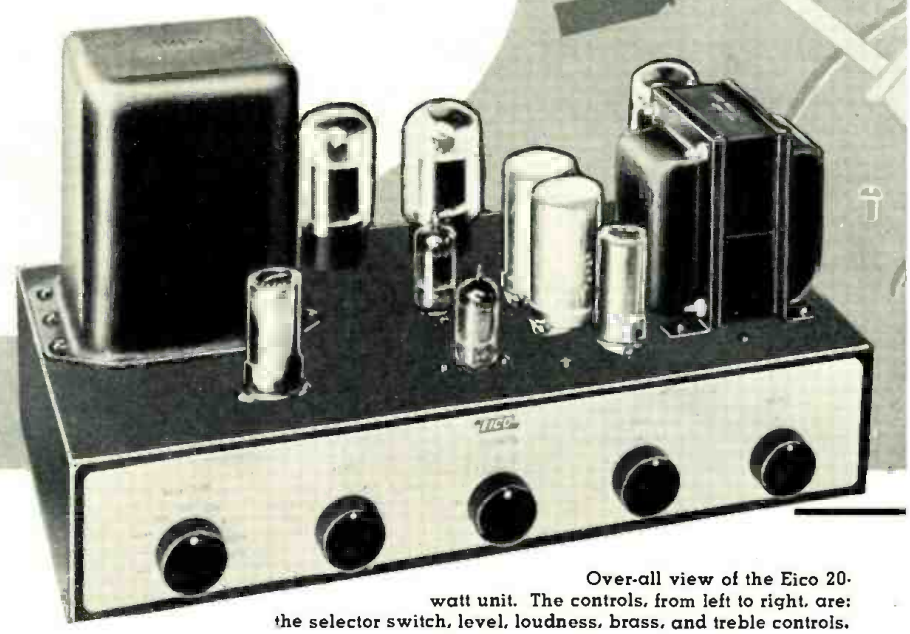
A 20-Watt Amplifier System

A preamp and power amplifier with six inputs, tone controls, and loudness control—all on a single chassis.



Over-all view of the Eico 20-watt unit. The controls, from left to right, are: the selector switch, level, loudness, brass, and treble controls.

FOR those who have been looking for a well-engineered yet inexpensive power amplifier, the newly-released *Eico* Model HF20 unit might offer a simple solution to their problem. Not only does this unit provide 20 watts of power but the circuit incorporates a preamplifier and a variety of controls on a single chassis.

Of the "Ultra-Linear" Williamson type, this compact (8½" high, 15" wide, and 10" deep) circuit provides up to 34 watts peak power. Frequency response is +0, −1 db from 13 to 35,000 cps at ¼ watt with power response at 20 watts +0, −1 db from 20 to 20,000 cps.

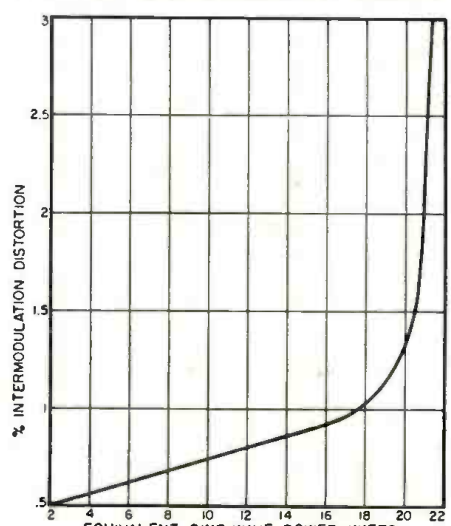
The circuit incorporates four high-level inputs and two low-level inputs. The high-level inputs will handle a TV set, tape recorder, AM-FM tuner, crystal and ceramic cartridges, or other equipment. The low-level inputs handle ceramic cartridges (with adapters) or FM and magnetic pickups, without component changes. A low-impedance output jack is conveniently placed for the accommodation of those owning or planning to buy a tape recorder.

There are five phono equalizer positions which can be selected by means of a rotary switch: RIAA, *Columbia*, *London*, European 78's, and American 78's. Bass can be boosted or cut 15 db at 50 cps, while the treble can be boosted or cut 15 db at 10 kc. Two separate controls provide this feature. These bass and treble tone controls are of the new feedback type for exceptionally low distortion and wide frequency range. They do not affect the volume or interact with each other, thus providing the easiest possible control settings. Since the turnover on both ends varies with the amount of boost and attenuation, boost or cut at the extremes of the audio range is possible without affecting the mid-range.

