No. 693,257. Patented Feb. 11, 1902.

W. J. GAVIGAN.

ELECTRICAL DEVICE FOR THE TREATMENT OF DISEASES.

(Application filed Nov. 19, 1901.)

(No Model.) 2 Sheets—Sheet 1.

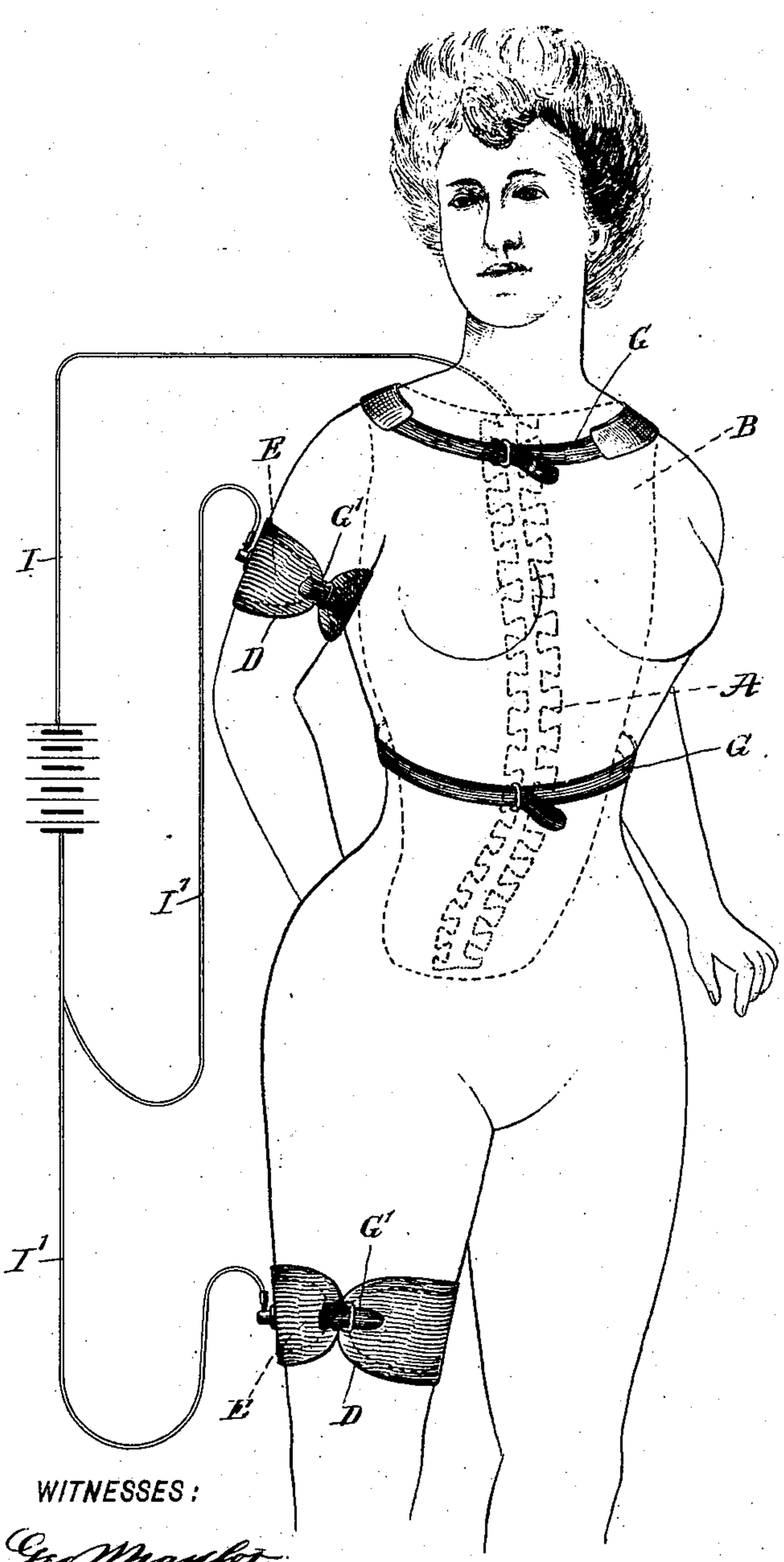

Fig. 1.

