Converting a 5-inch Telly Kit

FOR RECEIVING A 9-INCH IMAGE

Here's a plan for building a "5-inch" television receiver from a standard kit, becoming familiar with its operation, and then making the necessary changes so that this basic kit may operate a 9- or 12-inch Kinescope. Viewing is thereby greatly improved. It's probably the least expensive way so far suggested for obtaining a virtual 9- or 12-inch teleceiver.

CHARLES SICURANZA

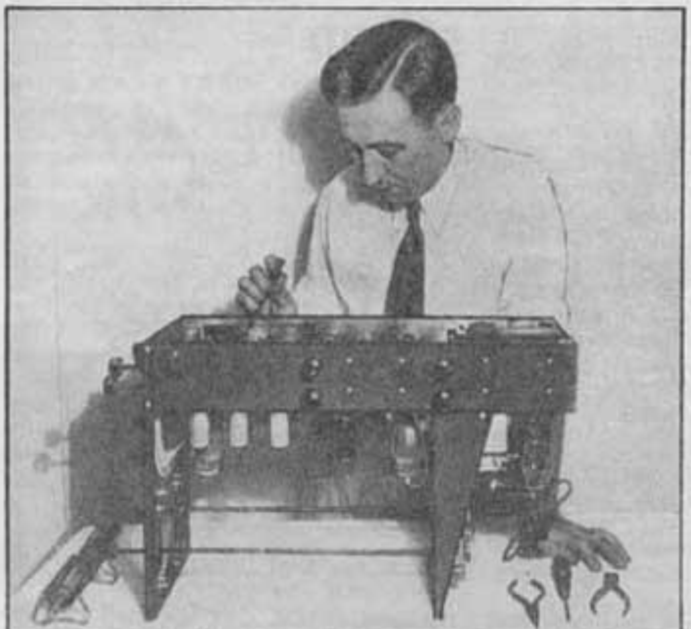
PART I

OF THE several commercial television kits available to experimenters and Servicemen, the writer chose the Meissner 5-inch receiver kit because it was admirably suited to his plan.

It was felt that the plan of converting this telly kit to use a larger cathode-ray tube would be of interest to the hundreds of Servicemen who have already built the kit and also might be of interest to those who prefer a larger image to begin with.

Let it be said at the outset that the writer could find no fault with the 5-inch kit—either with the operation or with the image size—except that one time 14 people squeezed into a small workroom to see a program and although everyone saw and liked the image, it was rather trying to have 6 or 8 people draped around one's neck for a solid hour, hence the conversion idea took shape.

Further, the plan has great educational value as well as considerable economic value. However in fairness to both the reader and the manufacturer it should be stressed that the kit be built first as a standard 5-inch job to learn how to work it properly and then it can be converted in easy stages as will be shown in Part II.



Handsome "Charlie" Sicuranza, author, going through the final alignment process on the 5-in. telly receiver. The cathode-ray tube is not yet in place.

"DO'S AND DON'TS"

The remainder of this Part I will be devoted to a review of some "do's and don't's" in building the set and a discussion of the necessary changes that will be made later on. If you are wondering what you are going to do with the 5-inch cathode-ray tube after converting the set, well—you need a good television 'scope anyway, so why not build one later on and make good use of that tube.

The first "don't" is, not to handle the 1852 (or 1853) like an ordinary tube. Don't "thump" the tube; and *never* drop it on the bench or floor. These tubes because of their close spacing, develop grid-to-cathode shorts very easily when dropped. Result—loads of plate current, and then burnout. Don't try to hurry the wiring job; "make haste slowly" as the manufacturers say, as they really mean it.

Even the assembly job is no cinch, so we will pass on a few hints to prospective builders. Mount the octal sockets first—each socket has a tube number on it. Be sure each socket keyway faces in the proper direction as shown in the pictorial diagram supplied with the kit; and don't forget to put a terminal lug on the 2—6F8G socket screws and also on the 6V6G socket. Scrape the chassis bright at one corner of each socket plate and put a spot of solder on each one. Do this now because later it will be hard to do properly with the wiring in place. The next step is to mount every terminal lug strip shown on the diagram. Look particularly for misplaced grounding straps on these lugs. Each one should look exactly like those shown in the diagram.

Mount *under* the chassis the 4 metal plates which hold the electrolytic condensers. Mount *over* the chassis the 3 bakelite plates for the remaining electrolytics. Mount the flat, wire-wound resistors and safety switch. Check these resistors for opens and grounds before mounting. Assemble all parts on the safety wall and mount permanently on to the main chassis.

Mount the front panel on the chassis and leave the speaker and band-change switch off to the very last. Mount all the I.F. transformers in their proper places according to number. Leave the low-voltage and high-voltage power transformers off until the last of the wiring is in.

The bracket which holds the single-plate variable condenser should be well soldered to the chassis; likewise the

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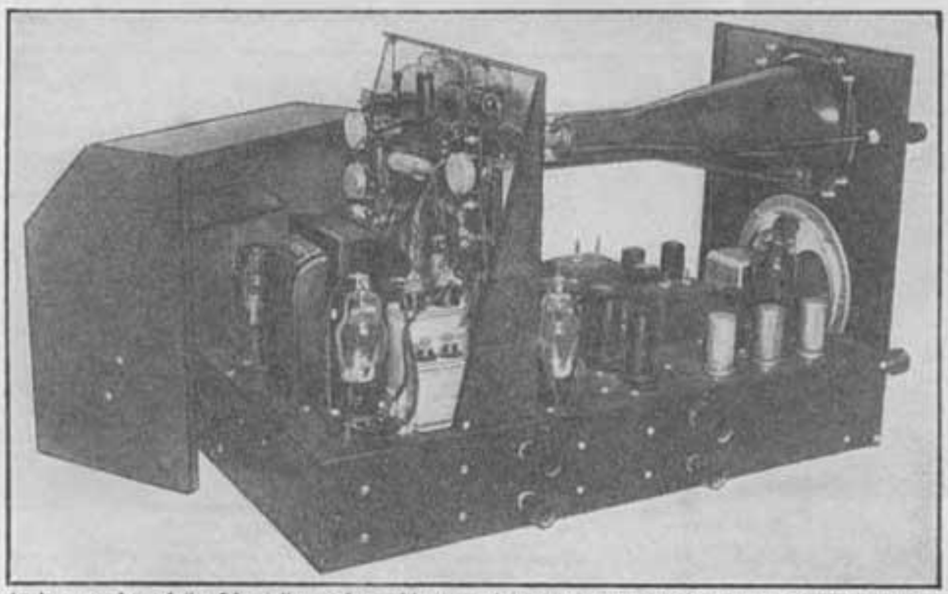


A close-up view of the 5-in. telly receiver with rear safety cover removed. The 2 upper controls on the side skirt are for image size and the lower 2 are for vertical and horizontal speed control.