The loudness control circuit is a *Centralab* "Compentrol" which raises and lowers the volume in strict accordance with the Fletcher-Munson response curves.

The IM distortion of the amplifier (60 to 6000 cps mixed 4:1 at 20 watts) is 1.3% while the mid-band harmonic distortion at 20 watts is .3%. The damping factor is 7:1 and the inverse feedback 14 db. Taps are provided for 4, 8, and 16 ohm speakers.

Equivalent sine wave power plotted against the per-cent of intermodulation distortion for the Eico 20-watt power amplifier.



Sensitivity is .004 volt r.m.s. (at 1000 cycles) for 20-watt output with magnetic phono pickups and .4 volt r.m.s. for 20-watt output with the tuner and other accessory units.

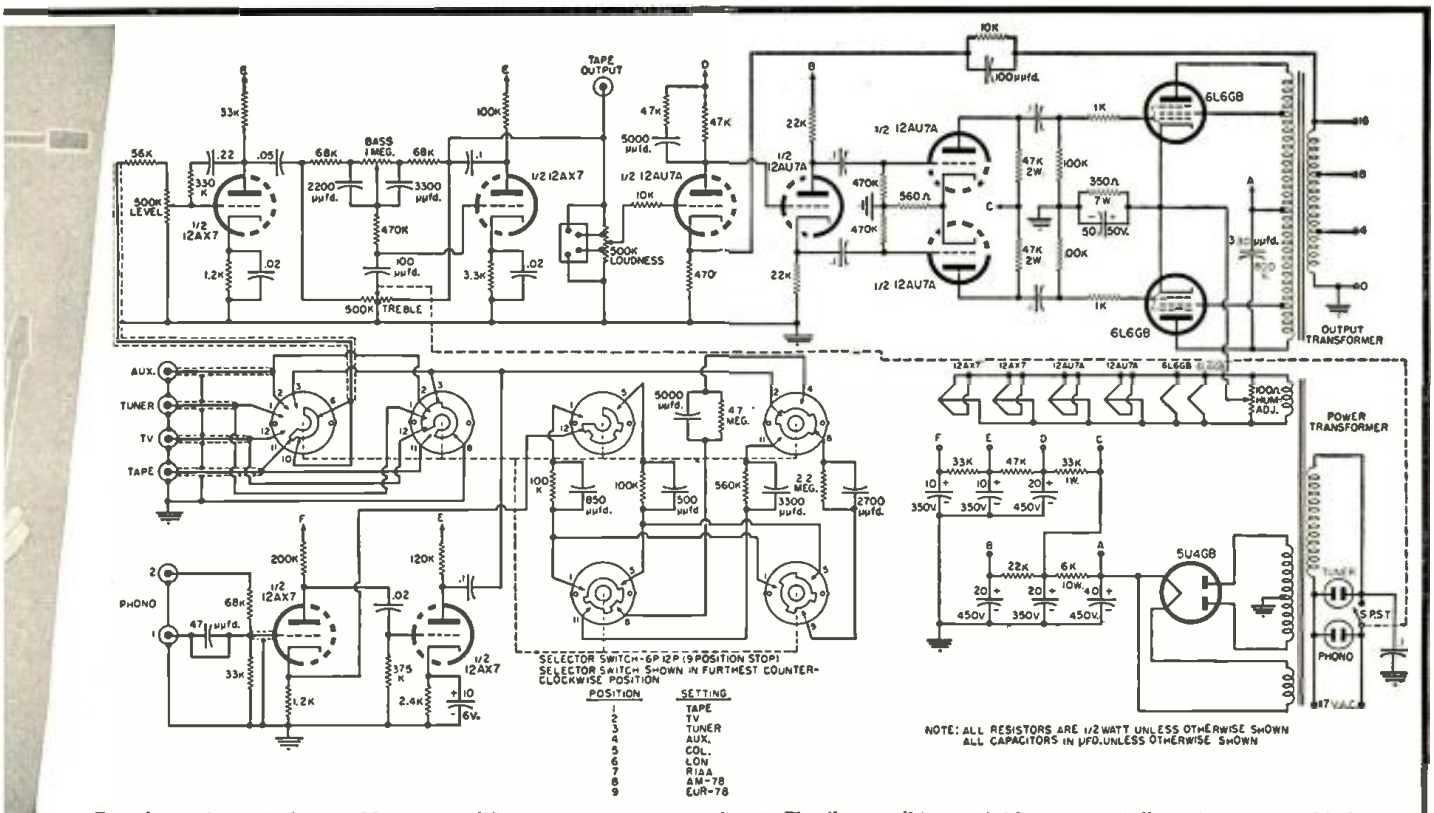
Hum and noise is −60 db below 20 watts with magnetic pickups (including the 16 db boost at 60 cps due to RIAA compensation) and −75 db below 20 watts with the tuner, etc. Both of these figures were obtained with maximum gain and the tone controls set at the "flat" positions.