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Fig. 2.

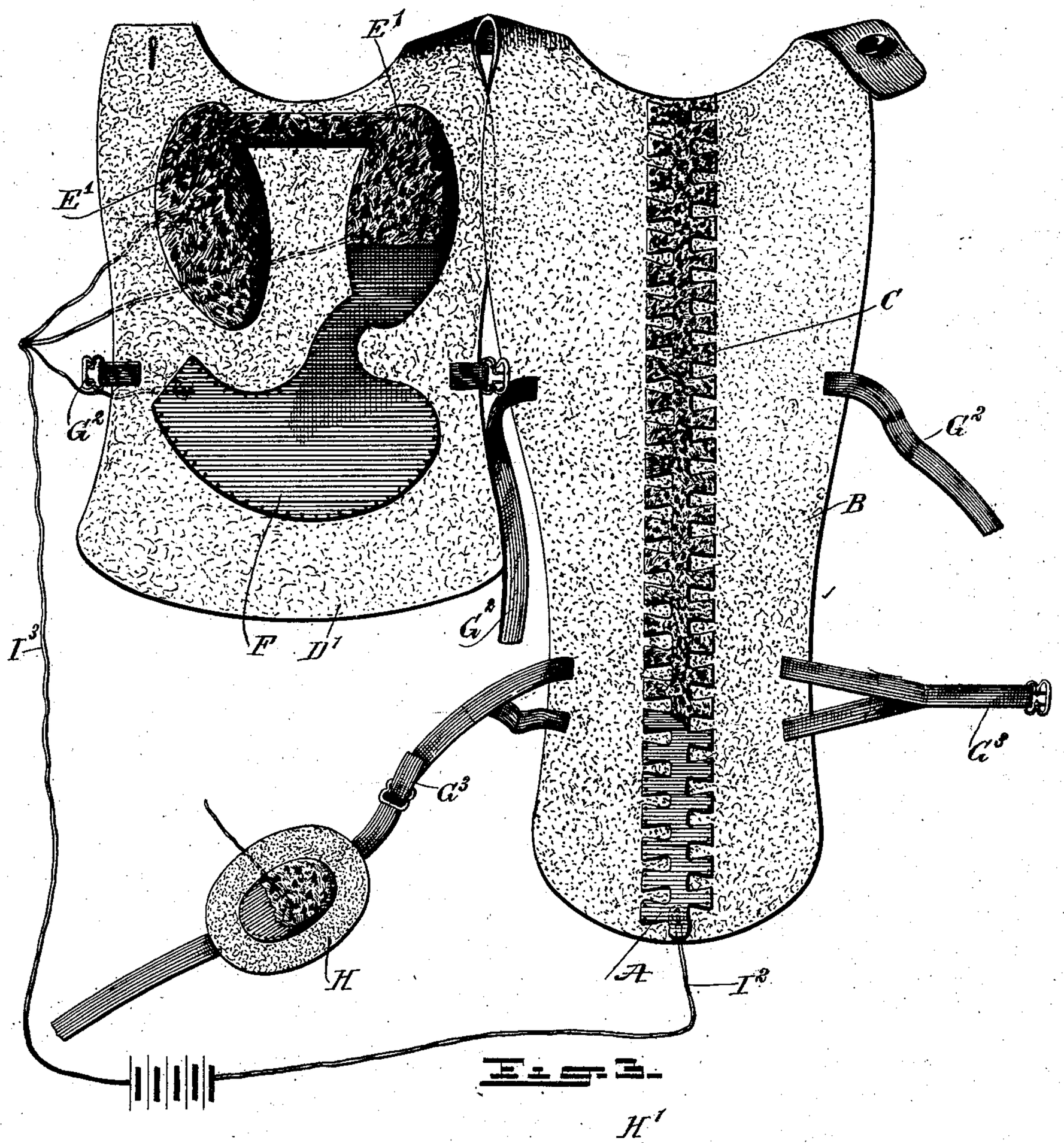
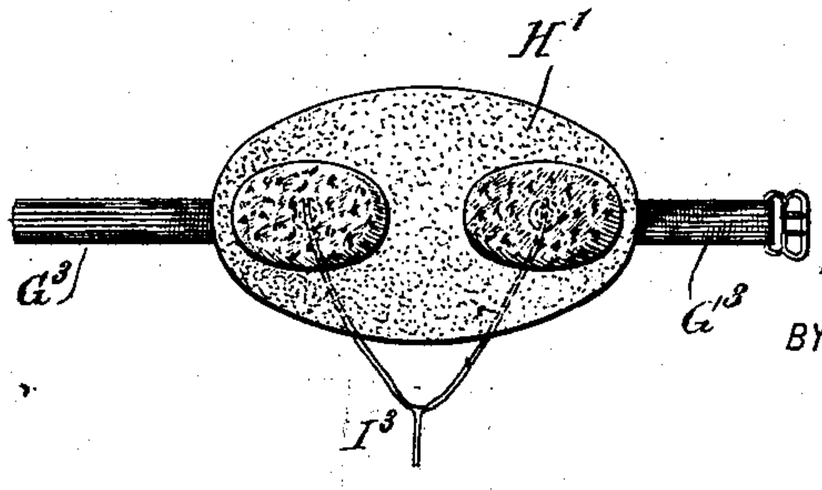


