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Stuart J. Osten
333 No. Michigan Ave.
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Dearborn J-367

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AUTO RADIO TOOL 24c net

JANUARY 1950 • RADIO AND TELEVISION MAINTENANCE
THE NEW YEAR— The end of 1949 found the industry in a healthier position than ever before. TV receiver production was soaring to all time highs, and teleset sales were at record levels. All this meant good prospects in 1950 for the service technician. If current predictions of a 3,000,000 plus teleset output in 1950 come true, he will be busier than he has ever been before.

FCC CALENDAR— The color situation was as indefinite as ever. The demonstration of the Color Television Inc. (CTI) system was postponed to the latter part of February, and the second comparison showing of the various systems proposed to date (CBS, RCA, and CTI) was to follow shortly thereafter. In the meantime, however, other organizations continued to announce their own developments. DuMont let it be known that it was evolving a device of its own, and the Rensselaer Polytechnic Institute released the information that two of its scientists had developed a color system fully compatible with today's black-and-white TV. Finally, Optiko Teletube Corp. claimed it had a new process for color television, using present-day receivers, and a transmission tube which will permit transmission of the entire color spectrum, using present TV channels. In addition, FCC instructed CBS and RCA to distribute a number of colorvision sets among various portions of the population in order to get their reaction. All in all, it looks as though the final decision on colorvideo won't be reached for some time.

The Commission had two other items on its TV agenda: Phonovision and a new frequency allocation. Phonovision, Zenith's system whereby first run films and other news events are sent via telephone lines to the properly equipped telesets of paying subscribers, will get its hearing in the middle of January. Sessions on the new television frequency allocation are scheduled for the end of February.

FOR SERVICES RENDERED— John F. Rider, president of the publishing firm bearing his name, has received another award from a servicemen's association. The latest one was presented to him by the Empire State Federation of Electronic Technicians Associations (ESFETA) "for his inspiring and pioneering educational efforts". The award, a bronze plaque, was made recently at an ESFETA banquet. Mr. Rider has been extremely active on behalf of the service technician, and was instrumental in inaugurating the current ESFETA TV lecture series (whose opening talk he delivered).

TOWN MEETINGS— During the recent meeting of the Radio Manufacturers Association (RMA), plans were submitted for a continuation of the "Town Meetings" program. Mr. Sprague, of Sprague Electric Co., and chairman of the Town Meeting Committee of RMA, was authorized to get together with teleset manufacturers and discuss with them a proposal to hold Town Meetings in 60 television areas. The meetings would be conducted by manufacturers and distributors through voluntary subscriptions. The plan includes the preparation of slide films which will summarize the topics which have been discussed at the seven previous RMA Town Meetings.

TELEVISION COMMITTEE— RMA has instructed its Television Committee to present to the FCC a plan for the immediate establishment of an industry-wide National Television System Committee to be composed of top engineers in the field of television and electronics and to (1) present technical data relative to allocation of the u-h-f frequencies and the lifting of the freeze on v-h-f allocations and (2) to recommend basic standards for the future development of color television. In 1941 a similar Television System Committee drafted and recommended to the FCC standards for present black-and-white television broadcasting.
As outlined in the preceding article, troubleshooting a teleset is best accomplished by following these three steps:

1. Locating the defective section.
2. Finding the defective stage.
3. Isolating the faulty component.

It was pointed out that for all of these steps the technician has a choice of several tools to expedite his troubleshooting.

In this and the following article, we will discuss the first step only—the various methods which the technician can employ to locate the defective section. These methods consist chiefly of three operations which generally take no more than a few minutes:

1. Analyzing of the sound and picture information coming over the TV receiver being serviced.
2. Applying this information to the block diagram of the set, in order to decide which section is causing the trouble.
3. Checking the appropriate controls to make sure that a fault really has developed in the receiver, and that the defect is not due to an incorrect setting of a control. It is often necessary to check on every channel instead of on only one if trouble appears in either sight or sound, before making a definite decision concerning the faulty section.

In transformerless sets, there is one extra step, which will be discussed later.

### The Block Diagram

As can be readily seen, using the block diagram is the most important step in locating the defective section.

One of the more popular types of electro-magnetic receivers consists of seven basic sections. A block diagram of this receiver appears in Fig. 1. Each section may consist of from one to more than nine stages, depending on its function and on the design of the particular receiver. These sections can be listed as follows:

1. **Front End**: antenna plus r-f oscillator and mixer stages.
2. **Video Strip**: video i-f stages, video detector, video amplifiers, d-c restorer, and picture tube.
3. **Audio Strip**: audio i-f stages, discriminator or ratio detector, audio amplifiers, and loudspeaker.
4. **Sync Circuits**: sync amplifiers and clippers, horizontal discriminator and reactance tube.
5. **Sweep Circuits**: horizontal and vertical oscillators, output tubes, output transformers, and deflection coils.
6. **High Voltage System**.
7. **Low Voltage System**.

Knowing the function of each section of the TV receiver is essential for quick servicing. The first three sections listed above are the signal circuits. The two signals (video and audio), coming from the transmitter, enter the front end (Section 1), and beat with the oscillator frequency. The two i-f frequencies resulting from the heterodyning process appear at the plate of the mixer. One is the video i-f, the other the audio i-f.

The video signal then proceeds through the video strip (Section 2), and reaches the picture tube to give the picture. The audio signal goes through the
The high-voltage system (Section 6) is of the fly-back type, and must receive the horizontal sawtooth in order to operate. It provides the large amount of voltage necessary to bring the beam from the cathode of the picture tube to the screen at a high enough speed to give the required brightness.

The low voltage system (Section 7) is of the standard a-c type. It provides the B+ necessary for the operation of all the other circuits in the set and the filament voltage for each tube.

The arrows in the block diagram show the path of the signal and the sweep voltages, as well as the route of the d-c voltages.

If a stage in any of these 7 sections becomes inoperative, it has a specific effect on picture, raster, or sound, or any combination of the three.

Referring to the block diagram in Fig. 1, defects in the various sections will have the following results:

**Locating Defective Section**

If the front end does not operate, two signals are lost: sound and video. Result: No sound, no picture. But since the rest of the set is functioning, we have a raster. If the video strip does not work, there will be no picture, but there will be sound and a raster. If the audio strip is out, there is a picture, but no sound. With the sync sections not functioning, sound comes through, but the picture does not stand still in either direction. If the vertical sweep is out, there is only a horizontal line on the screen, and sound. If the horizontal sweep is inoperative, there is sound and no raster (high voltage depends on horizontal saw-tooth). If high voltage does not operate, there also will be no raster, no picture, but sound. (For that reason, when working back from sound and a blank screen, both possibilities of trouble—high voltage system and horizontal sawtooth—must be kept in mind.)

With the low voltage out, there is no picture, no raster, no sound.

The troubleshooter just works backward. From the effect on picture, raster, and sound he decides which section or sections may be at fault, and then makes further checks in that part of the set to get at the faulty component.

