

(No Model.)

S. R. BRADLEY.
ELECTRICAL SURGICAL INSTRUMENT.

No. 472,968.

Patented Apr. 12, 1892.

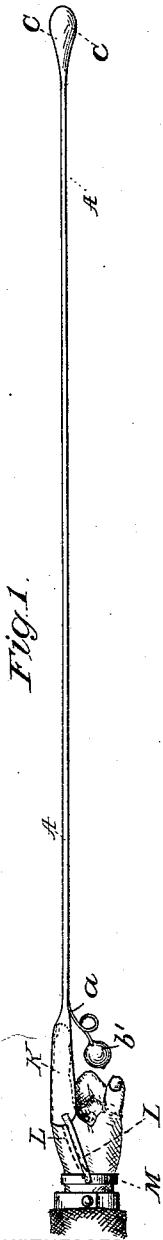


Fig. 1.

WITNESSES:

Edward C. Rowland.
Thos. A. Nolan.

Fig. 3.

Fig. 2.

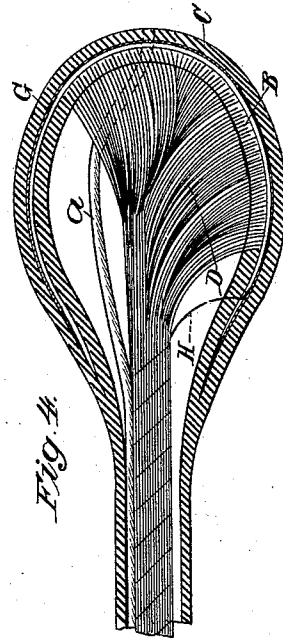
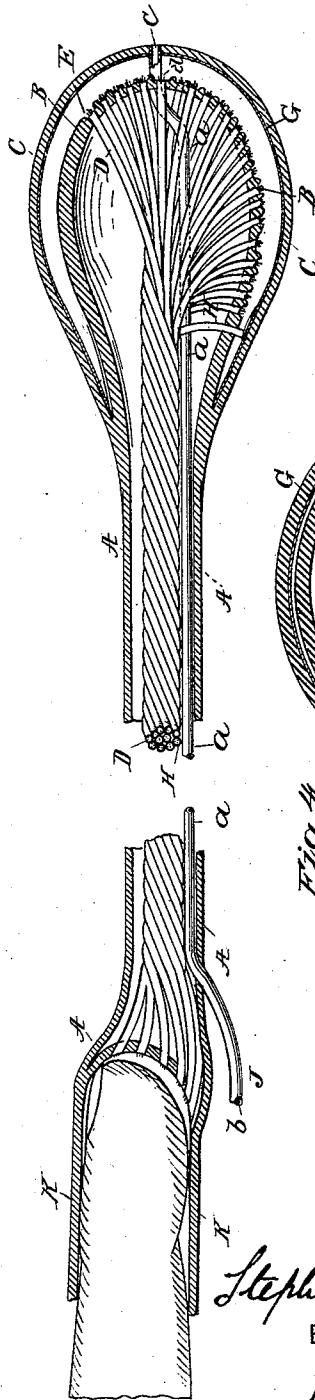


Fig. 4.

INVENTOR

Stephen R. Bradley

BY

Phillips Abbott
his ATTORNEY

UNITED STATES PATENT OFFICE.

STEPHEN R. BRADLEY, OF NYACK, NEW YORK.

ELECTRICAL SURGICAL INSTRUMENT.

SPECIFICATION forming part of Letters Patent No. 472,968, dated April 12, 1892.

Application filed February 4, 1892. Serial No. 420,289. (No model.)

To all whom it may concern:

Be it known that I, STEPHEN R. BRADLEY, a citizen of the United States, and a resident of Nyack, in the county of Rockland and State of New York, have invented a certain new and useful Surgical Instrument, of which the following is a specification.

My invention relates to surgical instruments; and it consists in a peculiarly-constructed electrical device whereby physicians or surgeons can ascertain the interior condition of various organs of the body and can detect the presence therein of harmful matter—as, for instance, stone in the bladder. The instrument is designed to be used in any of the organs of the human anatomy accessible by instruments, but into which the hand of the surgeon cannot pass nor optical observation be obtained.

The purpose of my invention is to supply a device which shall be in effect an electrically-operating extension of the finger of the operator which shall convey from the end of the instrument to his actual finger upon which it is attached substantially, or at least measurably, the same sensations that he would experience if his actual finger were present where the device is and in contact with the same surfaces.

