Two Types of Television Receiver One a T-R-F Circuit, th

By Edu

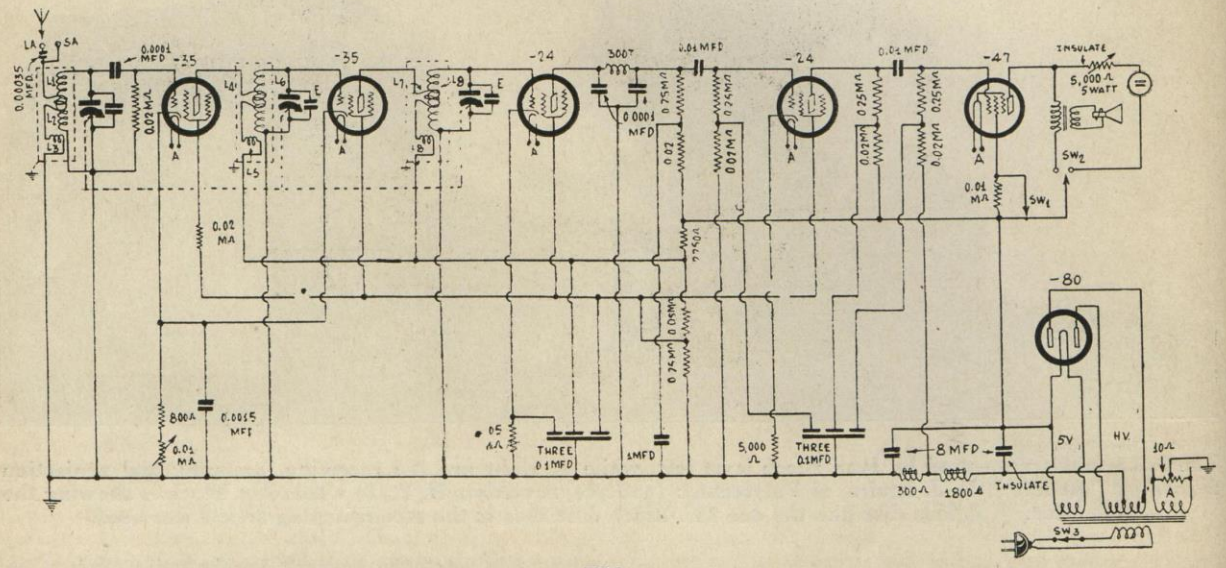

FIG. 1

Here is a television circuit of the tuned radio frequency type, using six tubes, with pentode output, and a switching arrangement to cut in neon lamp or speaker. The entire receiver may be put into a midget cabinet or console, except that the neon tube would be with the disc, and is not a part of the receiver proper.

A RECEIVER suitable for television is much like any other receiver, if of the tuned radio frequency type, except that the frequencies to be covered are different, and that broader tuning should prevail. The usual band covered by television receivers to-day is 80 to 200 meters, and this can be accomplished with a three-gang 0.00035 mfd. condenser, if the secondaries, on 1 inch diameter tubing, have 40 turns of No. 24 enamel wire. For stability reasons, and sufficient broadness of tuning as well as high sensitivity, it is well to use honeycomb coils as part of the antenna and plate loads, and have a few turns of wire, say, six, around the outside of the secondary for pickup. The honeycomb coils may consist of the small 200-turn type, placed inside the core of the form, at right angles, so there will be no coupling, since the few extra turns of primary around the secondary will afford sufficient transfer.

A volume control should be included, since it is possible to overload the detector, first audio and output tubes with a strong signal. Any who have tuned in television signals, including operators of short-wave converters, know how loud the buzz-saw sounds may be. Even stations a few hundred miles away may deliver a husky signal, as is the case in New York City of the television transmissions from Silver Springs, Md., not to mention some of the locals.

Spillover Spoils Picture

The receiver should be fairly stable, but if it does regenerate a little the volume control will check that, and besides a small amount of regeneration has no deleterious effect on the picture's clearness. In fact, it is only when the tube spills over, flops into oscillation, that the patterns like a negative of repeated forked lightning and other designs, appear. These of course not only spoil the picture but obliterate it entirely.

