WAAAT'S THAT SOUND!

Simple circuit uses variable tuning slug coil to get foot-pedal wah-wah sound.

by Steve Daniels

ALMOST POPULAR gadget in the well-equipped guitarist's sound effects bag is the Wah-Wah pedal, a foot-controlled, one-transistor (FET) amplifier which can produce many different effects, from plaintive wailings to blatantly sexy "wow-wow" sounds. If used in conjunction with a fuzzbox, even such off-the-wall sounds as that of a sitar can be closely approximated. Experimentation and imagination are all that are needed.

Commercial Wah-Wah pedals run 35 bucks or more, but you can build our goody for about $15. If you can find a breadpan and a used AM radio antenna loopstick lying around, you can do it for less than ten—a darn cheap way to beef up the sound of the old axe.

How it works. The Wah-Wah pedal control is an amplifier whose frequency response peak can be varied by an RC (resistance-capacitance) or LC (inductance-capacitance) circuit connected as the load (at the output) of a transistor. The circuit chosen here uses a variable inductance coil which is operated by a foot-pedal. Changing the size of the capacitor in the LC circuit could have been used to alter the output sound, but it would be more complicated mechanically, and would cost much more.

FET (field-effect transistor) Q1 is connected as a common-source amplifier with resistor R2 adjusting for differences in individual gain. Switch S2 couples signal to your guitar amp either from the instrument directly or from the drain of transistor Q1. The switch is a push-push type, so be sure to use the one specified in the Parts List.

Loopstick Lowdown. Commercial coils don't have as much "Q" as is required for this application, so we roll our own, starting with an old AM antenna ferrite loopstick, taken from any old broken AM radio. Remove the original windings, clean the terminals, and remove the metal collar from the slug by just screwing it off. Cut two discs about ¾-in. in diameter from thin cardboard, and nibble out a hole in the center of each so that they fit snugly on the loopstick. Position one disc right up against the collar that holds the terminals of the form and place the other disc about 3/16-in. from the opposite end. Cement the discs in place with just a few drops of household cement or good glue to hold them until the winding is complete. When the cement is dry, punch a pinhole through the cardboard at a point as close as possible to one of the coil terminals. Using a small piece of fine sandpaper strip the enamel from the end of the spool of fine (no. 28) wire. Thread this end through the pinhole to the coil terminal. Tin the bare wire end and solder it in place using as little solder as possible. Now chuck the longer end of the coil form in an electric drill. Stick a dowel through the center of the spool of wire and hold this between your knees, leaving your hands free to hold the drill with one hand and guide the progress of the winding with the other hand. The exact number of turns isn't critical—just distribute the turns evenly and fill the entire space between the cardboard discs. Finish the winding at the terminal end and bring the ending lead through a second pinhole. Strip the end with sandpaper and attach through the opposite pinhole to the other terminal.

Wire the FET transistor Q1 and the other electronic parts together on a small piece of perf board (the one shown in the picture is 1½-in. x 2½-in.). If this is one of your first projects it might be wise for you to use a transistor socket instead of wiring directly to the transistor itself (because you could overheat the transistor if you don't take the precaution of a socket—or of using a pair of long-nose pliers as a temporary heat sink when soldering to each lead of Q1). Use flea clips to assist in soldering to the various components on the board. The layout isn't critical since there are no radio frequencies involved.

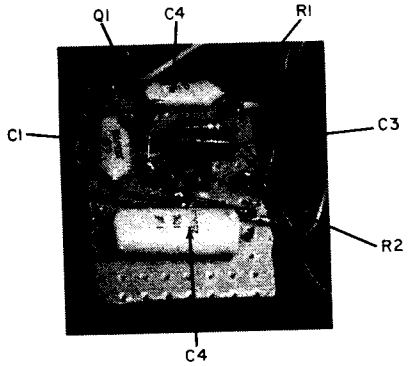
Be sure to use the capacitor specified for C2 because it packs the required amount of capacitance into a very small space. Bring out tie points to the edges

of the board to permit conveniently connecting them to the other parts of the circuit (switches, jacks, variable control inductor coil and battery).

Experiment for best sound. Varying the "Q" of the coil can change the sound, so you may wish at this point to experiment to find the exact LC combination that gives the sound that you want. If so, breadboard the circuit together on your workbench, but keep your leads fairly short. Connect up your guitar and an amplifier and turn S1 on. Set R2 to its midrange, and play a few notes while moving the slug of L1 in and out. If there is no effect, press S2. The Wah-Wah should now be heard. After adjusting R2 for the best effect, you may still want to experiment for a different sound. If so, unsolder the end of L1, unwind about 100 turns and reconnect the end. Replace L1 in the circuit and add capacitors in parallel with C2 in intervals of 0.05 *u*F until the Wah sound returns. Repeat this procedure until you get the effect you want, then find a single capacitor to use for C2. What you are actually doing is raising the "Q" of the tuned circuit while keeping the resonant frequency about the same.

