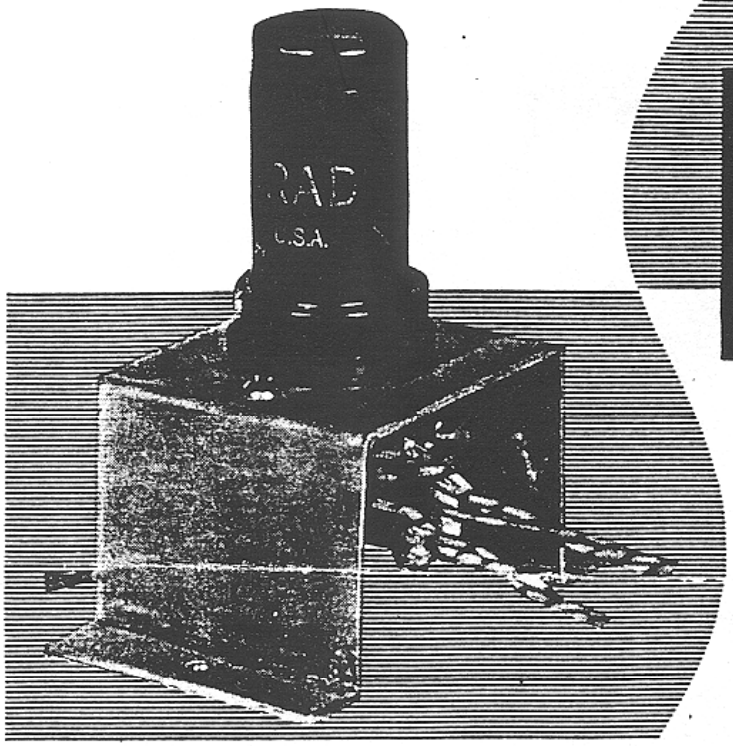

FM converter in its final form.

A Simple FM CONVERTER

P1154

By
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Electronics Research, Inc.

One solution to prevent obsolescence of pre-war FM receivers. WMLL will supply their listeners with this converter.

EDITOR'S NOTE: *In order to comply with FCC regulations all FM stations must move to the new 88-108 mc. band. Owners of pre-war FM receivers will, of necessity, have to replace or convert their present sets. The converter described herein is extremely simple in all respects. However, in view of the purpose for which it was designed this converter is limited in its application. This unit is designed to cover only from 92-108 mc. of the new band. It can, however, by simply changing the oscillator frequency, cover any bandspread which does not exceed nine megacycles, i.e. 100-108 mc., etc.*

If the entire 88-108 mc. band is to be covered, a switching arrangement can be employed, or a circuit such as that described in the June, 1945 issue of RADIO NEWS *can be used instead.*

WHEN the Federal Communications Commission changed the FM broadcast band from 42-50 megacycles to 88-108 megacycles, FM broadcasters were faced with the dual problem of changing their transmitters to operate in the new band while retaining a listening audience. The problem was complicated by the scarcity of receivers capable of covering the new frequencies. Some broadcasters solved the problem by operating transmitters simultaneously in both the old and new bands, at best a temporary and costly expedient.

At WMLL, in Evansville, Indiana, the specific task confronting station engineers was that of changing from an operating frequency of 44.5 megacycles to 94.7 megacycles, and at the same time retaining the good will of several hundred set owners. The solution decided upon was to discontinue operation on the old frequency entirely, and supply listeners with a simple, low-cost converter for their receivers. The converter design finally evolved is extremely simple and is described herewith.

