

July 19, 1949.

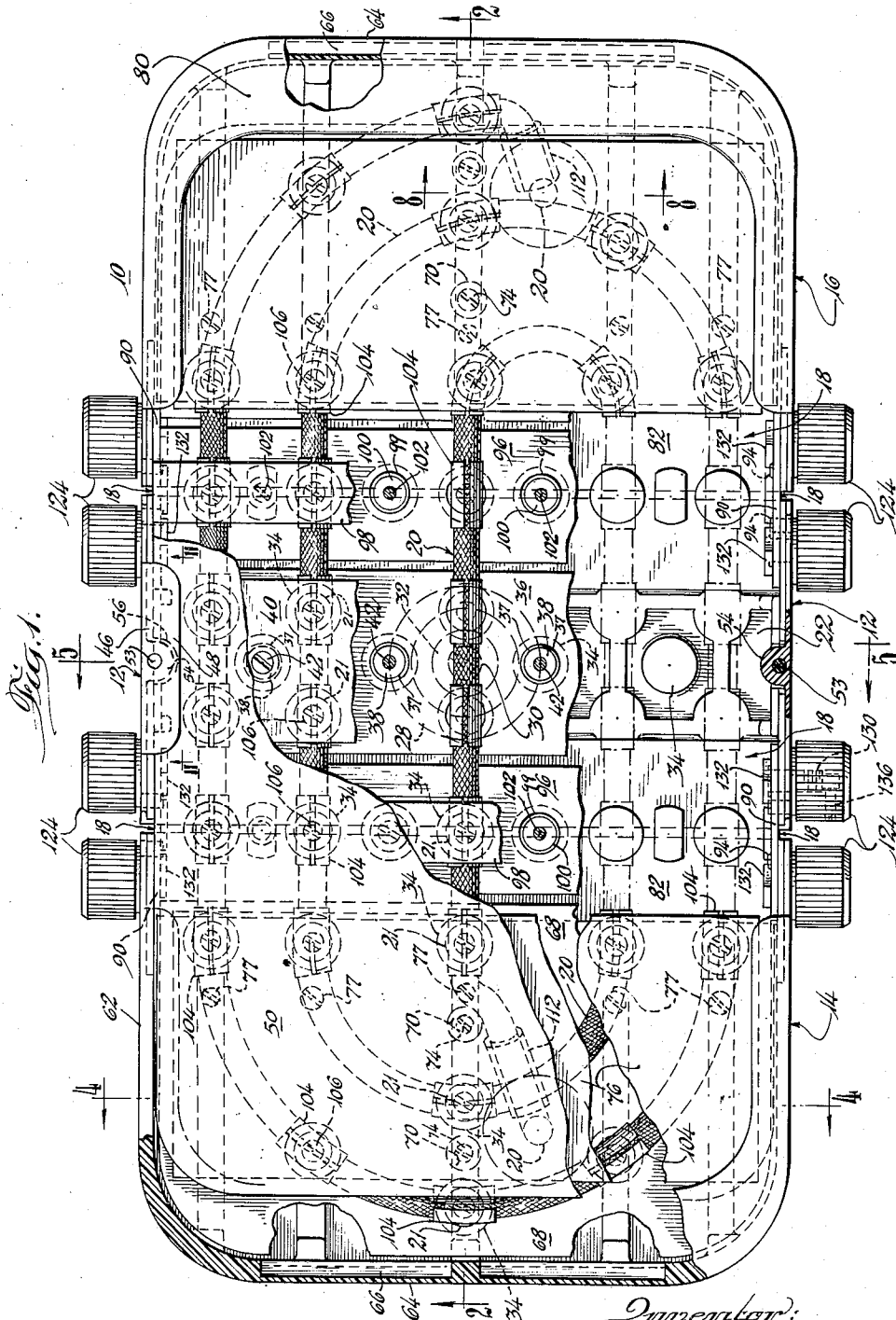
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2,476,645

HIGH-FREQUENCY DIATHERMY APPLICATOR

Filed Nov. 27, 1946

4 Sheets-Sheet 1



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July 19, 1949.