The apparatus consists, generally stated, in a series of insulated electrical wires which pass through a rubber or a similar tube having at one end a finger-sheath adapted to be placed upon one of the fingers of the hands of the surgeon, so that electric sensation will be conveyed to his hand, and at the other end there is an elastic bulb-like device composed of an inner and an outer part, and near the surface of the inner part the ends of the wires are arranged so that when the outer part, the inside lining whereof is a conductor of electricity, is compressed upon it an electric circuit will be closed and the physician will receive in his finger slight electrical sensations resembling those which would be experienced by his naked finger if in contact with the same surface, which will indicate to him the presence of unhealthful or disordered conditions in the interior of the organ. One of the wires connects with the lining of the said outside bulb and carries the current continuously to

it. The other wires are insulated from each other and are wrapped about between the finger-sheath and the enlarged terminal by any suitable substance, preferably insulating material, so that they in the aggregate constitute a flexible device somewhat like a catheter, which will have the requisite rigidity to serve the purpose and yet be sufficiently flexible. I also provide a tube connected to the instrument, through which solvents or medicinal preparations may be injected upon the unhealthful spot.

In the drawings, Figure 1 is a plan of the device. Fig. 2 is a sectional view of the finger-sheath and adjoining parts. In this figure the wires do not quite touch the finger of the operator, as they do in actual use. I show them separated for the sake of clearness in the drawings. Fig. 3 is a sectional view of the terminal or double bulb. This figure is very much enlarged from the actual size. Fig. 4 illustrates an alternative construction of the device.

A is the exterior wrapper, shown in this instance as in the form of the rubber tube or covering. At its forward end it is divided into two bulb-shaped parts, one within the other. The inner one is marked B, the outer one C.

D D, &c., are wires, which I sometimes arrange in groups of three, as shown, for a special reason hereinafter explained; but a single wire may be used in each place. These wires or groups of wires, as the case may be, are at their ends embedded in the inner bulb B, their terminals being exposed in little sunken recesses or pits E E made in the surface of the bulb B, and they are preferably so arranged that one of the wires comes nearly but not quite to the surface of the bulb; but the others are preferably set somewhat lower, not coming quite so near the surface of the bulb. The outer bulb C is lined upon its interior with a conductor of electricity G. This may be a thin film of metal deposited thereon electrically or a metal foil attached thereto, so that it will be flexible, the body of the bulb C being of rubber, as before stated. One of the wires (shown at H) extends through the inner bulb B and engages with the metallic lining G of the outer bulb. It is connected with a suitable generator of

electricity. The wires D all come together within the inner bulb, and being laid snugly side by side are covered with a wrapping I, which may be a continuation of the rubber tube-like structure A or any equivalent therefor, and inasmuch as the wires or sets of wires D are insulated it is not essential that this material should be an insulator; but I prefer it to be so. These wires or sets of wires are thus formed into a structure somewhat resembling a catheter and may be of such length as desired—a foot or more—depending upon the special organ of the body for the treatment of which it is to be employed. At the other or finger-sheath end of the device the wires are arranged in exactly the same relative position that they are in the bulb, and they project through the rubber lining J of the finger-tip K and terminateslightly beyond the inner surface of this lining, so as to come squarely against the finger of the operator, and in order that they may be held in good contact with the end of his finger I prefer to extend the finger-tip somewhat over the back of the hand of the operator and provide it with rubber bands L L, which at their rear ends are attached to a band or wristlet M, which buckles tightly around the wrist of the operator. The rubber bands serve to pull the finger-sheath tightly upon the finger of the operator, thus securing good contact of the ends of the wires with his finger.

a is a little tube of very flexible rubber, which passes through the exterior wrapping of the wires near the finger-sheath, the end b of which may be applied to any suitable injecting instrument—as, for instance, a bulb b', (see Fig. 1,) adapted to contain liquid. It (the tube) passes down within the exterior casing A by the side of the wires through the bulb and opens at the surface of the outer bulb at c, and it passes through the inner bulb, as at d. The opening in the bulb is quite large, so that there is no possibility of frictional contact between the tube and the sides of the opening. This little tube is very flexible, so that it will not interfere at all with the movements of the outer bulb. It is of course cemented or otherwise attached water-tight to the outer bulb.

In Fig. 4 I show an alternative method of constructing the bulbs and disposing the wires therein. In this form a great number of very fine wires are employed. I prefer as many as it is mechanically possible to place or embed properly insulated. In the inner bulb they are of course exceedingly fine wires and their ends are retracted slightly from the surface of the inner bulb, some of them being preferably more retracted than others. This adjustment of the ends of the wires relative to the surface of the bulb may be accomplished in various ways, as by pulling the wires back after they have been embedded in the rubber or equivalent material

of the bulb before it has hardened, or the rubber may be applied to the wires in the first instance, so as to cover their ends and be allowed to harden or dry, which is then removed, as by a sand-wheel or equivalent device, so as to expose the wires. The nature of the rubber is such that it will yield before the wheel and afterward rebound or expand, so as to practically cover and protect the wires when no pressure is applied.