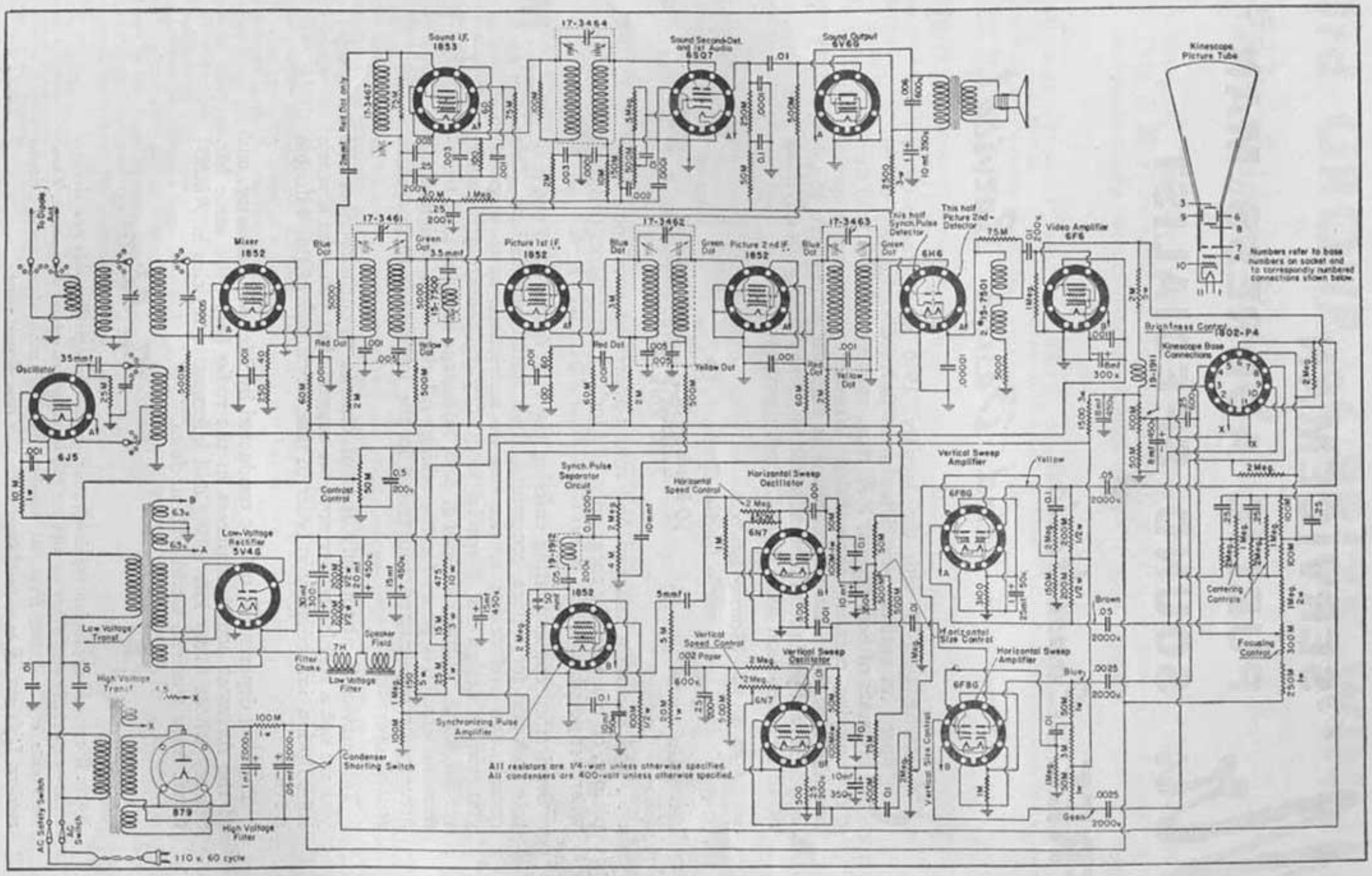
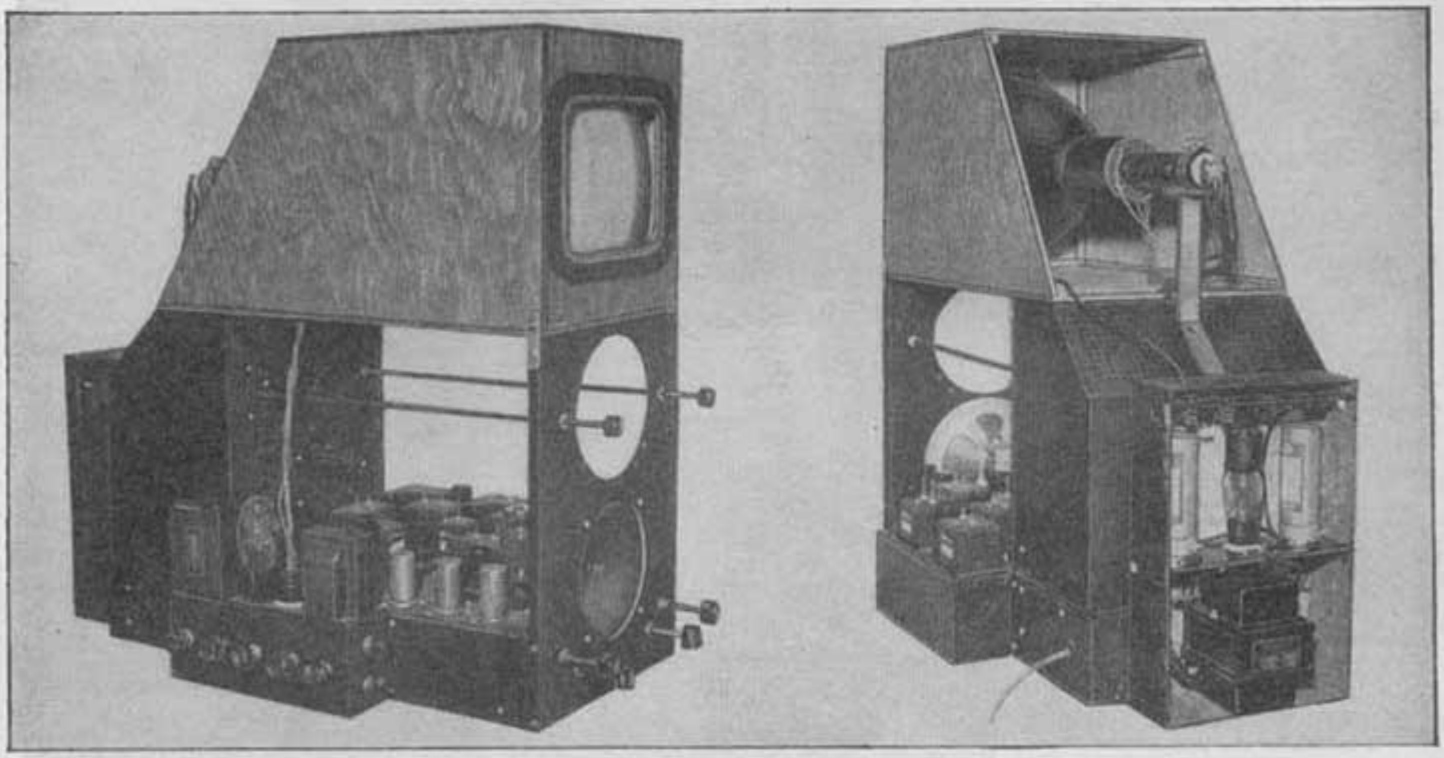


Fig. 1. Complete schematic diagram of the Meissner No. 10-1153 television receiver kit.

Receiver covers only the 2 lowest-frequency American television channels (44-50 megacycles and 50-56 megacycles), but has provisions for adding 2 additional channels when the need arises. The sound channel operates simultaneously with the image—when controlled—serving to tune both channels. The sweep circuit oscillators are multivibrators of simple design. Sweep voltage amplifiers are provided so that the image will occupy the desired area on the screen without the use of excessive voltage on the multivibrator. Synchronization is accomplished through the aid of synchronizing pulses transmitted between successive lines and frames of the image.



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Here's a plan for building a "5-inch" television receiver from a standard kit, becoming familiar with its operation, and then making the necessary changes so that this basic kit may operate a 9- or 12-inch Kinescope! Viewing is thereby greatly improved. It's probably the least expensive way so far suggested for obtaining a virtual 9- or 12-inch teleceiver.

CHARLES SICURANZA

PART II

THE writer begs his reader's indulgence for the delay between Part I and this, the 2nd part of the series. There was a large amount of experimental work and an even larger amount of paper work to be done before Part II could be released for publication.

However, the results obtained were even better than had been expected *and we feel confident* that those readers who convert their Meissner Kits according to the following instructions, will have a fine set; a considerable advance in their knowledge of Television technique; and, withal, at a cost entirely within reason. (See Part I, Nov. 1939 issue.)

4 NEW SECTIONS

The photos above show that 4 new sections have been fastened to the main chassis.

Looking at the set from the front we see on top a wooden box which holds the 9-inch tube and deflecting yoke.

On the right side there is a 2-stage image (pix) I.F. amplifier, and on the left side are the sweep output transformers to match the deflecting yoke; we see also, the horizontal damping tube, and a row of sweep controls.

At the extreme rear we have enclosed a high-voltage power supply which delivers 7,000 volts at 1 milliampere to the 9-inch tube.

We wish to point out here that the 12-inch RCA Kinescope may be substituted for the 9-inch tube with absolutely no electrical changes required!

Some readers may not care for the given arrangement of these 4 sections. It is possible, too, that some readers may want to use a 12-inch tube with *mirror viewing*, which would alter the layout. For high-definition television reception it is imperative that the wiring and stray capacities be held down to an absolute minimum; all unavoidable capacities then should be accurately known, and counterbalanced if possible. This important factor should be kept in mind when any alterations in layout are attempted.