A specific example will demonstrate the application of step one in troubleshooting: Isolating the trouble to one of the sections. We assume the receiver has been functioning and has developed a fault. The set is turned on and a picture is seen. But no sound is heard. Off-hand this would indicate trouble in the audio strip (Section 3). However, this fault might also be caused by mistracking of the r-f oscillator, by the volume control being all the way down, or by poor orientation of the antenna (the last if the set is on a high channel and an adjustable indoor antenna is being used). Therefore, to confirm the diagnosis, the volume control is turned completely up. The fine tuning control is rotated to see if sound can be brought in. If it cannot, the channel selector is switched to all other stations on...
New Developments

For increased gain in fringe area reception

New TWIN DRIVEN Yagi

An entirely new antenna which gives outstanding performance in weak signal areas. Matches 300-ohm line, eliminates ghosts

TACO's new Twin Driven Yagi is a high gain antenna, cut to frequency, and designed for fringe area reception on channels 2 to 6. It is an entirely new TV antenna, of four elements, two of which are driven and the other two of which are parasitic. The antenna is equivalent to a Yagi system which is energized from two sources. Such an arrangement assures better control of the current-phase relationships of the four elements and, for reasons which we will go into presently, gives a superior match to a 300-ohm transmission line. The Yagi antenna, used widely during the war, was generally designed for a 50-ohm impedance input. The problem which was solved by TACO engineers was to devise a Yagi which would provide a good match to a 300-ohm transmission line.

How the match is achieved

This match was obtained by a peculiar feeding arrangement developed for the Taco antenna system. As a rule, when a parasitic element is placed one-tenth wavelength from a driven element, a considerable change is brought about in the input impedance of the driven element. The reason for this change is the fact that a transformer action takes place between the driven and the parasitic element. It is this reaction which reduces the operating impedance of a conventional Yagi system to an extremely low value.

The Twin Driven Yagi is not affected by this loading condition because the director system, which is made up of one parasitic element and one driver, is fed by an impedance matching network from the main driven element. Through this rather ingenious system, TACO has developed a four-element array which is well matched for a 300-ohm system. For low signal areas, a single bay is usually sufficient.

For increased gain in sub-fringe areas, two single units can be stacked efficiently by using a TACO-developed transmission line. Use of this line assures a 300-ohm impedance match at the center terminals. This is an important factor, since there will be no loss in input impedance when stacking two single units, and no mismatch will result.

The curve in Fig. 1 shows the measured voltage gain (in db) of the new antenna as compared to a reference dipole, for both the single and the two-bay system.

Fig. 2 shows the horizontal radiation pattern for the Twin Driven Yagi. As can be seen, the beam width of the antenna array is very narrow. This means that extreme care must be taken in orienting the antenna and that it can be used to good advantage with a antenna rotating device. It is also apparent from a study of Fig. 2 that the antenna has a high front-to-back ratio; and it is therefore especially recommended for areas with co-channel interference.
"Like having someone to run interference for me on every sale!" Radio-TV servicemen feel that way about the General Electric trademark because experience has shown how highly their customers respect the symbol "G-E".

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How to CONSTRUCT the 1950 MODERN SERVICE BENCH

By The Staff of Radio & Television Maintenance

I N designing a new service bench to cover all the essential needs of servicing and laboratory work in radio, television, and electronics, a great number of problems are encountered. Some of these have been solved and developed in the design and models of the bench described in this article. Others have been compromised because of limitations of space and position, as opposed to operating needs, size, and optimum location of various equipments, and several other factors.

The former radio service bench design described in the February '46 issue of Radio Maintenance Magazine, was far simpler in design than the present model. The reason for this is that the requirements at that time were considerably less complex than they are today.

Preliminary analysis showed a need in a radio service bench for the following: Space for service manuals, test equipment, power and control facilities, tools, most used, replacement parts, and a receiver. There are, in addition, some other incidental requirements (props, test speaker, panel details, etc.).

Teleset problems

In earlier designs of a service bench, TV was a minor factor. Although it was taken into account, 95% of all the telesets were of the small-tube variety, and hardly affected bench design. The situation is different today. For the bench designer, the greatest single problem is television maintenance — including service, repair, and alignment. To service a TV receiver of the 16”-tube variety properly, the width and depth of the bench top required is far in excess of the ordinary bench in use today. True, you can service a teleset on the old size bench—usually kitchen - cabinet - size - designed in height and depth, and about six feet in width—but you cannot do so efficiently. The old size and location requirements led to the design of a bench with all meters, tools and other needed equipment within easy reach.

But new space requirements of the larger television sets themselves make it necessary that the meters and other facilities be set further back on the bench (by as much as a foot and a half) and that they be raised (by six inches), in order to accommodate the set and still leave ample working space for efficient service.

In designing the new bench, our purpose was two-fold: Improving the design of the former bench to fulfill present day service requirements, and reducing the cost for parts to below $100.

Design details

To begin, in laying out the design, standard kitchen cabinet top height was chosen, so that advantage could be taken of the price of mass production units, thereby lowering the cost. For the cabinets, Sears, Roebuck & Co. model 1K0601 (Fall-Winter Catalog) was selected. Models were built using this cabinet (top drawer, two shelves, and doors), and a model having four drawers. After
FIG. 1