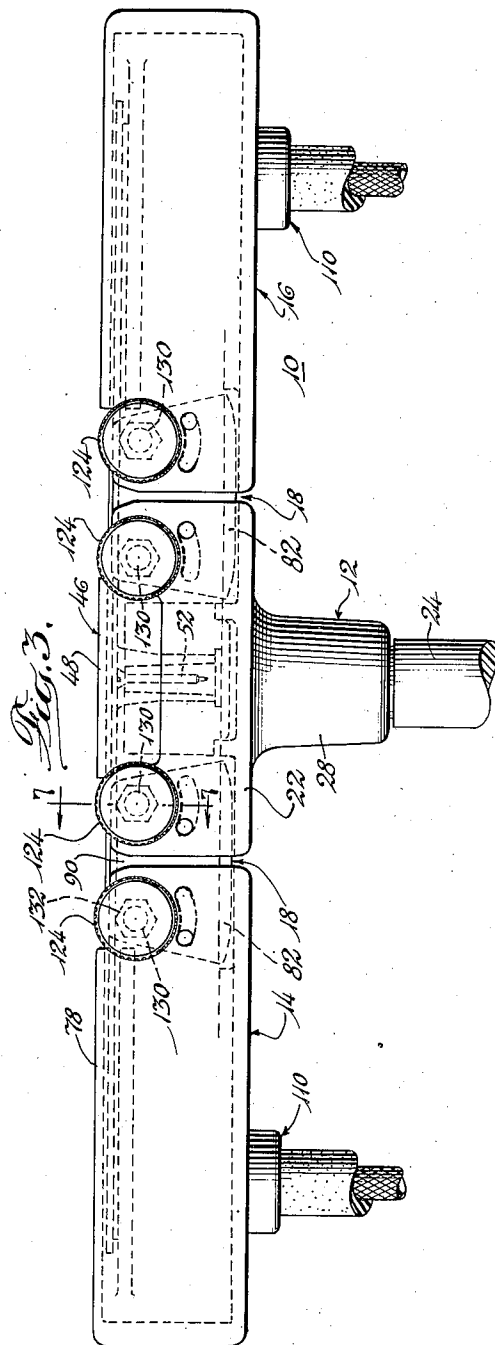
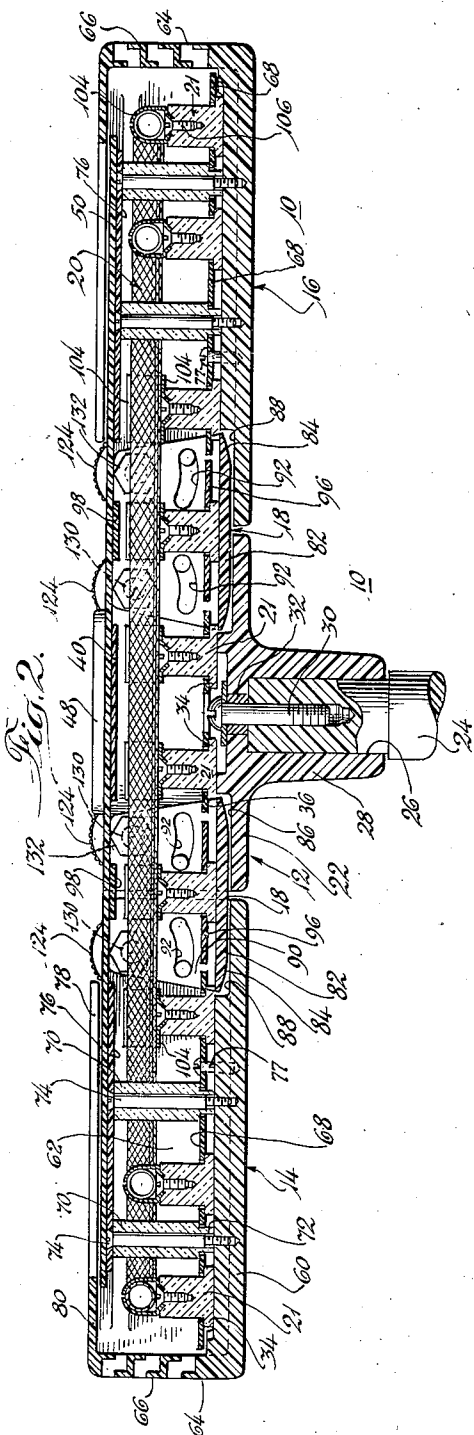
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2,476,645

