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Enjoy the benefits of electronic acupuncture without the use of needles.

BUILD A BIO-STIMULATOR

BY ROBERT A. HEIL

Ask around and you'll probably find that most people know what acupuncture is. However, not many of those individuals would want to have it actually done. That's because the treatment is often expensive and, let's face it, the idea of having needles poked into one's skin is not all that appealing. Well, with the *Bio-Stimulator* described in this article, you can avoid such drawbacks. The device provides a needleless and painless way to enjoy the benefits of acupuncture.

Acupuncture Basics. The Tabers Encyclopedic Medical Dictionary defines acupuncture as "the puncture with needles for diagnostic and therapeutic counter irritation purposes." Here's a look at how that technique came about.

Centuries before the Western world began to understand blood circulation and the nervous system, the ancient Chinese developed the theory that a system of energy circulation is present in the human body. The Chinese stated that vital life energy flows through a series of pathways, or meridians, 12 of which are located in each side of the body. Those meridians were said to course through the deep tissues of the body, surfacing occasionally.

Each of the areas where the meridians touch the surface were considered useful treatment points for ailments to one or more organs. It was believed that inserting needles at such surface points could cure problems with a patient's heart, lungs, colon, gallbladder, liver, or other organs.

Western interest in the technique (eventually called "acupuncture") did not become widespread until the 1970s, when physicians in the People's Republic of China demonstrated that it could be used to control surgical pain. After 20 minutes of stimulation, a recipient of effective acupuncture treatment would be wide awake, alert, and aware of all performed surgical procedures, but not aware of any pain.

The actual mechanisms by which patients are able to tolerate surgery during acupuncture stimulation are still unknown. Some scientists speculate that large sensory fibers are activated, thereby inhibiting the transmission of impulses from the small fibers carrying the sensory input of pain.

Other scientists believe that naturally produced, morphine-like substances (such as endorphins) might be released within the brain in response to the stimulation. When those types of substances bind to opiate receptor cells, a pain-inhibition system is activated. Patients suffering from pain in the back, head, abdomen, or other areas could experience short-term relief by such a pain-inhibiting process.

Although widely accepted throughout the Far East as a legitimate practice, acupuncture is viewed quite differently by the West. The main influential factor is the American Medical Association (AMA), which does not recognize acupuncture as a legitimate medical procedure to cure the sick.

Without the AMA's acceptance, acupuncture was for several years considered by many to be a form of "black magic." That's not surprising considering how many people find the idea of sticking needles into their skin repulsive. What's more, there is a considerable amount of danger present if the technique is performed by an unlicensed practitioner. One misplaced needle could do considerable damage if a major organ or artery is punctured.

The fear of possible needle damage led to the development of electronic acupuncture. That newer technique uses electronic pulses in place of needles to control pain, tone and strengthen muscles, increase blood flow, and release the body's

WARNING!!!

This article deals with and involves subject matter and the use of materials and substances that may be hazardous to health and life. Do not attempt to implement or use the information contained herein unless you are experienced and skilled with respect to such subject matter and materials. Furthermore the information contained in this article is being provided solely to readers for educational purposes. Nothing contained herein suggests the Bio-Stimulator system described herein can be or should be used by the assembler or anyone else in place of or as an adjunct to professional medical treatment or advice. Neither the publisher nor the author make any representations as for the completeness or the accuracy of the information contained herein and disclaim any liability for damages or injuries, whether caused by or arising from the lack of completeness, inaccuracies of the information, misinterpretations of the directions, misapplication of the information or otherwise.