SECTION A-A

RADIO & TELEVISION MAINTENANCE
MODERN BENCH DESIGN FOR 1950

3 ANGLE IRON BRACES ACROSS TOP

18-2-8 OVAL HEAD WOOD SCREWS, NICKEL PLATED WITH COUNTERSUNK NICKEL PLATED WASHERS

3-8 FLAT HEAD SCREWS

8-2-10 FLAT HEAD WOOD SCREWS IN WORKING SURFACE

5 ANGLE IRON BRACES UNDER WORKING SURFACE

Scale 2 - 1 Feet
**TABLE I**

<table>
<thead>
<tr>
<th>Detail No.</th>
<th>Name</th>
<th>Material</th>
<th>Quantity</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Top</td>
<td>1/2&quot; Plywood</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Bookshelf</td>
<td>1/2&quot; Plywood</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>Working Surface</td>
<td>1/2&quot; Plywood</td>
<td>1</td>
</tr>
<tr>
<td>4</td>
<td>Side</td>
<td>1/2&quot; Plywood</td>
<td>2</td>
</tr>
<tr>
<td>5</td>
<td>Upper Back Panel</td>
<td>1/2&quot; Plywood</td>
<td>1</td>
</tr>
<tr>
<td>6</td>
<td>Lower Back Panel</td>
<td>1/2&quot; Plywood</td>
<td>1</td>
</tr>
<tr>
<td>7</td>
<td>Left Instrument Panel</td>
<td>1/2&quot; Tempered Masonite</td>
<td>1</td>
</tr>
<tr>
<td>8</td>
<td>Right Instrument Panel</td>
<td>1/2&quot; Tempered Masonite</td>
<td>1</td>
</tr>
<tr>
<td>9</td>
<td>Front Brace</td>
<td>1/2&quot; Plywood</td>
<td>1</td>
</tr>
<tr>
<td>10</td>
<td>Top and Shelf Brace</td>
<td>3/4&quot; White Pine</td>
<td>1</td>
</tr>
<tr>
<td>11</td>
<td>Drawer Front</td>
<td>3/4&quot; White Pine</td>
<td>2</td>
</tr>
<tr>
<td>12</td>
<td>Door</td>
<td>3/4&quot; White Pine</td>
<td>4</td>
</tr>
<tr>
<td>13</td>
<td>Cabinet Side</td>
<td>1/2&quot; Plywood</td>
<td>4</td>
</tr>
<tr>
<td>14</td>
<td>Foot Board</td>
<td>1/2&quot; Plywood</td>
<td>2</td>
</tr>
<tr>
<td>15</td>
<td>Horizontal Door Frame</td>
<td>1/4&quot;x3/4&quot;x2' White Pine</td>
<td>4</td>
</tr>
<tr>
<td>16</td>
<td>Horizontal Drawer Frame</td>
<td>2&quot;x3/4&quot;x2' White Pine</td>
<td>2</td>
</tr>
<tr>
<td>17</td>
<td>Vertical Door Frame</td>
<td>1/4&quot;x3/4&quot;x2' 7 1/2&quot;White Pine</td>
<td>4</td>
</tr>
<tr>
<td>18</td>
<td>Cabinet Shelf</td>
<td>1/2&quot; Plywood</td>
<td>4</td>
</tr>
<tr>
<td>19</td>
<td>Drawer Bottom</td>
<td>1/2&quot; Plywood</td>
<td>2</td>
</tr>
<tr>
<td>20</td>
<td>Drawer Side</td>
<td>1/2&quot; White Pine</td>
<td>4</td>
</tr>
<tr>
<td>21</td>
<td>Drawer Back</td>
<td>1/2&quot; White Pine</td>
<td>2</td>
</tr>
<tr>
<td>22</td>
<td>Brace</td>
<td>3/4&quot;x3/4&quot;x3'-11&quot; White Pine</td>
<td>2</td>
</tr>
<tr>
<td>23</td>
<td>Brace</td>
<td>3/4&quot;x3/4&quot;x3' White Pine</td>
<td>2</td>
</tr>
<tr>
<td>24</td>
<td>Brace</td>
<td>3/4&quot;x3/4&quot;x2'-2&quot; White Pine</td>
<td>2</td>
</tr>
<tr>
<td>25</td>
<td>Brace</td>
<td>3/4&quot;x3/4&quot;x2'-4' White Pine</td>
<td>2</td>
</tr>
<tr>
<td>26</td>
<td>Brace</td>
<td>3/4&quot;x3/4&quot;x1'-6&quot; White Pine</td>
<td>2</td>
</tr>
<tr>
<td>27</td>
<td>Brace Panel</td>
<td>3/4&quot;x3/4&quot;x3' White Pine</td>
<td>2</td>
</tr>
<tr>
<td>28</td>
<td>Brace</td>
<td>3/4&quot;x3/4&quot;x1&quot; White Pine</td>
<td>2</td>
</tr>
<tr>
<td>29</td>
<td>Brace, Surface</td>
<td>5/4&quot;x3 3/4&quot;x2' 11/2&quot;Wh.Pine</td>
<td>2</td>
</tr>
<tr>
<td>30</td>
<td>Drawer Side</td>
<td>1&quot;x3/4&quot;x2' White Pine</td>
<td>4</td>
</tr>
<tr>
<td>31</td>
<td>Shelf Support</td>
<td>3/4&quot;x3/4&quot;x2' White Pine</td>
<td>2</td>
</tr>
<tr>
<td>32</td>
<td>Brace</td>
<td>3/4&quot;x3/4&quot;x4' White Pine</td>
<td>2</td>
</tr>
<tr>
<td>33</td>
<td>Shelf Bracket</td>
<td>6&quot;x8&quot; Steel</td>
<td>1</td>
</tr>
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</table>

**TABLE II**

<table>
<thead>
<tr>
<th>Material</th>
<th>Use (Detail numbers)</th>
</tr>
</thead>
<tbody>
<tr>
<td>5½ sheets 8&quot;x4&quot;x1/2&quot; Plywood</td>
<td>(1-2-3-9-14-4-13-18-19-5)</td>
</tr>
<tr>
<td>1 sheet 8&quot;x4&quot;x1/4&quot; Plywood</td>
<td>(6)</td>
</tr>
<tr>
<td>1 sheet 4&quot;x3&quot;x1/8&quot; tempered masonite</td>
<td>(7-8)</td>
</tr>
<tr>
<td>1 sheet 16&quot;x15&quot;x3/4&quot; White Pine</td>
<td>(10)</td>
</tr>
<tr>
<td>9 ft. 1&quot;x3/4&quot; White Pine</td>
<td>(12-11)</td>
</tr>
<tr>
<td>18 ft. 1 1/4&quot;x3/4&quot; White Pine</td>
<td>(15-17)</td>
</tr>
<tr>
<td>4 ft. 2&quot;x3/4&quot; White Pine</td>
<td>(16)</td>
</tr>
<tr>
<td>12 ft. 3&quot;x1/2&quot; White Pine</td>
<td>(20-21)</td>
</tr>
<tr>
<td>43 ft. 3/4&quot;x3/4&quot; White Pine</td>
<td>(22-23-24-25-26-28-31-32)</td>
</tr>
<tr>
<td>12 ft. 3-3/4&quot;x3/4&quot; White Pine</td>
<td>(27-29)</td>
</tr>
<tr>
<td>8 ft. 1&quot;x3&quot; White Pine</td>
<td>(30)</td>
</tr>
<tr>
<td>6 Door Pulls</td>
<td></td>
</tr>
<tr>
<td>8 Kitchen Cabinet Hinges</td>
<td></td>
</tr>
<tr>
<td>8 3/4&quot;x3&quot;x16&quot; Angle Iron Braces</td>
<td>1/2&quot; - No. 8 Flathead angle Iron Braces</td>
</tr>
<tr>
<td>18 3/4&quot; - No. 8 Oval Head Screws, Nickel Plated</td>
<td>1&quot;-No. 12-24 Flathead Machine Screws, Nuts, and Washers</td>
</tr>
<tr>
<td>3 1&quot;-No. 12-24 Flathead Machine Screws, Nuts, and Washers</td>
<td>1-3/4&quot;-No. 1-20 Flathead Machine Screws, Nuts and Washers</td>
</tr>
<tr>
<td>8 3/4&quot; - No. 8 Flathead Screws</td>
<td>3/4&quot; - No. 8 Flathead Screws</td>
</tr>
<tr>
<td>12 Friction Catches</td>
<td></td>
</tr>
<tr>
<td>180 1&quot; - No. 8 Flathead Screws</td>
<td>12-3/4&quot; - 8 Flathead Screws</td>
</tr>
<tr>
<td>40 2&quot; - No. 10 Flathead Screws</td>
<td>11&quot; - No. 8 Flathead Screws</td>
</tr>
<tr>
<td>18 Countersunk Washers, Nickel Plated</td>
<td>1 Stanley 796-J (8&quot;x8&quot;) Bracket (33)</td>
</tr>
</tbody>
</table>

---

**PARTS LIST**

**LIST OF MATERIALS TO BE PURCHASED**

After many sizes and shapes of sets had been placed on the bench and analyzed, the one shown was chosen for a test equipment panel with space for at least four instruments, and a center panel space for a large multi-meter.

