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ELECTROENCEPHALOGRAPH ELECTRODE COORDINATOR

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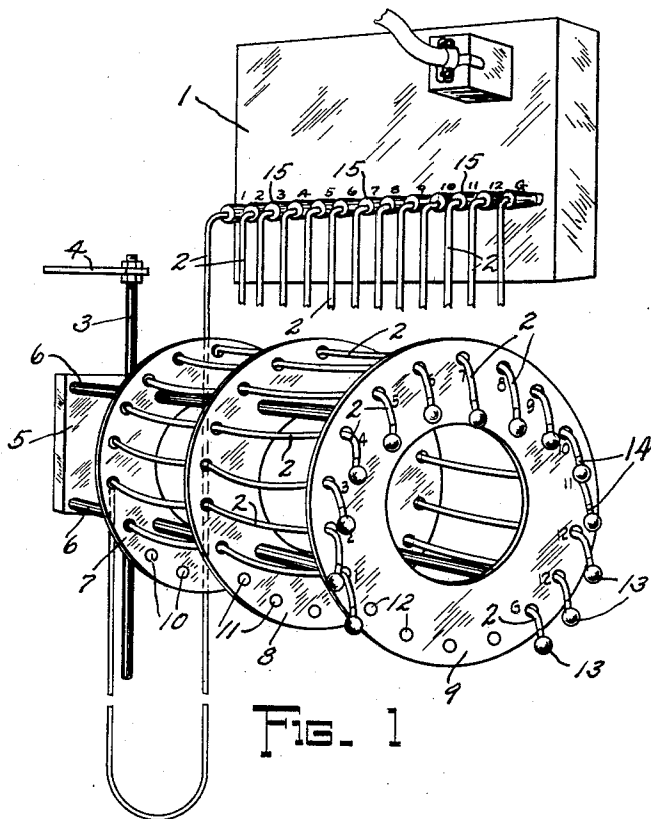


FIG. 1

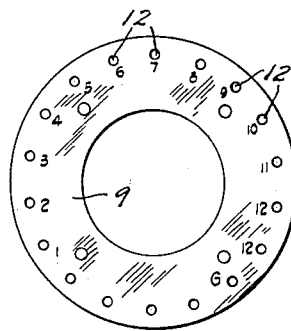


FIG. 4

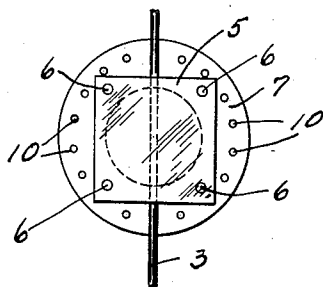


FIG. 5

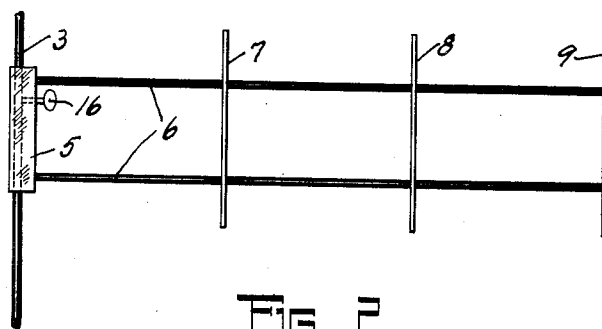


FIG. 6

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ELECTROENCEPHALOGRAPH ELECTRODE COORDINATOR

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11 Claims. (Cl. 128—2.1)

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My present invention relates to electroencephalography and more particularly comprises a coordinator device for suspending the electrode elements in a conveniently positionable manner while maintaining said electrodes in a separated condition wherein the individual electrodes are readily identifiable and their identification coordinated with the identification of their lead terminals at the terminal board of the electroencephalograph.

In the practice of electroencephalography, it is usual to provide a number of electrodes adapted to be secured in different positions upon the scalp or head of the patient whose encephalograph record is to be made. These electrodes are connected by suitable lead wires to the electroencephalograph apparatus, consisting of electrical amplifier means for amplifying the minute electrical impulses produced at the locations of the electrodes secured to the patient's head or scalp, and suitable recording mechanism for making a graphic record of the electrical impulses are produced. By proper selection of various combinations of two or more electrodes secured to the patient's scalp or head for recording of electrical impulses produced at the selected locations, the technician is enabled to secure a graphic record of conditions existing in certain areas of the patient's brain as indicated by electrical impulses produced at the pre-selected area of the patient's brain.