HIGH-FREQUENCY DIATHERMY APPLICATOR

Filed Nov. 27, 1946

4 Sheets-Sheet 2



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July 19, 1949.

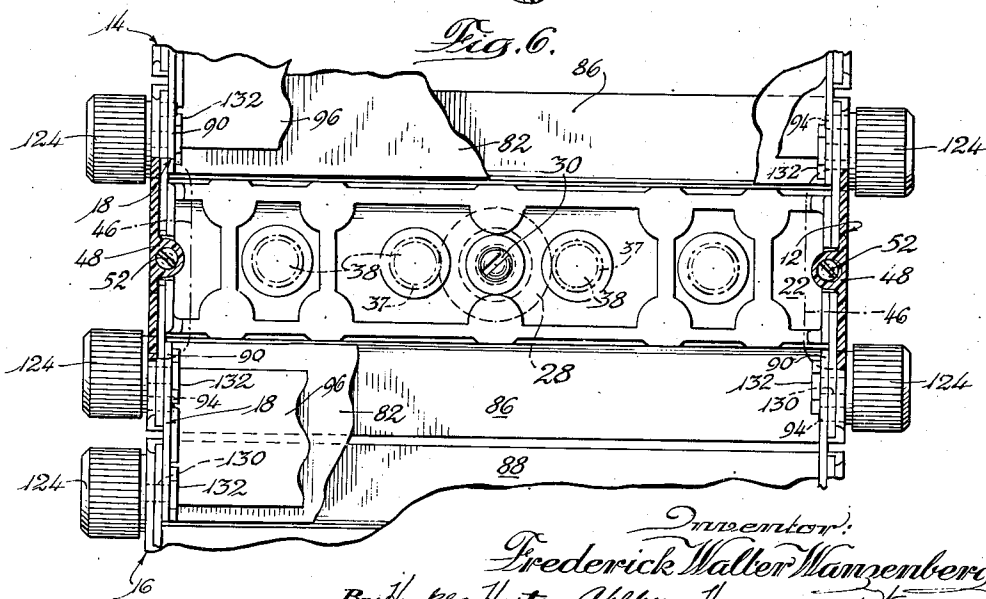
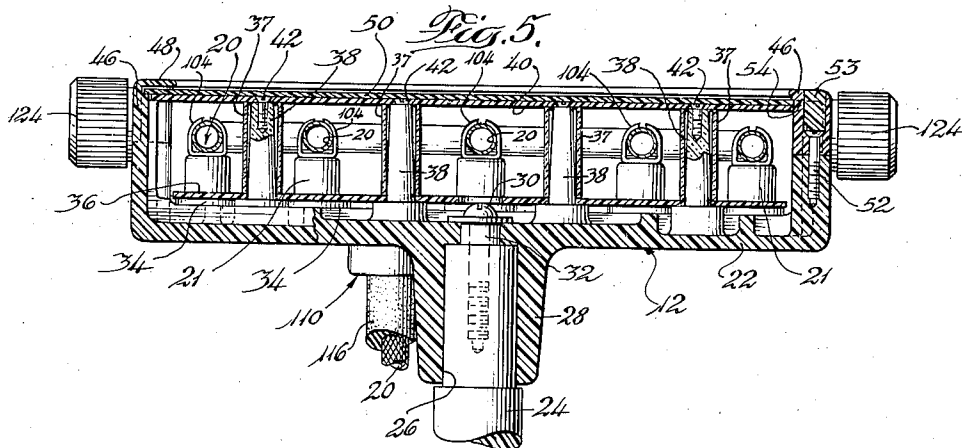
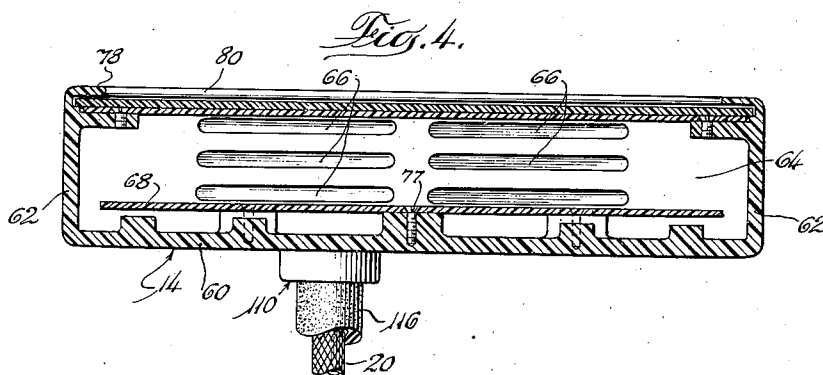
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2,476,645