**Visibility**

The instruments on the two diagonally placed panels are within easy sight reach for the size meter (four-inch scales); and the back panel meter, placed three feet from the front of the bench, has a large enough scale (7 x 8") to be highly visible. An outlet plate was also placed at the back of the bench for 110 volts a.c. and 6 volts d.c., as shown. The switch on the right was intended for the control of a fluorescent fixture to be located over the lid of the bench, and the left hand switch to turn on a 6-volt auto power supply, intended to be located at the rear of the bench, and wired to the outlet adjacent to the switch.

After the bench was designed and models built, it was found by experience that the power outlets were far in the rear; and it is therefore suggested that a plug-in strip be mounted instead on detail #9, the front brace underneath the bench top.

**Modifications**

Provision for manuals was made in the remaining spare section. Please note that the height called for this is 16", to provide for the new Rider TV Manual. The cover has been put on top to serve as dust catcher. It has been suggested however that the dust cover is not necessary, that lumber can be saved and the appearance of the bench improved.
12 - 3\(\frac{3}{4}\) - 8 FLAT HEAD WOOD SCREWS

8 - \(8\frac{1}{2}\) - \(\frac{1}{4}\) FLAT HEAD MACHINE SCREWS WITH NUTS & PLAIN WASHERS.

FIG. 3
proved, and its height reduced, by
fashioning the top in book case style,
with detail #4 cut down six inches, and
its front upper corner rounded
with a radius of approximately three
inches; as well as detail #5 cut to
3' 6" from its height of four feet.

If the overall height of the bench
need be reduced because of the height
of the ceiling, it is recommended
that the space between the work
bench and detail #7 and #8 be reduced
to 14", that details #7 and #8 be
reduced to 12" in height, and that
the open book case style, discussed above,
be used.

**Construction**

The large sections of the bench
are cut from plywood sheets, 5½ of
which are required. This type of
construction simplifies the problems
of bracing and assembly and gives
great strength. Many supply houses
have the necessary equipment and
will cut the plywood pieces to size for
a small charge. It is suggested that
the reader take advantage of such a
service if it is available. Since the
large sections of plywood are diffi-
cult to handle and transport, the price
paid will be well worth while.

If you have the sheets cut by a
lumber supply house, have them
make the long straight cuts, and do
the smaller cuts by hand later. For
example, have the piece from which
the two sides are made (detail #4)
cut across its short dimension, as in-
dicated in Fig. 4, and then cut in half
lengthwise, leaving
the smaller cuts by hand later.

For example, have the piece from
which the two sides are made (detail #4)
cut across its short dimension, as in-
dicated in Fig. 4, and then cut in half
lengthwise, leaving
the smaller cuts by hand later.

While complete information has
been given in the drawings for the
construction of the two storage cab-

eins, the reader who is short on
time and long on cash can substitute
commercial units for them. The
Sears, Roebuck & Co. unpainted
knockdown cabinets (see above) will
fit exactly. These units are avail-
able with a single drawer and doors,
or with several drawers. If com-
mercial units are substituted, their
tops should be discarded, as they are
unnecessary.

After the large plywood sections
have been cut to size, the smaller
parts should be made up. The reader
will note that several of the parts
are marked "cut to fit" on the detail
drawings. These parts should not be
made up until they can be fitted into
place, at which time they can be cut
and planed to an exact fit.

The Masonite test equipment pan-
els may be cut to size, with the ex-
ception of the small notches which
should be made when the panels are
being fitted into place.

**Assembly**

After all of the parts have been
made up, the job of assembly begins.
The cabinets should be assembled
first. The following is a step-by-step
procedure for assembling them:

1. Fasten the drawer and shelf
   supports (#30, 31) to the sides.
   Each drawer support is held in place
   by three 2" #10 flathead wood
   screws, inserted from the outside.
   Clearance holes for the screws
   through the plywood sides should be
   made with a 1/16" drill. Counter-
sinking is unnecessary since the
   screws will countersink themselves
   if they are turned in very tight. The
   shelf supports (31) are fastened with
   a 1" #8 flathead wood screws, inser-
ted from the inside.

2. Fasten the shelves (#18) in
   place. Fasten the lower shelf and
   then the upper, using six 1" #8 flat-
   head wood screws for each.

3. Fasten all the front cross pieces
   (#14, 15, 16, 17) in place, using
   1½" #8 flathead screws.

4. Assemble the drawers, using the
   parts indicated on the detail drawing
   (#11, 19, 20, 21), using 1½" #8 flat-
   head wood screws.

5. Mount the doors, using kitchen
   cabinet door hinges and 3/4" #8 flat-
   head screws, or those supplied with
   the hinges.

6. Mount the working surface sup-
   ports (#29), using 1" #8 flathead
   wood screws.

7. Place the cabinets in the relative
   positions they will have in the bench
   and fasten the back piece (#6) to
   them, using twelve 3¼" #8 flathead
   wood screws. These screws should
   be fastened into the back end of the
drawer and shelf supports (#30, 31).

8. Fasten the front working sur-
   face brace (#9) in place, using four
   2" #10 flathead wood screws. The
   screws go through the front brace
   into the front ends of the left and
   right hand working surface braces
   (#29).

9. Mount the superstructure sides
   (#4). The sides should be mounted
   in the following manner: take one
   side panel and, holding it in place,
   drill four holes through both the
   side panel and the cabinet to clear
   the 13¼" #4-20 flathead machine
   screws which are used to fasten the
   sides to the cabinets. The position of
   these holes is indicated on Fig. 2.

10. Mount the working surface
    supports (#28), using 1" #8 flat-
    head wood screws.

11. Place the working surface in
    position, and fasten it with eight
    2" #10 flathead screws and six 1½
    #8 flathead screws. Four of the
    2" screws fasten to the front-to-back
    supports (#29). The others are
    fastened to the fronts of the cabinet
    (#16). The 1" screws are fastened
to the corner supports (#28).

12. Mount the two back corner
    braces (#23) using 1½" #8 flat-
    head screws, placed from the inside
    out.

13. Mount the top supports (#26),
    using 1" #8 screws, placed from
    the inside out.

14. Mount the upper back section
    (#5), using 1" #8 flathead screws
    fastened into the back corner braces
    (#23) from the outside.

15. Mount the back shelf supports
    (#22), using eight 1" #8 flathead
    screws, fastened from the inside out.

16. Mount the side shelf supports
    (#32), using 1" #8 flathead screws,
    fastened from the inside out.

17. Mount the book shelf (#2),
    using 1½" #8 flathead screws fastened
    from the top down.

18. Mount the top (#1), using
    1" #8 flathead screws, from top
down.

19. Mount the eight small angle
    braces, three to back top, three to
    back bottom, and two to front brace
    (#9), using 1½" #8 screws.

20. Mount the top and shelf braces
    (#10, 33). Use nine 2" #10 flathead
    screws, three on top, three in the
    back, and three on the bottom of
    the top brace (#10). Use 1½
    #12-24 machine screws for the back
    of the shelf brace (#33).