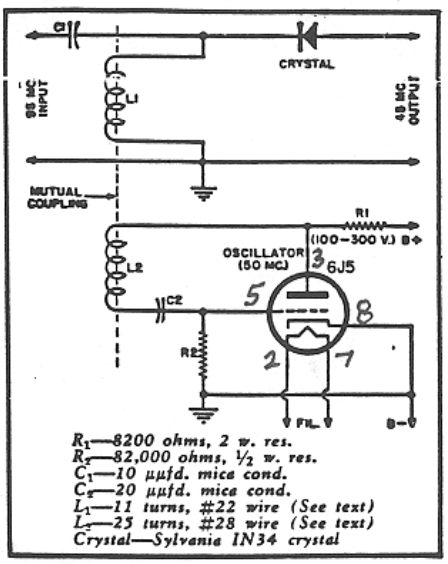
A number of converter circuits were tried, using dual purpose tubes to perform the functions of oscillator and mixer, the design centering around the idea of converting the 10 megacycle band of frequencies between 90 and 100 megacycles to a band extending from 40 to 50 megacycles using a fixed 50 megacycle heterodyning oscillator. The 40 to 50 megacycle output of the converter could then be received by a standard pre-war FM set, using only the normal tuning controls. It was desired to make the converter by a simple, easily-duplicatable design, if possible, involving no tuning controls or trimmer adjustments. It was found rather easy to eliminate trimmer condensers by winding all coils on high-ohmage resistors, using the resistors as coil forms. However, it was found rather difficult to use standard tube types, such as the 6SN7, 7J7, and 7S7, in the mixer stage of the converter, it being observed that converter gain at the frequencies involved was considerably less than was anticipated.

The advent of the *Sylvania* Type 1N34 crystal detector was a godsend. A converter using one of these crystals as a mixer and a 6J5 triode as oscillator proved to be, by all standards, the best design that could be evolved at a reasonable cost. The circuit was far simpler than one using vacuum tubes exclusively, and performance exceeded that of the best tube converters tried.

The circuit diagrams of Figs. 1 and 2 illustrate the simplicity of the WMLL converter. Fig. 3 shows the simple chassis layout, while the photograph presents an over-all picture of the unit. It is intended that power for the converter be obtained from the receiver with which it is used, a convenient means for doing this being the use of an adaptor under one of the audio output tubes in the receiver. Filament voltage can be obtained by connection to appropriate terminals on the tube socket, but some care must be exercised in obtaining plate voltage. In most receivers it is convenient to

(*Continued on page* 127)

Fig. 1. Schematic diagram for FM converter.



R_1—8200 ohms, 2 w. res.
R_2—82,000 ohms, ½ w. res.
C_1—10 μμfd. mica cond.
C_2—20 μμfd. mica cond.
L_1—11 turns, #22 wire (See text)
L_2—25 turns, #28 wire (See text)
Crystal—Sylvania 1N34 crystal

pany, Inc., 285-7 North 6th Street, Brooklyn, New York.

ALLIED CATALOGUE

Allied Radio Corporation of Chicago is announcing the release of the new 1946 catalogue covering over 10,000 items for the radio serviceman, the dealer, hams, experimenters, engineers, schools and industry.

The catalogue is indexed for easy reference. An enlarged section is devoted to amateur equipment needs, including communications receivers, keys, mikes, kits, books, and many other items.

Several special kits, designed for the experimenter, beginner and, radio student, are included in the catalogue.

A copy of the 1946 catalogue will be forwarded free, upon request to *Allied Radio Corporation*, 833 West Jackson Boulevard, Chicago 7, Illinois.

TEST EQUIPMENT

Two booklets containing a listing of several new test equipment items are now available upon request to *Metropolitan Electronic & Instrument Co.*

Included in the booklets is descriptive material and prices on such items as tube testers, pocket model V-O-Ms, multitesters, vacuum-tube volt-meters, combination tube and set testers, etc.

Copies of these booklets will be forwarded to those requesting them from *Metropolitan Electronic & Instrument Co.*, 258 Broadway, New York 7, New York.

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Simple FM Converter

(*Continued from page* 31)

obtain this by connection to the screen grid pin on one of the audio output tubes, but this connection should be made only if this screen voltage is not obtained through a dropping resistor in the set. A plate supply voltage for the converter, between 100 and 300 volts, will be satisfactory, and the current drain is considerably under ten milliamperes.