Under the foregoing conditions it is highly important that the individual electrodes secured to the patient's scalp be at all times readily identifiable in their relation to or coordination with particular lead wires selected for recording of the brain wave electrical impulses produced at certain areas of the patient's brain, so that the technician may at all times be assured or advised as to the portion of the patient's scalp or head from which the electrical impulses are coming to produce a given portion of the encephalograph record. In the practice of electroencephalography, according to present techniques, certain difficulties arise in the foregoing connection. These difficulties include the tendency of the lead wires to become entangled, with consequent difficulty of identifying the electrodes in relation to their terminals at the terminal board. Another difficulty arises from the fact that the unsupported weight of the lead wires pulls upon the electrodes and tends to break the contact thereof with the head of the patient, or result in poor contact reducing the value of the encephalograph record made under such condition.

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The foregoing difficulties have made necessary the use of lighter and less flexible wire than is desirable, and this in turn has made necessary frequent replacement of electrodes as the wire adjacent same becomes stretched or broken in use.

An alternative technique utilizes a head band electrode holder which involves other difficulties since it is necessary to rely upon pressure for contact of electrodes with the scalp of the patient rather than positive securing of the electrode to the scalp of the patient by means of an adhesive as possible in the technique to which the present invention relates.

In the light of the foregoing, therefore, it is the principal object of my invention to provide an electrode coordinator device capable of suspending the electrodes and their lead wires in a conveniently manipulatable segregated and readily identifiable condition.

Another important object of the invention is to provide such a coordinator device which will allow a free and unobstructed view for the electroencephalographer of the patient's head during use of the apparatus.

Another object of the invention is to provide such a device enabling electrodes to have longer life and reducing the necessity for frequent replacement of the electrodes.

A further object of the invention is to produce such a coordinator device whereby in the use thereof the production of artifacts or recording of conditions extraneous or unrelated to the conditions desired to be recorded, is minimized.

In general the coordinator device of my invention comprises a plurality of flat ring-like members and means for supporting said members in spaced concentric parallel relation, said means extending from a base member which is slidably and rotatably mounted in an adjustable manner upon a carrier shaft so that the whole device is conveniently manipulatable and adjustable to different positions in both vertical and horizontal planes. The ring-like members are each provided with a plurality of aligned openings through which pass the lead wires for the respective electrodes attached to the free ends of said wires. The whole device is preferably made substantially entirely of transparent plastic, or other suitably similar material so as to permit the operator technician to have an unobstructed view of the patient's head at all times. The outer ring-like member adjacent the free ends of the electrodes has its respective openings designated by suitable indicia appropriately identifying the respective electrode. The electrode lead wires are of rugged

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and flexible construction readily drawn in either direction through the openings in the ring-like members for adjustment of the electrodes to the desired position, and the latter are attached to their lead wires in a manner such as to minimize the necessity for frequent replacement.

Other objects, advantages and features of the invention will appear from the following detail description taken in conjunction with the accompanying drawings, in which:

Figure 1 is a perspective view of a portion of the electroencephalograph apparatus embodying my invention, and showing the electrode coordinator device and the terminal board for the terminal ends of the electrode lead wires.

Figure 2 is a side elevational view of the electrode coordinator device alone, electrodes and lead wires being omitted from this view.

Figure 3 is an end elevational view looking toward the left of Figure 2.

Figure 4 is a view showing the outer or face ring-like member alone having the indicia thereon differently designating the respective openings therein.

Now referring to the drawings, there is shown in Figure 1 the portion of the electroencephalograph equipment including a terminal board designated by the numeral 1, having a plurality of sockets or plug receiving elements designated by suitable numeral indicia on the face of the board numbered from 1 to 12, and one socket being designated by the letter G indicating the ground terminal. The plug receiving elements designated on the face of the board 1 are adapted to receive the plug terminals of the respective electrode lead wires, designated individually by the numeral 2. The terminal board 1 connects the electrode lead wires 2 through suitable switching means to the electric amplifying means and recording means of the electroencephalograph apparatus, the latter means not being shown in the drawings.