Fig. 3.



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ELECTRICAL DEVICE FOR THE TREATMENT OF DISEASES.

SPECIFICATION forming part of Letters Patent No. 693,257, dated February 11, 1902.

Application filed November 19, 1901. Serial No. 82,820. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM J. GAVIGAN, M. D., a citizen of the United States, and a resident of the city of New York, borough of Manhattan, in the county and State of New York, have invented a new and Improved Electrical Device for the Treatment of Diseases, of which the following is a full, clear, and exact description.

The object of the invention is to provide a new and improved electrical device, more especially designed for use on the human body to treat or cure certain diseases and arranged to send electrical currents from the spinal cord to distant or affected parts which are symptomatic of a disturbance in the ganglionic center of the spinal cord or the course of the nerve-supply to the afflicted organ.

The invention consists of novel features and parts and combinations of the same, as will be fully described hereinafter and then pointed out in the claims.

A practical embodiment of the invention is represented in the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the views.

Figure 1 is a perspective view of the improvement as applied and arranged for treating by the motor nerves neuritis, partial paralysis, rheumatism, and the like in the limbs and arms of a patient. Fig. 2 is a face view of a modified form of the improvement in an open position and parts broken out, the modified improvement being designed for treating reflexly by the abdominal plexuses the lungs, stomach, abdomen, ovaries, and like organs; and Fig. 3 is an inner face view of the electrode for use on the abdomen when treating reflexly the ovaries or pelvic organs of the female.

As a whole the spinal cord serves as a pathway for the conduction of motor impulses from the brain and for sensory impulses to it. It contains centers for reflex action. It also contains centers which, in connection with the sympathetic nervous system, govern the action of the blood-vessels and the viscera, and finally the state of its nutrition affects the nutrition of every part to which its nerve fibers are distributed.

While it is known that motor, sensory, and reflex functions are represented by corresponding spinal mechanisms of more or less definite area, especially in a vertical direction, still a very exact localization of these centers is not as yet possible. It is certain that groups of muscles are represented in certain segments of the spinal cord. There is also a progressive representation of cutaneous sensation in the posterior nerve-cells, while the reflex centers have a fixed relation to the intermediate gray substance lying between the ingoing and the outgoing nerves which go to constitute the reflex arc of each spinal segment. The bearing of these facts upon the electrical treatment of diseases of the spinal cord is most obvious, not only in diagnosis, but in treatment. From both points of view localization is important.

There can be no hesitancy in adopting the rule to treat diseases of the spinal cord *in loco morbi*, and to this end when possible the seat of the disease must be carefully located.

