Chapter 7

Cables and Pickups

Not all servicing problems involve the amplifier chassis; there are occasions when parts mounted on the guitar need repair. Disassembly is usually fairly obvious; once the plastic or chromed cover plates are removed, all the electronic parts are exposed (Fig. 7-1). Be very careful in handling the guitar. Keep the finish protected as you would the most expensive TV cabinets. You might try leaving the guitar in the case while you work on it. A carpet sample from the furniture store makes a dandy bench cover to protect the finish of the guitar while it's being serviced.

MICROPHONE AND INSTRUMENT CABLES

One important feature of electric guitar systems is the use of shielded cable for all connections between the guitar, microphone, remote (foot) volume controls, and the amplifier. This is absolutely necessary in order to keep these sensitive circuits from picking up hum and noise. You need to know how the cables are made and to find ways of repairing them if they give trouble.

Because they are flexible and because they get hard wear from being rolled up, stepped on, pulled, and jerked, cables often break. If the hot wire (center conductor) breaks, the instrument will simply go dead. If the ground (shield) is pulled loose, the amplifier will give a very loud hum when this cable is plugged in: that is the key clue to cable trouble. When hum troubles are being checked out, the first thing to do is pull all cables out of the input jacks to find out whether the hum is in the amplifier itself or from an ungrounded cable.

Most guitar amplifiers use standard phone plugs (Fig. 7-2 shows the construction of one). The sleeve of these plugs is always connected to ground and the tip to the hot wire (center conductor). This provides an easy way to check for a broken cable: plug it into an amplifier input, turn the volume up on that channel, and touch the tip of the plug that goes into the guitar. If you hear a loud buzz, the cable is all right. If you get a loud hum, particularly if the hum gets louder when you hold the cable in your hand, the ground connection is open, probably at the amplifier end.

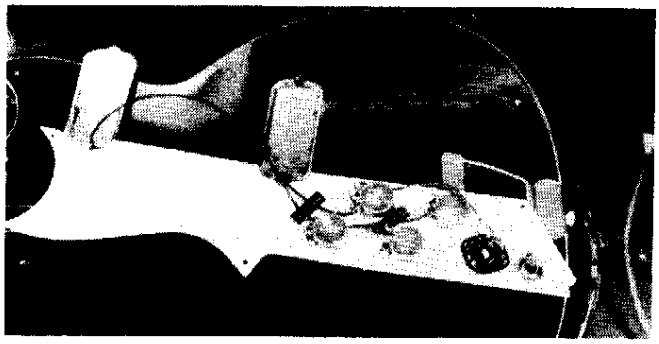


Fig. 7-1. View of a disassembled electric guitar.

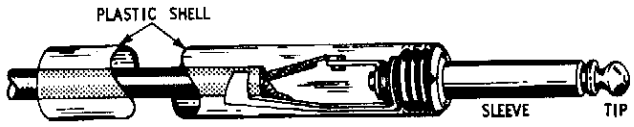


Fig. 7-2. Shielded cable attached to a standard phone plug.

If the cable ground is open at the guitar end, the amplifier will not hum too badly when you check the cable since only a half inch or so of the hot wire is exposed. However, when it is plugged into the guitar, the whole guitar will be hot: you will get a loud hum when you touch any of the metal parts. Take the cable out at both ends, and reverse it. Now, if the amplifier hums very loudly when you grab the cable, you have found the trouble. Hint: Because of the flexing of the cables, you will find almost all cable troubles located in the six inches at either end. This is where it takes the sharpest bending in use.

Installing Phone Plugs

There is a right way and a wrong way to install a phone plug. Here is the right way. Prepare the wire by cutting off the insulation for about an inch and a half; ring the jacket with a very sharp knife, being careful not to cut through the braided shield. Now pull out a pigtail from the shield (Fig. 7-3A). The easiest way is to double the cable very sharply just at the end of the jacket, then work a pointed tool such as a soldering aid through the braid, parting the strands but not breaking any more than you can help (Fig. 7-3B). Work the inner insulator and wire out through this hole. Pull the braided shield left empty out into a pigtail. This will not unravel, and it will give you a sturdy ground connection (Fig. 7-3C).

Trim the insulation off the hot wire *very* carefully so as not to cut the very fine inner conductor. In most cables you will find a silk inner wrapping which is hard to get off. The easiest way is to burn it off with a match or cigarette lighter (Fig. 7-3D). Then scrape the inner conductor very delicately, twist the strands together, and tin them with a clean soldering iron (Fig. 7-3E).

Next, put the shell of the plug on over the cable. Be sure that it is right end too. It's embarrassing to have to take the plug off just to reverse the shell—it's even more embarrassing to forget it completely, so watch it.