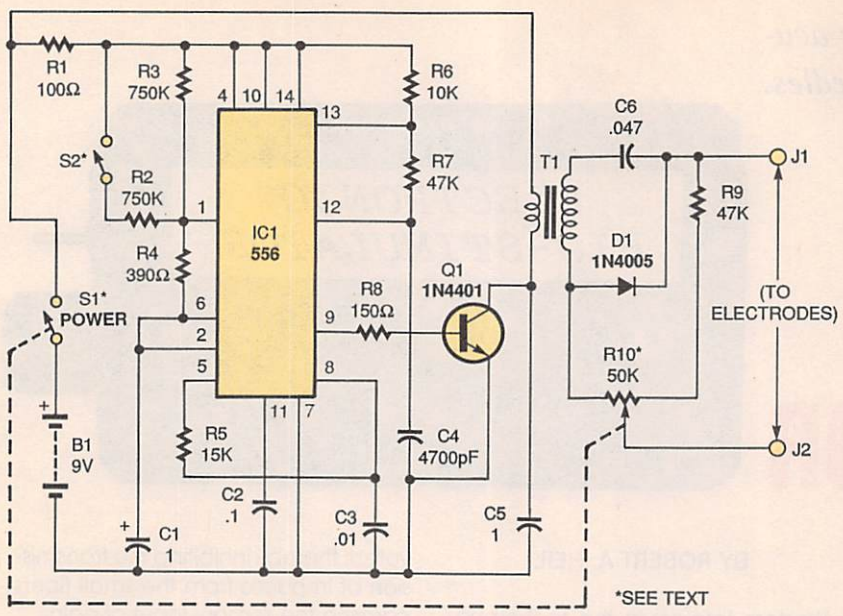


Fig. 1. Here's the schematic diagram for the Bio-Stimulator. Adjusting the settings of potentiometer R10 and switch S2 let you fine tune the output pulse.

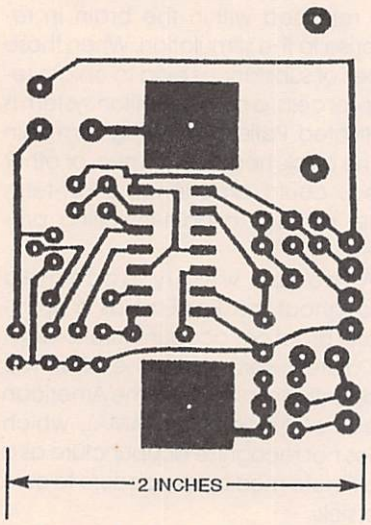


Fig. 2. Use this full-size template to make your own PC board.

own natural pain and inflammation reducers. Although still not fully recognized by the AMA, electronic acupuncture has recently gained acceptance among chiropractic practitioners and a small percentage of physicians as an alternative technique to their therapeutic methods; they feel it is safe and works well for certain problems.

The Bio-Stimulator produces the same basic waveforms found in professional electronic-acupuncture devices. It contains common components and easy-to-find hardware, and is designed to be rugged, easy-to-use, lightweight, and portable.

Just a word of caution before we go any further: **Misuse of the Bio-Stimulator can be dangerous.** Do not use the device on the eyes or on open sores, or if you have a pacemaker, are currently under treatment for heart disease or arrhythmia, or are pregnant. Even if you are in perfect health, you might want to consult your doctor before using the device.

Circuit Description. The schematic for the Bio-Stimulator is shown in Fig. 1. Power for the circuit is supplied by a 9-volt battery, B1. Switch S1 is used to turn the unit on and off, and resistor R1 acts a current limiter for the circuit.

Resistors R2–R4 and capacitor C1 form a timing circuit with IC1, a 556 dual timer. When S2 is open, the charge and discharge time of C1 is set at approximately 2 Hz. Closing S2 increases the charge and discharge time of C1 to approximately 4 Hz. The output of the first timer at pin 5 of IC1 is sent via R5 and C3 to pin 8 of IC1; that section of IC1 and components R7, R8, and C4 complete the second timing circuit. While the first timer creates the delay time in Hz, the second timer creates the actual pulse time for the inductor.

The inductor pulse time is applied to the base of transistor Q1 through a current-limiting resistor, R8. When Q1 conducts, the primary side of audio-transformer T1 is momentarily grounded, thereby energizing T1. Capacitor C5 charges and discharges every time T1 is energized and de-energized. That charge cycle slows down the rise and fall time of the pulse, which in turn increases the duration of the output pulse from T1, and at the same time shapes the edges of the output waveform to more closely resemble a half sinewave.

Components C5, D1, and R9 form the rest of the output-wave-shaping circuit. Potentiometer R10 is used to adjust the amplitude of the pulse up to a maximum of about 200 volts with a duration of 2 ms and an overall current drain of less then 10 mA.