HIGH-FREQUENCY DIATHERMY APPLICATOR

Filed Nov. 27, 1946

4 Sheets-Sheet 3



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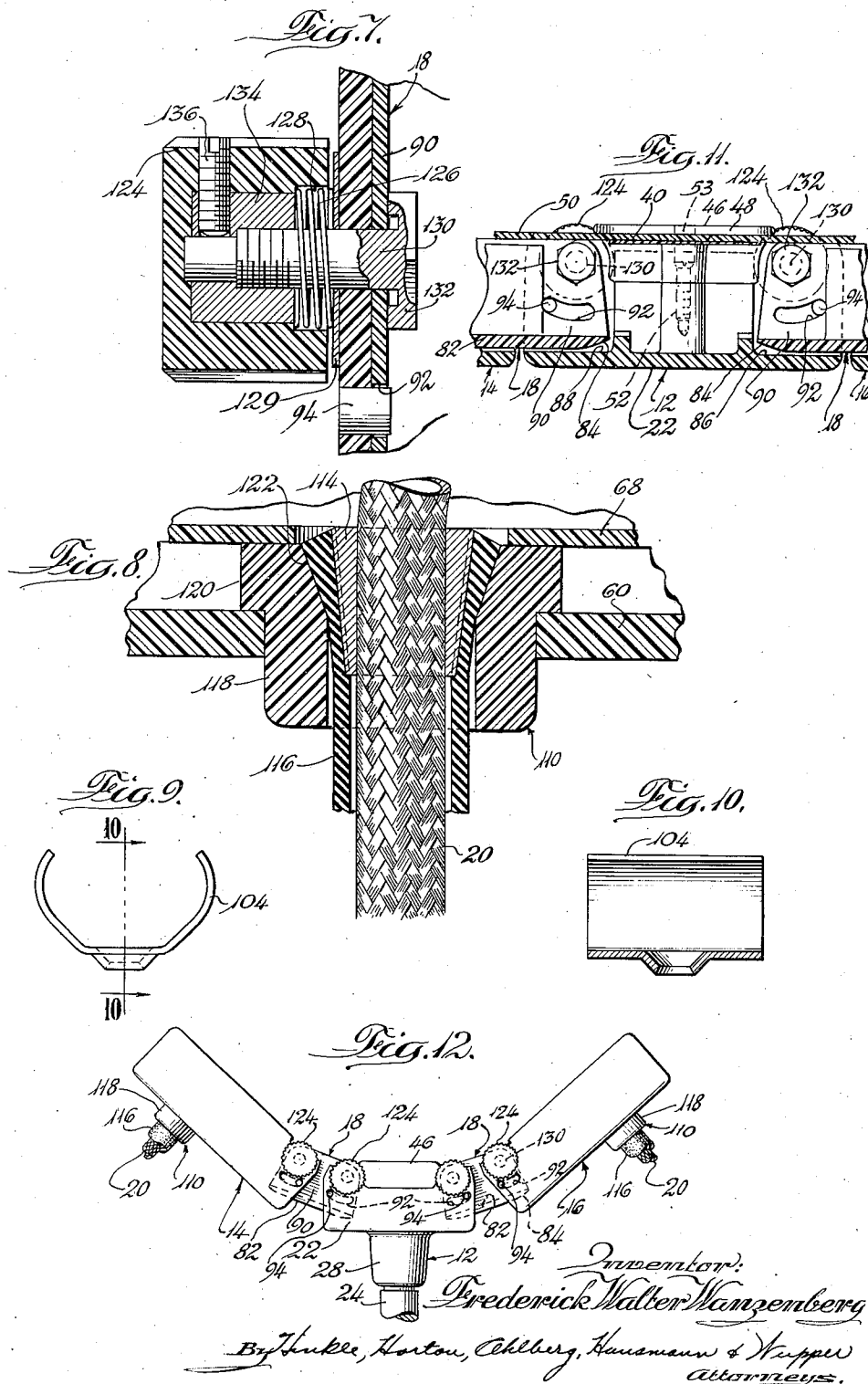
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HIGH-FREQUENCY DIATHERMY APPLICATOR