Solder the hot wire to the terminal going to the tip of the plug. You can tell which one this is; it will always be obviously insulated from the body of the plug. Also, it will be in the center. Next, fasten the ground pigtail to the sleeve terminal (Fig. 7-3F).

For long life the most important point in wiring a connector is to be sure that the strong ground pigtail is pulled tightly enough so that the hot wire shows just a little bit of bend. This means that any pull or strain on the plug and the solder joints will be taken up by the stout ground connection and not by the delicate hot wire. Some plugs are provided with a strain-relief clamp. This is fastened to the outer jacket of the cable. In some versions the jacket slips through a sleeve at the back of the plug and is held in place by being wrapped with strong linen thread. Other plugs can be wrapped with this thread if you want to make a good strong connection (Fig. 7-3G).

Splicing Coaxial Cables

There is a right and wrong way to splice broken cables, too. Splicing must be done correctly every time if the cable is to work properly. The splice must be as strong as the original cable, neat, and inconspicuous.

To start, cut back the outer jacket of each piece about 2 inches. Next, push the braided shield back over the jacket. Cut the insulation off the hot wire with a sharp knife, leaving about ½ inch insulated. (Save one of the pieces of insulation; you will see why in a minute.) Slit it and peel it off; that is the easiest way.

Burn the inner silk insulation off as before, and scrape the wires clean. Tin the hot wires, keeping the strands neat. Hold the center conductors of each cable parallel to each other, and solder them together very carefully. Don't leave a big blob of solder on the joint —it isn't necessary. If the wires are properly tinned, just touching them with the soldering iron will do the job. This soldering sometimes takes three or four hands or requires the use of some kind of clamp to hold things in place.

Take one of the bits of insulation you saved, slit it down one side, trim it to the right length, and slip it over the wire between the ends of the inner insulation. Press it tightly in place. If it is plastic, you can sometimes seal it very nicely by touching it lightly with the tip of the soldering iron. Make it smooth.

Take about a 5-inch piece of plastic electrician's tape, and slit it down the middle. If you have some of the special ¼-inch tape, use it without splitting. Hold one piece of the tape over a hot soldering iron until it gets limp. Then, start well up on the insulation at one end, and wrap the joint very smoothly. Keep your fingers off the sticky side as much as possible. Holding the whole thing over the soldering iron while doing the wrapping will help keep the tape soft and smooth. Make this neat; you will see why soon.

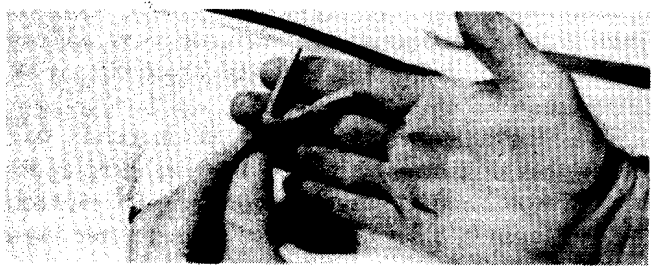
Take the other piece of tape and wrap it in the other direction, using the same method. Now, pull

one of the shields back down over the joint, smoothing it out as much as possible. Pull the other shield back over this one, smoothing it down too. Roll this between your fingertips to get things smooth and round. Now, clamp the cable down again, and tack the braided shields together, using a very clean soldering-iron tip and a low-melting solder. Be very careful not to hold the iron on the cable at one point for too long. If you do, you will melt the plastic tape or the inner insulation, and possibly make a short in the cable. Just "hit and git" until you get the shield tacked down in at least three places. Don't leave blobs of solder.

For the finishing touch, warm up a longer piece of tape and, starting about an inch back on the jacket, lay on two layers of tape in opposite directions. Keep your fingers off the sticky side until the tape is stuck down tightly—grease from your fingertips will make the tape pull loose. The best way is to hold it by one end, pull it tight, and then, with a sharp knife, trim off the piece where you have been holding it. You can get a very neat joint here by warming the tape and pulling it smooth. Properly done, the joint should be almost undetectable even when viewed from short distances.