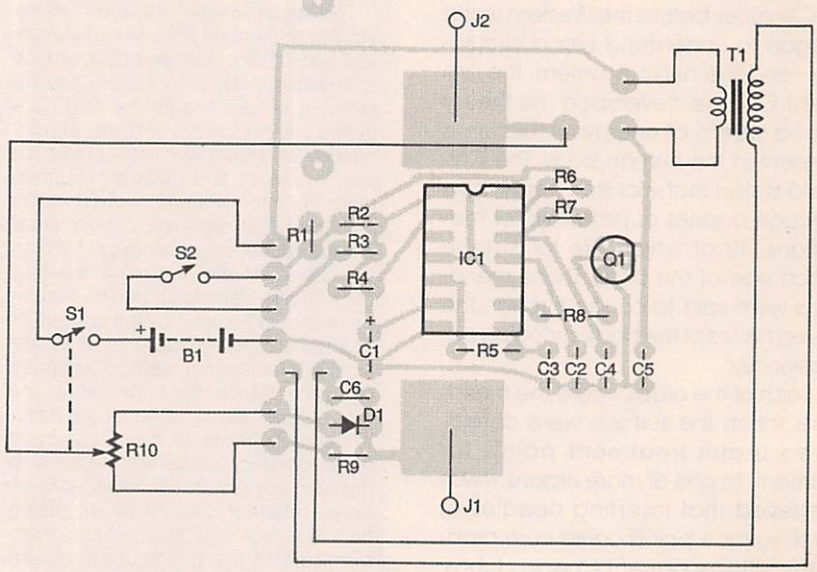
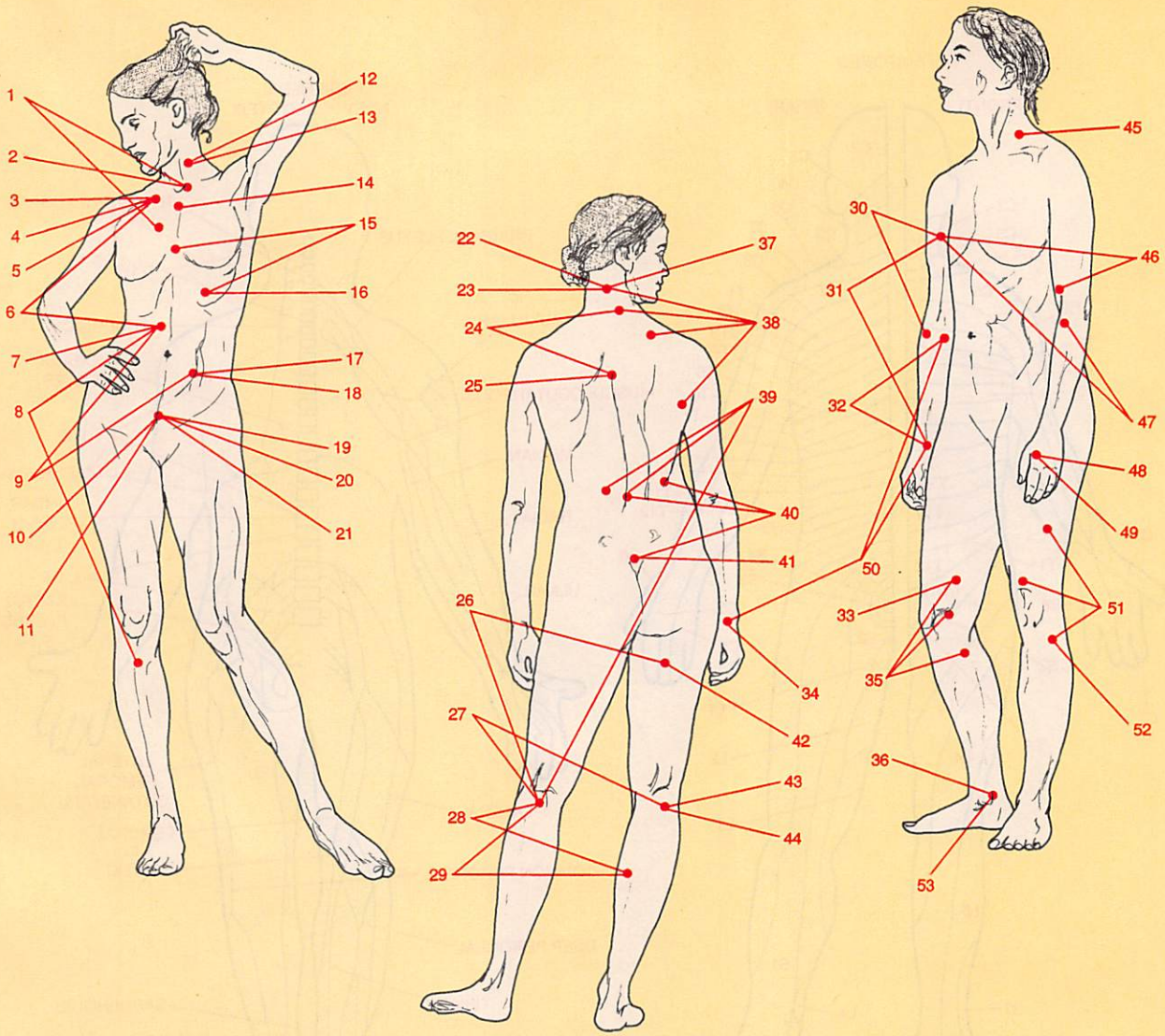


Fig. 3. If you're building the unit on a PC board, use this parts-placement diagram as a guide.



