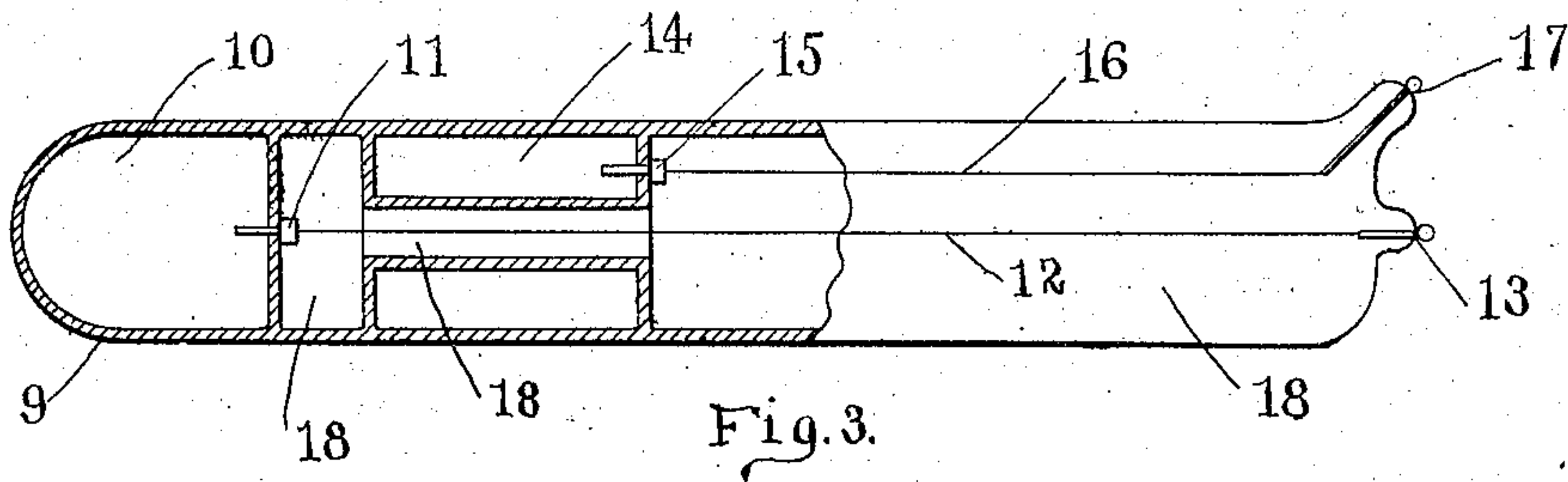
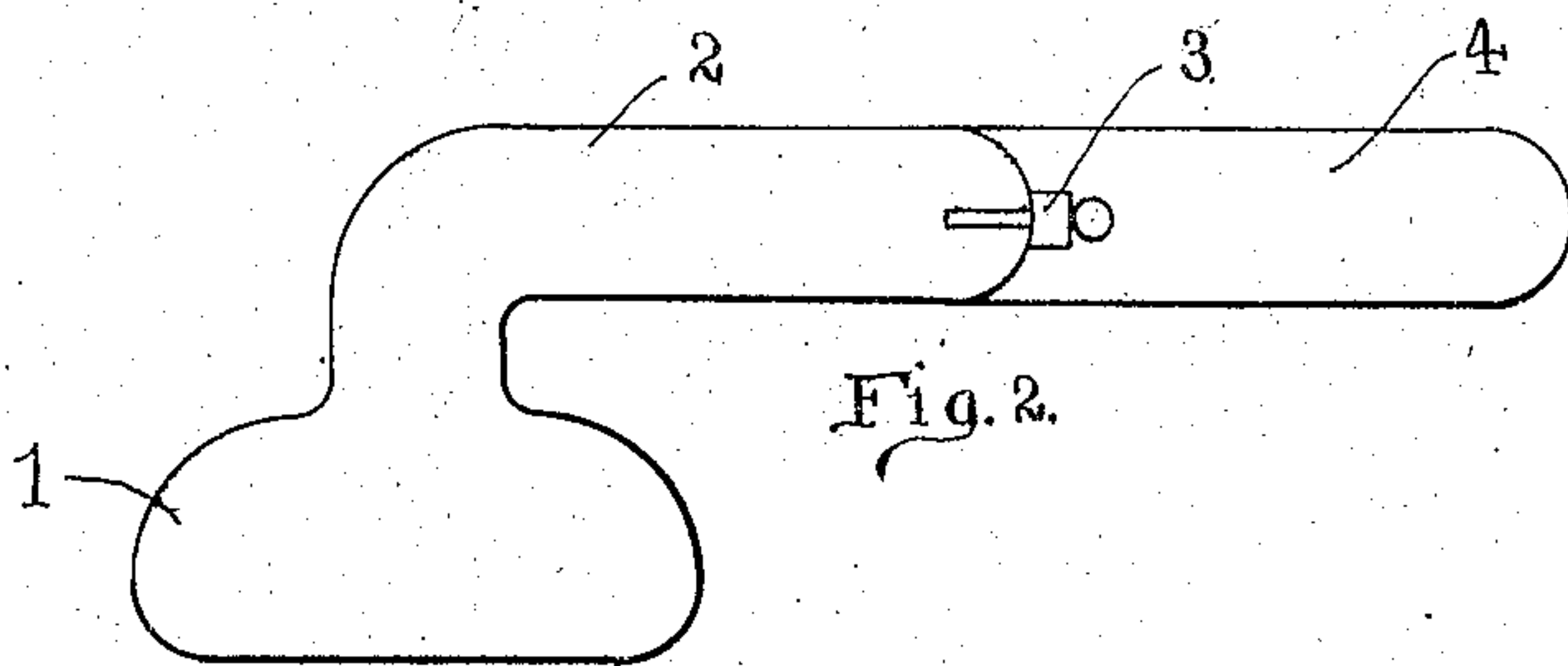
