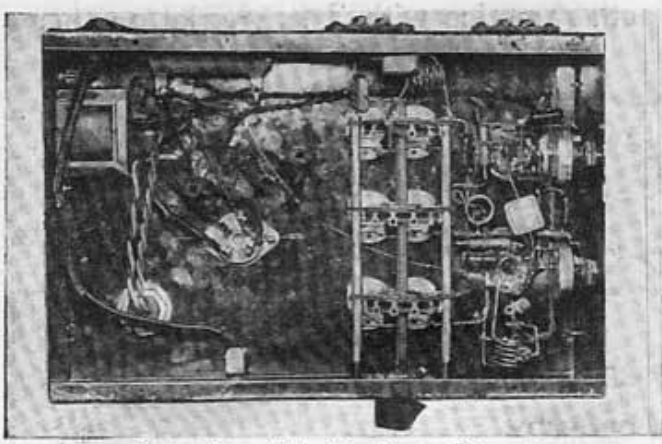
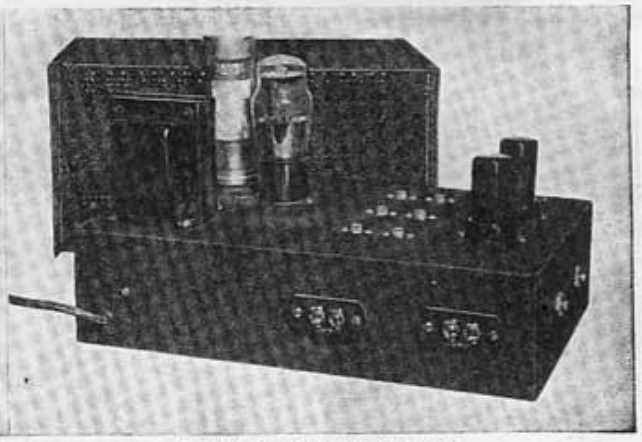


Bottom View of Television Pre-Amplifier.



Front view, with cover removed.

Television Signal Booster

—A 2-Stage Pre-Amplifier

Ricardo Muniz, E.E.

● HERE'S a real *first!* A crying need for a signal boosting amplifier has been felt by many of the men making installations of television receivers in the *twilight zone* of the service area of the television transmitters. Even in the city—near the transmitter—there are areas which are effectively *shadowed*. The installation instruction sheet supplied to men installing television sets for one of the very large manufacturers states under the heading **Too Weak a Signal,** quote: *"The signal may be too weak even to ensure stable synchronism as noise pulses may be strong enough to override the signal and so trip the deflection oscillators at the wrong times. The remedy is to install the antenna at greater height or in an unshielded location, provided increased transmission line loss does not offset the increase in signal strength—there* MAY BE NO ALTERNATIVE EXCEPT THE INSTALLATION OF A SPECIAL R.F. AMPLIFIER TO OFFSET INCREASED TRANSMISSION LINE LOSS . . . ."*