CONSTRUCTION—UNIT NO. 1

Prepare the small image I.F. chassis from the drawing (Fig. 2). Drill all holes exactly as shown and have your local tinsmith "fold" the bends indicated on the sketch. The 2 sockets, the 2 image I.F. transformers, and the sound-trap, are now assembled. The blue dot on each I.F. transformer should point toward the loudspeaker at the front panel.

The signal sequence is given in Fig. 3; and the schematic circuit of the complete image I.F. channel is shown in Fig. 4.

It will be necessary to drill a ½-in. hole for each of the 4 grid leads in the side of the main chassis. Next, proceed to wire-up the small chassis, leaving the grid wires off until the small chassis is fastened to the main chassis. Run a twisted pair of filament leads from the Sync. Separator socket to the 2 sockets in the small chassis. Run a "B-plus" lead from the main chassis to the terminal strip in the small chassis and also solder a ground lead from the main chassis to the small one. Now solder the grid leads in proper order, and as short and direct as possible. The plate leads, the grid-return leads, and the grounded connections should be checked against the schematic of Fig. 4 and the signal sequence of Fig. 3. The values of all resistors must be as shown, otherwise the combination of sensitivity, stability and band-width will be upset.

REALIGNMENT—WITH 5-IN. TUBE IN PLACE

Having completed this stage of the conversion the next

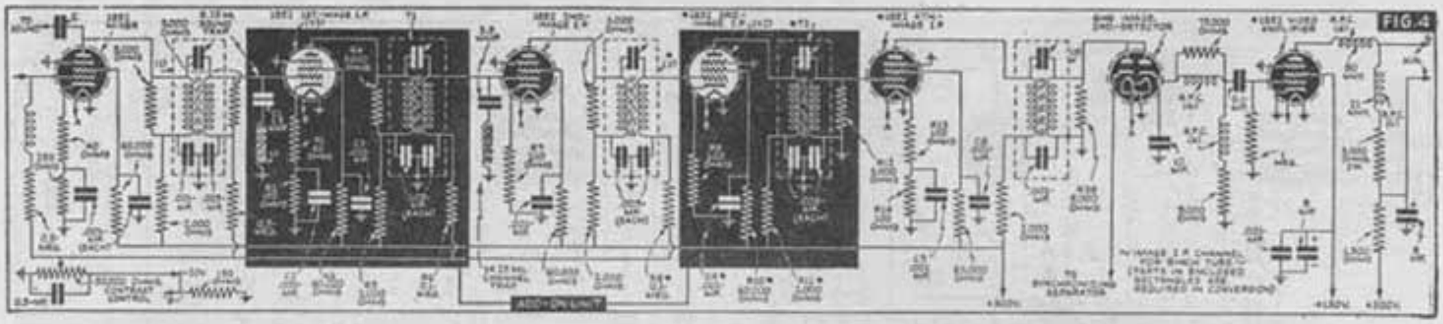

FIG.4

step is to realign the image I.F. channel while still using the 5-inch tube. Alignment of wide-band television I.F. amplifiers is a difficult and tedious task even when all necessary equipment is available, as fortunately it was in the writer's case.

For example, the *development* of the present circuit required the use of a $500 Standard Signal Generator, an Impedance Bridge, a sensitive Vacuum-Tube Voltmeter, a 10,000-volt Electrostatic Voltmeter, a Television Alignment Wobbler, and an Oscilloscope.

However, the only equipment actually required in the realignment process is a fairly good shop oscillator, and a V.-T.Vm. with low input capacity and range from 1 to 10 volts. A few sheets of square graph paper should be prepared as shown in Fig. 5. The ideal response curve is shown in Fig. 6. Five important items should be kept in mind during the alignment process:

(1) Always start aligning at the last I.F. stage feeding into the image-detector. The V.-T.Vm. is connected between ground and the junction of the 2 chokes in the image-detector cathode circuit.

(2) Be sure to disconnect the grid lead of the preceding I.F. transformer as otherwise resonant effects of the grid winding will upset results.

(3) Measure and maintain a constant bias of 2 volts on the stage being aligned.

(4) Maintain the signal generator output constant, at say 50,000 microvolts, through the range of 7 to 15 mc. on the stage under alignment. Reduce the signal generator output, from stage to stage, but leave the bias setting of the I.F. amplifier at 2 volts throughout.

(5) When through aligning a stage reconnect the grid lead and disconnect the preceding one. The mixer-tube grid must be disconnected and a 10,000-ohm resistor connected in series, as described in the Meissner instruction sheet.

ALIGNMENT—WITH 5-IN. TUBE REMOVED

Since the addition of 2 stages to the image amplifier modifies the band-width to 4 megacycles the following details must be strictly adhered to.

(1) Disconnect the high-voltage primary and remove the 5-inch tube. Place the set upside-down on the work-bench. Do *not* align the set on a metal surface such as a kitchen table.

(2) Connect the V.-T.Vm. across your shop oscillator (previously warmed up) set at 11.5 mc., and adjust the attenuator to 100,000 microvolts (equal to 0.1-volt) as indicated on the V.-T.Vm. Now, shift the frequency of the oscillator from 8.25 mc. up to 14.25 mc., and note *where* the oscillator output varies, and how much. It will then be necessary to check, and set, the oscillator output each time the frequency is shifted.

Having re-set the oscillator to 11.5 mc. and 100,000 microvolts, shift the

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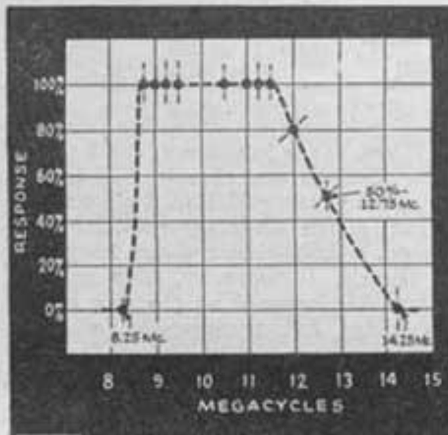