The operation is as follows: The surgeon or physician after adjusting the finger-sheath on one of the fingers of his left or right hand, as preferred, introduces the other end of the instrument into the organ in the manner that catheters and like instruments are now introduced. In so doing he may employ his other hand in aid of the one upon which the finger-sheath is, or an assistant may manipulate the instrument. The bulb being introduced is moved about within the disordered organ with as near as may be the same movements and into the same parts or places that the physician would move his actual finger to detect or ascertain its interior condition, and the pressure of the walls of the organ against the outer bulb compresses it with greater or less pressure upon the inner one, and the outer surface at least of the inner one being elastic, and preferably decidedly so, it yields slightly, so that the ends of the wires are brought in contact with the metallic lining of the outer bulb. Thus the electric circuit is closed, and the surgeon feels in the end of his finger an electric sensation at exactly the same spot upon the end of his finger that he would if his finger were actually where the bulb is, because, as before stated, the wires are arranged upon the bulb in exactly the same relative position that they are in the finger-sheath. If the bulb come in contact with any abnormal enlargement or disordered condition—as, for instance, a stone in the bladder, tumor, or the like—then the bulb may be carried all about such thing, whatever it may be, and by increasing the pressure of the bulb against it the wires which are farthest from the surface of the inner bulb will be likewise brought in contact with the metallic lining of the outer one. Thus the electrical sensation will be increased in exactly the same way that the physician would receive increased sensation if the actual finger pressed harder upon such body. I do not mean that the electrical sensations produced in this manner are of exactly the same character as the sensations experienced through the nerves of the finger, but after little experience with the instrument the surgeon will learn to associate the electrical sensations which he receives through the instrument with their properly-corresponding nervous sensations if his actual finger were in contact with the disordered part in place of the bulb of the instrument. In this way he can determine with consider-

able exactness, and frequently absolute positiveness, the presence, size, and extent of the disordered part or abnormal growth and its precise location. After he has ascertained these facts he can inject liquids—as, for instance, a solvent—directly upon the part requiring them and not haphazard into the organ generally, as now usually done, through the tube *a* by the use of an ordinary injection-syringe or other preferred device, such as the bulb *b'*, connected with the open end of the tube near the finger-sheath.

It will be observed that there are no wires extending to the part of the bulb which would correspond to the part of the operator's finger upon which the finger-nail is placed. This is because there is practically little sensation receivable through the finger-nail of the actual hand. I make, however, the bulbs round in shape, because they will be more readily introduced than if of an irregular contour. The electric circuit may be completed through the body of the operator to the ground and thence to the other pole of the generator, or a return-wire may be engaged with the wrist or other part of the body of the operator, extending thence to the other pole of the generator.

The information which the surgeon receives by the use of this instrument is frequently of vital importance. Great suffering can often be avoided if this knowledge is had, and sometimes the necessity for serious if not fatal operations may be postponed for relatively long periods or perhaps entirely avoided; also, sometimes this knowledge will show the surgeon that an operation is immediately necessary.

It will be obvious to those who are skilled in this art that certain alterations may be made in the details of construction of my device and yet the essentials of the invention

be employed. I therefore do not limit myself to the details as described.

I claim—

1. The above-described instrument, comprising a finger-sheath, wires extending from the interior of the sheath to or near the exterior of a bulb at the other end of the instrument, an elastic exterior bulb or covering for the said bulb, the inner surface whereof is a conductor of electricity, and a wire extending to the said inner surface of the exterior bulb, substantially as set forth.

2. The above-described instrument, comprising, essentially, a finger-sheath, wires extending from the interior of the sheath to the exterior of a bulb at the other end of the instrument, an elastic exterior bulb or covering for said bulb, the inner surface whereof is a conductor of electricity, a wire extending to the said inner surface of the exterior bulb, and means to hold the finger-tip firmly upon the finger of the operator, substantially as set forth.

3. The above-described instrument, comprising a finger-sheath at one end, wires extending from the interior of the sheath to or near the exterior of a bulb at the other end of the instrument, an elastic exterior bulb or covering, the inner surface whereof is a conductor of electricity, a wire extending to the said inner surface of the exterior bulb, and a tube extending from near the finger-sheath and discharging at or near the exterior bulb, substantially as set forth.

Signed at New York, in the county of New York and State of New York, this 2d day of February, A. D. 1892.

STEPHEN R. BRADLEY.

Witnesses:

PHILLIPS ABBOTT,
J. E. HOFFMAN.