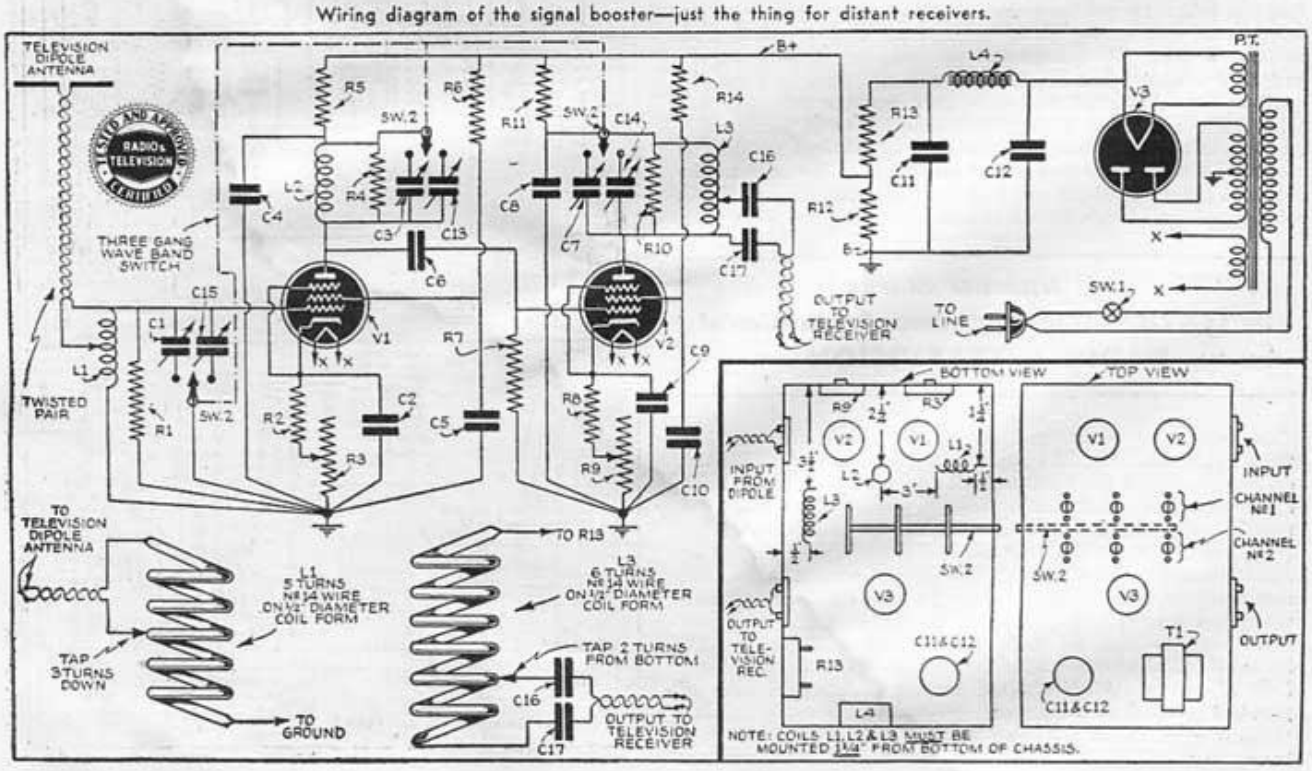
The author, wishing to be fully prepared to meet any emergency, diligently sought to locate, on the market, such a *"Special R.F. Amplifier"* without meeting with any success. The gadget being unavailable, he decided to design and construct one himself. The unit described in this article was the result of these efforts.

PERFORMANCE: This signal booster amplifier was tested in a location where

*See RCA's "Practical Television."

(Continued on page 40)

Wiring diagram of the signal booster—just the thing for distant receivers.



Television Signal Booster

(Continued from page 12)

no picture signal was receivable and brought in a full strength picture *perfectly sharp and steady*. At this location some television sound was heard without the pre-amplifier. The receiver under consideration was a Du Mont 183X. The band pass characteristic proved ample to bring the picture through without any loss of the fine details which are carried by the higher modulation frequencies. The sound channel was also amplified.

FEATURES: There is full equipment for two channels built in and provisions are made for at least one more channel—an additional one might be squeezed in (making four). The two channels now built in are used for W2XBS 45.25 mc. picture, 49.75 mc. sound; and W2XAB 51.25 mc. picture, 55.75 mc. sound. A self-contained power-pack is built in. A gain control is provided for each of the two R.F. amplifier stages to permit optimum adjustment of each without the feed-back problems introduced by using the same potentiometer for both stages. A band-change switch changes from one channel to the other at one flip. The outfit is in very presentable form and reasonably compact so that it will not be an eyesore if it must be installed outside the cabinet and yet will quite probably fit inside it.