The electrode coordinator itself comprises the vertical carrier shaft 3 suitably secured to bracket 4 mounted upon the framework of the operator's cage, not shown. Slidably and rotatably mounted on the carrier shaft 3 is a base member 5 consisting of a block of Lucite or other suitable transparent material. Suitably connected to and extending from the base member 5 are four rods 6 comprising means for supporting the flat ring-like members 7, 8, and 9 which are mounted in concentric spaced parallel relation upon the rods 6 in any suitable manner such as that shown wherein the rods 6 pass through openings provided in said ring-like members, the latter being secured permanently to said rods in the aforesaid concentric spaced parallel relation of said ring-like members.

Said members 7, 8, and 9 are each provided with a plurality of alined openings designated respectively by the numerals 10, 11, and 12, the number of said openings 10, 11, and 12 being sufficient to accommodate the number of electrode lead wires employed, each of the lead wires 2 extending through alined openings 10, 11, and 12 of the members 7, 8, and 9. Each of the lead wires 2 has attached to its free end a respective electrode element 13 consisting of electrically conductive metallic material such as solder or the like.

Electrode lead wires 2 preferably comprise a type of wire known as "tinsel" wire which consists of a fabric sleeve covered cord made up of strands of linen thread on which have been spun

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ribbons of copper. These strands are woven together to make a continuous cord of great strength and flexibility, well insulated, which has the same electrical characteristics as the type of solid wire (usually No. 29 enameled copper wire) which is commonly used in the apparatus employed in the technique to which the present invention relates. The tinsel wire employed by me is bonded inside the soldered pellets comprising the electrodes 13 and sealed at the point of entry by an acetone resisting tape, indicated by the numeral 14, which ensures the positive seal against corrosive elements, particularly acetone used in the technique employed by me. The other ends of these wires 2 are attached by heat bonding to plugs 15 which are inserted in the numerically designated plug receiving openings of the terminal board 1. Components of these plugs 15 are removable without disturbing the bond to the wire 2, so that the wire 2 may be removed or installed at will.

Thus the lead wires 2 employed by me are of very rugged though extremely flexible construction, and these factors, together with the method of attachment of the electrodes 13 is such as to prolong the life of the electrodes and greatly reduce the frequency of replacement, since the lead wires may be flexed greatly and frequently relative to their electrodes as necessary in attaching the latter to the head of the patient without detaching the electrodes from the lead wires and without reducing the efficiency of the electrical contact therebetween.

The supporting rods 6 and ring like members 7, 8, and 9 are preferably also composed of Lucite or other suitable transparent material through which the vision of the operator is largely unobstructed, so that he can have unobstructed vision of the patient's head at all times, although the coordinator device is in his line of vision between his eyes and the patient's head as is necessarily the case under various conditions of use of the apparatus.

The outer ring-like member 9, or face flange, of the coordinator device is provided with suitable indicia numerically designating certain of the openings 12 by numerals from 1 to 12 as indicated in Figures 1 and 4, thereby providing means for identifying the respective electrode 13, including the one designated by the letter G for the ground terminal electrode, for coordinating or correlating the respective electrodes 13 with the position of attachment of their respective lead wires 2 to the respective socket or plug receiving elements of the terminal board 1, likewise designated by corresponding numerical and letter indicia.

The base plate 5 is provided with suitable adjusting means comprising the set screw 16 operable with the carrier shaft 3 to enable a portion of the coordinator device comprising the base plate 5, supporting rod 6, and members 7, 8 and 9 to swing in a horizontal plane rotatively around the axis of the rod 3 and to be adjusted vertically by upward and downward movement relatively to the shaft 3 axially thereof, the set screw 16 enabling the movable elements to be fixed in desired positions of adjustment after said movable elements have been swung rotatively, or moved axially of said shaft 3 to the desired position.