Breadpan to Bandstand. The breadpan that we used for our model measures 9½-in. x 5½-in. x 3-in., but anything in this range will serve. The pedal itself is made from a piece of masonite about 3½-in. x 6-in. Cut a piece of thin sheet metal the same size and screw the two together with the shortest 4-40 hardware that will work. Cut off or file down the ends of the screws as much as possible when this is done. The hinge that allows the pedal to move up and down can be an ordinary butt-hinge from your local hardware store. It is secured in the center of the pedal from the underside, using 4-40 hardware. Here again, file down the screw shanks as short as possible. The rubber matting that we use as a covering also came from a hardware store. Cut a piece exactly the size of pedal and glue it on the metal side with rubber cement.

Using the photographs as a guide, position the pedal assembly on top of the breadpan and mark the position of the mounting holes with a scriber or awl. Drill and deburr these holes. The hinge is supported off the pan by ⅛-in. spacers and secured with 4-40 hardware, but only mount it temporarily at this time. Let the pedal lie flat. Take a pencil, and gently draw a line across the pan to indicate where the business end of the pedal rests in the full-down position. Find the center of this line, move in toward the hinge about ⅛-in. and you have located the center of one side of the slot through which the coil slug passes. The one we used measured 7/16-in. x 7/8-in. The slot is best cut with a nibbling tool. Now locate and drill holes for the two switches and two jacks, and the screw holding the circuit



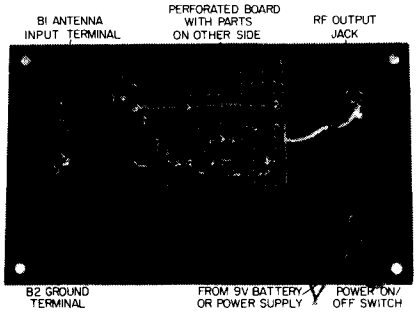
The layout of components on perfboard is not critical. Use any handy arrangement.

board. If it's going to be painted, now's the time to do that.

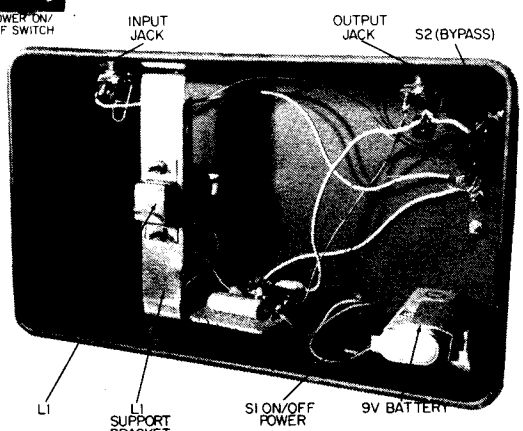
Build the bracket. The support for the variable inductance control coil, L1, is made from 18-gauge aluminum. The dimensions may be adjusted to your convenience and taste. Find the exact center of the bracket and bore a ¼-in. hole there. Get a large rubber grommet which just fits comfortably onto the tubing of L1. Ream out the hole in the bracket so that the grommet fits in with just a little bit of slack. If you now slip the long end of the coil into the grommet, it should move easily back and forth. The coil form should project about 5/16-in. above the top of the grommet. A small bracket of sheet metal is used as the stop for the coil slug. It's held with two 4-40 screws as the photo indicates. Solder two 6-in. leads to the coil terminals and you are ready to mount the whole assembly in the pan.

Final assembly. Remount the pedal and drill a small hole through the masonite about ⅛ in. from the business end, right on the center line. Don't go

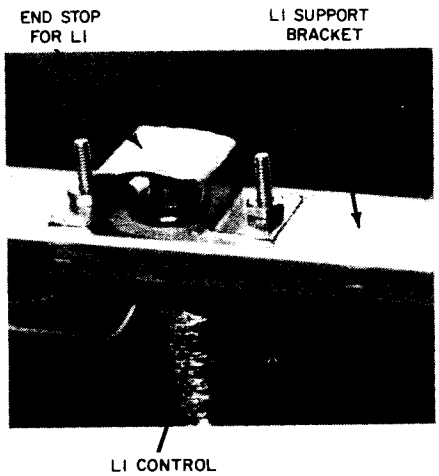
WAAAHS SOUND



Point-to-point wiring is used to connect the FET, the input and output jacks, bypass switch, battery, and the few components on the small perf-board. Layout on the board is non-critical. Just position parts for convenience.