Basically, the converter consists of a crystal detector used as the non-linear element in a mixing system in which a received signal in the frequency range 90 to 100 megacycles is made to beat with the output of a fixed 50 megacycle oscillator to produce a signal in the 40 to 50 megacycle tuning range of a pre-war FM receiver. The circuit diagram of Fig. 1 shows the 50 megacycle oscillator stage comprising a 6J5 tube, the resistors R_1 and R_2, the coil, L_2, and the condenser, C_2. The circuit is that of a high-frequency Colpitts oscillator whose tank circuit consists of the tube interelectrode capacities and the coil L_2. The condenser C_1 and coil L_1 between the converter input terminals and crystal, function as a high-pass filter having a cut-off frequency slightly below 90 megacycles, attenuating spurious responses resulting from low-frequency signals.

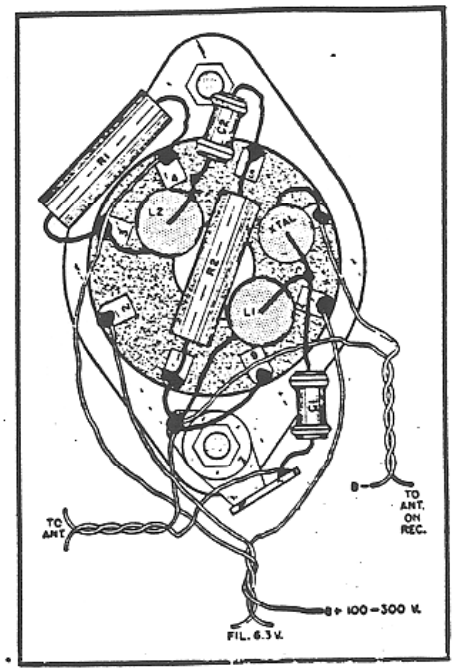

Fig. 2. Under chassis view showing component connections to 6J5 socket pins.

In service the converter is used with a suitable antenna connected to the input terminals. It has been found advisable to exercise some care in location of antenna wiring to insure proper functioning of the high-pass filter. The output terminals of the converter should be connected to the antenna input terminals of the receiver with which it is to be used. Tuning of the converted receiver is accomplished by the same means as it was previously tuned.

The only converter components which even remotely approach being critical are the coils L_1 and L_2. L_1 should have sufficient inductance to function with condenser C_1 to form a high-pass filter having a cut-off frequency between approximately 65 and 85 megacycles. The oscillator coil L_2 should be proportioned to obtain an oscillator frequency of 50 megacycles, although deviation from this figure of plus or minus one megacycle is acceptable. It has been found most convenient, as mentioned previously, to wind both coils on resistors using *Allen-Bradley* type GB, 1 watt resistors as coil forms. The use of resistance values above 500,000 ohms is recommended.

The parts layout shown in the photographs, is a design involving a minimum of hardware. Dead pins on the 6J5 oscillator tube socket are used as tie points.