In the use of the electroencephalographic apparatus embodying the electrode coordinator device herein described, the patient will be seated with his head adjacent the face flange 12, the

elements of the device including the base member 5, rods 6, and members 7, 8, and 9 being adjusted to the desired position by rotative and axially sliding movements of the base member 5 relative to shaft 3. Thereupon, the operator or technician will suitably attach the electrodes 13 to the patient's scalp, drawing the lead wires 2 through the openings in the members 7, 8 and 9 to increase the length of said wires 2 extending from the outer side of the face flange 9, as desired, sufficient slack in the lead wires between the terminal plugs 15 and the electrodes 13 thereof being provided for this purpose. Having secured any desired number of the electrodes 13 to the patient's head, arranging the same to the desired location thereon, the operator-technician is now able to select desired areas of the patient's head for recording of brain wave electrical impulses produced at any selected area of the patient's head. This selection is accomplished by switching means at the terminal board 1 or other place intermediate the latter and the recording apparatus. The switching means will cut into the amplifier recorder circuit selected ones of the numerically designated plug receiving sockets of the terminal board 1, and the correspondingly numerically designated electrodes 13 connected with the patient's head at known areas.

The use of the coordinator device of the invention greatly facilitates the work of the technician operator in making electroencephalograph recordings since it prevents entanglement of the electrodes and their lead wires, maintains them in segregated and readily identifiable condition, and in conveniently manipulatable condition readily positionable in the desired location for facilitating the operation of attaching the electrodes to the patient's head. The use of the coordinator device further eliminates the weight factor of the wire, eliminating the tendency of the latter to pull the electrodes from the head of the patient by the weight of the wire. The device therefore permits the use of heavier, and at the same time more flexible and rugged electrode lead wires, and this flexibility and the manner of attachment of the lead wires to the electrodes prolongs their usable life and greatly lowers frequency of replacement.

It will be understood that there is sufficient slack, or extra length, in the lead wires 2 to permit the same to be drawn through the supporting members 7, 8, 9 so that the electrodes 13 may be disposed a considerable distance from the face member 9, as may be necessary to secure the electrodes 13 in electrical contact with the patient's scalp. When not in use, the lead wires 2 will be drawn in the opposite direction through the members 7, 8, 9, so that the electrodes 13 are disposed adjacent the face flange 9 as shown in Figure 1. In the latter condition it will be understood that the lead wires 2 hang down from the terminal board 1 looping below the members 7, 8, 9 between said terminal board 1 and the points of entry of said wires 2 into the openings 10 from the rear side of member 7, referring to Figure 1. Only one of the lead wires 2 is fully illustrated, by way of example, in said looped condition in Figure 1, the other wires 2 being broken away for clarity of illustration.

Having thus described my invention, what I claim as new and desire to secure by Letters Patent of the United States is:

1. An electrode coordinator device of the class described, comprising a carrier shaft, a base

member slidably and rotatably mounted on said shaft, a plurality of flat ring-like members, means associated with said base member for supporting said ring-like members in spaced relation concentrically disposed and with their planes parallel to one another, and means adjustably cooperable with said shaft and said base member for adjusting the same in different rotative and axial positions relative to said shaft, said ring-like members each having a plurality of circumferentially spaced openings, each of said openings being alined with a respective opening on each of the other of said ring-like members.

2. An electrode coordinator device of the class described, comprising a carrier shaft, a base member slidably and rotatably mounted on said shaft, a plurality of flat ring-like members, means associated with said base member for supporting said ring-like members in spaced relation concentrically disposed and with their planes parallel to one another, and means adjustably cooperable with said shaft and said base member for adjusting the same in different rotative and axial positions relative to said shaft, said ring-like members each having a plurality of circumferentially spaced openings, each of said openings being alined with a respective opening on each of the other of said ring-like members, a plurality of flexible wire elements, each of the latter extending through respective alined openings of said ring member, and a respective electrode secured to each respective wire element adjacent the free end thereof.

3. An electrode coordinator device of the class described, comprising a carrier shaft, a base member slidably and rotatably mounted on said shaft, a plurality of flat ring-like members, means associated with said base member for supporting said ring-like members in spaced relation concentrically disposed and with their planes parallel to one another, means adjustably cooperable with said shaft and said base member for adjusting the same in different rotative and axial positions relative to said shaft, said ring-like members each having a plurality of circumferentially spaced openings, each of said openings being alined with a respective opening on each of the other of said ring-like members, and a plurality of flexible wire elements, each of the latter extending through respective alined openings of said ring members.

4. In electroencephalograph apparatus, in combination, a terminal board, a plurality of electrode lead wires having their terminal ends secured thereto, an electrode coordinator device comprising a carrier shaft disposed in fixed relation to said terminal board, and means rotatably and slidably mounted on said carrier shaft for supporting said wires in segregated condition.

