RADIO & TELEVISION MAINTENANCE

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RADIO INDUSTRY NEWSLETTER

Edited by Joseph J. Roche

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 scienists 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.

Service Technique

You'll save more time by using the

BLOCK DIAGRAM IN TV TROUBLESHOOTING

by Cyrus Glickstein

American Radio Institute

Let the block diagram be your roadmap to find your way around in a teleset

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. The 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

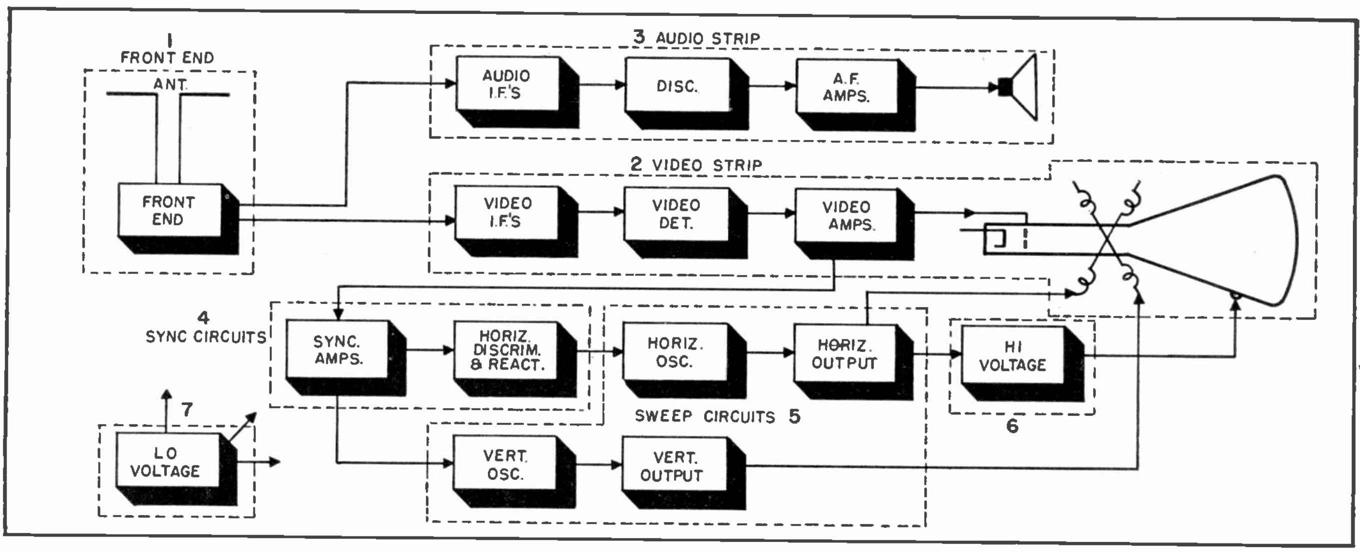
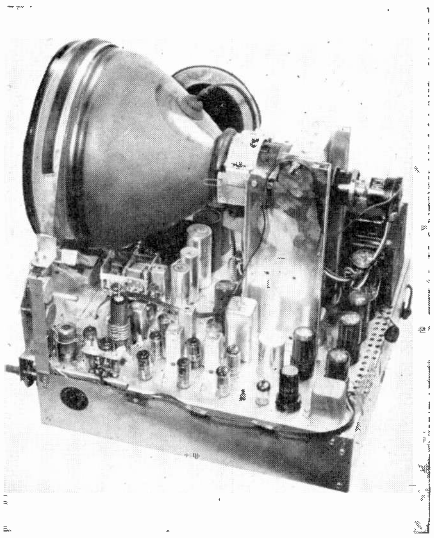


Fig. 1 Block diagram of the RCA-630-TS type receiver. Knowing the function of each of the sections of this type of receiver is essential for speedy television maintenance. Block diagrams are important in a-m, much more so, however, in television



audio strip (Section 3) to give the sound.

Part of the video signal is taken off at the video amplifier and sent through the sync circuits (Section 4). Here the video information is removed and only the sync pulses are kept. These are fed to the sweep oscillators to trigger them at the proper time, to prevent the picture from being jumbled.

The sweep circuits (Section 5) generate saw-tooth voltages and currents which move the fine stream of electrons in the picture tube rapidly horizontally and vertically to produce a raster on the screen. When signal information from Section 2 arrives at the grid of the picture tube (or, in some cases, at the cathode), the beam becomes lighter and darker, thereby producing the shading of the picture.