The spinal-cord "segment" is that portion of the cord from which each pair of spinal nerves arises. Each pair at its level of origin—viz., at its segment—is situated on a plane considerably above its level of exit through the corresponding vertebral foramina. The lower down the spinal cord the origin of the pair of nerves the longer distance must the pair extend to reach its foramina, and finally a point is reached at the second lumbar pair where all the pairs which arise below it find their foramina of exit at a level of the vertebral column below the lower end of the spinal cord. The vertebral spinous processes, which are easily felt beneath the skin, are our only guide from the outside to the position of these segments. Did each spinous process correspond with any reasonable degree of accuracy with each segment, the localization of the latter would be easy; but it does not. The spines at their tips where they may be felt are not on a level with their bodies, and consequently not on a level with the origin of the nerve pairs.

The preceding considerations relating to the positive localization of the electric current to the seat of disease are advanced, in the main, in reference to the direct electrization of the cord; but the cord may be affected indirectly by aid of the extension of its continu-

ity into the peripheral distribution. Each segment, comprising within itself or in connection with adjoining segment a center for the spinal representation of the motor, sensory, and reflex anatomical mechanism and functions, has a corresponding representation in the periphery in the form of the ramifications of the spinal nerves. This peripheral distribution of the nerves may also be directly influenced by electric currents. Indeed, to this method of treatment or to this effect when in the course of spinal-cord disease peripheral nerves and their muscles are treated is to be attributed most important results. One characteristic and almost invariable effect due to electric stimulation of the peripheral nerves and their end organs is the improved nutrition of the patients. They make a rapid increase in weight and in general health irrespective of the progress which may ensue in the disease for which they are under treatment.

In order to insure proper electrical treatment of a diseased part, I arrange one electrode over the entire spinal column and place the other electrode as near as possible to the seat of the disease, so that a current of electricity passes from the spinal cord through the corresponding nerve to the part showing the symptoms of the disease. As shown in Fig. 1, the appliance is arranged for motor functions, while the construction illustrated in Fig. 2 is more particularly for sensory and reflex functions. In either case I employ the same spinal electrode A, which is made of a strip of sheet metal (copper) having integral flanges extending alternately from opposite sides, as plainly indicated in Fig. 2, and the strip and flanges are secured to the inside of a back B, made of a suitable fabric material, and the faces of the strip and flanges are covered by a sponge C of the same shape as the strip and flanges. The strip is sufficiently thin to readily bend to the shape of the spinal column, and the strip extends the length of the spine, preferably from the sixth cervical vertebra to the first sacral vertebra, and the flanges extend sufficiently sidewise to cover the skin lying over the muscles at the sides of the spine, so as to come as near as possible to the centers of the spinal nerves. A band D of a similar material to the back B carries the other electrode E, which is in the form of a thin metal strip (copper) to readily bend and conform to the shape of the leg or arm on which the electrode is to be applied, suitable fastening devices G, such as straps and buckles, serving to fasten the back B and its spinal electrode in place on the human body, and similar fastening devices G′ serve to fasten the band D and its electrode to the leg or arm, as will be readily understood by reference to Fig. 1. An insulated wire I connects the electrode A with the positive pole of a source of electrical energy (galvanic or faradic, preferably galvanic, to reach the deeper structures) and a similar wire or wires I′ connect the other electrodes E with the negative pole of the supply of electrical energy, so that when the device is applied to the human body and the electric current is turned on then the said current passes from the source of electrical energy by the wire I and electrode A to the spinal column and by the corresponding nerve to the afflicted part and its electrode E, the wire I′ completing the circuit. The electrodes to be used for sensory and reflex functions follows the shape of the respective organ, as illustrated in Fig. 2, in which a fabric front D′ of a similar material to the back B carries the connected electrodes E′ E′ for the lungs and the electrode F for the stomach, the said electrodes being approximately of the shape of the parts for which they are intended and are located on the front D′ in such a manner that when the front is in position the electrodes lie near the corresponding parts—that is, the lungs and stomach. Fastening devices G^2, such as straps and buckles, may be used to connect the front D′ with the back B to draw the parts tightly on the body, and thereby securely hold the same in proper position.