Filed Nov. 27, 1946

4 Sheets-Sheet 4



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UNITED STATES PATENT OFFICE

2,476,645

HIGH-FREQUENCY DIATHERMY
APPLICATOR

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Application November 27, 1946, Serial No. 712,656

8 Claims. (Cl. 128-405)

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The present invention relates to a high frequency diathermy applicator or, as it is sometimes called, an electrode, which is particularly designed for use in diathermy treatment of individuals.

The applicator disclosed and claimed herein is an improvement over the applicator disclosed and claimed in the contemporaneously filed application of Oscar R. Bowers which is assigned to the assignee of this application.

The primary object of the present invention is the provision of a new and improved high frequency diathermy applicator characterized by ease of adjustability, efficient operation, and structural features making it easy to manufacture and contributing to its durability.

Another object of the present invention is to provide a new and improved sectionalized high frequency diathermy applicator including a single unjointed coil distributed over the area of the applicator.

A further object of the present invention is to provide an applicator of the character set forth in the preceding paragraph wherein the sections are hinged and the unitary coil is a hollow woven flexible tube which flexes or moves in a hinged manner with the various sections.

A further object of the present invention is to provide a new and improved adjustable diathermy applicator so constructed and arranged that it is frictionally held in its various positions of adjustment.

Other objects and advantages of the present invention will become apparent from the ensuing description of an embodiment thereof, in the course of which reference is had to the accompanying drawings, in which:

Fig. 1 is a top plan view, partly broken away, illustrating an applicator constructed in accordance with the invention;

Fig. 2 is a longitudinal transverse cross sectional view taken along the line 2-2 of Fig. 1;

Fig. 3 is a side elevational view;

Fig. 4 is a transverse cross sectional view taken along the line 4-4 of Fig. 1;

Fig. 5 is another transverse cross sectional view taken along the line 5-5 of Fig. 1;

Fig. 6 is a fragmentary enlarged top plan view, partly broken away and with parts omitted, of the center section of the applicator;

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Fig. 7 is a fragmentary enlarged cross sectional view taken along the line 7-7 of Fig. 3;

Fig. 8 is an enlarged fragmentary cross sectional view taken along the line 8-8 of Fig. 1;

Fig. 9 is an end elevational view of one of a number of cable holding clips;

Fig. 10 is a cross sectional view taken along the line 10-10 of Fig. 9;

Fig. 11 is a view taken along the line 11-11 of Fig. 1 and illustrating a bracket associated with the center section of the applicator; and

Fig. 12 is a view, on a reduced scale, showing the applicator adjusted to present a concave inner face for the treatment of a curved portion of a patient's body.

