

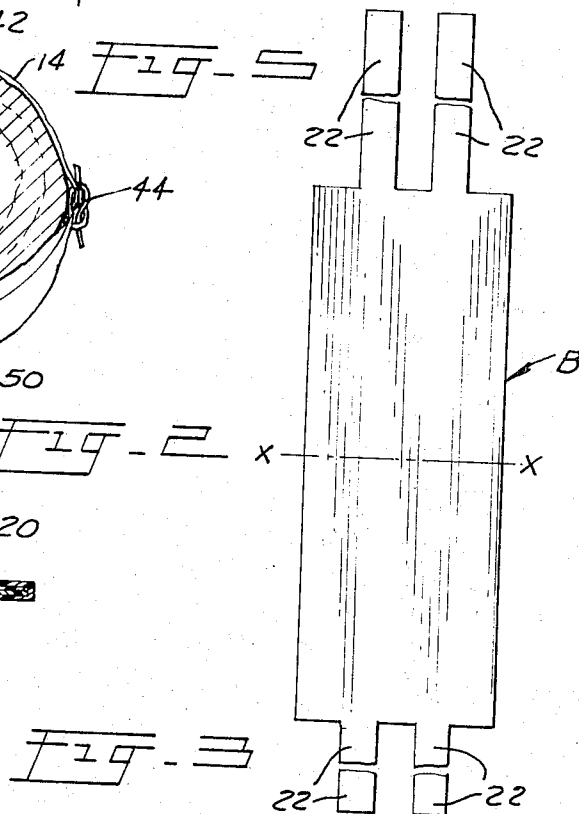
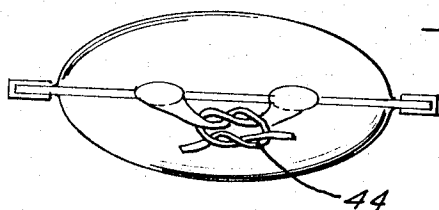
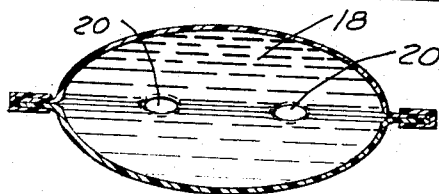
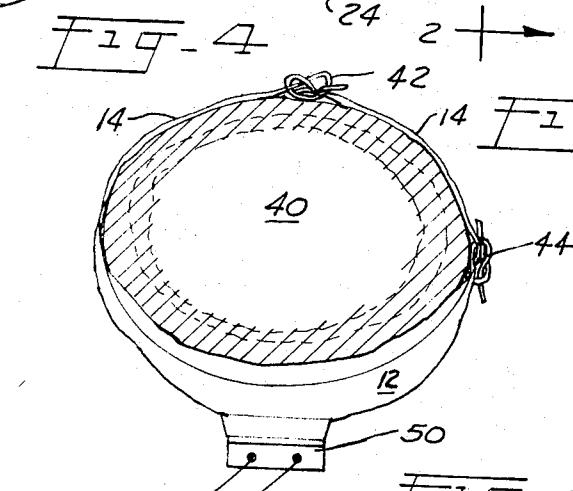
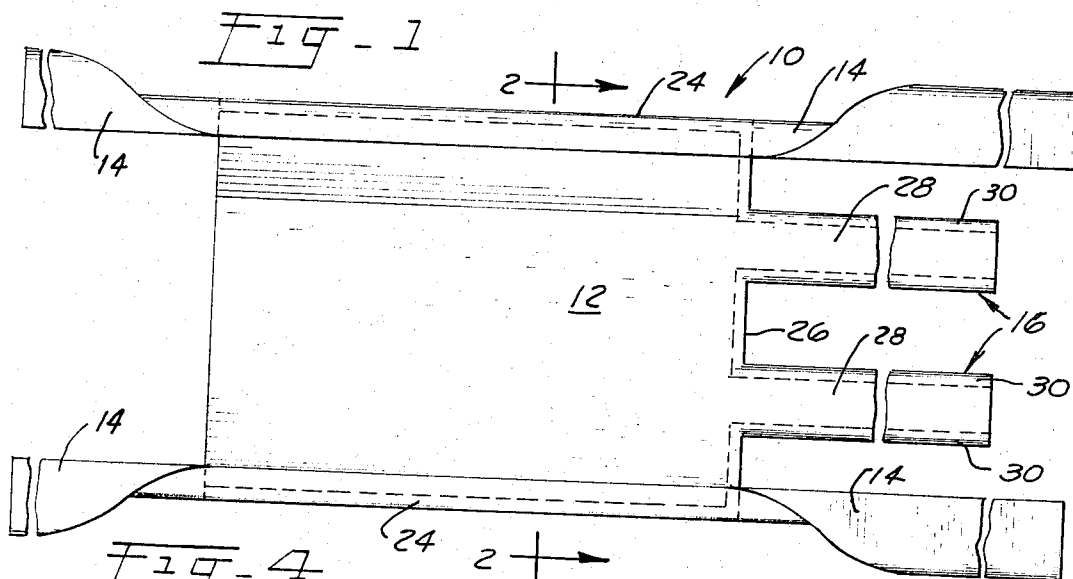
Dec. 5, 1967