1. BRONCHITIS
2. HYPERTENSION
3. SHOULDER DISTRESS
4. PALSY OF THE UPPER EXTREMITIES
5. INTERCOSTAL NEURALGIA
6. GASTROPTOSIS
7. VOMITING
8. STOMACH ILLNESS
9. DIARRHEA
10. GYNECOLOGICAL DISTRESS
11. CYSTITIS
12. DIZZINESS
13. CERVICAL NEURALGIA
14. ASTHMA COUGH
15. GENERAL FATIGUE
16. DIABETES
17. INTESTINE ILLNESS
18. LIVER AND KIDNEY ILLNESS
19. ENURESIS
20. RECOVERY OF FATIGUE
21. CONSTIPATION
22. HEADACHE
23. SPASMOTIC PAIN OF THE NECK
24. DIZZINESS
25. GENERAL FATIGUE
26. SCIATICA
27. LEG FATIGUE
28. CLONUS
29. PALSY OF LOWER EXTREMITIES
30. HAND-MUSCLE PAIN
31. PALSY OF THE HAND
32. FINGER-JOINT PAIN
33. GYNECOLOGICAL DISTRESS
34. CONSTIPATION
35. KNEE-JOINT PAIN
36. EDEMA OF LEGS
37. ALCOHOLIC DROWSINESS
38. SHOULDER DISTRESS
39. LUMBAGO
40. RECOVERY OF FATIGUE
41. PILES
42. NEURALGIA OF LOWER EXTREMITIES
43. KNEE-JOINT FATIGUE
44. KNEE-JOINT PAIN
45. SHOULDER PAIN
46. ELBOW-JOINT PAIN
47. PALSY OF UPPER EXTREMITIES
48. EYE STRAIN
49. TOOTHACHE
50. HAND-JOINT PAIN
51. PALSY OF LOWER EXTREMITIES
52. HYPERTENSION
53. RECOVERY OF FATIGUE

Fig. 4. What ails you? By placing J2 of the Bio-Stimulator on one of these points, and having J1 touch your skin as well, you can explore the possibilities of electronic acupuncture.