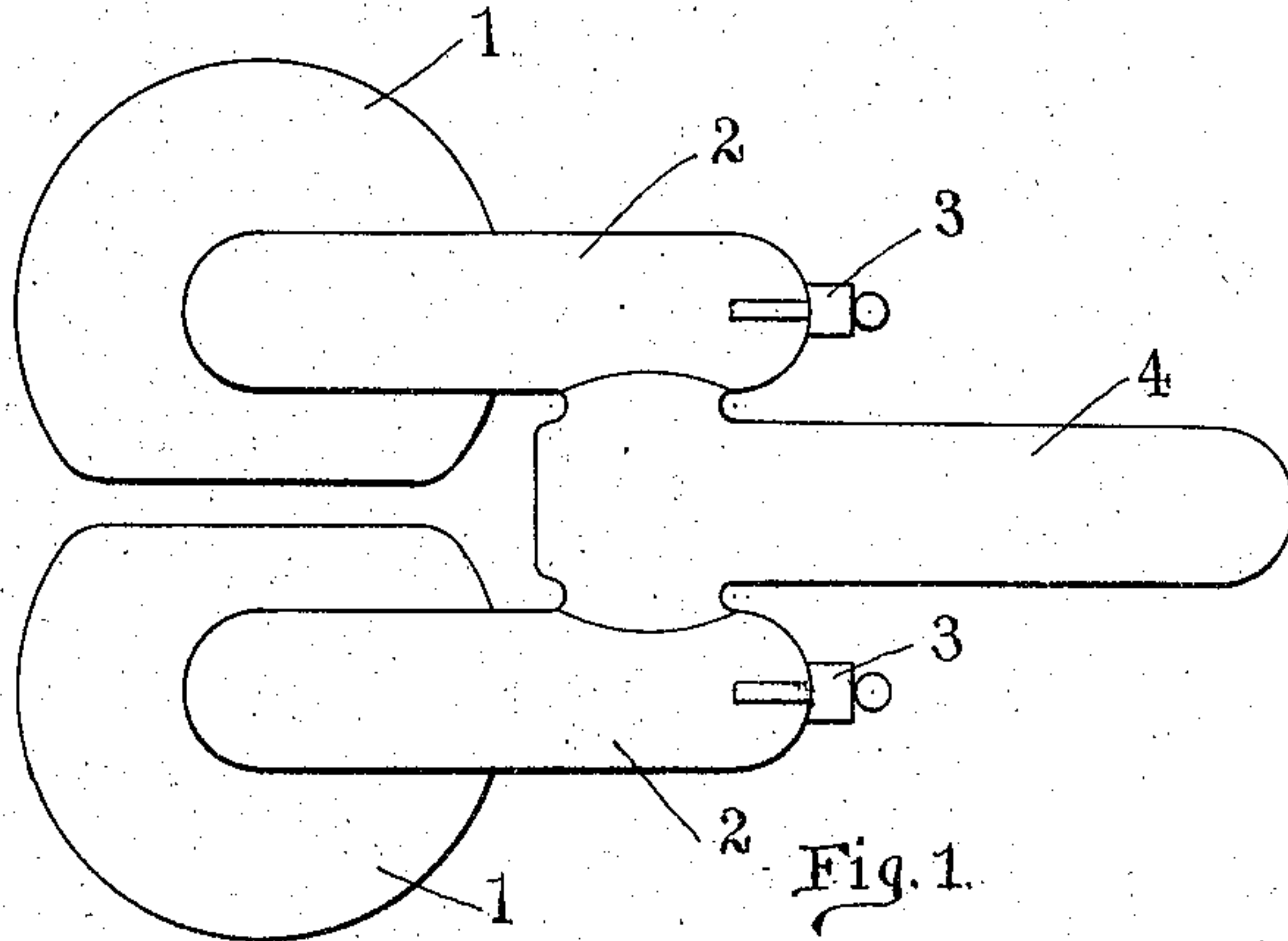


