

How to Use Magnetic Pickups

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Adapting a radio-phonograph to use a magnetic pickup is a simple operation if you use the methods described by the author. All the equipment is readily available, and there is nothing to build.

THE PRESENT TREND among people who like good music and like to have it sound better is to replace crystal phonograph pickup cartridges with magnetic-type cartridges such as the Audak, Clarkstan, General Electric, Pickering, and others. Magnetic cartridges are capable of better performance than most crystals because they give much smoother reproduction and are able to extend the music reproduction to the higher overtones. However, you can't eat your cake and have it too—in audio any more than in a restaurant; for along with the *potentially* fine results goes the necessity to add something to the other parts of the system. If you don't do it, or if you do it wrong, the fine results remain potential and your time and money have not been spent in the most gainful way.

All crystal and magnetic pickups are small electrical generators. But modern magnetic pickups generate far less than crystals. To get sufficient power from the amplifier to drive the loudspeaker, the amplifier must do a bigger signal-magnifying job—and most amplifiers designed for crystals just don't have enough amplifying capability to do it. Standard radio-phonographs are included in this category. The simple and effective answer is to add a preamplifier, which is a small amplifier increasing the capability of the existing one. The prefix "pre" indicates that it is connected *before* or *ahead* of the main amplifier, usually between the magnetic pickup cartridge and the amplifier itself. Fig. 1 is a block diagram showing the record-playing chain, including a preamplifier.

Several phonograph preamplifiers are sold especially for this purpose. In this article we shall describe only a few of them to indicate how they should be used.

Figures 2 and 3 show the General Electric SPX-001 and UPX-003 preamplifiers. They are the same, except that the UPX-003 (Fig. 3) has its own built-in power supply and is energized from a 115-volt a.c. outlet; the SPX-001 has a

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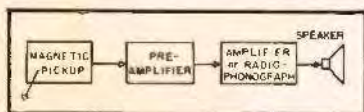


Fig. 1. Block diagram of the basic elements of a record-playing system using a magnetic pickup.

four-wire cable which is connected to the power supply within the amplifier with which it is used. There is no significant difference in performance—it's simply a question of whether or not it is convenient to take power from the amplifier. Many amplifiers today have sockets for this purpose, and a plug may be soldered to the end of the 4-wire cable and inserted in this socket. Commercial radio-phonographs do not have this socket so that soldered connections must be made inside the chassis to obtain power if the SPX-001 is used.

The GE preamplifiers have enough amplification to compensate for the low output of any magnetic cartridge, more than enough, in fact, for some, though this is not harmful. To install it, power must first be provided as outlined previously. Then the plug on the shielded cable coming from the pickup arm must be inserted in the input jack, seen on the side of the chassis in the photos. This is the same kind of jack as appears on most amplifiers and radio-phonographs, so presents little problem. If,

rect one. In both cases, a technician or serviceman should do the soldering job unless the owner is familiar with the work.

The Pickering Model 230H preamplifier appears in Fig. 4. The gain is slightly less than that of the GE preamplifier, but still sufficient. It has the



Fig. 4. Another self-powered preamplifier is the Pickering, Model 230H, with vibration-reducing rubber grommets for mounting.

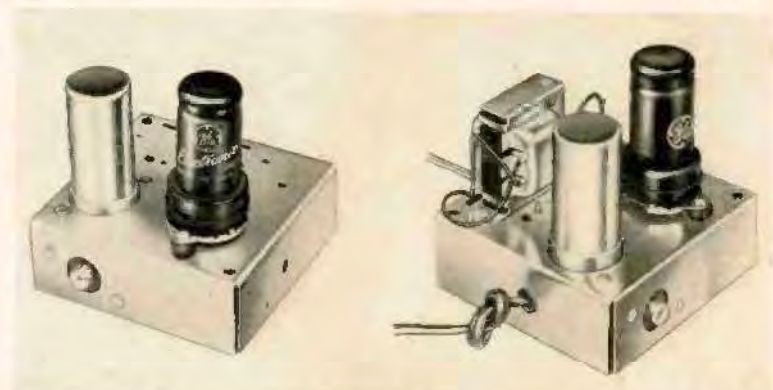


Fig. 2 (left) and Fig. 3 (right). Two types of General Electric preamplifiers—SPX-001 at left requires power supply from the amplifier or radio chassis, and UPX-003 at right, which is self-powered.

however, the pickup cable ends in some other type of plug, it must be removed and the correct plug soldered in place. Any radio parts store or serviceman can supply the correct plug. A shielded cable comes from the preamplifier (it does not appear in the photographs) and has a similar plug at its end which is to be inserted in the jack on the amplifier or radio-phonograph. Again, if the jack does not correspond to the plug, a parts store or serviceman can supply the cor-

same connection provisions as the GE units, but is available only with built-in power supply. The distortion of the Pickering is extremely low (a maximum of 0.2 per cent intermodulation at normal output level).