FIG.5 —CURVE CALIBRATION POINTS—

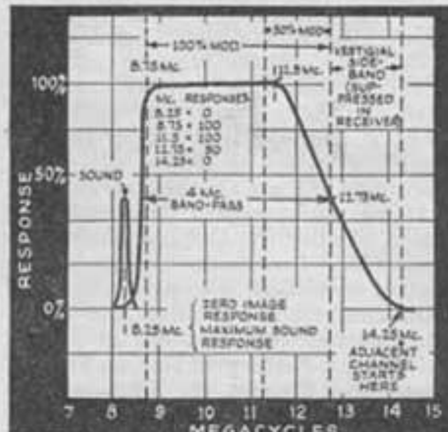

FIG.6 —IDEAL RESPONSE CURVE, IMAGE I.F. CHANNEL—

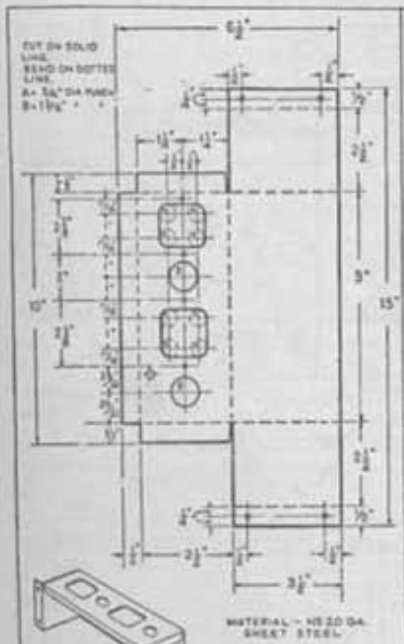

FIG.2 — I. F. CHASSIS —

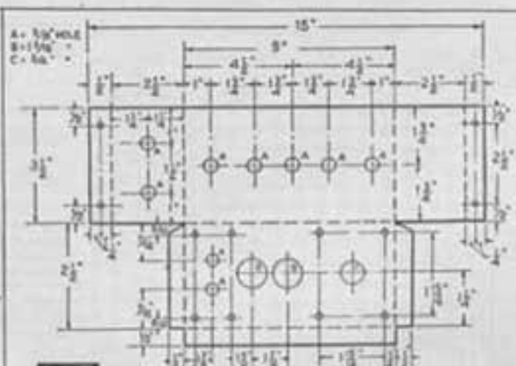

FIG.7 —SWEEP CHASSIS—

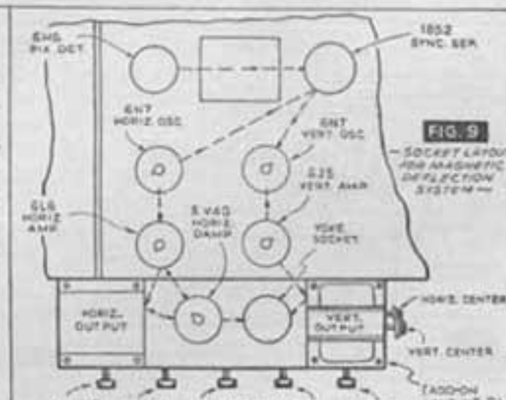

FIG.9 —SOCKET LAYOUT FOR MAGNETIC DEFLECTION SYSTEM—

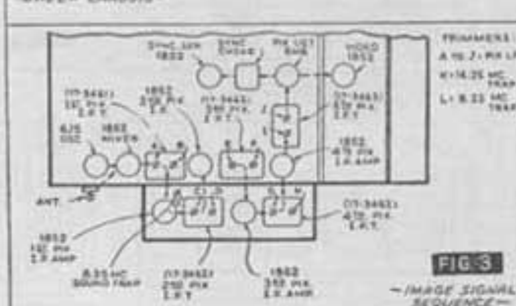

FIG.3 —IMAGE SIGNAL SEQUENCE—

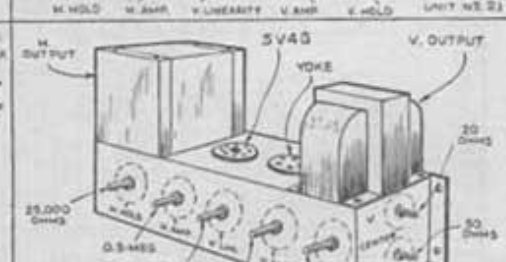

FIG.8 —UNIT NO. 2—

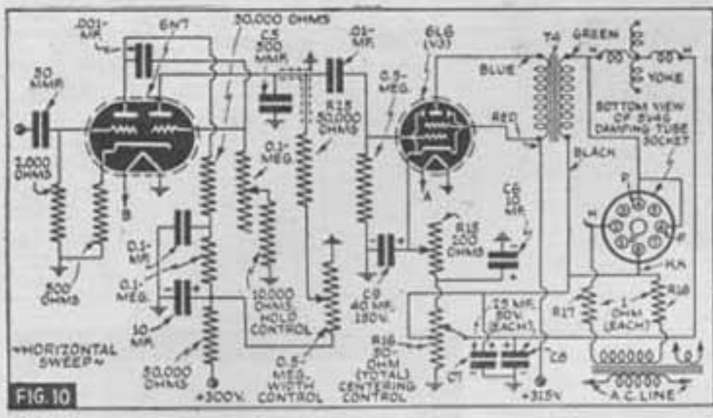

FIG. 10

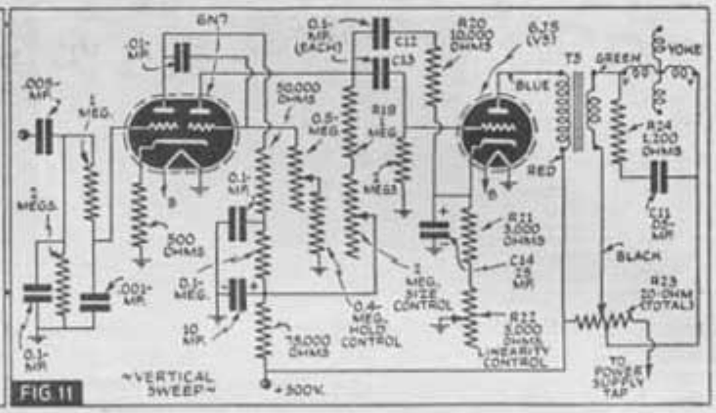

FIG. 11

(Continued from preceding page)

V.-T.Vm. to the junction of the 2 chokes (No. 15-7501) and chassis. The oscillator is fed to the grid (No. 4 pin on each socket) of the 4th image-amplifier tube, connect a 5,000-ohm resistor from grid to chassis, temporarily. The ceramic trimmer is loosened all the way on the 5th image I.F. transformer, and the plunger screws are turned all the way out, until a single peak is obtained at 11.5 mc. Note the V.-T.Vm. reading, and mark the graph paper at 11.5 mc. and 100 per cent. Now, shift the oscillator frequency to 9 mc., set the attenuator at 100,000 microvolts, and slowly screw-in the ceramic trimmer until the V.-T.Vm. reads as before. We now have 2 peaks in the resonance curve; the valley between peaks is found by shifting frequency from 9 to 10 mc., noting the reading on the graph, shifting from 10 to 11 mc., and marking the graph, and finally, shifting to 11.5 mc. When the 2 peaks have been made equal the alignment of this stage is completed.

Disconnect the oscillator and 5,000-ohm resistor, reconnect the grid lead, and disconnect the grid lead on the 3rd image-tube. Connect the 5,000-ohm resistor from grid to chassis as before. Reset the oscillator output to 50,000 microvolts and the frequency to 11 mc. Loosen the ceramic trimmer on the 4th image I.F. transformer and turn the plunger screws about half-way in until one peak shows at 11 mc. Shift frequency to 9.5 mc. then slowly screw-in the ceramic trimmer until the same reading appears at 9.5 mc. The overall graph will show about 15 per cent dip in the valley between peaks. The alignment of this stage is now done.

We shift now to the 3rd image I.F. transformer and 2nd image-amplifier tube. Proceed as before, but reduce the oscillator output to 25,000 microvolts. Turn the ceramic trimmer out all the way and the plungers nearly all the way in. Set the oscillator to 10.5 mc. and obtain maximum reading on this peak. Screw-in the ceramic trimmer and obtain the same reading at 9.5 mc. The valley between peaks is now wiped-out and the response should be flat, or nearly flat, between 9 and 11.5 mc.

We proceed now to the 2nd image transformer and 1st image-amplifier tube. Set the oscillator to 12. mc. and 10,000 microvolts.

Incidentally, in order to reduce attenuator output and still get fair accuracy, use a voltage divider consisting of a 900-ohm and 100-ohm carbon resistor across the output posts. This will reduce the input voltage to the set to a value 1/10 that across the attenuator posts at the generator. Thus when the V.-T.Vm. reads 0.1-volt across the total resistance, the voltage at the junction of the 2 resistors will be 0.01-volt.

Unscrew the ceramic trimmer all the way, and unscrew the plungers ¾-out, until one peak shows at 12 mc. Screw-in the ceramic trimmer until the 2nd peak appears at 8.75 mc.

Now take an overall response curve from 8 mc. to 14 mc., in 1-mc. steps, on the graph paper.

The curve should show 50 per cent response at the carrier frequency of 12.75 mc., 100 per cent response at 11.5 mc. straight across up to 8.75 mc., and drop abruptly to zero at 8.25 mc. The sound-trap should be set for maximum attenuation at 8.25 mc. and the adjacent channel-trap set for maximum attenuation at 14.25 mc. Slight retouching of the plunger screws may be necessary to get the best response curve. In this respect a graph record of each stage's response would be helpful in locating the weak point on the curve and the proper plunger to adjust. The alignment of the image I.F. channel is now complete. Where do we go from here? Next is the comparatively simple job of aligning the sound I.F. channel.