No. 791,572.

PATENTED JUNE 6, 1905.

E. L. OVINGTON.
BIPOLAR VACUUM ELECTRODE.
APPLICATION FILED MAR. 6, 1905.



Inventor

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Witness

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BIPOLAR VACUUM-ELECTRODE.

SPECIFICATION forming part of Letters Patent No. 791,572, dated June 6, 1905.

Application filed March 6, 1905. Serial No. 248,722.

To all whom it may concern:

Be it known that I, EARLE L. OVINGTON, a citizen of the United States, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Bipolar Vacuum-Electrodes, of which the following is a specification.

This invention relates to an improvement in "vacuum-electrodes," by which term is meant those forms of electrodes comprising in the main of an insulating material, usually glass, inclosing a gaseous medium, usually rarefied air, said electrodes being adapted for use in connection with currents of high potential and preferably high frequency.

The object of my invention is to provide an electrode suitable for localizing the effects produced and concentrating the action at the point of application.

I accomplish my object by providing a bipolar electrode instead of the monopolar one usually employed.

In the treatment of disease by means of high-potential high-frequency currents it is common practice to connect the patient with one terminal of the source of energy, the other terminal being connected to a vacuum-electrode, which electrode is then applied to the affected part. Under certain circumstances the direct connection of the patient with the generating source is discarded, the only connection being then through the vacuum-electrode. Whichever method of treatment is employed a monopolar electrode is used, said electrode being connected with only one terminal of the current source.

One of the greatest disadvantages inherent in both of the above methods of treatment employing a monopolar electrode is due to the fact that the patient not only receives the desired local treatment produced by application of the electrode to the affected part, but receives a general treatment due to the fact that he is connected to one or both terminals of the machine. Where the potential and frequency of the current supplied are both high, this incidental general treatment must often be made objectionably rigorous in order to obtain the desired local effect. In certain cases,

notably where the patient is unusually sensitive or nervously excited, this general treatment is not desirable.

Another undesirable feature present when employing the above-mentioned methods of treatment is the unpleasant sparking which takes place when the electrode is brought near to the body of the patient in the act of placing it in actual contact. When the electrode is a short distance from the flesh or when an insulating medium, such as an article of clothing, lies between the electrode and the affected part, an irritating sparking takes place across the intervening dielectric, which sparking is often sufficient to redden the skin to a perceptible degree. This at times is very distressing, especially in the case of the affected part being oversensitive. In such an instance resort is often made to the expedient of decreasing the energy flowing through the electrode, which means that a correspondingly longer treatment must be given to accomplish the desired result.