There is another and extremely important job that must be done for best results when a magnetic cartridge is used—equalization. Each recording company emphasizes the volume level at certain portions of the pitch range—this is

known as pre-emphasis—and reduces that of other parts. Generally the higher frequencies are emphasized. In playing back, we must reduce the highs to offset the pre-emphasis, and in so doing we reduce surface noise, too. The problem is to reduce the highs in approximately the same way as the manufacturer emphasized them. In addition, the bass range is attenuated in recording to avoid cutting over into adjacent grooves. To offset this, we must emphasize the bass in playback, again in just the right way. The rub is that different record makers do these two things in different ways. Ideally, therefore, we should have controls to change the treble attenuation and the bass boost so that they will complement the characteristics of the particular record we are playing at the moment.

Many amplifiers and radio-phonographs have tone controls. These are *not* equalizers. They cannot adjust the points in the frequency range at which the emphasis and attenuation begin; they can adjust only the amount of rise and fall, always beginning at the same point. While tone controls can give a rough approximation which satisfies some ears, a more exact method is required for really good results. And the only way to achieve it is to provide multiposition rotary switches, each step of which selects a special circuit which has been designed for correct equalization.

Very few systems provide for step-type bass equalization. Ordinarily only custom installations are so equipped. The writer's preamplifier has separate bass and treble equalization switches, with a total of twenty calibrated combinations. However, almost all preamplifiers including the GE and Pickering, have fixed bass equalization which is a good match for most American records and for London LP's. Beginning at 500 cycles per second, the output voltage doubles each time the frequency is cut in half—a rise of 6 db per octave with decreasing frequency. Some, unfortunately, do not carry this scheme to a low enough frequency—ideally, about 10 cps should be the lower limit. Most units carry equalization down to between 50 and 100 cps, which is in many cases a satisfactory compromise unless the ultimate in



Fig. 5. In order to match the pre-emphasis used by most record makers, the Pickering 132E Record Compensator can be connected between Pickering pickups and the preamplifier.

Fig. 6. Typical of complete control units is the Pickering Model 410 Audio Input System, which has volume and tone controls in addition to preamplifier.



good reproduction is sought. European records require less bass boost since their dropoff begins at 250 cps or thereabouts. As a result, they often sound "boomy" when played through the usual system.

The Pickering Model 132E Record Compensator, Fig. 5, does a good job of equalizing in the treble range. It has a rotary switch with six positions, each of which is a satisfactory match for certain records. As the photo shows, the record types are indicated on the dial. The Record Compensator is inserted between the pickup and the preamplifier. The cable from the pickup is plugged into the connector on the left side of the case and the cable from the Compensator is plugged into the preamplifier. The shortest possible lengths of cable should be used in any system of this kind, longer lengths cause loss of high-frequency response. The Pickering Compensator may be used with any preamplifier which has an input resistance of 47,000 ohms. The GE units have a lower input resistance, but any serviceman can replace the 6,800-ohm input resistor with a 47,000-ohm resistor. The Pickering preamplifier is supplied with the correct resistor. The Compensator will not, however, equalize correctly for any but the Pickering cartridges.

An interesting and useful unit is the new Pickering Model 410 Audio Input System. This unit contains a preamplifier, a step-type equalizer, and all necessary controls for an entire installation.

The first rotary switch selects either phonograph, television (if an audio take-off is provided on the TV set), or radio tuner. Only the phonograph pickup is put through the preamplifier. The second control selects one of three high-frequency record-equalization characteristics, including, incidentally, the standard playback curve of the Audio Engineering Society. The next two controls are step-type bass and treble tone controls. The fifth is a volume control and the last is an on-off switch for the entire system, including amplifier and turntable.

The question of which pieces of equipment to select are dependent on how much money there is to spend and what any individual likes best. The former can be decided without any help. The latter should be resolved by listening tests. At least in the larger cities, more and more audio salesrooms are equipped to demonstrate these and other units, with pick-up-equalizer-preamplifier-amplifier-speaker combinations as desired. There is still no better way to reach a decision than to listen with both ears.

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NUMEROUS eagle-eyed readers have noted a few errors in past issues which have heretofore escaped detection by the pseudo-eagle-eyes on our staff. For the record, and with the suggestion that readers make suitable notes in the issues involved, here are the corrections.

In O'Brien's article, November 1951, no mention was made of the switch S_1 and capacitor C_{11} at the output of the unit. This switch, when closed, provides a fixed amount of high-frequency roll-off, approximating that required for the AES curve, although not quite sufficient for this purpose. If complete correction were desired, the capacitor C_{11} should be .0013 μ f. However, the input capacitance of the power amplifier, together with the shielded connecting cable must be considered in determining the roll-off. These two capacitances may be considered as being indigenous to the power amplifier, and should be lumped together in making calculations.

In the continuously-variable-turnover preamplifier described by Jones in the January issue, the capacitor shown as .001 from the cathode of the 6C4 to the variable resistance R_2 will give turnover frequencies which are much too high for commercially available phonograph records. The amplifier as shown would be more useful for a tape playback amplifier than for record reproduction. If, however, the capacitor had a value of .005 μ f, the range of turnover frequencies would extend from 1100 cps down to 250 cps, and would be better for phonograph use.

Last, but not least in the recent history of errors, is the transposition of Figs. 8 and 9 on page 15 of the February issue, in the Toth article. This is reasonably obvious to the reader, but is here mentioned to indicate that we are regrettably aware of the misup.

To our observing proofreaders, orchids; to our unobserving proofreader, a series of brief but effective "tch-tch's."