Another fact, submerged from notice because of the obliteration of the image by spillover, is that detuning takes place, for when tubes oscillate the frequency is changed unless some provision for stabilizing the frequency is included.

High Bias on Power Detector

The first r-f tube is the one likely to oscillate, if any tubes do that, so a grid leak and condenser are included, for minimizing the frequency distorting effect of any amount of regeneration below the point of actual oscillation. In fact, more regeneration can be used this way than without the inclusion of the leak-condenser combination. Sometimes a television fan will be goaded to build up the sensitivity this way as much as possible. While some distortion may appear, the resultant effect is a better picture, sometimes, because there was not enough "hop" to the radio-frequency amplifier otherwise.

Again for the reason of stability an unbypassed resistor of 0.02 meg. is shown in the screen leg of the first tube. Moreover, this resistor, and the relatively low value of resistance for grid leak, tend to broaden the tuning a little, the result being that sufficient sidebands are passed for a satisfactory image.

Coming to the detector, we find that the biasing resistor for this tube is 0.05 meg., a larger value than commonly recommended, but if the screen voltage is high the bias may be high, therefore actually around 8 volts negative bias will result, rather than the usual 5 volts. The current is less than 0.2 milliampere. It is therefore futile to try to read the voltage drop in the 0.05 meg. resistor with any save an electrostatic voltmeter, as any other meter would draw more current by far than would the "measured" circuit.

The detector plate circuit is filtered carefully, with a pi-filter consisting of a 300 turn honeycomb choke coil and two 0.0001 mfd. condensers. The capacities are 20-100 mmfd. equalizing condensers set at maximum. It is unwise to use large values of condensers in this position, because of the necessity of passing high audio frequencies of the modulation. The other part of the detector filter consists of the bypassed 0.02 meg. resistor between the true load resistor (0.25 meg.) and B plus maximum, for it can be seen that the full plate voltage, which may be from 230 to 250 volts, is applied. A condenser of 1 mfd. is connected between the juncture of these two resistors and ground, to prevent not only radio frequencies from getting into the power supply and thus becoming hum-modulated, but also for preventing hum from backing into the detector tube.

Resistor-Capacity Filters

It is well known that hum troubles arise more pronouncedly in two-stage resistance-coupled amplifiers than in single-stage amplifiers, and therefore the detector filtration has to assist in meeting this exigency.

The same resistor-capacity filtration system is continued in the grid leg of the first audio tube and repeated in the plate and grid circuits of the first audio and output tubes. For any greater reduction in hum than results from the wiring of the circuit as shown, an extra condenser, of 0.25 mfd. to 1 mfd., may be placed across the 0.1 mfd. that bypasses the 0.02 meg. resistor in the lower part of the pentode grid circuit. However, it is hardly to be expected that any will complain there is much hum, for there is hardly any, the filtration being good in the rectifier circuit.

The dynamic speaker's field coil is used as B supply choke,

that Give Results: Other a High-Intermediate Super

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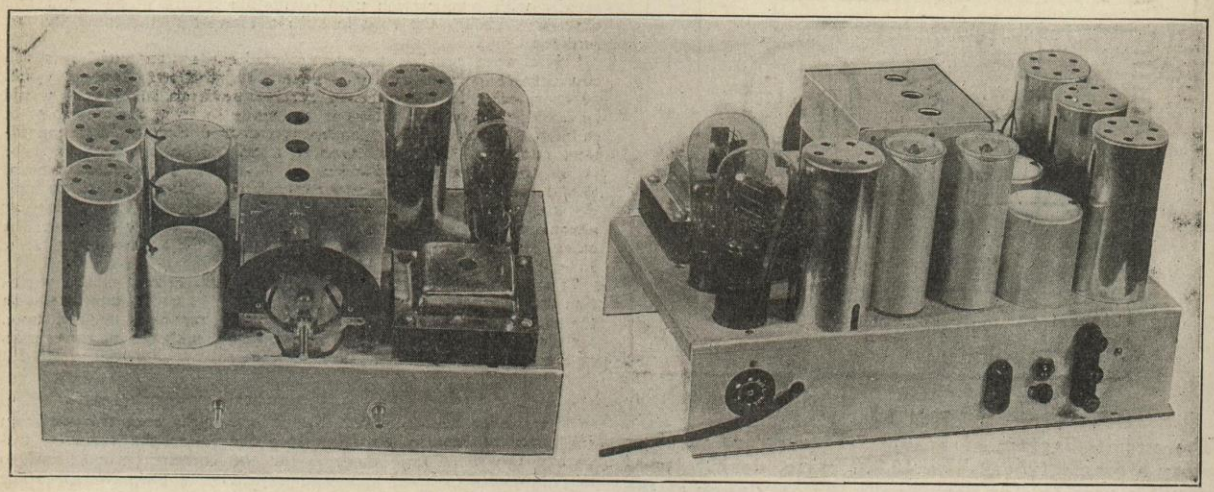