Another disadvantage of the system mentioned, which employs a monopolar electrode with the single terminal connection, is that it is limited to apparatus producing electricity of high potential, since the current in the electrode is only that which flows to the body of the patient, due to the condenser action of the patient with respect to the current. Now the energy which flows into a condenser is a function of the potential, and the capacity of the human body is small. For this reason a high potential must be employed in connection with a monopolar electrode connected with only one terminal of the generating source.

Still another undesirable feature of the monopolar method is due to the fact that the current used in the electrode must pass through the resistance of the body in addition to the usual contact and electrode resistance. This means a decreased current-flow for a given potential. Then again the current which can be comfortably borne by the patient is less when the current has to pass through the whole body than when the path is from one electrode of a bipolar system through the affected part to the other electrode. Hence,

other things being equal, a longer treatment is necessary when employing a monopolar electrode than is the case when a bipolar electrode is utilized.

5 I have overcome all of the above disadvantages by providing a bipolar vacuum-electrode. By employing my bipolar electrode the treatment of the affected part may be localized and the undesirable general treatment above
10 mentioned done away with, since the tendency of the current is to flow from one terminal of the electrode through the affected tissue to the other terminal, the current having practically no tendency to flow to other parts of
15 the body.

By employing my bipolar electrode the disagreeable sparking mentioned in connection with monopolar electrodes is eliminated. This is due to a peculiar phenomenon which I have
20 discovered. If the two terminals of my bipolar electrode be connected to a source of high-potential high-frequency currents, the current turned on, and the electrode held out of contact with conducting substances, the
25 current flows from one terminal of the electrode through the intervening dielectric to the other terminal. In this case the flow of current is confined to the neighborhood of the electrode itself. If now a conducting body,
30 such as the human flesh, be brought into contact with the two terminals of the electrode, the current ceases to flow directly from one terminal of the electrode to the other and now takes a course from one terminal through the
35 affected part to the other terminal. Under such conditions this peculiar effect is due to capacity phenomena. In each case the conducting gaseous medium of the electrode-terminals form two plates of a condenser. In
40 each case the conducting material of which the vacuum-electrode is constructed forms part of the dielectric between the plates. The difference lies in the fact that in the first case—that in which the electrode is not in contact
45 with the patient—the path through the dielectric is of high resistance, while in the second case, where the electrode is in contact with the patient, the path through the dielectric is of comparatively low resistance, the
50 patient's body being a good conductor for such high-potential currents as those employed. For this reason the current is confined to the electrode when same is not in use, but immediately appears at the surface of
55 the electrode when same is brought into contact with the body of a patient. I take advantage of this phenomenon in constructing my electrode, with the result that the irritating sparking above referred to is eliminated.
60 In just that proportion to the amount the electrode is in contact with the affected part does the current flow through the diseased tissue or other part of the body under treatment. The rest of the current flows inside the elec-
65 trode instead of causing disagreeable sparks.

On account of the fact that my bipolar electrode has its terminals close together it may be employed in connection with potentials far below the point where the monopolar electrodes become inoperative. This greatly
70 widens the field of operation.

Having thus outlined the advantages of my invention and briefly stated the theory upon which its operation is based, I will now describe its construction in detail, reference be-
75 ing had to the drawings accompanying and forming a part of this specification.

Figure 1 is the plan view of one form in which my bipolar electrode may be made, while Fig. 2 is a side elevation of same. Fig.
80 3 shows another construction incorporating the principle of my invention. I have found glass to be the most suitable material for use in construction of the electrodes, although any other suitable insulating material might
85 be employed.

Referring to Figs. 1 and 2, 2 2 are tubular pieces of glass, upon the ends of which are blown the bulbs 1 1, which are subsequently flattened, as shown. Terminals 3 3 serve to
90 lead the current into the compartments thus formed, said compartments being exhausted or otherwise treated, so that they contain a rarefied gaseous medium. The portion 4 serves to mechanically, although not electric-
95 ally, connect the two vacuum compartments, thus forming a double or bipolar electrode which may be used in connection with the various electrode-handles employed with the usual form of monopolar electrodes. 100