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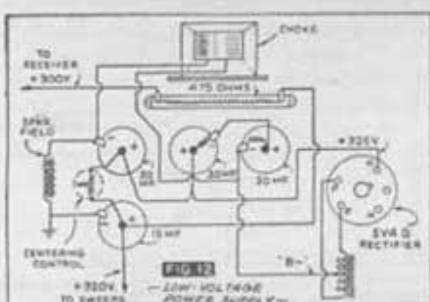


FIG. 12 — LOW-VOLTAGE POWER SUPPLY —

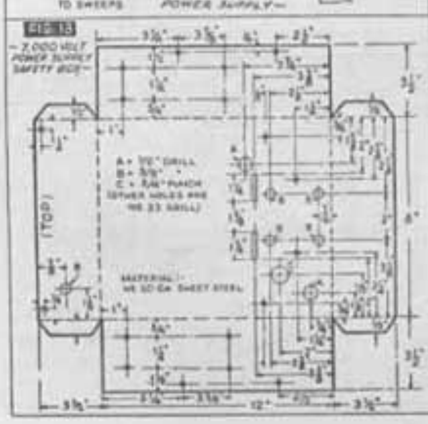


FIG. 13 — 7,000 VOLT POWER SUPPLY SAFETY BOX —

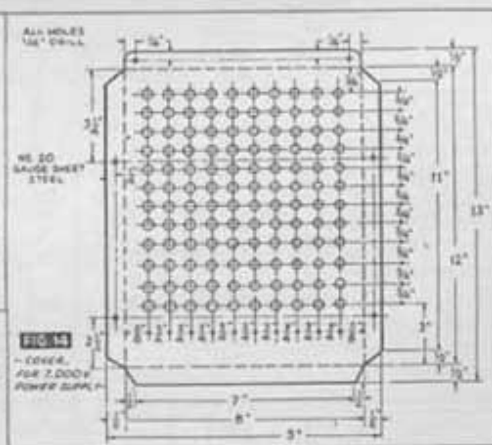


FIG. 14 — COVER, FOR 7,000 V. POWER SUPPLY —

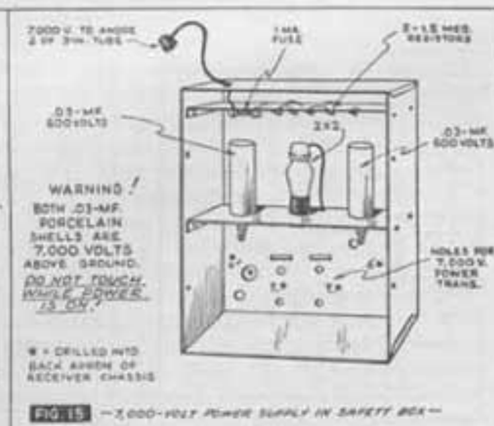


FIG. 15 — 7,000-VOLT POWER SUPPLY IN SAFETY BOX —

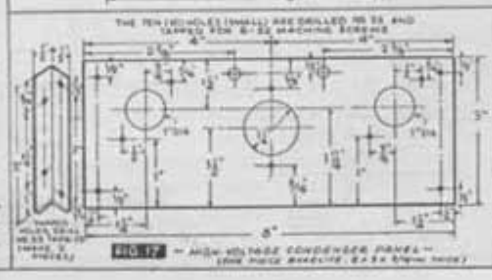


FIG. 17 — HIGH-VOLTAGE CONDENSER PANEL — (ONE PIECE BAKELITE, 8 x 3 x 3/16-IN. THICK)

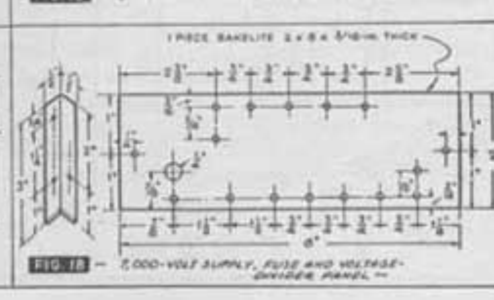
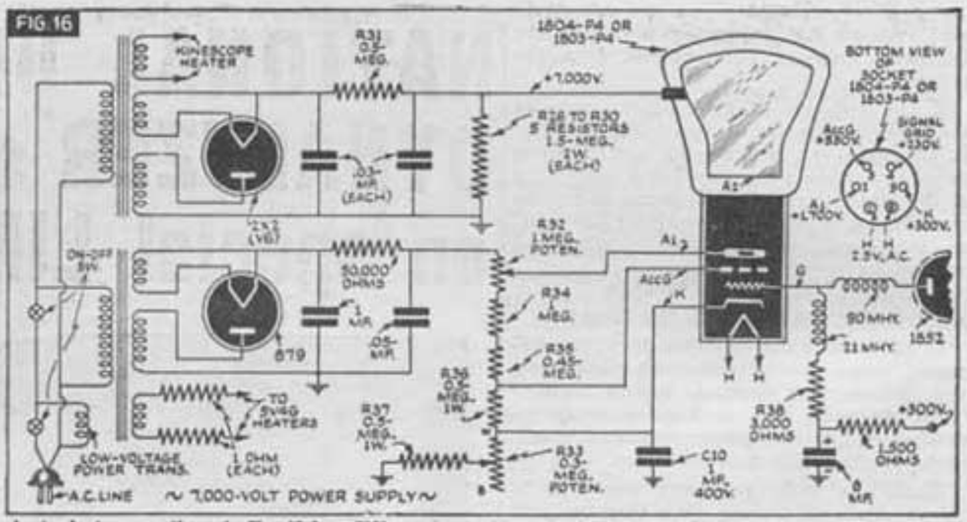


FIG. 18 — 7,000-VOLT SUPPLY, FUSE AND VOLTAGE-DIVIDER PANEL —



Last minute corrections: In Fig. 15 (pg. 530), as shown above, the 0.03-mf. type XAT-1 condensers are 6,000-V. units (*not* 600V.); in Fig. 4 (pg. 529), R.F.C. (c) and R.F.C. (d) are rated in *microhenries*.

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(Continued from page 530)

ALIGNMENT—SOUND CHANNEL

It is a good plan at this point to check the alignment of the *sound I.F. channel.*

Shift the oscillator frequency to 8.25 mc. and 1,000 microvolts with modulation, remove the V.-T.Vm. from the junction of the 2 chokes in the image detector, and connect the V.-T.Vm. from grid to chassis of the 6V6G sound output tube.

Trim the sound grid coil, and the primary and secondary plungers of the sound I.F. transformer, to a single maximum peak at 8.25 mc. If resonance occurs off-side of 8.25 mc. then the 2 bus wires on the sound I.F. transformer should be spread apart or brought closer together until resonance does occur at 8.25 mc.

Proper alignment of the sound channel enables one to tune-in the image carrier of 12.75 mc. (which would be hard to find) coincidentally with the sound carrier, at its maximum peak, at 8.25 mc.

Remove the 10,000-ohm resistor and align the R.F. and oscillator trimmers by means of the station signal,—preferably, the test pattern.

In the New York metropolitan area, Station W2XBS (N.B.C.) at the present time is operating on a regular schedule and transmits the test pattern referred-to. To the trained eye this pattern tells the whole story of receiver performance at a glance.

We shall say more on the subject later on. For the present, while still using a 5-inch tube, note closely how far in towards the "bull's eye" extend the black lines forming the vertical wedges. These lines, black and white, should be clearly defined to about ¼-in. from the outer circle of the "bull's eye" and will merge into a uniform gray in this ¼-in. region. This represents the best that a 5-inch tube can give, and so, we will now take up the construction of the sweep chassis for electromagnetic deflection.

CONSTRUCTION—UNIT NO. 2

Prepare the small sweep chassis from the drilling layout of Fig. 7 in the same manner as the small image I.F. chassis. After assembling the 2 output transformers, the 2 sockets, and the centering and linearity controls, it will be necessary to dismantle the sweep circuits on the main chassis. The 4 sweep controls are removed and reassembled on the small chassis as shewn in Fig. 8. Note that the socket layout has been altered to conform with Fig. 9.

The circuit changes required in the horizontal sweep are shown in the schematic of Fig. 10 while the revised vertical sweep circuit is shown in Fig. 11. The vertical centering control requires a rearrangement of the "B" supply wiring as shown in Fig. 12. Study these diagrams very carefully as a small mistake here may do a lot of damage.

When all components have been completely assembled on the small chassis, check against Fig. 8 for correct placement of parts. Wiring of this unit should be done before fastening to the main chassis. All the leads which run from the controls on the small chassis to terminating points on the main chassis may be passed through the 4 holes which previously were occupied by the electrostatic sweep controls. These 4 holes should be enlarged to at least ¾-in. size to prevent interaction between leads.