C. A. BEHNEY

3,356,086

ULTRASONIC ENERGY COUPLING

Filed Aug. 24, 1965



INVENTOR.  
CHARLES A. BEHNEY  
BY *Norman Gerlach*  
ATTORNEY

1

3,356,086

## ULTRASONIC ENERGY COUPLING

Charles A. Behney, Cochise Lane, Bisbee, Ariz. 85603

Filed Aug. 24, 1965, Ser. No. 482,171

4 Claims. (Cl. 128—24)

The present invention relates to an ultrasonic energy coupling in the form of an applicator for an ultrasonic treatment head and by means of which ultrasonic vibrations emanating from the treatment head or transducer may effectively be conducted to selected localized regions of a patient's body. More specifically, the invention is concerned with a hydraulic applicator in which a liquid is employed as the conducting medium for such ultrasonic vibrations, yet in which the afflicted body part undergoing treatment is maintained out of direct contact with the liquid and hence is not wetted.

Heretofore, in the treatment of such conditions or ailments as arthritis, bursitis and a wide variety of other afflictions ranging in seriousness down to simple bruises, muscular aches and related swellings, it has been the practice to submerge the afflicted body part of the patient in water and orbit or partially orbit the ultrasonic treatment head, likewise submerged, slowly about the submerged body part to be treated. This has been considered necessary since direct application of the treatment head to the body part to be treated is impractical, especially where protuberances are involved, while the transmission of ultrasonic vibrations through air is impractical since dissipation of the vibrations takes place in a rarefied media and the vibrations do not reach the afflicted body part with sufficient force to be effective.

Such submersion procedure, although a troublesome and disordered one, is feasible in connection with the treatment of humans, but in the case of animals, it is impractical and, therefore, it has been the practice of veterinarians to apply a layer of petroleum jelly to the afflicted part and then apply the ultrasonic treatment head to the coating of jelly. Obviously, where protuberances which do not conform to the contour of the ultrasonic head are involved, this latter method is ineffective. The same is true where there are involved human body parts which cannot readily be submerged in water.

The present invention is designed to overcome the above noted limitations that are attendant upon the transmission of ultrasonic vibrations emanating from a treatment head or transducer to the body of a patient, and toward this end, the invention contemplates the provision of an extremely simple, yet effective, bag-like applicator which is capable of being inflated or filled with a suitable energy-transmitting liquid, such as water, heavy mineral oil, or other liquid which is capable of transmitting ultrasonic energy, the liquid enabling the applicator to conform to the various contours of the part or parts undergoing treatment. The applicator, by way of its dimensions and the extent to which it is liquid inflated or filled, maintains the ultrasonic treatment head or transducer at a predetermined distance from the surface of the patient's body where initial entry of the vibrations is desired.

The provision of an ultrasonic applicator of the character briefly outlined above being among the principal objects of the present invention, it is a further object to provide an ultrasonic energy applicator which acts as a cushion between the ultrasonic treatment head and the patient's body, thus avoiding painful contact with the treatment head.

A further object of the invention is to provide a relatively simple inflatable pad-like applicator having associated therewith novel liquid filling and discharge means, such means being devoid of a mechanical valve or other working parts and the entire structure being formed of a suitable inexpensive flexible plastic material, by a simple

2

heat-sealing process, and at a cost sufficiently low as to justify disposal of the applicator after use thereof.

A still further object of the invention is to provide an ultrasonic energy applicator having associated therewith integral fastening means whereby the applicator may be tied in position on or over the afflicted body part undergoing treatment and either untied or severed from such position after the ultrasonic sound treatment has been completed.