Abdominal electrodes H H′ may also be connected by fastening devices G^3 to the back B. The electrodes E′ E′, F, H, and H′ are similar in construction to the electrode E—that is, are formed of a piece of sheet metal fastened to the fabric and covered by a sponge. The electrode A, as shown in Fig. 2, is connected by a wire I^2 with the supply of electrical energy, and the electrodes E′, F, H, and H′ are connected by a wire I^3 with the supply of electrical energy, so that when the device is applied on the human body and the electric current is turned on the said current passes from the source of electrical energy by the wire I^2 and electrode A to the spinal column and by the corresponding nerve to the afflicted part and its electrodes E′ E′, F, H, or H′, the wire I^3 completing the circuit.

As all the vertebral spinal processes are covered by a set of electrodes, the seat of disease in functional and nutritional diseases of the spinal cord is necessarily reached by the electricity acting either directly upon the ampere-cells or affecting them indirectly by their different pathways. The current enters the nerves at the periphery of the patient's spine and the skin covering the muscles on each side thereof, thus giving the patient the benefit of a current of electricity along the spine without shock or disagreeable sensations of any kind. It is understood that the density of the current is greatest close to the electrode A, and the greater the distance from any point of the electrode A the less is the current density at that point. By having the electrodes covering considerable area of the human body it is evident that very strong currents can be used, especially as the cuticle is the chief obstacle to the current, and from a given number of cells, for instance; but a certain quantity of the current can be forced through each square inch of the body's surface. The more square inches there are in-

cluded in the conducting-surface therefore the more current will go through from the given number of cells; but there will be no increase in and possibly a slight diminution of the number of milliamperes passing through the original inch of skin unless the number of cells is increased or the resistance of the controller lessened. The use of broad or combined electrodes is indicated, therefore, whenever it is desired to introduce a large galvanic current into the human body with a minimum of pain and without a special concentration at the point of entry of the current. It is expressly understood that by the arrangement described I am enabled to reach the seat of the disturbance in the spinal cord, as by the corresponding nerve and the electrodes applied to that part of the human body showing the symptom of the disease I am enabled to send the electric current to the seat. By the arrangement described I not only produce a beneficial effect on the diseased part, but also on the nerve and column. In fact, the current as applied to the entire spinal column acts as a tonic to other parts of the body.

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

1. An electrical device for the treatment of diseases of the human body, comprising a flexible spinal-cord electrode arranged for uninterrupted contact with the spinal cord approximately throughout the length thereof, a flexible electrode for application to the human body at or near the part of the human body showing the symptoms of the disease, and a source of electrical energy connected with the said electrodes, as set forth.

2. An electrical device for the treatment of diseases of the human body, comprising a fabric back, a fabric front, means for fastening the back and front to the human body, a flexible spinal-cord electrode secured on the said back and arranged for uninterrupted contact with the spinal cord approximately throughout the length thereof, a flexible electrode on the said front and arranged for contact with the human body at or near the seat of the disease, and a source of electrical energy connected with the said electrodes, as set forth.

3. An electrical device for the treatment of diseases of the human body, comprising a fabric back, a fabric front, means for fastening the back and front to the human body, a flexible spinal-cord electrode secured on the said back and arranged for uninterrupted contact with the spinal cord approximately throughout the length thereof, and a flexible electrode on the said front and arranged for contact with the human body at or near the seat of the disease, the said front electrode being shaped to correspond approximately to the shape of the afflicted organ, as set forth.

4. An electrical device for the treatment of diseases of the human body, provided with a spinal-cord electrode consisting of a flexible strip of sheet metal, and integral flanges extending sidewise therefrom, as set forth.

5. An electrical device for the treatment of diseases of the human body, provided with a spinal-cord electrode consisting of a flexible strip of sheet metal, and integral flanges extending sidewise therefrom and arranged alternately on opposite sides of the strip, as set forth.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

WILLIAM J. GAVIGAN.

Witnesses:
THEO. G. HOSTER,
EVERARD B. MARSHALL.