CHOICE OF CIRCUIT: The circuit published together with this description of the signal booster is the result of a good deal of experimental work. It is the simplest possible circuit which was found to work well. The design of a signal frequency amplifier is a big headache to any television engineer—he would much rather design any other part of the circuit. It is a big headache because it is very likely—after all the math. has been juggled—and after all the careful planning has been completed—that very little advantage will be found to accrue from the use of an R.F. stage. For this reason most television receivers on the market today do NOT HAVE ANY R.F. AMPLIFICATION. The author carefully considered circuits using tuned links (three tuned circuits at each tuned position), circuits using tuned coupled circuits, and others. Many were tried. Some can be made to give slightly more gain than the one described, under ideal conditions, but are so exceedingly troublesome to line up properly, that they are entirely out of the class of equipment which can be made in the average service shop or "home laboratory." The actual advantage of these "fancier" circuits over the one finally chosen were found to be mostly "on paper." The circuit used is very stable and will not oscillate at *full gain* if the described parts placement is adhered to.

DESCRIPTION OF CIRCUIT: The television di-pole antenna is fed down through the usual type of transmission line. In locations requiring use of the signal booster it is desirable to use relatively good line—concentric, co-axial, etc. It will be noted that the two ends of the transmission line are connected to taps on the grid coil of the 1st stage. See diagram for details of this coil marked L_1. It was found after extensive testing that this was the least troublesome way to match the line impedance into the amplifier input. Several other methods work well—but this was found equally good—and much simpler to adjust—as a matter of fact, if you make the coil just as specified no adjustments are required. If you are of an experimental bent, however, juggling the lower tap—nearest ground—will permit exact matching. It is necessary to adjust C_1 and C_{13} every time the tap is moved a fraction of a turn. The first stage uses tuned grid, tuned plate. The second is coupled by a .005 mf. condenser to the first. The second uses tuned plate. It will be noted that single tuned circuits are used. A ganged switch switches from C_1, C_2, C_7 to C_{23}, C_{25}, C_{14} for switching from channel No. 1 to channel No. 2. The *output* link to the television receiver again must match the impedance of the usual transmission line (about 72 ohms) because the *input* of a standard television receiver is designed to work from an antenna line. This is accomplished by connecting a piece of transmission line (twisted pair may be used) at one end, to the television set at the other end; the two wires are connected to the plate side of the last plate tuning inductance L_3 as indicated. Many arrangements were tried here without success—this is the only one that worked at all well. Since L_3 has B-plus on it, blocking condensers C_{16} and C_{17} were necessary.

ADJUSTING THE SIGNAL BOOSTER: It is desirable to adjust the signal booster in a location where the signal strength is sufficient to operate a television receiver without the booster. Final trimming of the first and last trimmer may then be made "on location" to match up as best can be done.

Connect the antenna transmission line to the *INPUT* terminals; the television receiver to the *OUTPUT* terminals. Turn on both the "telly" set and the signal booster. Adjust the padders while observing the transmitted "Test Pattern" on the screen of the telly set. It will be necessary to bring the gain or contrast control down on the telly set as the adjustment proceeds. The adjustment should be made with the gain controls on the signal booster both set about ¾ of the way up. Adjustment of the booster padding condensers until the picture is the strongest or most contrasty will be correct. It will be noted that the television *sound* gets stronger at the same time.

PRECAUTIONS TO BE OBSERVED IN CONSTRUCTION: To one familiar with construction of ultra short wave receiving equipment no especial difficulties will present themselves. To those familiar with ordinary radio receiver construction, a few words of advice will not be amiss. The author does not advise anyone without previous radio construction experience to tackle the construction of any piece of television equipment unless he is willing to devote the time necessary to master the many problems encountered. The latter group may find it necessary to re-build the booster after having completed preliminary experiments.

The distributed constants of the wiring and equipment assume primary importance in ultra high frequency work. A wire is not only a lead, *but also a condenser, an inductance and a resistance.* The proximity of the various parts introduces into the circuit unexpected capacitances and inductances. Bearing these facts in mind, avoid paralelling any R.F. wiring and keep a reasonable amount of space between parts without unduly lengthening the wiring. Remember that small changes in wiring location often require changing the number of turns on the tuning coils. The number of turns should be adjusted in such a manner that the NBC channel (45.25 mc. and 49.75 mc.) comes in with the padder condenser almost all the way in. CBS (51.25 mc. and 55.75 mc.) will then come in at about the half-way position, leaving room for a third set of padders for a third channel.

The specified band-switch has to be extended to get the required spacing of 2 inches between switches. This is an easy job for the experimenter. Trimming is best accomplished using the special screw-driver specified in the parts list to reduce the effect of body capacitance.