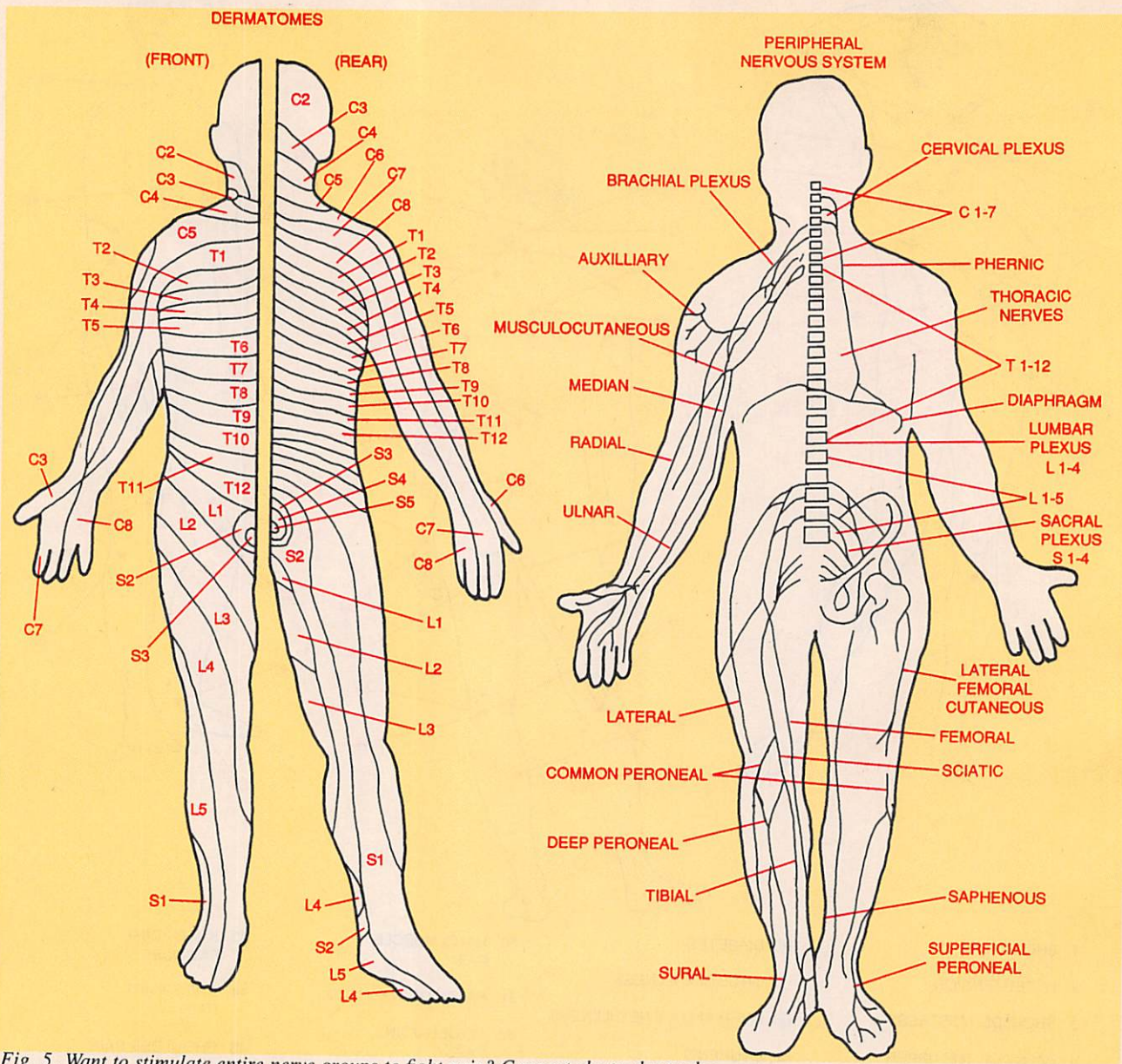


Fig. 5. Want to stimulate entire nerve groups to fight pain? Connect electrodes to the Bio-Stimulator and place them along the appropriate nerves.

Construction. The author's prototype was built on a printed-circuit board. That is the preferred way to build the Bio-Stimulator because it prevents stray capacitance and ensures that the unit is kept small. You can either etch your own PC board using the template shown in Fig. 2, or order one from the source mentioned in the Parts List. If you would rather use another assembly method, make sure to keep all wire leads short.

If you're building the circuit on a printed-circuit board, use the parts-placement diagram in Fig. 3 as a guide. Begin by installing an IC socket for IC1. Then solder the resistors and capacitors to the board, making sure the electrolytic capacitor, C1, is oriented properly. Mount the diode next.

Solder four-inch lengths of 22-gauge insulated wire to the board for the connections to the potentiometer/power switch (R10/S1), toggle switch (S2), and transformer (T1). Next, solder a battery clip to the board. Then complete the on-board assembly by installing Q1 and inserting IC1 into its socket. Check the orientation of both of those components.

The next step is to mount the off-board components and PC board in a suitable project case; the one used in the author's prototype is a Radio Shack enclosure (part number 270-231). If you choose to use another case, make sure the dimensions are at least 4 × 2 × 1 inches.

At one end of the case, drill two holes and mount R10/S1 and S2. Then install two acorn cap nuts (J1 and J2) on the enclosure. You can either connect J1 and J2 to the PC board with wires, or try to position them directly over the pads and connect them with screws.

Once the jacks are connected, mount the board inside the project case using spacers and screws. To complete assembly, go on to solder the wires already connected to the PC board to their respective off-board components.

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BIO-STIMULATOR

(Continued from page 34)

Calibration and Use. Insert a battery and turn on the power using R10/S1; then continue to adjust R10 to its middle setting. Place the acorn nuts across the inside of your arm and toggle S2 to each position. You should feel an increase or decrease of the shock pulse. Slowly turn R10 clockwise or counterclockwise to feel an increase or decrease (respectively) of the shock-pulse intensity.

See Fig. 4 for a list of ailments that traditional acupuncture has been claimed to remedy. If you suffer from one of those problems, then choose the appropriate acupuncture point and place cap-nut J2 directly over it. The other cap nut, J1, can be placed on any part of the skin. For best results, try applying the Bio-Stimulator up to three times a day for durations of between 5 and 15 minutes. You should be able to stop when the pain is reduced to your satisfaction.