21. Mount the lower test equip-
    ment panel brace (#27), using 2½
    #10 flathead screws, two back,
    and two in side end. These braces
    are cut to fit at the time of mounting.
    The front edge must be beveled to
    fit the slanting test equipment panel.
    However, they should be mounted in
    place temporarily, and the planing
    left until the panels are being fitted
    into place.

22. The side panel and top panel
    braces (#24, 25) should be mounted.

→ to page 38
THE advantages of flywheel sync circuits in TV horizontal sweep systems have been amply demonstrated. They give the receiver a great immunity to noise signals; and make possible good pictures in weak signal areas with low signal-to-noise ratio, or in strong signal areas where noise signals may be great.

In the triggered-sync system which was used in all receivers several years ago, the frequency of the sweep oscillator was controlled by each successive sync pulse. If noise came through with the sync signal, the sweep oscillator would momentarily lose synchronization and cause several lines of the picture to tear. This effect was more troublesome in the horizontal than in the vertical sweep system. For this reason, the more expensive flywheel sync circuits which were developed were used only to control the horizontal sweep oscillator.

With a flywheel sync system, the frequency of the horizontal sweep oscillator is controlled by a d-c voltage on its grid. This voltage results from the phase difference between the incoming sync signal and a voltage wave obtained from the output of the sweep generator. The d-c voltage thus produced is called an automatic frequency control (a-f-c) voltage. It takes many successive cycles of the incoming sync signal and the signal from the sweep generator to establish the level of the d-c voltage. If a sudden noise burst over-rides the sync signal, it has little effect on the a-f-c voltage, and the oscillator does not lose synchronization. In effect, like a flywheel, the circuit is immune to sudden changes; hence its name.

Until recently, two types of a-f-c sync systems were used in television receivers. These have been in existence for several years and most technicians are familiar with them. It is, however, well to review their operation briefly before discussing the latest circuits.

**Early flywheel sync**

The first a-f-c sync system to make its appearance is shown in Fig. 1. The horizontal sync pulses and the sawtooth voltage generated in the horizontal discharge-tube circuit are fed to a phase detector. If the two voltages are out of phase, a d-c voltage is produced in the detector. This voltage is proportional to the amount by which the sawtooth generator is off frequency from the sync pulses. The filter network removes noise signals from the d-c voltage, which is then amplified and fed to the grid of the sweep oscillator. The d-c bias on the grid changes the frequency of the oscillator, so that it falls into synchronization with the incoming sync pulses.

A later variation of this circuit is shown in Fig. 2. Again the horizontal sync pulses are fed to a phase detector, but this time the phase-comparison voltage is a sine-wave which is generated by a stable Hartley oscillator. The free running speed of the oscillator is 15,750 cps.

If this sine wave signal and the sync pulses are not exactly of the same frequency and phase, a d-c voltage is produced by the detector. The d-c signal is filtered by a filter network to remove disturbing, high-frequency noise, and is then fed to a reactance tube. The reactance tube is connected in parallel with the tank circuit of the Hartley oscillator. A reactance tube circuit acts like a variable inductance or capacitance, depending upon the amount of signal on its grid. This inductance or capacitance in parallel with the tank circuit of the oscillator affects the oscillator frequency. The d-c signal from the phase detector causes the reactance tube to change the effective capacitance or inductance across the tank circuit by an amount which makes the oscillator frequency the same as that of the incoming sync pulses.

In the plate circuit of the oscillator, a differentiating circuit is employed to derive triggering pulses which are used to synchronize the sawtooth generator.

**Latest flywheel sync circuit**

Both of these a-f-c circuits work well and are employed in many of the latest receiver models. More recently, another flywheel sync circuit has been introduced which performs equally well, but has the advantage of being lower in cost. It requires fewer tubes and components. A schematic diagram of this circuit, as it appears in the G-E model 820, is shown in Fig. 3.

The horizontal sawtooth generator uses one section of a 12SN7 (V12B), connected in a blocking oscillator circuit. Instead of its frequency being directly controlled by the horizontal sync pulses, it is controlled by the adjustment of the operating bias on the grid of the tube. A control tube, consisting of the other triode section (V12A), compares the phase between the incoming horizontal sync pulses and the blocking oscillator frequencies, and produces a voltage proportional to the phase displacement. This voltage is applied as bias to the grid of the
blocking oscillator tube, V12B, and results in the oscillator frequency being maintained at the proper phase relation with the incoming sync signal. Thus far, the circuit is the same in principle as those previously described. The important difference arises from the method by which the control tube generates the d-c a-f-c voltage.

Several signals are fed simultaneously to the control tube V12A. The incoming sync pulses (waveform A in Fig. 3) are fed to the grid. The sawtooth voltage (B), generated in the plate circuit of V12B, is mixed with the integrated output (waveform C) of the horizontal sweep amplifier tube and produces waveform D, which is also fed to the grid of V12A.

V12A obtains its operating bias by being connected to the grid circuit of blocking oscillator V12B through resistor R51. The blocking oscillator produces a large negative bias in its grid circuit during its normal operating cycle. When the horizontal sync pulses (waveform A), or the combined output voltage (D) are impressed separately on the grid of V12A, they do not have sufficient positive amplitude to cause appreciable plate current flow in tube V12A. However, when they are fed simultaneously to the grid of V12A, they rise above cut-off bias and cause the tube to conduct. The amplitude of the signal which rises above the cut-off bias, and hence the conduction time of the tube, depends upon the phase relationship of waveforms A and D. Three different phase conditions are shown in Fig. 4.

How it operates

During conduction, capacitors C86 and C78 become positive with respect to ground. Since resistor R50 is in the bleeder circuit across the filter and also forms a part of the grid return circuit for the sweep...
More compact telesets coming with new RECTANGULAR Picture Tube

Latest picture tube design developments promise improved receivers in near future

As is well known, the aspect ratio (the ratio of length to height) of the transmitted television picture is four by three. Until now, no receiver on the market has been able to utilize this transmitted picture, or the tube face, fully because the picture tube in the receiver was round.

Three methods have been employed to show the rectangular picture on a circular screen:

1) Showing the entire picture being transmitted on the tube face. Doing this leaves approximately 25% of the tube face unused (and generally masked). This condition is illustrated in Fig. 1A.

2) Enlarging the 4 x 3 transmitted picture so that its vertical edges were tangential to the round sides of the tube, losing the corners of the transmitted picture (Fig. 1B).

3) Expanding the picture until the top and bottom of the transmitted image were tangential to the upper and lower part of the tube. This filled the whole round tube face with the image, but over 38% of the televised image was lost (Fig. 1C).

A tube is now available whose face is rectangular with an aspect ratio of four by three. With a tube of such construction, no part of the picture is cut off, and no part of the screen remains unused, as illustrated in Fig. 1D.

The 16-inch rectangular tube announced by Hytron provides a picture of 10⅝" x 12½", or a viewing area of approximately 140 square inches. Conventional tube screens showing a picture of the same proportion, take up appreciably more space.

Production difficulties

The new tube will play an important role in the design of future telesets. Hytron has already supplied samples of the new 16RP4 to a large number of manufacturers, and has definite production orders from many of them. Since the new tube, though of the 16-inch type, takes up only the space of a conventional 12" tube, we can expect more compact receivers in the near future.