Fig. 3 shows another form my bipolar electrode may take, it being especially designed for use in the treatment of certain cavities of the human body. Referring to the figure, 9 is a glass tubular portion which constitutes the
105 exterior wall of the electrode. The compartment 10 is partitioned off, as shown, and is connected through the interior terminal 11 by means of the wire 12 with the external terminal 13. 14 is a compartment formed so as
110 to surround the wire 12, said compartment being connected, through internal terminal 15 by means of wire 16, with the external terminal 17. The remaining space constitutes the largest compartment 18. The smaller com-
115 partments 10 and 14 are exhausted to a low vacuum, which makes them a good conductor of high-tension electricity. The largest compartment 18 is exhausted to the highest attainable vacuum, which makes it a very poor
120 conductor of electricity, thus insulating the wires 12 and 16 from each other, as well as the two smaller compartments 10 and 14. When this electrode is introduced into a cavity of the body, a condenser is formed, the con-
125 ducting-compartments 10 and 14 comprising the condenser-plates, while the external walls of the electrode and the surface of the cavity form the dielectric of the condenser. The current therefore passes from one compart- 130

ment to the other, traversing the diseased area and penetrating the affected part to a depth dependent upon the character of the current employed.

5 In the drawings and description I have indicated the terminals which lead the current into the conducting-compartments of the electrode as being internal terminals penetrating the walls of the compartments. With cer-
10 tain forms of currents, notably those having high potential and frequency, it is not necessary to employ leading-in terminals of the above type. Under such conditions it is only necessary to make connection with conduct-
15 ing-surfaces attached to the exterior of the glass tubular portion. It is of course understood that my invention operates with either type of terminal.

I believe it is broadly new to employ a bi-
20 polar vacuum-electrode in the treatment of disease, the term "bipolar vacuum-electrode" being applied to an electrode adapted for connection with both terminals of the generat-
25 ing source, the current passing from one conducting portion of the electrode to the other through the affected part of the body under treatment.

In the drawings I have not attempted to illustrate the most desirable or most practi-
30 cal forms in which my invention may be constructed, but have chosen those forms which best show the principle upon which my electrode is based.

Throughout this specification I speak of a
35 "vacuum-electrode." Ordinarily by a "vacuum" is meant rarefied air, although it is evident that any other suitable conducting gaseous medium could be used in connection with my invention, and same is intended to embrace such
40 modifications.

This invention must not be confounded with bipolar vacuum-tubes devised to generate various kinds of visible and ultraviolet radiations. My invention may be differentiated
45 from the above class by noting that in applying my invention a portion of the patient forms part of the electric circuit from one terminal of the electrode to the other, while in the tubes above mentioned this is not the case.

50 Having thus described my invention, what I claim as new is—

1. A bipolar vacuum-electrode for therapeutic treatment of such a construction that the electric circuit through the electrode may be completed by the body of a patient. 55

2. A bipolar vacuum-electrode for therapeutic treatment of such a construction that the electric current, in passing from one terminal of the electrode to the other, may flow through the part of the body of a patient to 60 which the electrode is applied.

3. A bipolar vacuum-electrode for therapeutic treatment, adapted for connection with the two terminals of the source of electricity, the construction of the electrode being such 65 that the current in passing from one terminal of the electrode to the other, is compelled to flow through the affected part under treatment.

4. A bipolar electrode comprising inclosed 70 gaseous conductors, said conductors being insulated from each other and provided with a means of connection with the source of current.

5. A bipolar electrode comprising two in- 75 sulated compartments, said compartments containing a gaseous conductor, means for supporting the compartments in proximity to each other, and means for connecting the gaseous conductors with the source of current. 80

6. A bipolar electrode, comprising gaseous conductors in mechanical but not electrical connection with each other; means for connecting the gaseous conductors to the source of current-supply, the construction being such 85 that when the electrode is used for treatment the current flows from one gaseous conductor to the other through the diseased part.

7. A bipolar vacuum-electrode for therapeutic treatment comprising two glass com- 90 partments from which the air has been partially exhausted, means for mechanically but not electrically connecting said compartments, and means for electrically connecting the compartments with the source of current. 95

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

EARLE L. OVINGTON.

Witnesses:

WM. O. EDDY,
E. J. OVINGTON.