Electrode Pads. Many electronic-acupuncture practitioners attach electrode pads to a patient's skin at various pressure points (determined by an electrode-placement chart), thereby allowing stimulation of an entire group of nerves covering a large area. With a simple modification, electrode pads can be attached to the Bio-Stimulator, adding to the unit's versatility. However, keep the following in mind:

Note: Federal and State laws regulate the sale of electrode pads. Check with your doctor to find out if you need a prescription to purchase them.

Three items are necessary to add electrodes to your unit: alligator clips (Radio Shack part number 270-347 or equivalent), test leads with pin tips (Radio Shack part number 278-705 or equivalent), and Unipatch 624 electrode pads (available at major medical suppliers). Assembly is simple. Remove the probe from each test lead, then solder an alligator clip on to each exposed wire. When finished you should have pin tips at one end and alligator clips at the other.

Clip the alligator clips to J1 and J2. Then insert the pin tips into the electrode receptacles. The electrode pads can be removed from the plastic sheet and applied to various body locations. Keep in mind that the adhesive material that is on the electrode pads allows for greater conductivity. Therefore, to keep the adhesive from wearing off too quickly, and to make it possible to use the pads more than once or twice, make sure to place them back on the plastic sheet after each use.

Refer to Fig. 5 to find the locations of nerves where you can place the electrode pads. The spinal system, which is the original base for all nerves, consists of 31 nerves divided into 4 major groups. The Cervical (C1 to C7) and Sacral (S1 to S4) groups spread to the arms and legs, while the Thoracic (T1 to T12) and Lumbar (L1 to L5) groups spread to all parts of the body as shown in the figure.

The path to both ends of the nerve groups can be found by looking for the C, S, T, or L locations in Fig. 5. You can place the electrode pads at both ends of or along the nerves crossing the pain area. You will then have to experiment to find the optimum locations for reducing pain.

Experimenting with all the possible uses of the Bio-Stimulator could take you quite a bit of time; however, the results you get from the device could be worth it. You just might be pleased to discover the benefits of East-meets-West technology. ■

PARTS LIST FOR THE BIO-STIMULATOR

SEMICONDUCTORS

IC1—556 dual timer, integrated circuit
Q1—1N4401 NPN transistor
D1—1N4005 silicon rectifier diode

RESISTORS

(All resistors are ¼-watt, 5% units.)
R1—100-ohm
R2, R3—750,000-ohm
R4—390-ohm
R5—15,000-ohm
R6—10,000-ohm
R7, R9—47,000-ohm
R8—150-ohm
R10—50,000-ohm potentiometer with SPST switch (S1)

CAPACITORS

C1—1-μF, 16-WVDC, electrolytic
C2—0.1-μF, ceramic-disc
C3—0.01-μF, ceramic-disc
C4—4700-pF, ceramic-disc
C5—1-μF, ceramic-disc
C6—0.047-μF, ceramic-disc

ADDITIONAL PARTS AND MATERIALS

T1—Audio transformer, 8-ohm primary, 1000-ohm secondary (Radio Shack part number 273-1380)
J1, J2—Acorn cap nut
S1—SPST switch (part of R10)
S2—SPST switch
B1—9-volt alkaline battery
Printed-circuit materials, project enclosure, battery clip with leads, alligator clips (optional, see text), test leads with pin tips (optional, see text), Unipatch 624 electrode pads (optional, see text), wire, solder, hardware, etc.

Note: The following items are available from RAH Projects (P.O. Box 15904, Newport Beach, CA 92659): etched and drilled PC board—$6.95; kit of parts including the PC board (but no project enclosure)—$30.00. Add $2.50 shipping and handling; California residents please also add appropriate sales tax. Check or money order only; personal-check orders will be shipped after the funds have been cleared. Allow 4 to 6 weeks for delivery.

DTMF TONE PAD

(Continued from page 56)

coated them with a layer of clear lacquer to protect them from damage in everyday use. You can do the same or use another type of labeling technique.

To use the Tone Pad with a transceiver you have to first decide how you would like to connect the two. While the unit could be hard-wired to the transceiver, using matching plug-and-socket connectors would be a better idea. Some transceivers have +12-volt, ground, transmit audio, and PTT keyline connections already available at an accessory socket on the rear panel. If that is the case, simply use matching plugs on the unit's connection wires.

And that's all there is to it! Once it's connected to your transceiver, the DTMF Tone Pad can be used for countless tasks, making it a constant reminder of the money-saving benefits you can enjoy by being an electronics hobbyist. ■