One of these leads, namely the Horizontal Amplitude pot.'s moving arm must be shielded up to within ¼-in. of the 50,000-ohm limiting resistor which terminates at the plate of the 6N7 Horizontal oscillator, V1. All other leads are not critical providing that a little space is left between them. A 5-prong socket is used for the deflecting yoke, with pin No. 3 grounded. Four separate wires should be connected to the yoke, the shield lug on the yoke need not be grounded.

Do *not* attempt to substitute this yoke or the Horizontal and Vertical output transformer with that of some other make, as the result will be an unsatisfactory image. In fact, you cannot substitute any 1 of the 3 companion units, unless you also change the other 2 parts to match.

THE DAMPING TUBE

The filament power of the *damping tube* is supplied by the winding which formerly was used on the 5-inch cathode ray tube. Note that the 4.5-ohm metal-sheathed resistor is discarded and that two 1-ohm wire-wound resistors are connected, 1 in each green filament lead, before reaching the damping-tube socket. These resistors control to some extent the horizontal linearity and their value may have to be changed up or down in some special cases.

The bias resistor for the 6L6 Horizontal Amplifier should be of the variable-slider type, adjusted to the full amount of resistance at the start. Later on, when the set is working properly, the slider may be adjusted to about the half-way mark, or until the inner and outer large circles of the test pattern are an equal distance apart. We will describe the purpose and operation of the 7 sweep controls under "Test and Operation." In the meantime let us build Unit No. 3, the High-Voltage Power Supply.

CONSTRUCTION—UNIT NO. 3

The Safety Box. Preparation of the steel box and cover of this unit represents a considerable amount of hard work. It is designed first for maximum safety and next for maximum ease of accessibility and servicing. Only 1 dangerous wire emerges from this box, that is, the wire (insulated for 10,000 volts) coming out of the top of the box and terminated in a bakelite cup which fits over the Anode 2 metal cap on the side of the Kinescope. Thus the safety box may be removed from the main chassis and placed at a distance if alterations in layout are desirable.

It is advisable to center-punch the sheet metal while still flat, on each indicated hole, after which the folding may be done, and finally, each hole drilled to size. Drilling layouts for the safety box and cover are given in Figs. 13 and 14.

The arrangement of the parts within the box is given in Fig. 15; while the upper portion of Fig. 16 gives the schematic wiring of the unit.

The drilling layout of the bakelite strip which holds the two 0.03-mf. condensers and the 2 X 2 rectifier is given in Fig. 17.

The bakelite strip which holds the voltage divider resistors and fuse is shown in Fig. 18. The position of these resistors is shown in Fig. 19.

Wiring of these 2 panels should be done first, then partial assembly in the box and final assembly and wiring when the unit is fastened to the main chassis. The photo shows the completely assembled unit with cover removed.

SAFETY FIRST!

The set should never be operated with this cover removed. If at any time it is necessary to service the unit, first shut off all power and next discharge each high-voltage condenser to ground by touching an insulated screwdriver between ground and the condenser terminal lugs.

In order to keep the box size within reason the spacing of components with respect to the metal box is already at a minimum. Under certain conditions of excessive moisture it is possible that arcs may leap from the rectifier socket prongs to the shell of the power transformer ¾-inch below. Do not be alarmed, as a piece of oiled cambric or a thin sheet of bakelite inserted between socket and transformer will prevent any further arcs.

Testing the maximum high-voltage should not be done with the usual 1000 ohms/volt meter. Instead use either a 25,000 ohms/volt tester or an electrostatic voltmeter with 10,000-volt range. For safety's sake test only from within the bakelite cup lead of Anode 2 (which is fused), to ground, or frame of box. The voltage should be between 6,800 and 7,200 V. depending on the line source.

CONSTRUCTION—UNIT NO. 4

There remains only one more item to be done—the construction of Unit No. 4, the wooden box which holds the 9-inch tube. The box is made of ¼-inch plywood reinforced at the inside corners with ½-inch-square runners. The exact dimensions of the box and *mask* are given in Figs. 20 and 21. Small metal tabs are used for fastening the box to the front and rear chassis partitions.

The tube support at the rear of the Kinescope is made according to Fig. 22. The mounting holes must be drilled so that they fall in between the perforations on the slope

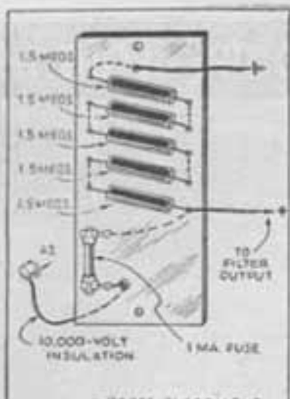


FIG. 19 —PARTS PLACEMENT, VOLTAGE DIVIDER RESISTORS AND FEEDTHROUGH

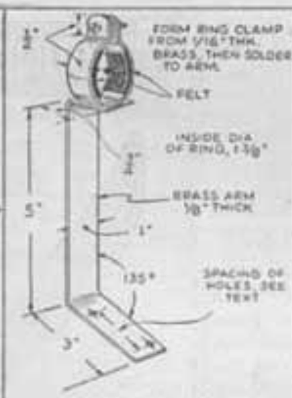


FIG. 22 —REAR SUPPORT FOR 9-IN. TUBE—

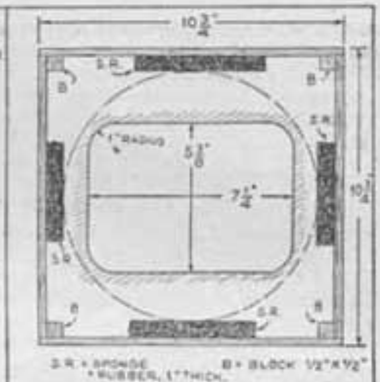


FIG. 21 —BOX AND MASK FOR 9-IN. TUBE— (FRONT VIEW)

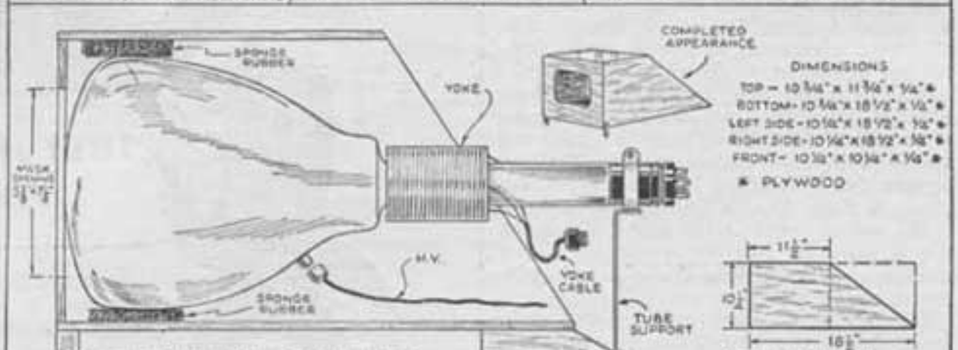


FIG. 20 —BOX AND MASK FOR 9-IN TUBE. (SIDE VIEW)

(Continued from preceding page)

of the Meissner safety cover. The 6-prong socket and wiring for the Kinescope passes through a large hole (socket size) punched into the flat top surface of the Meissner safety cover thence through a similar hole in the bottom of the wooden box. The signal grid lead should be spaced away from the other 5 wires as much as practicable.

The former high-voltage supply for the 5-inch tube (2,000 V.) is rewired according to the lower portion of the schematic, Fig. 16, where it now serves as a separate source of focusing voltage. The voltage divider resistor should be within 10 per cent of the values given. After all connections have been checked the safety cover must be replaced to close the interlock switch. Voltage tests may be made under operating conditions, at the prongs of the Kinescope socket.

The construction of these 4 units will require about a month of spare-time work so we will defer "Test and Operation" to next month's issue. The parts recommended for this conversion are given in the list below.

LIST OF PARTS

Tubes

One RCA Kinescope, 1804-P4 9-in. or 1803-P4 12-in.;
One RCA 6L6, V3;
One RCA 5V4G, V4;
One RCA 6J5, V5;
One RCA 2X2, V6;
Two RCA 1852's, V1 and V2.

Sockets

Three Amphenol sockets, bakelite octal;
One Amphenol socket, 4-prong isolantite;
One Amphenol socket, 5-prong isolantite;
One Amphenol socket, 6-prong isolantite.