FIG. 2 **FIG. 3**

The front view is shown at left and the rear view at right. The chassis size is 14x8x3 inches, and the assembly is compact and makes for simplicity of wiring. A speaker plug connects to the socket shown on the rear wall of the chassis.

LIST OF PARTS

Coils

Three shielded radio frequency transformers as described (L1L2L3, L4L5L6, L7L8L9).
One 300 turn honeycomb coil.
(Note: field coil and output transformer are built into dynamic speaker specified later).
One power transformer for pentode tube and five heater tubes.

Condensers

Three 20-100 mmfd. equalizing condensers, set at maximum for 0.0001 mfd. shown in Fig. 1.
One three-gang shielded 0.00035 mfd. condenser with equalizers (E) built in.
One 0.0015 mfd. fixed mica condenser.
One 0.00035 mfd. fixed condenser.
Two shielded blocks, three 0.1 mfd. in each block.
One 1 mfd. bypass condenser, 150 volts rating or higher.
Two 0.01 mfd. mica condensers.
Two 8 mfd. electrolytic condensers, one with two insulating washers and extra connecting lug.

Resistors

Six 0.02 meg. (20,000 ohm) pigtail resistors.
One 800 ohm biasing pigtail biasing resistor.
One 0.01 meg. (10,000 ohm) rheostat or potentiometer with a-c switch attached.
Two 0.05 meg. (50,000 ohm) pigtail resistors.
One 0.025 meg. (25,000 ohm) pigtail resistor.
Four 0.25 meg. (250,000) pigtail resistors.
One 0.01 meg. (10,000 ohm) pigtail resistor.
One 0.005 meg. (5,000 ohm) pigtail resistor.
One 10 ohm center-tapped resistor.
One 0.005 meg. (5,000 ohm) 5 watt rheostat.
One 2,250 ohm 5 watt resistor.

Other Requirements

One dynamic speaker, 7 inch cone; 1,800 ohm field coil, tapped at 300 ohms; output transformer built in; speaker plug and cable.
One 14x8x3 inch chassis, drilled, with six UY sockets and two UX sockets. (Speaker and neon sockets included.) Two insulators for neon lamp rheostat.
Four grid clips. Four tube shields and bases for shields.
One antenna-ground three-post assembly.
One vernier dial, lamp, scale, escutcheon.
One midget cabinet.
One single pole double throw switch (SW-2.) One single-pole single-throw switch (SW-1).
One twin jack assembly for television terminals, and two tinsel cord leads with speaker tip jacks.

with 16 mfd. of filter capacity, and part of this field coil (the 300 ohm section) is used for biasing the pentode.

The output is so circuited that either the neon lamp or the speaker is cut in. Many prefer to tune in by ear, and the speaker serves not only that purpose but also permits enjoyment of other than television reception—for instance, police calls and amateurs—within the frequency band covered.

Fits in a Midget Cabinet

Besides, the whole arrangement is such that the receiver may be put in a midget cabinet or any console. Of course the television lamp would be behind the scanning disc, not in the set, so the television terminals, for which a phono jack is used, will receive tipped leads from the neon lamp.

The volume control has a switch attached for the a-c line. The other front panel control is the rheostat used as limiting resistor for the neon lamp, but this rheostat may be put on the motor frame, if preferred. It is customary with present-day lamps for non-projected vision to draw about 15 milliamperes, and the rheostat may be set until the correct amount of current flows, and also serves to prevent a negative impedance being presented to the plate circuit of the output tube, as the neon valve may "turn negative" on occasions if this precaution is not taken.