One might wonder why the rectangular tube was not produced in the first place. The reason for this lies in the manufacturing process of tube envelopes. When the tube face is sealed to the tube funnel, the two are fused together under intense heat. In order to assure a satisfactory fusion, the heat which is applied to the various areas must be of uniform temperature. With circular tubes, this problem was easily solved. While the face and the funnel were rotated on the tube axis, a stationary flame was applied to the surfaces to be fused. Because the face and funnel were round, the distance between the rotating tube and the flame was constant, and the heat therefore uniform. It was, however, a different story with rectangular tubes. When a rectangular tube is rotated, the distance between any point on the tube and any other stationary object does not remain constant, and the heat which would be applied to such a tube would not be uniform on the various surfaces, making the seal imperfect. This problem has only now been solved.

There are some other features of the Hytron tube which are worth mentioning: the use of lightweight glass plus the rectangular shape make its weight only about 70% of conventional 16" glass tubes; there is no high-voltage isolation problem of the tube itself; a relatively flat face incorporates a neutral gray density filter to increase contrast; and an external conductive coating, which acts as filter capacitor when grounded, provides shielding action against external electrostatic fields.

![Fig. 1 Reproducing rectangular transmission on circular screen. A) 25% of tube face area lost. B) 14% of face area, corners of picture lost. C) Tube face area completely utilized. D) No loss of tube face or picture area.](image-url)
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How can you determine what merchandise is wanted by enough customers to make selling it a profitable operation? How can you determine the quantities to carry in stock? How can you be sure when to re-order? Or in what quantities? When prices change, how can you insure the right markup, so that all of your stock—the old and the new—will carry a satisfactory profit? The answer to all these questions is simple: a perpetual inventory system.

The old fashioned method of "taking inventory" at periodic intervals has been replaced today with the perpetual inventory. Instead of practically stopping work every three or six months and tying up the business in a tedious counting job, good businessmen today keep their inventory records in a card file, taking physical records in a card file, taking physical inventory (counting all items in stock) not more than once a year.

The perpetual inventory offers many advantages besides the saving in overhead. It is easy to keep. A simple: a perpetual inventory system.

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The perpetual inventory offers many advantages besides the saving in overhead. It is easy to keep. A perpetual inventory system.

There are a few quick notations give a complete picture of your reserve stock situation at all times; and it can be used as an efficient pricing tool. An inventory which does all these things should be pretty complicated. But in practice it is not. All you need is some file cards (8 x 5's do the job well) and a place to keep them (for instance, a visible reference file of the Kardex type, a card cabinet, or even a shoebox).

Each card has space at the top for the name of the product, its manufacturer, your distributor's name, and your stock number. There is also space at the top to show maximum and minimum stock you should keep on hand, as well as the markup the item should carry.

The maximum can be determined by good horse sense. It is the number which you can expect to sell in any given period, 2 months, 3 months, a year, etc. The minimum stock is the smallest number of items which will carry you over—should a sudden heavy demand arise—until you can replace stock in a normal way.

Here is an illustration of how this works: You sell Blank Batteries. If you order new stock, it would take the wholesalers six days to deliver it to you. During these six days, you would ordinarily sell four Blank Batteries. Sometimes during peak seasons, however, you sell as many as forty in six days. So to be safe, you would need forty batteries to tide you over till new stock arrives. Forty then is the minimum stock you should keep in reserve. Mark this number on the card and, when sales reduce your stock to forty, you can reorder.

Reordering is easy

The beauty of the perpetual inventory system is that it not only tells you what is on hand every day, but also tells you when to reorder.

Below the information on top of the card, the cards should be ruled as shown in the illustration. The vertical columns should be headed: Quantity Purchased, Quantity Drawn Out, Total on Hand Unit Cost, Extended Unit Cost, Selling Price.

As you buy stock, enter the quantity and date in the first column, and the total number this puts in your stock in column three. Enter cost of this order in column four. The unit cost (total cost divided by number of pieces) goes in column five. To get the figure for column six, take the cost of all items of this merchandise in stock and divide by the number of items (including those you just purchased). This gives you the extended unit cost, which is an average cost for everything in your stock, taking care of price rises and reductions. Selling price is entered in the last column. You obtain it by adding your markup to the extended unit price.

On the horizontal columns, mark the dates on which you draw out merchandise from reserve, and the dates on which you add to it.

How it works

To illustrate how effectively this perpetual inventory system works we'll consider the case of Joe Brown.
vho operates a service organization

Joe's present volume of sales runs

since he has changed to the per-

he does not “run out” of his fast

Portables are his fastest sell-

record indicated that 18 portables were in stock. On

Mr. Brown took out 11 to

Mr. Brown $15.99

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HIGH VOLTAGE COUPLER CONTROL

To provide safe insulation for controls used in high-voltage circuits, Clarostat has now available a high-voltage coupler feature which they will incorporate on request in most of their controls when ordered. Known as the type 56-125 high-voltage coupler, this feature makes use of a plastic straight-through shaft, instead of the previous insulating strip joining separate sections of the metal shaft. This eliminates backlash and provides more critical settings. An insulating tube isolates the control proper from its mounting bushing. The control-to-ground breakdown rating is better than 10,000 volts. For full details, get in touch with Clarostat Mfg. Co., Inc., Dover, N. H.

NEW ANTENNA LINE

Cornell-Dubilier has just introduced the first model of its Skyhawk antenna line. It's called the Skyhawk Strateline, comes in 5 models, all with hi-lo coverage. Model 85X has 8-foot mast, phase line, 6 standoffs & base mounting bracket. T85X is similar but comes with 60-inch transmission line. Model 85XAX is double stacked 85X with feeder bars, 6 standoffs, 8 ft-mast, phase lines & base mounting bracket. T85XAX is same model with 60-inch transmission line. Model K85X is single 85X bay, feeder bars, "U" bolt mast bracket for converting single to double stack. For details, write Cornell-Dubilier Electric Corp., South Plainfield, N. J.

MINIATURE RESISTORS

Two new miniature resistors have been announced by IRC, completing its line of IRC BT Insulated Resistors. They are 1/3 watt and 2-watt units. Type BTR at 1/3 watt meets JAN-RC10 specifications, and type BTB at 2 watts is equivalent to JAN type RC40. They have filament type resistance elements, making for low operating temperature and good power dissipation. Phenolic resin provides moisture protection. Both are characterized by their small size. Interna-

3”-OSCILLOGRAPH

A successor to the 164-E has just been announced by DuMont: the 3-inch type 292. Very portable instrument, incorporates features found previously only in 5” models. Weight is 21 lbs, dimensions 10¼” x 8¼” x 11”. Deflection sensitivity 0.4 rms volt/inch (vertical) and 0.56 rms volt/inch (horizontal). Flat tube face minimizes optical distortion. Recurrent sweeps from 8 to 30,000 cps are supplied, and balanced deflection is used. Full info obtainable from DuMont Labs, 1000 Main Ave., Clifton, N. J.
Sweep Generator

Note how the TV band is covered without the use of bandswitching, eliminating a possible source of erratic operation, and at the same time reducing the cost of the unit. For ease of operation, the dial is calibrated in terms of TV channel numbers. The sweeping effect is produced as follows:

The fixed frequency oscillator is tuned by means of a flat open wound spiral coil (L3), mounted on a bakelite plate. The plate is mounted on the chassis close to a unit which is essentially a PM speaker with a metal membrane attached to the cone. The membrane is free to follow the voltage variations in the voice coil and will thus vary the frequency of the oscillator at a rate determined by the frequency of the voice coil voltage and by an amount (sweepwidth) determined by the amplitude of the applied voltage.