The HF20 will operate at either 50 or 60 cycles and voltages from 105 to 125 volts. The unit draws 100 watts.

The amplifier uses seven tubes: two 12AX7's, two 12AU7A's, one 5U4GB, and a pair of 6L6GB's in push-pull. If desired the output tubes can be replaced by 6L6GA's or the metal 6L6's or, if the builder chooses, the premium 5881's can be used. No circuit changes are required with these tube substitutions but the tubes must be matched to insure minimum distortion.

Circuit Description

The circuit employed in the HF20 is fairly straightforward and conventional in design. The two low-level phono inputs are applied to a 12AX7

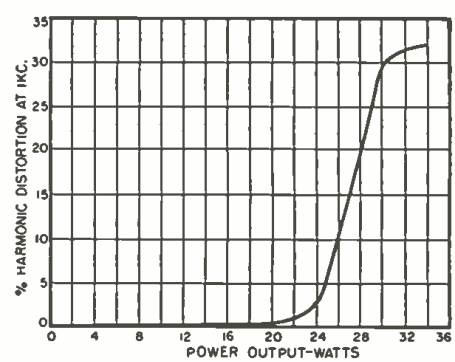


Complete schematic for the 20-watt amplifier, preamp, tone-control unit. The "system" is available commercially in kit or assembled form.

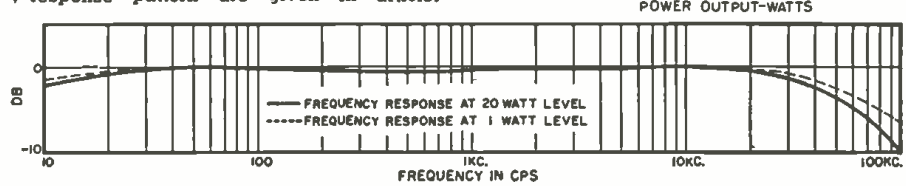
equalizer-preamplifier whose response characteristics are determined by the setting of the selector switch. Note that a jumper is wired across the 47 µµfd. input coupling capacitor from phono terminal 1. This jumper is clipped open when it is desired to use a *Weathers* FM capacitance pickup without the *Weathers* adapter. With such an adapter, this pickup is connected to terminal 2 and the jumper is left intact. Note also that the selector switch not only determines the equalization but also connects the proper input terminal to the unit. Output from the equalizer circuit or directly from the four high-impedance inputs is then applied through the level control to a second 12AX7 preamplifier circuit incorporating bass and treble controls. The output of this stage is then fed through the loudness control to a 12AU7A, operating as direct-coupled, low-level voltage amplifiers. The second section of this tube is a phase-splitter which feeds equal amplitude but opposite polarity signal voltages to another 12AU7A, the driver amplifier. Outputs from this driver are then applied to the grids of the 6L6GB push-pull power amplifiers whose screen grids are connected to taps on the output transformer to provide "Ultra-Linear" operation. Degenerative feedback is taken from the secondary winding of the output transformer and is applied to the cathode of the first section of the 12AU7 low-level voltage amplifier.

The HF20 is being offered in two forms, as a kit at $49.95 and completely wired at $79.95. -30-

Harmonic distortion at 1000 cps versus the power output of amplifier (in watts).



Over-all frequency response of the amplifier at 1 and 20 watt levels from 10 cps out to 100,000 cps. The details on this response pattern are given in article.



The available power of the amplifier before the clipping action and the over-all power of the unit at one per-cent harmonic distortion.