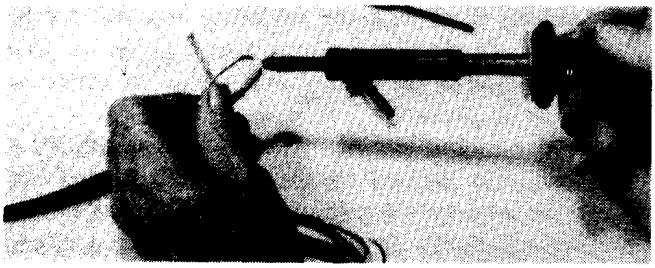
(*A*) *Step 1.*

(*B*) *Step 2.*



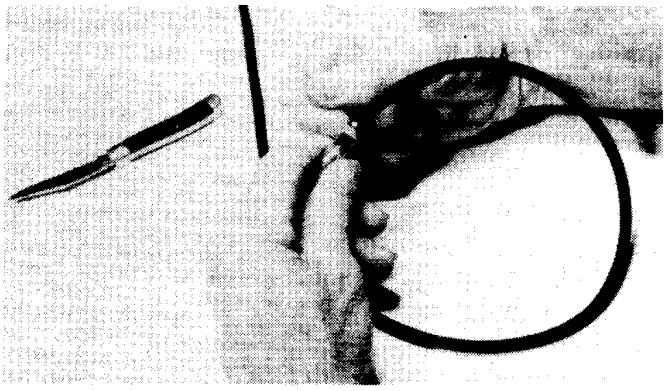
(*C*) *Step 3.*

(*D*) *Step 4.*



(*E*) *Step 5.*

(*F*) *Step 6.*



(*G*) *Step 7.*

Fig. 7-3. Attaching shielded cable to a phone plug.

MAGNETIC PICKUPS

If the amplifier itself is all right and the cables check out, then there must be trouble in the magnetic pickup on the guitar. Basically this is nothing but a roll of fine wire in a case, so it can be checked for continuity with an ohmmeter. Pickups have resistances ranging from 500 to 600 ohms up to several thousand ohms, depending on the amount of wire used and its size. The smaller the wire is, the higher is the resistance.

Fig. 7-4 shows the basic circuit of all pickups. The first check should be for continuity at the jack on the guitar. This can be made more easily by plugging one of the cables into the jack and checking between tip and sleeve of the open plug. The volume control is connected directly across the pickup coil in most units, so you will read a combination of both their resistances. If the volume control happens to be set at off, then you will get a fairly low reading. Turn it to loud or full on.

Volume controls are usually a half-megohm or larger—quite a bit larger than the resistance of the pickup coil. If you read the full resistance of the volume control, then the pickup coil must be open. Otherwise you get the resistance of the coil in shunt with the control, and your greatest resistance would be about 10,000 ohms.

If there is no variation in the resistance when the control knob is turned, then the control is open. Replace it. If the pickup coil is open, this is a different story indeed. Many of the pickup units are sealed in metal cases and are not designed to be opened for servicing. However, if it is definitely open, you can't hurt anything by trying, and you may be lucky.

First, get into the case—this may not be so easy. Many have metal lids on the bottom, soldered in place. Pry or melt the solder loose, and take the lid off very carefully to expose the coil. Watch out that you don't pull the wires loose in taking the lid off if they happen to be stuck to it by varnish or insulating material.

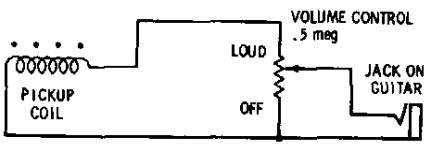


Fig. 7-4. Schematic of pickup coil and its volume control.

You will be able to see where the wires come into the case from a shielded cable and join the coil; the shield will always be soldered to the case just inside the point of entry. Get a jeweler's loupe or a powerful magnifying glass, and check the very fine wires. In many cases the wires have been found to be broken just inside the case. If so, they can usually be picked up out of the winding, cleaned, and soldered back.

Pickups are always wound with very fine enamelled wire. Use a delicate touch in working with it; a sharp-pointed tool is handy. Find a small round wooden stick, and drive a sharp pin or needle into one end; this makes a good pick for working wires loose.

If you can find the two ends of the wires, check them for continuity; you can touch the broken end of a wire with the tip of a clean ohmmeter prod while holding the other prod on the case. Find out if the coil has continuity from this point to ground.

To make a solder joint with such fine wire, don't try to clean it—it will break. If there is enough of an end available, heat it with a cigarette lighter; this burns the enamel off and lets you get to the copper. You can sometimes dissolve the enamel off by very carefully applying a little acetone to the end of the wire, but don't let it drip into the coil itself. Lay the coil on one side if this is attempted.

If you can't clean the wires at all, hold them close together and start heating the ends with a soldering iron. This will require a very clean iron with a very fine, sharp tip. Touch the wires with the end of a piece of solder, using some of the low-melting-point fluxcore solder now available. The soldering flux and heat will eventually burn off the enamel and make the joint. Just a "wee touch" is enough. You won't have enough to twist; be satisfied with any kind of a lap joint. Recheck continuity. If this does the job, tuck the joint very carefully back inside the case, and paint it with some kind of insulating dope. Let this dry, put a very small piece of plastic tape over it (to keep it from shorting to the lower lid), and replace the lid. This will not have to be resoldered completely, just enough to keep it in place.