5. In electroencephalograph apparatus, in combination, a terminal board, a plurality of electrode lead wires having their terminal ends secured thereto, an electrode coordinator device comprising a carrier shaft disposed in fixed relation to said terminal board, and means rotatably and slidably mounted on said carrier shaft for supporting said wires in segregated condition, said means comprising a plurality of spaced members having a plurality of openings therein for receiving said wires, each opening in each of said members being alined with an opening in each of the other members each lead wire extending through respective alined openings in said members.

6. In electroencephalograph apparatus, in combination, a terminal board, a plurality of electrode lead wires having their terminal ends secured thereto, an electrode coordinator device comprising a carrier shaft disposed in fixed relation to said terminal board, and means rotatably and slidably mounted on said carrier shaft for supporting said wires in segregated condition, said means comprising a plurality of spaced members having a plurality of openings therein for receiving said wires, each opening in each of said members being alined with an opening in each of the other members each lead wire extending through respective alined openings in said members, and a respective electrode secured to each respective lead wire adjacent the free end thereof, said lead wires having sufficient extra length to permit the same to be looped intermediate the terminal board and the point of entry of said wires to said openings of one of said members when the electrode ends of said wires are disposed adjacent another of said members.

7. An electrode coordinator device of the class described, comprising a carrier shaft, and means rotatably and slidably mounted on said carrier shaft for supporting a plurality of wires in segregated condition, said means comprising a plurality of spaced members having a plurality of openings therein, each opening in each member being alined with an opening in each of the other members, and means for adjusting the first means to different rotative and axial positions relative to said shaft.

8. An electrode coordinator device of the class described, comprising a carrier shaft, a base member slidably and rotatably mounted on said shaft, a plurality of flat ring-like members, means associated with said base member for supporting said ring-like members in spaced relation concentrically disposed and with their planes parallel to one another, and means adjustably cooperable with said shaft and said base member for adjusting the same in different rotative and axial positions relative to said shaft, said ring-like members each having a plurality of circumferentially spaced openings, each of said openings being alined with a respective opening on each of the other of said ring-like members, said members being composed of transparent material.

9. An electrode coordinator device of the class described, comprising a carrier shaft, a base member slidably and rotatably mounted on said shaft, a plurality of flat ring-like members, means associated with said base member for supporting said ring-like members in spaced relation concentrically disposed and with their planes parallel

to one another, means adjustably cooperable with said shaft and said base member for adjusting the same in different rotative and axial positions relative to said shaft, said ring-like members each having a plurality of circumferentially spaced openings, each of said openings being alined with a respective opening on each of the other of said ring-like members, and a plurality of flexible wire elements, each of the latter extending through respective alined openings of said ring members, one of said ring members being provided with indicia differently designating the different openings.

10. An electrode coordinator device of the class described, comprising a carrier shaft, a base member slidably and rotatably mounted on said shaft, a plurality of flat ring-like members, means associated with said base member for supporting said ring-like members in spaced relation concentrically disposed and with their planes parallel to one another, and means adjustably cooperable with said shaft and said base member for adjusting the same in different rotative and axial positions relative to said shaft, said ring-like members each having a plurality of circumferentially spaced openings, each of said openings being alined with a respective opening on each of the other of said ring-like members, the said carrier shaft being disposed with its axis substantially vertical for vertical adjustment of the said base member axially of said shaft and for rotative adjustment of said base member in a horizontal plane.

11. An electrode coordinator device of the class described, comprising a carrier shaft, a base member slidably and rotatably mounted on said shaft, a plurality of flat ring-like members, means associated with said base member for supporting said ring-like members in spaced relation concentrically disposed and with their planes parallel to one another, and means adjustably cooperable with said shaft and said base member for adjusting the same in different rotative and axial positions relative to said shaft, said ring-like members each having a plurality of circumferentially spaced openings, each of said openings being alined with a respective opening on each of the other of said ring-like members, a plurality of flexible wire elements, each of the latter extending through respective alined openings of said ring member, and a respective electrode secured to each respective wire element adjacent the free end thereof, the electrodes comprising metallic pellets and their respective wire elements being bonded within respective pellets and sealed at the point of entry by an acetone resisting tape.

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