A similar and related object of the invention is to provide an ultrasonic energy applicator which may, if desired and prior to disposal, conveniently be emptied of its liquid contents by the simple expedient of severing the filling and discharge tubes that are associated therewith.

Other objects and advantages of the invention, not at this time enumerated, will readily suggest themselves as the following detailed description ensues.

In the accompanying single sheet of drawings forming a part of this specification, one illustrative embodiment of the invention is shown.

In these drawings:

FIG. 1 is a plan view of an ultrasonic energy applicator embodying the invention and showing the applicator in its flattened or collapsed state;

FIG. 2 is a transverse sectional view taken on the line 2—2 of FIG. 1 and in the direction of the arrows but showing the applicator operatively expanded;

FIG. 3 is an end view of the expanded applicator showing the manner in which it is sealed against egress of liquid;

FIG. 4 is an end view of the applicator, showing the same operatively applied to an irregular-shaped body part undergoing ultrasonic treatment; and

FIG. 5 is a plan view of the blank from which the applicator, in the main, is formed.

Referring now to the drawings in detail, and in particular to FIG. 1, an ultrasonic energy or vibration applicator embodying the present invention is designated in its entirety by the reference numeral 10, and it is in the form of a flexible bag-like structure which is formed in its entirety of a suitable plastic sheet material. Preferably, the plastic material of which the applicator is formed is translucent or transparent and is of light gauge construction on the order of from one to two mils. Various plastic sheet materials are available for construction of the applicator 10 and it has been found that commercial one or two mil polyethylene sheeting is entirely satisfactory for purposes of the present invention.

The applicator 10 involves in its general organization a generally rectangular expansible bag 12, four fastening tapes 14 which extend outwardly from the four corners of the bag, and two filler, bleeder and discharge tubes 16. The applicator 10, in the form which is illustrated in FIG. 1, is flattened and lies in a common plane, both the bag 12 and the tubes 16 being flat. When extended, however, the bag defines an internal chamber 18 (see FIG. 2), while the tubes 16 define entrance and exit passages 20.

The applicator 10 is formed from a blank of polyethylene sheet material, the blank being shown in FIG. 5 and designated by the reference letter B. The blank B is comprised of an elongated rectangular sheet from the end edges of which there project longitudinally outwards four tongues 22, these tongues being disposed in paired opposition so that when the blank is folded along the fold line x—x, the opposed tongues may be brought into co-extensive face-to-face contiguity. With the blank B thus folded on the line x—x, the same is subjected to a high frequency resistance welding operation by utilizing a suitable welding die combination so as to effect welded seam lines around the three unfolded edges of the folded blank as shown in FIG. 1. The longitudinal welded seams 24

are continuous seams, while the transverse welded seam 26 is interrupted to allow for tube bores 28 that are associated with the tubes 16. Such bores are provided by the provision of welded seams 30 on the mating pairs of tongues 22.

The fastening tapes 14 are formed separately from the blank B and are preferably in the form of elongated ribbons of polyethylene sheet material. The proximate ends of the tapes are heat-sealed to the corners of the bag 12 after the aforementioned high frequency resistance welding operation. If desired and as shown in FIG. 1, each pair of longitudinally-aligned tapes may be formed of a single strip of polyethylene material. In such instance, the central portion of each strip is folded longitudinally and then, after being manipulated into straddled relation with the adjacent longitudinal heat seal edge of the bag, heat-sealed to such edge.

In applying the applicator 10 to a given localized area of the body of a patient, for example, the outer surface area of a limb structure such as is shown in FIG. 4 and designated by the reference numeral 40, the bag 12 is first draped about the desired area and, thereafter, the fastening tapes 14 are caused to complete the encircling operation about the limb structure, whereupon the adjacent tape ends are tied together as indicated at 42 in order to hold the applicator in position. Thereafter, the bag is filled with a suitable energy-transmitting liquid, such as water or mineral oil, utilizing one of the tubes 16 for this purpose by introducing a suitable nozzle (not shown), such as a syringe nozzle, into the tube bore 28, the other tube serving as a bleeder tube to permit the escape of any air which is initially entrapped within the bag. After the bag has been filled with the liquid and the desired degree of encompassing tension about the part 40 attained, the two tubes 16 may be individually knotted or they may be tied together, each to the other as shown at 44 in FIG. 3, thus sealing off the chamber 18 in the bag 12.