The control voltage is tapped from the 6.3-volt filament winding and applied to the voice coil through R3 and R2. R3 serves to limit the maximum voltage applied to the coil at any setting of R2, and thus prevents excessive excursions of the metal membrane. R2, which is accessible from the front panel, then functions as the sweepwidth control.

The design of the modulator unit allows a sweepwidth of up to 30 Mc, which is more than adequate for use with any single channel. By using the full 30 Mc sweep, it is possible to compare the relative gain of several channels. For example, by setting the main frequency control to channel 3 and the sweepwidth to maximum, the gain of channel 3 can be compared with that of channels 2 and 4, simply by rotating the receiver selector switch. This procedure is particularly effective in revealing defective r-f coils, switches, etc.

Attenuation

Another requirement of sweep generators is that suitable means of attenuating the output must be found. This requirement is met by using a low value (125 ohms) potentiometer in the cathode of the upper half of the 12AU7. Since cathode follower output is used, no trouble in coupling to the set under test should be encountered. Occasionally (particularly at high frequencies) a high standing wave ratio may be set up in the output cable and result in oscillation and deterioration of the response pattern. This may easily be remedied by placing a resistor of from 50 to 100 ohms across the output cable clips, thus matching the impedance at the clip end of the cable.

A desirable adjunct to an instrument of this type is some means of providing a sync signal or horizontal sweep voltage to the oscillograph. This sweep must be in sync with the sweep voltage used for frequency modulation. To accomplish this the 6.3-volt filament voltage is again tapped off and applied to the network consisting of R18, R17, and C17. A portion of this voltage is available at the front panel from a connector marked 60 CYCLES. R17 provides a phase control adjustment so that double trace patterns resulting from phase shift may be resolved into a single response pattern. It must, however, be remembered that phasing control may become ineffective if there is 60-cycle hum pickup in the test or the scope connecting leads.

Failure to use shielded test leads for the oscillograph, neglect of proper

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the air. If in every case no sound comes in, but a picture is received, it is reasonable to assume the trouble is in the sound strip. Obviously, the antenna, front end, video strip, and all other sections except for the sound strip, must be operating since a picture comes in on all channels.

**Design Differences**

It should be kept in mind that even sets of the same general type (electro-magnetic, flyback high voltage system, standard a-c low voltage supply) may not have exactly the same design. For example, a large number of Admiral models follow the block in Fig. 1 very closely, except that there are two low voltage supplies, one feeding B+ to the tuner and audio strip, and the other providing B+ for the other circuits. If B+ fails in the first low voltage power supply, there is a raster, but no sound or picture. If the second goes, there is no raster, but there is sound. This does not throw out what has been said about using the block diagram in servicing. It merely emphasizes the point. The block diagram of the receiver must be kept in mind, including the connections from the low voltage supply or supplies to the other sections of the set.

Most 7-inch receivers being sold today use static deflection and focusing, inter-carrier sound system, and an r-f high voltage power supply. The basic block diagram for this group of receivers follows generally the block diagram in Fig. 2.

**Flywheel Sync**

generator tube V12B, any change in voltage across R50 will result in a change of frequency in the horizontal sweep generator. Thus, if the contributing voltage of R50 makes the grid of V12B less negative, the frequency will be raised; likewise, if the contributing voltages make the grid of V12B more negative, the frequency will be lowered. It will be seen that the longer the conduction period of tube V12A, the higher will be the frequency of the blocking oscillator and of its sawtooth output.

Referring to Fig. 4, curve 2 shows a sync pulse phased so that about 50 percent of the horizontal sync pulse width is riding on top of waveform D, while the remainder of the pulse, after point P, falls down into the trough, making the conducting portion have a width which is average between the curves represented by (1) and (3).

If each successive sync pulse falls in the same phase relation as shown in curve (2), the horizontal hold control, which controls the amount of current flowing through V12A, is set so that this phase relation does not change. This would cause the sweep generator V12B to run at the same frequency as that of the incoming horizontal sync pulses. Under this condition, if the sweep generator tends to run slower than the incoming sync signal, the conduction period will be made longer through V12A, because the pulse will move forward in relation to waveform D with the result as shown in curve (1).

It will be noted that the conducting pulse is of greater duration (wider) than in curve (2). Therefore, tube V12A will conduct for a greater period of time, thus decreasing the negative potential across R50. This greater conduction period causes the sweep generator to speed up until it attains the condition in curve (2).

Likewise, if the sweep generator is operating at too high a frequency, the pulse will advance along the integrated sawtooth wave until a large portion of it falls down into the trough of waveform D, as shown in curve (3). This condition results in the shortening (narrowing) of the
con ducting pulse, causing the frequency of the sweep generator to be reduced until the condition in curve (2) is again restored.

The horizontal frequency capacity (C49) forms part of the discharge circuit in the grid of the blocking oscillator, V12B. By varying its value, the free-running speed of this oscillator can be adjusted to supplement and act as a coarse control for the horizontal hold control on the front panel. The free-running speed of the blocking oscillator is also adjusted by the inductance variation of the blocking oscillator coil T16.

Because this type of a-f-c circuit depends upon the width of the pulses above the cut-off bias of the control tube, it is often called the pulse-width flywheel sync circuit.

A slight variation of this circuit is worth noting. In some receivers a parallel tuned circuit, consisting of a variable coil and a fixed capacitor, is used in series with the B+ lead to the blocking oscillator. This tuned circuit is inserted at the point marked X in Fig. 3. The resonant frequency of the tuned circuit is adjusted to 15,750 cps. It is shock excited into oscillation by the pulses of plate current and adds to the sawtooth wave (developed across C50) in proper phase to increase the slope of the wave just prior to discharge (retrace portion of sawtooth). This increase in slope affects waveform D, as shown in Fig. 5. The increase in slope gives greater sensitivity of control, for it defines more sharply the shape of the pulse which rises above the cut-off bias on tube V12A. The net effect is to stabilize the sync, especially in the presence of noise.