The high frequency applicator illustrated in the drawings is indicated as a whole by reference character 10. It is characterized by a novel sectionalized construction including a center section 12 and side sections 14 and 16, which are of similar but opposite construction for attachment to opposite sides of the center section, and knee sections 18 which connect the end sections to the center section. The various sections are made of some suitable insulating material, preferably Bakelite, and they may be constructed in suitable manner, as by casting.

One of the main features of the present invention resides in the use of a single unitary but unhinged high frequency coil 20 housed within the multiple section housing. The coil contains a relatively few turns which are distributed over the major portion of the applicator to provide uniform distribution of the diathermy current. The coil is located near the inner face of the applicator to increase its effectiveness and the coil is of a character such as to flex or move in hinged manner with means hingedly supporting the sections of the applicator relative to each other.

In order that the coil may be utilized as a hinge, it is of flexible construction and preferably a hollow bronze woven flexible tube of a type obtainable from the Chicago Metal Hose Corporation by which it is ordinarily used as a metal hose covering. This material has sufficient conductivity to enable it to be used as a conductor for the diathermy current and, surprisingly, it has sufficient flexibility to be flexed or bent over the range of adjustability of the applicator without undue or excessive deformation in the regions where it

flexes. The manner in which the cable is supported by the cable supports 21 to insure reliable operation will be described later after consideration of the construction of the various sections of the applicator.

The center section 12 includes a main center section member 22 by means of which the applicator is supported from a holder 24 which may form a suitable handle for attachment to the diathermy apparatus. The handle is adapted to be secured in a recess 26 formed centrally within a dependent boss 28. The handle is secured to the center section by a screw 30 passing through a central sleeve 32 located in a central aperture in the center section member.

In accordance with another novel feature of the present invention the coil supports 21, which are made of a suitable insulating material, are held in place by means considerably facilitating assembly of the applicator. This means includes the peripheral flanges 34 at the lower ends of the supports which are engaged by a center section lower plate 36, thereby to hold the insulators in place. The lower plate is prevented from moving upwardly by sleeves 37 surrounding the two center posts 38, which are tapered and circular in cross section and formed integrally with member 22.

The center section includes also an upper center plate 40 adapted to be secured to the main center section member above the coil. It is so secured by a plurality (preferably four) screws 42 passing through it and threaded into a corresponding number of the posts 38.

The center section is also provided with oppositely disposed guiding brackets 46 of a construction illustrated best in Fig. 11. These brackets have inwardly extending flanges 48 spaced a short distance above the upper plate 40 for the purpose of receiving an inner face shield 50, which constitutes another of the features of the invention.

The brackets are secured to the main center section by sunken screws 52 covered by plugs 53. The brackets are also provided with rounded inwardly extending bosses 54 (see Fig. 1) receiving semicircular grooves 56 in the shield to prevent longitudinal displacement of the shield relative to the center section.

The side sections 14 and 16 are substantially alike and, therefore, only one, the end section 14, will be described in detail, although like reference characters will be applied to like parts of each. It includes a main side section member 60 having side walls 62 and an end wall 64 provided with a suitable grill work 66 to provide ventilation assisting in cooling the applicator in use. The flanged coil supports 21 are held in place by a lower plate 68 which in turn is held in place by the spacers 70 having reduced ends 72 projecting through apertures in the plate and abutting against the bottom. The spacers are secured by screws 74 which also hold in place the upper plate 76 against which the shield 50 rests. The lower plate 68 is additionally held in place by the screw 77 passing therethrough and threaded into the bottom wall.

The shield 50 is so constructed and arranged that it is movable relative to the side sections. This arrangement is necessary because the housing sections hinge about the axes of flexing of the coil, whereas the shield flexes about an axis displaced therefrom and near the face of the applicator. The relative movement of the shield is guided by opposed inwardly extending flanges 78 on the side sections spaced above the upper

plates 76 a distance sufficient slidably to receive the shield. The end sections are further provided with a longer flange 80 which serves to maintain the coil housing completely closed when the applicator is flat, as illustrated in Fig. 2 and also in its other adjusted positions.