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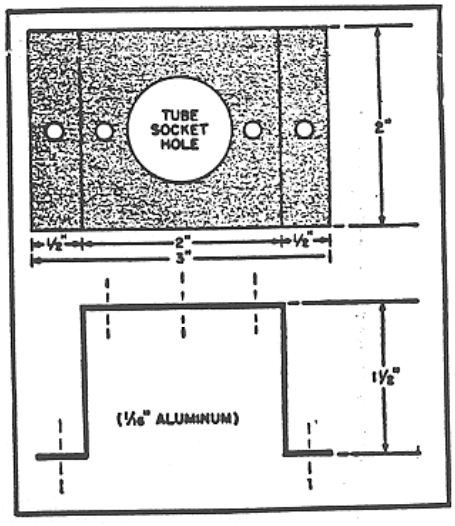
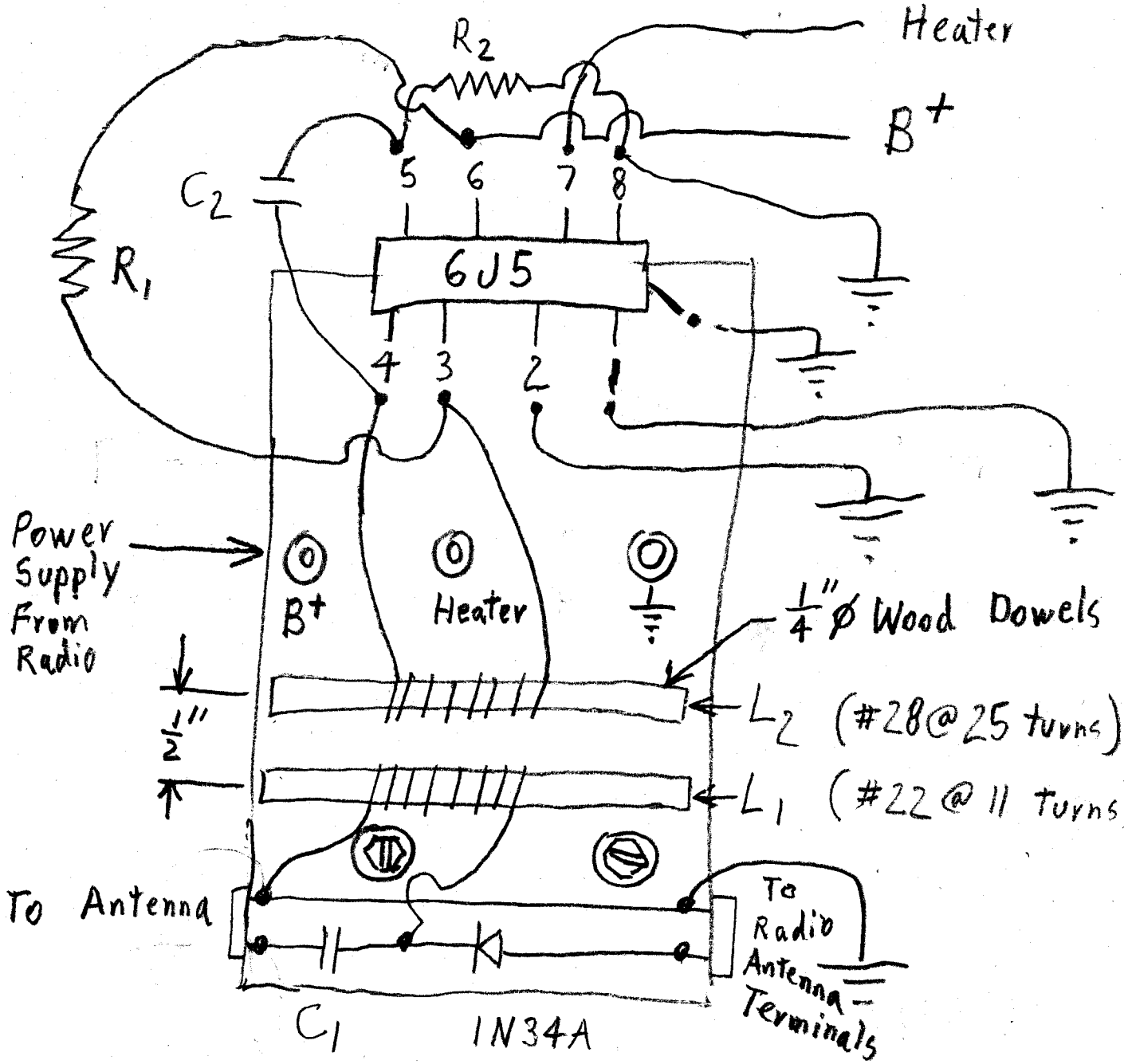
Fig. 3. Converter chassis.