The pentode tube may heat up to a cherry red, the illumination running completely down to the stem of the tube, due to the high voltage on the screen, as compared to the effective voltage on the plate. In fact, the effective plate voltage may be only 50 volts with the neon lamp in circuit, while the screen would have 250 volts. Therefore a limiting resistor of 0.01 meg. is used when the lamp is in circuit, and may be shorted out for audible signal reception.

A switch is obtainable that serves the single-pole double-throw purpose of SW-2, to throw the output from lamp to speaker, and single-pole single-throw switch may be built into the other, so one operation would control both functions.

The Layout of the Set

No bypass condenser is needed across the 5,000 ohm biasing resistor of the first audio tube, as the negative feedback produces a counter signal current that serves excellently as a hum reducer, with only slight sacrifice in audio amplification.

The circuit diagram, Fig. 1, has the coils designed L1, L2, L3, L4, L5, L6, L7, L8, L9, the data for winding which have been given. The coils should be shielded and the shields grounded which grounding results if a grounded metal panel is used. E represents equalizing condensers built into the main tuning condensers. The tubes are identified. All resistors may be of 1 watt rating, unless otherwise marked. These two exceptions are the 2,250 ohm 5 watt, to reduce the maximum B load to a lower voltage for tuner plates, and the 5,000 ohm 5 watt rheostat. Add the 10 ohm

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The Tuned R-F Television Receiver

(*Continued from preceding page*)

center-tapped resistor, which is wirewound and of all-sufficient wattage in commercial production.

The front and rear views of the receiver, as built up by the author, are shown in Figs. 2 and 3. The tuning condenser is shielded, and the equalizers are accessible to a screwdriver. It is well to trim the circuit somewhere between 30 and 50 on the dial. The r-f and detector tubes are at left, Fig. 1, the detector at rear, and these tubes are shielded.

First Audio Tube Requires Shield

It is also imperative to put a shield over the first audio tube, and this shield can be seen to the right of the electrolytic condensers at rear of the chassis. The pentode tube is at right near and the rectifier tube in front of it. The chassis is 14x8x3 inches and nicely accommodates the parts, the wiring being easy and direct. The volume control is at left, the rheostat for the neon tube at right. This rheostat must be insulated from the chassis, for which purpose two extended washers may be used, the washers attached to a 7/16 inch hole, one on the inside, the other on the outside of the chassis front, the collars of the washers facing each other. Then the rheostat may be tightened in place with safety. Also the 8 mfd. electrolytic condenser on the negative side must be insulated, and two washers are used for this purpose, as well as an extra connecting lug to establish contact with the otherwise insulated case of the condenser.

The rear view, Fig. 3, shows a socket at left, this socket being the speaker plug receptacle. The speaker has the dynamic field coil built in, and there are three connections to this coil: two extremes of the 1,800 ohm winding, and the tap representing the pickup for the 300 ohm section. Connect the Rola speaker as follows: left rear terminal, end of field coil, to plate prong of the speaker socket; next terminal, tap, to G spring of this socket; next terminal, B minus end of field coil, to K terminal socket; pair of leads at right, representing primary of output transformer; interchangeable, one to the heater adjoining cathode and the other to heater adjoining plate. Then in the set connect the P of speaker socket to grounded chassis, G to grid return of pentode, K to B minus (yellow) lead of power transformer's high-voltage secondary, heater adjoining cathode to plate of pentode tube, heater adjoining plate to B plus maximum.

Television Terminals

The television terminals are represented by the twin assembly, the switching is shown, with separate single-pole double-throw, and separate single-pole single-throw, for purposes already outlined, while the binding post assembly at right has marked posts for ground, long antenna (LA on Fig. 1) and short antenna (SA).

The construction of the receiver should be free from any difficulties as the circuit is a good one and is in general along the lines of six-tube television t-r-f receivers familiar to the "visionists."

Besides the receiver and its tubes, there are required a motor, disc and framing device and a neon lamp. The receiver is the amplifier-detector. The rest is the picture maker. Using a 1 foot disc, a picture about 1 inch in size is observed, but may be made to appear larger by putting a magnifying glass in front. The receiver serves excellently for projected television, and but to that end a lens disc is necessary. (*Super next week.*)

Radio World, Februay 27 1932