The shield 50 constitutes one of the important features of the present invention. It is flexible and is preferably made of polyethylene. It is guided as heretofore indicated by the flanges 48 on the center section brackets 46 and by the flanges 78 and 80 of the side sections. It is kept in spaced relation to the coil 20 by the top plates of the center and end sections which also serve as a support therefor and serve to heat-insulate it.

In order to facilitate and also to limit the relative movement between the housing sections, the sections are interconnected by the previously referred to knee sections 18. These sections are alike so that here again only one of them will be described in detail. Each knee section includes a knee bracket 82 having a somewhat rounded outer portion 84 fitting into transverse apertures 86 and 88 in the center and outer sections, as best illustrated in Fig. 2. The brackets include also opposed end walls 90 each having a pair of arcuate apertures 92 cooperatively associated with pins 94 secured to the end walls of the center and outer sections to limit the extent of the angular movement of the sections relative to each other. The construction is such that a considerable angular adjustment of the sections relative to each other may be had to accommodate the applicator to smaller and round parts of the patient's body.

The coil supports 21 of the knee bracket are held in place by the lower knee plate 96. An upper knee plate 98 is secured to the posts 100 by the screws 102 and sleeves 99 surround the two center posts, which are tapered and round as distinguished from the outer posts, which have flattened sides.

The coil is secured in the housing by the coil supports 21 which have coil receiving clips 104 secured to their outer ends by the screws 106. The clips are preferably made of soft copper and are initially of a form illustrated in Fig. 9 better to receive the coil. After the coil has been positioned, the arms of the clip are pressed fairly closely to embrace the coil.

In order to prevent the coil from coming into contact with the upper plates and shield, the clips have a length approximating the width of the upper knee plates 98 and are so positioned at the adjacent edges of the upper plates that the coil itself will not come into contact with the plates. This result is obtained by positioning the clips, as shown best in Fig. 2, with their edges substantially in line with the edges of the upper plates. Consequently, when the applicator is moved to its various adjusted positions, the coil cannot possibly come into contact with either the upper plate or the shield.

The ends of the coil are led to the exterior of the housing through novel clamping means indicated generally by the reference character 110, one of which is best illustrated in Fig. 8. The ends of the coil in the interior of the housing are bent downwardly and surrounded by cable insulating members 112 which take the form of sleeves (see Fig. 1). From the sleeves the cables extend through the side sections 60 to which they are secured by the clamping means 110. The clamping means includes an inner tapered brass bushing 114 having a knurled outer surface. The

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bushing surrounds the cable and it is in turn surrounded by a rubber covering 116 which it securely holds against an annular bushing 118 having a flange 120 abutting against the wall 60 and held in place by the lower plate 68. The arrangement is thus such that both the cable and its rubber covering are securely held in place. The bushing 120 is preferably provided with an inner taper 122 somewhat greater than the taper of bushing 114 more effectively to squeeze and hold the end of the rubber covering.

The housing sections are resiliently held in adjusted position by friction means adjustable by the knobs 124. The frictional holding is provided by springs 126 located within hollows 128 provided in each of the knobs. One end of the spring bears against the knob and the other against a washer 129 located adjacent the end wall of the housing. The knob is secured to a bolt 130 having a head 132 bearing against the inside of the knee bracket wall so that the spring forces the walls of knee and side or center section brackets, as the case may be, into frictional engagement. The knob is provided with a threaded brass insert 134 and the knob with its insert is held in adjusted position with the spring at the desired compression by a set screw 136.

The housing sections are hingedly secured for angular adjustment relative to each other by the bolts 130 which pass, as just described, through the knee sections and the center and end sections. These bolts are located at approximately the level of the coil so that the coil will better flex in hinged manner with the housing sections.