Inductance Units

One Meissner sound-trap, No. 17-3467, L1;
Two Meissner I.F. transformers No. 17-3462, T1, T2;
One Thordarson power transformer, No. 17-R-33, T3;
One Jefferson deflecting yoke, No. 465-311;
One Jefferson Horizontal output transformer, No. 467-548, T4;
One Jefferson Vertical output transformer, No. 467-549, T5.

Condensers

Two Solar high-voltage, type XAT-1, 0.03-mf.;
One Cornell-Dubilier silver-mica, 2.5 mmf., C1;
Three Cornell-Dubilier bakelite mica, 0.001 mf., C2, C3, C4;
One Cornell-Dubilier bakelite mica, 500 mmf., C5;
One Cornell-Dubilier paper tubular, 0.05-mf., 400V., C11;
Two Cornell-Dubilier paper tubular, 0.1-mf., 400V., C12, C13;
One Cornell-Dubilier paper tubular, 1.0 mf., 600V., C10;
One Cornell-Dubilier electro-tubular, 10 mf., 25V., C6;
Three Cornell-Dubilier electro-Tubular, 25 mf., 25V., C7, C8, C14;
One Cornell Dubilier electro-tubular, 40 mf., 50V., C9.

Resistors

One I.R.C. 5,000-ohm potentiometer, R22;
One I.R.C. 20-ohm potentiometer, with fixed center-tap, R23;
One I.R.C. 50-ohm potentiometer with fixed center-tap, R16;
Two I.R.C. 1-ohm wire-wound resistors, 10 watts AB, R17, R18;
One I.R.C. 200-ohm wire-wound resistor, 10 watts AB, R15;
Five I.R.C. 1.5-meg., 2 watts, R26 to R30;
One I.R.C. 1-meg., 2 watts, R33;
One I.R.C. 3,000-ohms, 2 watts, R38;
One I.R.C. *0.5-meg., R31;
Two I.R.C. *0.45-meg., R34, R35;
One I.R.C. *0.3-meg., R37;
One I.R.C. *0.25-meg., R36;
One I.R.C. *0.1-meg., R32;
One I.R.C. *50,000-ohm, R25;
One I.R.C. *1,200-ohm, R24;
One I.R.C. **1.-meg., R19;
One I.R.C. **10,000-ohm, R20;
Two I.R.C. **0.1-meg., R6, R8;
Two I.R.C. **60,000-ohm, R3, R10;
One I.R.C. **5,000-ohm, R39;
Three I.R.C. **3,000-ohm, R4, R12, R21;
Two I.R.C. **2,000-ohm, R5, R11;
Two I.R.C. **200-ohm, R7, R9;
Three I.R.C. **100-ohm, R2, R13, R14;
One I.R.C. *60-ohm, R1.

—

* 1-watt.
** ½-watt.

Miscellaneous

One Alden insulated cap for Kinescope, No. 92TINL;
One Alden insulated cap for 2X2, No. 91TINL;
One Littelfuse, 1 milliampere, with mounting clips;
One Amphenol plug, 5-prong;
One piece sheet steel, Image chassis, 6½ x 15 x 1/32-in.;
One piece sheet steel, Sweep chassis, 6½ x 15 x 1/32-in.;
One piece sheet steel, Power Box, 15 x 19 x 1/32-in.;
One piece sheet steel, cover, 9 x 13 x 1/32-in.;
One piece bakelite, voltage-divider panel, 2 x 8 x 3/16 in.;
One piece bakelite, condenser panel, 3 x 8 x 3/16 in.;
One piece sheet brass, 1 x 8¾ x ⅛-in.;
One piece sheet brass, ½ x 6 x 1/16-in.;
Wooden box (per specifications);
Hardware, etc.

Complete plans for building the basic "5-inch" Meissner television kit, around which the conversion procedure was later developed, appeared as Part I in the November, 1939, issue of Radio-Craft. *Part II, in the March, 1940, issue, described the entire mechanical and electrical sequence for utilizing a 9-inch Kinescope. Here, in Part III, aligning information and final check-up details are given. The result is a large-screen (even a 12-inch C.-R. tube may be used!!), 441-line teleceiver experimenters may build at much less cost than a set originally designed for large-screen images.*

Converting a 5-inch Telly Kit
FOR RECEIVING A 9-INCH IMAGE

CHARLES SICURANZA

Part III (Conclusion)

IN last month's issue we gave details on the construction of the 4 add-on units. In the course of the experimental work, it was found necessary to revise certain portions of the original circuit to conform with the new conditions.

Those readers who bought the earliest kits found that the circuit called for a 6F6 video output with *shunt* peaking, while later kits used an 1852 video output with *series* peaking. In each case the circuit constants were based on a video response flat to nearly 3 mc. This was changed in our case to series and shunt peaking, *flat to 4 mc.* The data required in the making of the 2 peaking coils is given in Fig. 22.

These coils should be fastened to the safety wall on the main chassis, as close as practical to the video output socket, taking care that no other parts or wiring come nearer than ½-in. to either coil.

In outlying districts where the signal level is poor, you may find that the passing auto traffic disrupts image synchronism to an annoying extent. This is because the sync. separator input was purposely adjusted to give a feeble pulse. When ignition interference over-rides this pulse, "tearing" of the image and loss of synchronism result. The sync. pulse may be strengthened by removing the 2-meg. resistor in the cathode circuit of the image detector, replacing it with a 1-meg. resistor, leaving the 4,000-ohm resistor in series with it as before. This procedure should be attempted only when absolutely necessary, however.

PRELIMINARIES

Assuming that the 4 units are completed, and have been double checked for possible errors, place the deflecting yoke over the stem of the Kinescope as far forward as it will go. The yoke terminal lugs should face to the rear. Now put the yoke plug in its socket and see that the 6-prong Kinescope socket is slipped on to the base pins of this C.-R. tube. The high-voltage lead ending in the bakelite cup is slipped over the metal cup on the side wall of the image tube.

Every tube should be in its place, **having first made certain that *every* tube is in good condition.**

An important point—the tubes with which the image I.F. channel was aligned should be numbered, and thereafter never switched around without good reason, as this may seriously alter the original response curve.

Another important point: never operate the set with the yoke disconnected from its socket as the result will be a blown 6L6 and a burned spot on the screen of the Kinescope.

GET SET!—

Now we are almost ready to plug the set into the line. First, turn the Brightness control to its Minimum position; then set the Focus control at its midway point; next set the Contrast control at about halfway-on; and finally, set the Vertical and Horizontal Amplitude controls at their center marks.

Standing in front of the set, at your left-hand side are the 7 controls for the sweep system. The 2 positioning controls are placed one above the other, the upper one moves the raster up or down while the lower one moves the raster from left to right. Once these controls are properly set they may not need readjustment for months.

Around the corner from the positioning controls we have 5 controls in a row—the first one (nearest your hand) is the *vertical speed* control. This control and the one after it, the Vertical Amplitude control, both function exactly the same as before. The 4th and 5th knobs are, respectively, Horizontal Amplitude, and Speed—these 2 controls also work the same as before.

The 3rd knob, however, is a new addition to the family and is called the Vertical Linearity control. The function of this control is to enable the operator to adjust the spacing between the lines of the raster evenly from top to bottom. Its function is affected by the Vertical Amplitude control and also to some extent by the Vertical Positioning control. In general, once the linearity control is correctly set, preferably on the test pattern, it will seldom require readjustment.

Note that the 2 most used controls, namely the Vertical and Horizontal Speed are placed 1st and last, respectively, in the row. Thus you can easily memorize their location and avoid upsetting the other controls.

READY!—

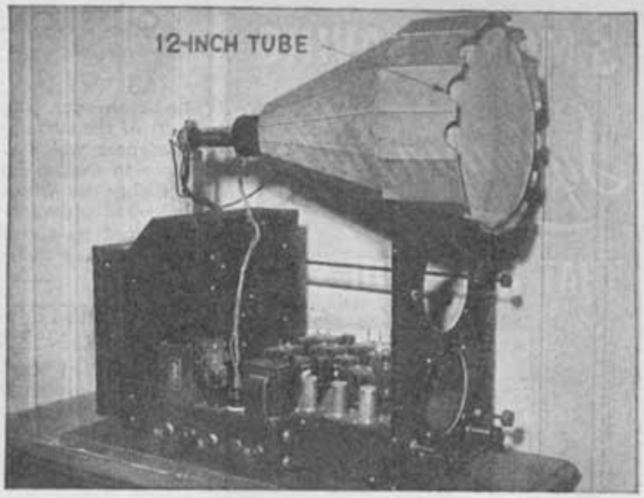
With all this in mind, plug the set into an A.C. receptacle that is really handy, so that you will be able to yank the plug out instantly if something should go wrong.