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**Fig. 5 Comparison of a-f-c waveshapes, with and without additional tuned circuit in plate of blocking oscillator.**
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Increasing Audio Output

To increase the audio output on the "30A, B, C, and D Series" Admiral TV Chassis for fringe area operation, the following changes should be made:

a. Remove R620 (the 150,000-ohm resistor) in the 4H1 tuner chassis.
b. Increase the values of R219 and R220 ratio detector 15,000-ohm load resistors to 27,000 ohms.
c. Remove the 6AG5 r-f amplifier V101 grid return from the center arm of R306A contrast control and connect the junction of R305 and R307. This fixes the grid bias on the 6AG5 r-f amplified tube at about .25 volts, resulting in more r-f gain. However, if the receiver is located in an area where strong signals are to be received as well as weak signals, this change may cause the contrast control to function improperly on strong signals. If this happens, fix the bias at a higher negative voltage by reversing the grid return from the video i-f and the 6AG5 r-f amplifier from the original wiring shown in the schematic, by changing the i-f grid return from the junction of R304 and R305 to the movable arm of the contrast control. The r-f grid return of the 6AG5 r-f amplifier should then be changed from the contrast control arm to the junction of R304 and R305.
d. Realign the ratio detector transformer.
e. Check the 6AU6's in the audio IF. Be sure these are good tube.
f. Change the 6K6GT audio output tubes to 6V6GT. No circuit change will be needed.

The above changes will improve audio sensitivity and output, but is recommended on receivers where the complaint is low volume on TV in fringe area operation. It must be remembered that in some areas the TV transmitter is only deviating it audio transmission 7 to 10 kc it stead of the allowable 25 kc, which will result in low audio volume a the receiver.

If stations are found to be the cause of low TV audio, these change will improve output but may no produce more than room volume.

From Admiral Service Bulletin TV-44

Coupling Sweep and Marker Generators to Receiver

When using a sweep generator marker generator, and oscillograph to check the i-f response curves of a television receiver, it is sometimes difficult to obtain the correct balance between sweep output and marker output. This is particularly true when the ranges of the individual attenuators are limited. For best results, the amplitude of the applied sweep voltage as well as that of the marker voltage must be adjusted to a fairly critical level.

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frequency stability

In the Model 360, the problem is solved by providing a crystal oscillator lower half of 12AU7 and a crystal older mounted on the front panel. The most obvious procedure is to use crystals at the exact frequencies specified for alignment. However, it is too can be a costly process. A simple and very effective alternative is to use a crystal of any frequency and use its harmonics to calibrate a standard r-f generator, which then becomes the marker generator. For example, assume that a frequency of 21.25 Mc is required for sound alignment. A 5000 kc crystal is available. The external r-f generator is set to 20 Mc and checked against the 4th harmonic of the crystal oscillator. If the external generator is out of calibration, it may be realigned.

The amount of error may be noted and allowed for when setting to the desired frequency. Naturally, a judicious choice of crystal is important. It reduces the amount of necessary interpolation, and increases the effectiveness of this method.

Sweep Generator

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Rounding provisions, etc. are all robable sources of unsatisfactory results. Finally, the sweep generator should supply an extremely accurate goal for marker pips. One answer to incorporate into the unit a variable frequency oscillator with exceptionally high frequency stability and vibration. This solution would result in high expense, which may not be necessarily justified.

SOUND CARRIER

CHANNEL 4

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MULTIPLIER PROBE

This probe, known as the "Kilovolt- or", extends the usefulness of existing d-c voltmeters into the television range by effectively adding 15,000 volts to the scale of readings of conventional high-resistance voltmeters. Fully insulated against high TV voltages, this instrument is 8 1/2" long, built with phenolic barrel and clear lucite nose piece. Three models are available, for 50, 100, and 200 microampere meter movements. Insuline Corporation of America, 3602-35 Ave., Long Island City 1, N. Y.

ANTENNA ROTATOR

Antenna rotators have been used for some time to insure clearer reception. Now Radiart has added its own model, called the Tele-Rotor. It has 375-degree rotation in either direction at 1 r.p.m., and positive electrical stop at the end of each rotation. Lights on the remote control unit indicate the position of the antenna. The aluminum cast frame of the rotator will take a 150 pound load and up to 11/2" diameter mast. Power consumption is a low 20 watts. Radiart Corporation, Cleveland, Ohio.

SIGNAL TRACER

Called the Dynatracer, the new model 777A is a signal tracer which provides high amplification, allowing actual gain measurements for receiver; uses meter instead of "magic eye", and traces all disturbance or circuit defects from antenna to speaker. Attenuation is 10,000 to 1, sensitivity 10,000 microvolts for full scale deflection, freq. range appr. 160 Mc. Has little hum or noise pickup because of low 3 mmf input capacity. Radio City Products, 152 W. 26 St., N. Y. C.
Notebook

The coupling method shown in the diagram provides additional control of the sweep and marker voltages. By sliding the tube shield up or down on the tube, the capacitance between the shield and the tube elements is varied, and the coupling can be adjusted as desired. Another advantage of this method is that it is not necessary to make a direct connection to the circuit under tests; simply slide the tube shield over the converter tube.

The system is particularly applicable with a Mega-Sweep and Mega-Marker. When using the two pieces of equipment together, the output of the Mega-Sweep should be connected to the Mega-Marker, and the common output should be taken from the Mega-Marker. Then, by adjusting the attenuators on the two generators and sliding the tube shield up or down on the tube, the correct relative voltage amplitudes can be obtained. During the preliminary peaking, when only the Mega-Marker is used, the Mega-Sweep output cable should be disconnected from the Mega-Marker for best results.

Any tube shield can be used, provided that it fits the tube snugly and does not ground to the chassis.

from Westinghouse Service Hints.

Emerson Model 6C448

Most frequent complaint on this model is that it plays on batteries, but will not play on a-c or d-c lines.

You will find upon checking these sets that resistors R16 and R17, 1500 and 50 ohms respectively, very often tend to increase in value. You can very easily locate these units as they may be mounted upright near the 117Z4 rectifier. Make sure to replace these resistors with 10 watt units of the proper value. This will clear up the trouble.

Albert Loisch
Darby, Pa.

Service Bench

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in place temporarily, using 1" #8 flathead woodscrews, fastened through the braces into the plywood. The upper braces are fastened to the underside of the shelf.

23. The Masonite panels (#7,8) should now be held in place temporarily, and the small notches in the upper inside corners marked and then cut. Following this, the test equipment panel braces should be beveled with a plane until the test equipment panels fit snugly into place. This procedure is best done on a cut and try basis. After the braces have been properly beveled, they may be mounted permanently in place. The test equipment panels are mounted with ¾" #8 nickel plated ovalhead woodscrews and washers. The test equipment panels should not be mounted until after the cutouts for the test equipment have been made.

Gluing

Considerably greater strength can be achieved by gluing all of the surfaces which come into contact with one another. If there is a possibility that the bench will have to be moved at some time after assembly, not all surfaces should be glued, since the bench is so large that it can best be moved in a semi-knocked down condition. In the event that the bench is to be moved, glue only the following:

#23, 26, 28, 32—to sides only.
#22—to back only.
#25—to shelf only.
All parts of the cabinets.

The plywood working surface should be covered with a more durable material to improve its appearance and lasting qualities. Material which can be used, in order of preference are: hardwood tongue-in-groove flooring, tempered Masonite and linoleum. Formica may also be used, but is quite expensive.

Painting

Two coats of paint (any color are sufficient for a utility job to protect the surfaces. The first coat can be thinned out for priming purposes. Where appearance is important, the various wood ends and surfaces should be carefully sanded and the entire bench covered with a first coat of Firzite.

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