The author will be very glad to hear from builders of this booster and to give them any reasonable amount of advice should they encounter problems. Address him care RADIO & TELEVISION Magazine. Enclose a self-addressed *stamped* envelope.

The author wishes to acknowledge the able assistance rendered by Andy Tait in the actual assembly of the booster.

Parts List
2 Stage Pre-Amplifier

I.R.C.
1—10,000 ohms, type DHA, 25 W. R13
2—10,000 ohms BT-1, R5, R11
2—160 ohms BT-½, R2, R8
3—3,500 ohms, BT-½, R1, R4, R10
2—60,000 ohms BT-1, R6, R14
1—250,000 ohms BT-½, R7
2—10,000 ohms Pot. type CS, R3, R9
1—40,000 ohms type AB, 10 W., R12

AMERICAN PHENOLIC CORP.
2—Super MIP sockets No. 54-8
1—4-prong socket, MIP-4T

INSULINE CORP. OF AMERICA
1—8x12x3 amp. chassis (black crackle) No. 3873
1—Amp. chassis cover for same, same number
1—Bottom plate for same, No. 4062

CORNISH WIRE CO.
2—25 foot coils Braidite radio hookup wire

BUD MFG. CO.
1—Power switch type 1003, SW1

RCA RADIOTRON
2—Type 1852, V1, V2
1—Type 83-V, V3

HAMMARLUND MFG. CO.
6—25 mmf. air pad condensers, type APC-25, C1, C15, C3, C13, C7, C14

KENYON TRANSFORMER CO., INC.
1—Type R200 power transformer T1

THORDARSON ELEC. MFG. CO.
1—40 ma. choke, type T13C27, L4

CORNELL-DUBILIER CORP.
1—8-8 mf. type EB8800—C11, C12
6—.01 mf. type 1W—C2, C4, C5, C8, C9, C10
3—.005 mf. type 1W, 5D5, C6

AMERICAN RADIO HARDWARE CO., INC.
1—No. 2370 low capacity alignment screw-driver
1—Pkg. No. 14 round buss bar
1—No. 1504 terminal strip
1—No. 1505 terminal strip
2—No. 5220 Archo terminal lug strips
2—No. 5320 Archo terminal lug strips
2—No. 5420 Archo terminal lug strips

P. R. MALLORY & CO. INC. (YAXLEY)
1—3-section, 3-circuit, 6-position band switch, type 1336-L, SW-2

COIL DATA
L1—5 turns No. 14 copper wire on ½" Dia.
L2—6 turns No. 14 copper wire on ½" Dia.
L3—6 turns No. 14 copper wire on ½" Dia.
All turns spaced equal to diameter of wire

Let's Listen In with Joe Miller

(Continued from page 22)

YUGOSLAVIA

YUE, 11.735 mc., Belgrade, is testing lately from 9:05-10 p.m. which is probably to ascertain the advisability of programs to No. America at this time. For this frequency, we are certain YUE will be well heard this Spring, and up to Fall, provided it is not QRM'd. YUC, 9.505 mc., continues to be a good bet from 8-9 p.m. and 12:43-2 a.m. but XEWW is too close on the 8-9 p.m. sked. For full listings see Jan. 1940 article.

CHINA

XGOX, 15.19 mc., Szechwan, has altered skeds to No. America to 8:30-9:30 and 10-11:05 p.m. This station should be *very* well heard all Spring and Summer. XGOY, 9.65 mc., now operates 9-9:40 a.m. for No. America. Reports on these Chinese broadcasters may be sent to Mr. Ying Ong, 1001 E. Roosevelt Ave., Phoenix, Arizona, who will relay them for confirmation. Thank you, Mr. Ong, for kindly keeping us informed of the Chinese station skeds. A new station XGSE, 9.84 mc., is being heard daily 7 a.m. onward, but not giving any clue as to location.

We'd like to get reports from all of the boys, and will try to do a Ham Stardust column if we've sufficient material, so it's up to you! Will you help? Good hunting to all! VY7J—Joe Miller.