Alternatively, the bag 12 may be expanded by the introduction of the liquid thereinto prior to application of the applicator to the part 40 and, thereafter, the applicator may be tied in position, the tension of the fastening tapes 14 serving to control the degree of pressure of the bag against the part to be treated.

With the applicator thus positioned on the patient's body, an ultrasonic treatment head or transducer such as that which is shown in FIG. 4 and designated by the reference numeral 50 is applied to the exposed or outer surface area of the bag 12, and when the treatment head is energized, ultrasonic waves pass radially inwardly toward the part 40 and enter the part at a region directly opposed to the treatment head 50. The treatment head may, if desired, be moved in various directions on the outer surface of the bag 12 in order to shift its position and thus avoid prolonged treatment of a localized area of the part 40.

To enhance the conductive path for the ultrasonic waves issuing from the treatment head and proceeding to the part 40, the area of the part to be treated may initially have applied thereto a thick coating of a suitable oil, such as petroleum jelly. Then, after the applicator has been positioned about the part as described above, the outer or exposed surface of the bag where the treatment head is to be applied may also be coated with the petroleum jelly. Not does the presence of the petroleum jelly on the outer or exposed surface of the bag enhance the conduction of ultrasonic waves, but it also reduces the frictional opposition of the bag to the exploratory movements of the treatment head 50 on the surface of the bag as heretofore described.

After the part 40 has thus been exposed to the action of the treatment head 50, the applicator 10 may be removed from the part 40 by either untying the fastening tapes 14 or by severing the same with a knife or a pair of shears. Since the applicator is disposable after use thereof, the bag 12 may be emptied of its contents by severing one or both of the tubes 28 behind the tied knot 44 or by otherwise puncturing the bag 12. If the liquid within the bag 12 is to be reclaimed, the knot 44 may be untied and the ends of the tubes 16 introduced into the neck of a suitable storage vessel.

The invention is not to be limited to the exact arrangement of parts shown in the accompanying drawings or described in this specification as various changes in the details of construction may be resorted to without departing from the spirit or scope of the invention. Therefore, only insofar as the invention has particularly been pointed out in the accompanying claims is the same to be limited.

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

1. An applicator for an ultrasonic treatment head comprising a flat generally rectangular expansible bag formed of plastic sheet material capable of being heat-softened, and defining an internal chamber adapted to contain a quantity of ultrasonic energy transmitting liquid, said bag being heat-sealed along at least three adjacent marginal edges thereof, an integral filler tube projecting outwardly of the bag, in communication with said internal chamber and of sufficient length that a sealing knot may be tied therein, and fastening tapes connected to the end portions of the bag.

2. An applicator for an ultrasonic treatment head comprising a flat generally rectangular expansible bag formed of plastic sheet material capable of being heat-softened, and defining an internal chamber adapted to contain a quantity of ultrasonic energy transmitting liquid, said bag being heat-sealed along at least three adjacent marginal edges thereof, an integral filler tube projecting outwardly of the bag, in communication with said internal chamber and of sufficient length that a sealing knot may be tied therein, and a series of four fastening tapes formed of similar plastic material and having their proximate ends heat-sealed respectively to the four corners of the bag.

3. An applicator for an ultrasonic treatment head and comprising a flat generally rectangular expansible bag formed of plastic sheet material capable of being heat-softened, and defining an internal chamber adapted to contain a quantity of ultrasonic energy transmitting liquid, said bag being heat-sealed along at least three edges thereof, a pair of closely spaced integral filler and bleeder tubes projecting outwardly of the bag, the spacing between said tubes and the length thereof being such that they are capable of being tied together in sealing relationship, and fastening tapes connected to the end portions of the bag.

4. An applicator for an ultrasonic treatment head as set forth in claim 3 and wherein said filler tubes communicate with the interior of the bag through one of said heat-sealed edges thereof.

#### References Cited

##### UNITED STATES PATENTS

|           |         |                |         |
|-----------|---------|----------------|---------|
| 2,920,617 | 1/1960  | Boiarsky       | 128—24  |
| 3,157,312 | 11/1964 | Kitterman      | 128—275 |
| 3,332,422 | 7/1967  | Jinkens et al. | 128—275 |

##### FOREIGN PATENTS

|       |      |                |
|-------|------|----------------|
| 8,353 | 1899 | Great Britain. |
|-------|------|----------------|

L. W. TRAPP, *Primary Examiner*.