2"×2"×4" Aluminium Project Box

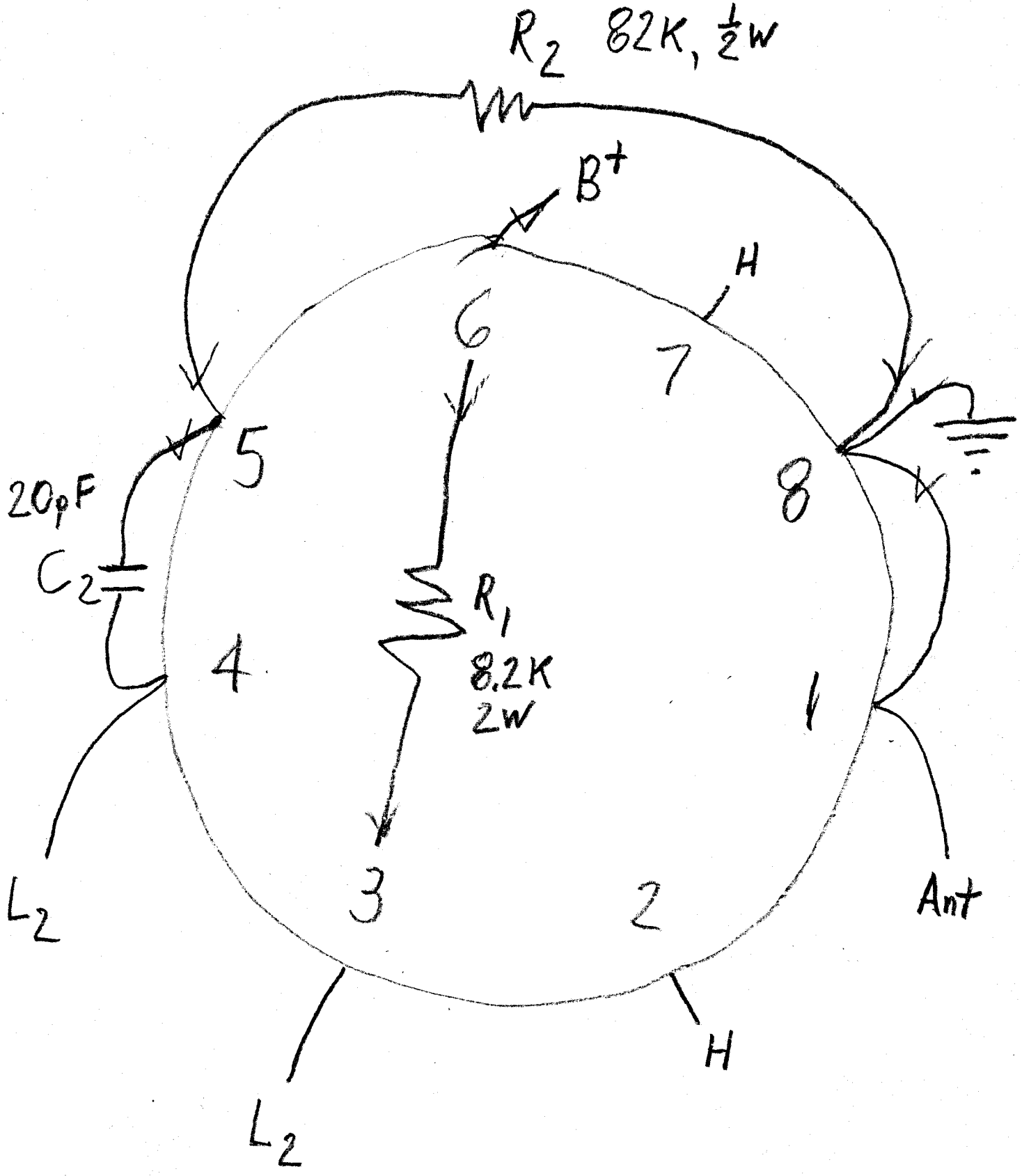
R_1	8.2K 3w	Pin 3 ~ Pin 6
C_2	20 pF	Pin 4 ~ Pin 5
R_2	82K ½w	Pin 5 ~ Pin 8
⏚	Pin 8 ~ Term. Strip	

Heater
Pins 2 + 7

B+ (100-300V)
Pin 6

⏚ Pin 8
To Radio
Ground

FM 45 To FM 100 Converter



FM 45 To FM 100 Converter

6U5
Socket