GO!!

If everything is working properly, you snap the power switch to ON, and this is what will happen:

1. After a few seconds you will hear a faint, shrill note emanating from the Horizontal sweep circuit—this is normal.

2. As the Kinescope warms up you will see a narrow white line expanding vertically from top to bottom. This line denotes the Vertical sweep is working and because of the smaller tubes, gets into action a few seconds sooner than the Horizontal sweep. The vertical line is extinguished in a few seconds because as you remember, the Brightness control was set at minimum and since this control is in the cathode of the Kinescope (which is warming up) the electron beam is soon cut off by the current



The photos at left (see facing page) and right show the ex-5-inch telly kit as revised, at comparatively low cost, to operate larger viewing tubes. The photo at left shows the 9-inch Kinescope in place; "the missus" and a small member of the author's family get real pleasure out of the tele-show.

Photo at right shows a 12-inch cathode-ray receiving tube, in its protective "overcoat," used experimentally to prove that the converted kit-set is well able to drive even this large size of C.-R. tube!

BE SURE, when working on this television receiver, to observe the instructions given on pg. 555 of the preceding issue under the heading "SAFETY FIRST!".

flowing through the Brightness control. Under normal conditions this current amounts to ½-milliampere.

3. You should hear a slight hum from the speaker, if you are standing within 2 feet of the cone. A loud hum signifies heavy overload.

4. Advance the brightness control slowly up to the medium bright level. *Note carefully that if only a single vertical line or a single horizontal line or, worst of all, only a bright spot is visible—yank the plug immediately and start looking for trouble in the "sweeps."* Normally however, you will see a rectangular raster.

5. With the contrast control set at minimum, no signal will reach the Kinescope grid, consequently no sync. pulses or noise voltages reach the sweeps. They are running free; and the scanning lines horizontally should be clean and straight, from top to bottom. When the contrast control is turned full on, all kinds of noise voltages trip the sweeps at odd moments causing the raster to take on a ragged appearance at the edges.

6. If a signal is on the air, adjust the horizontal and vertical speed; then adjust the height and width of the image to fill the mask opening; and finally, center the image properly. Last but not least the linearity control should be adjusted so that the vertical wedges in the inner circle of the test pattern are of equal length. It is rather difficult to make this adjustment correctly on subject matter in motion.

A final point to remember is not to use too much contrast as it is easily possible to overload the video output tube—resulting in a "washed-out" image; or, in case the sync. separator is over-driven, a ragged double image.

7. It may happen that the reading matter on the screen of the Kinescope is reversed. If so, transpose the 2 Horizontal leads at the deflecting yoke. If the image is upside down, rotate the deflecting yoke 180 degrees until the image is straight side up. For mirror viewing you must intentionally reverse the reading matter (at the yoke) so that the mirror reflection reads straight.

To keep the yoke snug up against the bell of the C.-R. tube, simply wrap a narrow strip of ordinary writing paper around the stem of the tube and then slide the yoke over the paper, up to the bell. From the foregoing it can be seen that the operation of the set is practically the same as before the conversion.

SERVICING

Now let us shift over to the gloomy side of the picture and see how many things can go wrong with a telly set. As the writer pointed out in a previous article, *a telly set "gone wrong" practically tells you where and what ails it*, quite often unmistakably!

We will enumerate below some of the troubles which actually occurred from time to time over a period of 4 months. Strangely enough these troubles always occurred when the set was first turned on. In other words the set had been working perfectly when switched off and whatever defect was about to happen was helped along by the high "surge" voltages at the start of operation.

1. The high-voltage power supply (7,000 V.) once arced intermittently from the rectifier socket to the shell of the power transformer. Besides sparking, sizzling and sputtering, the raster on the Kinescope waxed and waned both in size and brightness. Should the high-voltage supply fail gradually you will see that the raster gets smaller and dimmer in proportion to the extent of the failure of the supply. Look first to the 2X2 rectifier; then check the 2 filter condensers for leakage; and finally, check the voltage divider resistors for breakdown.

2. Failure of the medium-high-voltage supply (1,700 V.) will be evidenced by complete loss of focus and some loss in brightness. Check for trouble in the same way as before.

3. Failure of the low-voltage supply is evidenced immediately by the absence of the raster and the presence of the single bright spot. Note that this same trouble can be caused by leaving the yoke disconnected or by failure of the "B" supply to the sweeps (only). Check the circuit in the usual way, for shorts, opens and defective tubes.

4. If the screen is blank (no spot, nor raster) and the Brightness control has no effect over its full range, only 2 things can be wrong; either there is no high voltage (7,000 V.) or the Kinescope cathode circuit is *open*.

Connect, momentarily, a 500,000-ohm carbon resistor from chassis to the cathode prong of the Kinescope socket. If the screen lights up instantly then the trouble is definitely in the cathode circuit. If, on the other hand the screen does *not* light up, the trouble is just as definitely in the high-voltage supply.

5. Another form of trouble associated with the Brightness control is evidenced by inability to darken the screen of the Kinescope. Three causes were found for this trouble: (1) leaky or shorted 1-mf. condenser from Kinescope cathode to ground; (2) burned and shorted Brightness control; and, (3) leakage from grid to cathode within the Kinescope. Almost the same effect can also be had by removing the video output tube from its socket.

6. When the sound program comes through OK but with no image reception, look for *open* screen-grid, cathode, or plate resistors, in the image I.F. channel. This is likely to happen whenever one of the 1852 image tubes "goes sour," as these tubes draw as much as 50 ma. when they short.

7. If the sync. separator tube or circuit should go bad the result will be a succession of drifting images both vertically and horizontally. No amount of knob twiddling will bring the image into sync. Almost the same action occurs when reception is extremely weak, but in this case the drifting images will be speckled with noise voltages.

8. Complete or partial failure of either sweep is self-evident by noting the size and appearance of the raster. Always check the tubes first, the yoke windings next and the remaining components last.

TESTING VIDEO RESPONSE

The instruments required for testing the video response are the usual shop oscillator and vacuum-tube voltmeter (with *known* input capacity). The V.-T.Vm. is connected through a blocking condenser of 0.1-mf. to the Kinescope grid, and chassis. Start the frequency run at the lowest possible frequency (about 50 to 100 kc., in most generators). With a known input of 0.1-volt of unmodulated R.F. on the video output tube grid, measure the output voltage between Kinescope grid, and chassis. Note reading (and frequency) on paper. Now feed 0.1-volt at 500 kc. to the video grid, and again note output on paper.

Continue this procedure from here on, in steps of 500 kc. and each at 0.1-volt, until a frequency of 5 mc. is reached. The voltage output readings should be within 5% from 50 kc. up to 4 mc., at which starting point the voltage readings should become higher, denoting a resonant rise is occurring in the peaking circuits. This is a normal action for this type of circuit.

We could not list in the above space, all the possible troubles that might crop up, but the writer will be only too glad to render any possible assistance to those readers who run into some unusual trouble. Just state your problem clearly and address it to the writer in care of *Radio-Craft.*

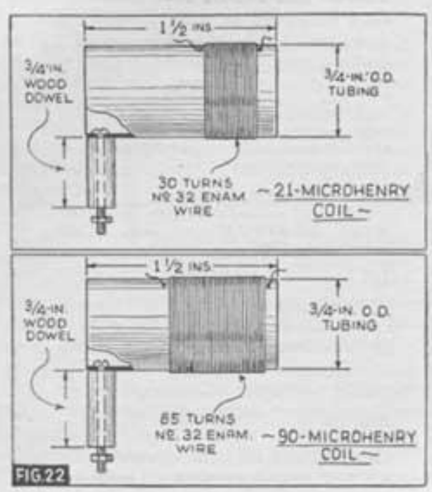


FIG.22