above described, only from the railway rail itself and independently of the railway ties or any part of the road-bed. Hence the effective operation of the device in closing and opening the circuit will be maintained irrespective of any sinking of the ties or other irregularity of the road-bed or rails. This feature also makes the device specially valuable for use on unyielding viaducts, bridges or other structures on or over which the ties may be laid in building a railway track.

At times it may be desirable to more or less prolong the closure of the electric circuit through the wire K, for special purposes. In the drawings I provide for this action either by using a valve cutting off quick return of the mercury from the vessel E, or by enlarging the top of the stand-pipe, or by adopting both these means at once. Any other equivalent means for prolonging the electrical contact may however be used.

In Fig. 3, of the drawings, the stand-pipe H, is enlarged at the top and receives a valve M, which is closed downward by a spring *m'*, and has a small orifice *m*, through which the mercury, which had rapidly risen past the open valve as the diaphragm C, was depressed, must flow back slowly through the closed valve, and thus prolong contact of the mercury in the pipe H, with the contact J, to any extent, depending on the area of the orifice.

Fig. 4, of the drawings shows a ball check valve N, fitted to a suitable seat located at the inner end of the passage F, and an orifice *n*, connects this passage with the interior of the main mercury chamber B, to assure slow return of the mercury thereto, while mercury contact at J, is being maintained to prolong a closed circuit.

Fig. 5, illustrates how a multiple or three-pronged contact J', may be used within a stand-pipe H, having an enlarged upper portion with a non-conducting tube L, rising at its center. In this case the pipe H, has a second orifice *h'*, which allows drainage or back-flow of mercury from the space between the tube I, and the upper wall of the stand-pipe, while the back-flow from the tube itself is assured by the other orifice *h*.

In Fig. 6, of the drawings, is shown a stand-pipe H, having an enlarged upper end within which hangs a smaller cup H', to provide an intermediate space h^2. This cup has a bottom orifice h^3, and near its upper end is provided with a series of orifices h^4, which give communication between the interior of the cup H', and the intermediate space or passage. In this construction the mercury rising in the stand-pipe can enter the cup H', only through the intermediate space h^2, and the orifices h^3, h^4, to make electrical connection with the contact J, within the cup, and as the mercury subsides that much of it left in the cup H', can escape only at its bottom orifice h^3, whereby mercury contact with the part J, will be prolonged for purposes above explained.

Fig. 7, of the drawings illustrates how a corrugated diaphragm C', may itself form the cap or cover of the main mercury chamber of the device; and has a suitable upward projection or stud *c'*, upon which the deflected rail 1, presses to force the mercury up the stand-pipe to the contact within the smaller vessel E.

The term "mercury" used in this specification includes, besides quicksilver, any fluid which will operate within the communicating chamber and vessel D, E, in substantially like manner for the purposes herein described.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. In an electric circuit closing device, the combination of two communicating mercury-charged chambers or vessels, a diaphragm at one vessel adapted for flexure by deflection

of a railway rail to which it is or may be attached, and an electrical contact in the other vessel with which the rising mercury closes the circuit, substantially as described.

2. In an electric circuit closing device, the combination of two communicating mercury-charged chambers or vessels having relatively larger and smaller areas, a diaphragm at the larger vessel adapted for flexure by deflection of a railway rail to which it is or may be attached, and an electrical contact in the smaller vessel with which the rising mercury closes the circuit, substantially as described.

3. The combination with a railway rail, of two communicating mercury-charged chambers or vessels sustained from or by the rail alone, a diaphragm at one vessel adapted for flexure by deflection of the rail, and an electrical contact in the other vessel with which the rising mercury closes the circuit, substantially as described.

4. In an electric circuit closing device, the combination with fluid charged communicating chambers or vessels, one having a flexible diaphragm and the other having an electrical contact, of a yielding, elastic or resilient piston or part adapted to actuate the diaphragm by deflection of an adjacent railway rail, substantially as described.

5. In an electric circuit closing device, the combination with fluid charged communicating chambers or vessels, one having a flexible diaphragm and the other having an electrical contact, of means for prolonging the electric circuit through the fluid and contact, substantially as described.

6. In an electric circuit closing device, the combination of two communicating mercury-charged chambers or vessels, one vessel having a diaphragm adapted for flexure by deflection of a railway rail to which it is or may be attached, and the other vessel having an interior stand-pipe provided with a drainage orifice; and a circuit closing contact within the stand-pipe, substantially as described.

7. In an electric circuit closing device, the combination of two communicating mercury-charged chambers or vessels, one vessel having a diaphragm adapted for flexure by deflection of a railway rail to which it is or may be attached, and the other vessel having a stand-pipe provided with a drainage orifice and a non-conducting lining; and a circuit closing contact within the non-conducting lining of the stand-pipe, substantially as described.

8. In an electric circuit closing device, the combination of two communicating mercury-charged chambers or vessels, one vessel having a diaphragm adapted for flexure by deflection of a railway rail to which it is or may be attached, and the other vessel containing a stand-pipe having an enlarged upper portion and a lower drainage orifice; and a circuit closing contact within said stand-pipe, substantially as described.

9. In an electric circuit closing device, the combination of two communicating mercury-charged chambers or vessels, one vessel having a diaphragm adapted for flexure by deflection of a railway rail to which it is or may be attached, and the other vessel containing a stand-pipe and a valve at the passage connecting the two vessels; a drainage orifice being provided to allow back-flow of mercury when the valve is closed, substantially as described.

10. The combination with a railway rail, of a girder A, fixed thereto, communicating mercury-charged chambers or vessels B, E, held to the girder with the vessel B, under the rail, a diaphragm at the vessel B, adapted for flexure by the flexed rail, a stand-pipe H, within the vessel E, and provided with a drainage orifice *h*, a contact J, entering said pipe H, and electrical connections to said contact, substantially as described.

11. The combination with a railway rail, of a girder A, fixed thereto, communicating mercury-charged chambers or vessels B, E, held to the girder with the vessel B, under the rail, a diaphragm at the vessel B, adapted for flexure by the flexed rail, a stand-pipe H, in the vessel E, and having an interior non-conducting lining L, and a drainage orifice, a contact J, entering said lining, and electrical connections to said contact, substantially as described.

In testimony whereof I have affixed my signature in the presence of two witnesses.

FRIEDRICH VON HEFNER-ALTENECK.

Witnesses:

MAX WAGNER,

GUSTAV STENZEL.