From the foregoing detailed description it may be noted that the applicator of the present invention may be constructed readily from suitable materials and that it may also readily be assembled. The main portions of the housing are first cast or otherwise formed, after which the coil supporting insulators are assembled in the various sections along with the lower plates 68 and spacers. The coil is then secured in place by the clips and the ends are clamped in place by the clamping means 110. Thereafter the upper plates 76 are secured by the screws. The shield 50 is then positioned with its ends guidably received in the side sections and thereafter the brackets 46 are secured in place to hold the shield.

In use, the sectionalized housing can be readily adjusted so that its inner face has the desired contour for treatment of the patient. The adjustment can be made easily and the sections are held in adjusted position by the resilient holding means including the adjustable knobs and springs.

The coil is at all times maintained spaced from the upper plates and the shield, and at the same time is maintained at substantially the same position relative thereto so that all portions of the coil are effective in all positions of adjustment. The coil is so held that it does not come into contact with the plates or shield and the coil is cooled by conduction toward the back of the applicator and also by ventilating air which has access to the interior of the housing through the grill work 66. The shield 50, being made of flexible material, is readily flexed during the adjustment of the sections of the housing and maintains the housing closed at all times.

The adjustment is limited to the desired range by the pins 94 and slots 92 as hereinbefore described in detail.

While but a single embodiment of the invention has been described in detail, it should be

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understood that the details thereof are not intended to be limitative of the invention except in so far as set forth in the accompanying claims.

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

1. A high frequency applicator including a housing section having a back wall, flanged coil supports mounted in said section with the flanges disposed toward the back wall, an apertured plate through which the coil supports extend and abutting against the flanged portions of said supports, and means including spacers at least portions of which abut against the plate for securing said plate.

2. A high frequency applicator including a housing section having a back wall, flanged coil supports mounted in said section with the flanges disposed toward said back wall, an apertured plate fitting over said supports and abutting against the flanged portions thereof, spacers including portions projecting through said plate and portions abutting against said plate, a top plate located above said spacers, and means passing through said top plate and spacers for securing them to said housing section.

3. A high frequency applicator including a housing section, flanged coil supports in said section, a series of posts in said section, an apertured plate fitting over said supports and posts and abutting against the flanged portions of said supports, and means including tubular spacers fitting around said posts and abutting against said plate for securing said plate in position.

4. A high frequency applicator including a housing section, flanged coil supports in said section, a series of posts in said section, an apertured plate fitting over said supports and posts and abutting against the flanged portions of said supports, and means including tubular spacers fitting around said posts and abutting against said plate and a plate seating upon said spacers for securing said plate in position.

5. A high frequency diathermy applicator comprising a housing having a plurality of sections hingedly secured together for relative angular movement, a flexible coil in said housing, a flexible cover for said housing, coil supports in said housing supporting said coil below said cover, top plates supported below said cover and above the coil in the various housing sections, and means including coil holders secured to said supports for preventing the coil from coming into contact with said flexible cover, said coil holders extending to the edges of the top plates in the regions of flexing of the applicator.

6. A high frequency diathermy applicator comprising a housing having center and side sections hingedly secured together for relative angular movement, a flexible cover, and means including separable brackets secured to the center section having flanges overlying said cover and portions interengaging with said cover for holding and preventing relative movement of said cover relative to said center section.

7. A high frequency diathermy applicator comprising a plurality of open sided coil housing sections hinged together for relative angular movement whereby the open sides may be moved toward and away from each other, and a single piece flexible cover common to the open sides of all housing sections, said cover flexing when the sections are moved relative to each other.

8. A high frequency diathermy applicator comprising a plurality of open sided coil housing sec-

tions hinged together for relative angular movement whereby the open sides of the sections may be moved toward and away from each other, and a single piece flexible cover covering the open sides of all housing sections, said cover secured to one of said sections and movable relative to the remaining sections, said cover flexing when the sections are moved relative to each other.

FREDERICK WALTER WANZENBERG.

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