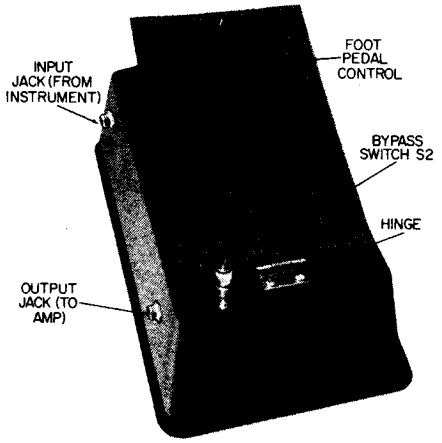


Inside view of Wah control box, showing the few parts needed. Bypass switch S2 is a push-push type which can be foot-operated to cut the control in, or let your instrument (guitar or other) feed directly to your amplifier-speaker.

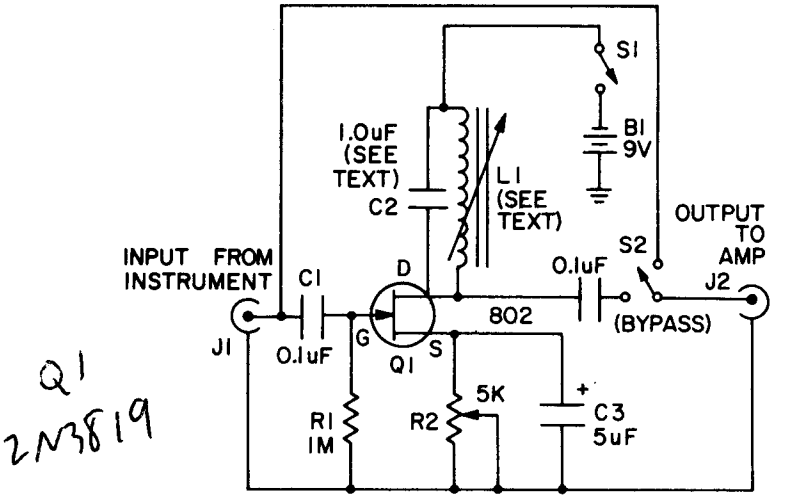


Upside-down view of the support bracket for control coil L1, with small end-stop for the coil. Both are aluminum strip.

e/e WAAAT'S THAT SOUND



Wah-sound foot pedal control ready to work. Your instrument (guitar or whatever) plugs into the rear-side jack, and connecting cable to your amplifier-speaker plugs into the front side jack. Bypass switch is foot-operated to cut the foot-pedal in.



PARTS LIST FOR WAH-WAH PEDAL

B1—9-volt transistor radio battery (Radio Shack 23-151 or equiv.)
C1, C4—0.1 μF tubular capacitor—any voltage over 50. (Radio Shack 272-1058 or equiv.)
C2—See text. 1.0 μF (not electrolytic) capacitor any voltage over 50. (Radio Shack 996-69)
C3—5.0 μF, 15 VDC miniature electrolytic capacitor (Radio Shack 272-951 or equiv.)
L1—Inductor, home brewed on old AM antenna ferrite loopstick (or use Radio Shack 270-1430 or equiv.)
Q1—Field Effect Transistor (FET) Motorola HEP 802 (Radio Shack RS-2036 or equiv.)
R1—1-megohm ½-watt carbon resistor (Radio Shack 270-1000 series or equiv.)
R2—5K miniature potentiometer printed circuit board mtg. (Radio Shack 271-217 or equiv.)
S1—SPST power On/Off switch (Radio Shack 275-602 or equiv.)
S2—SPDT push On, push Off switch (Radio Shack 275-1560 or equiv.)
Misc.—Connecting clip for battery (Radio Shack 270-325 or equiv.); small perfboard (Radio Shack 270-1582 or equiv.); perfboard terminal clips, push-in type (Radio Shack 270-1394 or equiv.); aluminum strip 18 gauge, 1-in. x 6-in. approx.; small piece rubber matting; masonite or thin composition board (see text); small breadpan.

through the sheet metal because this is where the slug shaft is anchored, using sweat soldering. The slug is properly positioned when it is perpendicular to the top of the pan with the pedal at a 40-degree angle. Bring the bracket with the coil in from the bottom, slip the slug into the form, and find a mounting angle for the bracket that allows the slug to travel freely up and down. Bore mounting holes for the bracket and screw it securely in position. Remove the slug from the coil momentarily and drop a small spring into the form. Find a spring size that allows as much travel vertically as possible. The rest of the assembly should be clear from the photos. The circuit board is held off the pan with a small spacer, and the battery clamp is bent from sheet aluminum.

It will take some practice to coordinate the use of the Wah sound with your playing, but once you have the trick, you'll have the listeners all asking *Waaah's that Sound?* ■