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 mis-tuning 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

→ to page 34

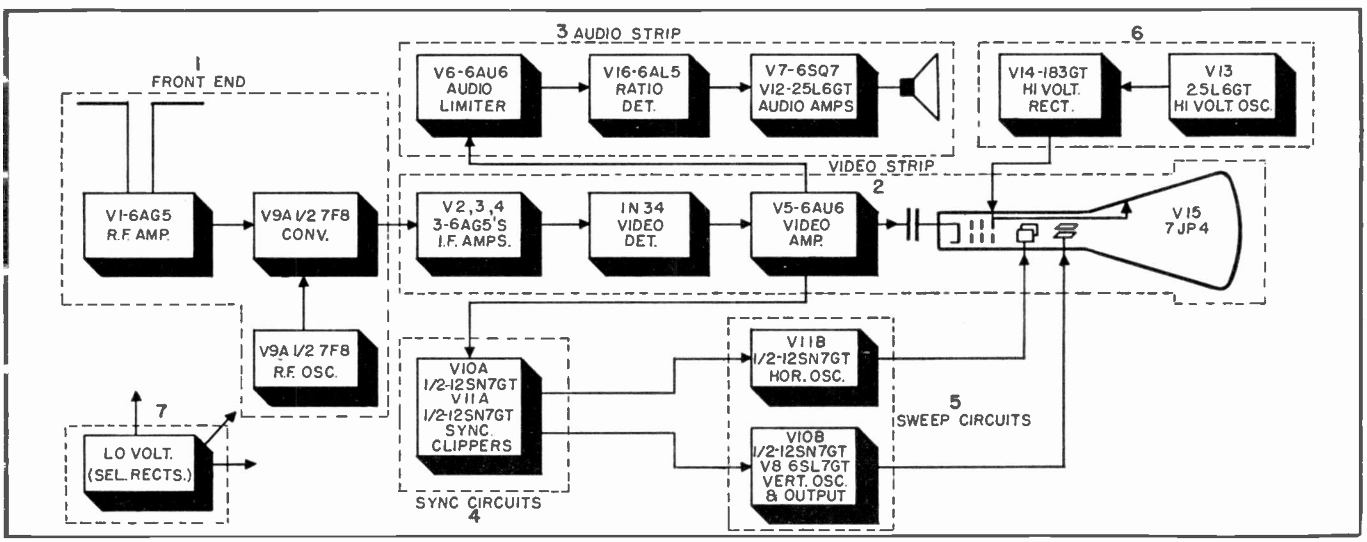
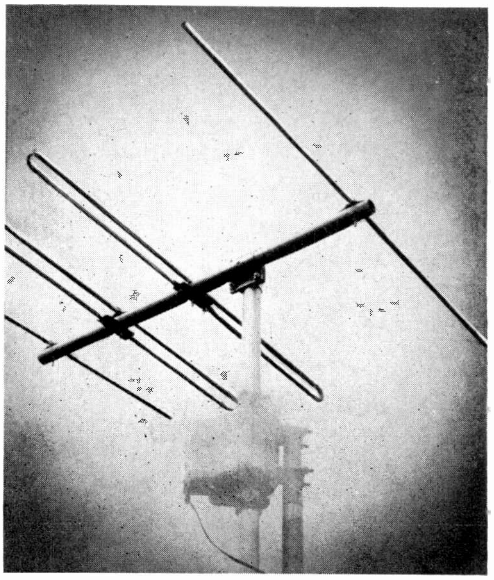


Fig. 2 The basic block diagram of the 7-inch receiver, using static deflection and focusing, inter-carrier sound system, and an r-f high-voltage power supply. This diagram is essentially the same as that shown in Fig. 1, serves the same purpose

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.

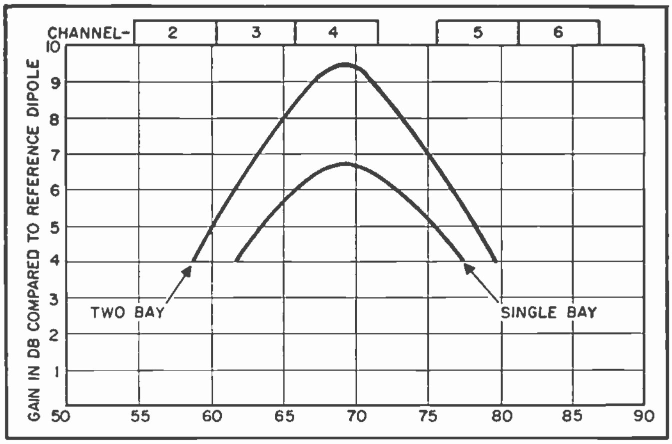


Fig. 1 Measured gain of new antenna in db, compared to standard dipole. Curves are for both signal and two-bay arrays

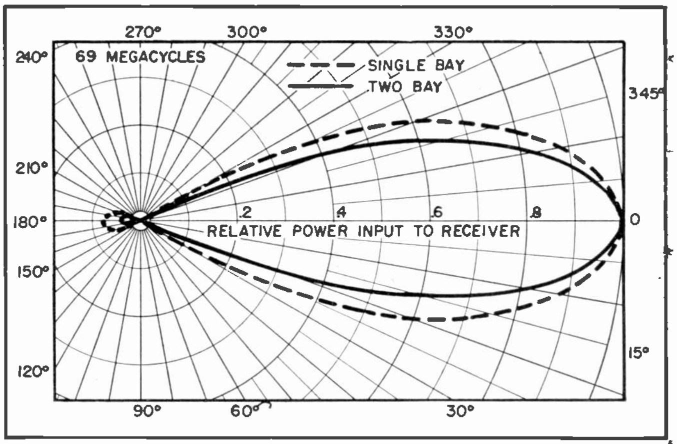


Fig. 2 Horizontal radiation pattern of Twin Driven Yagi, for both single and two-bay arrays, measured at 69 megacycles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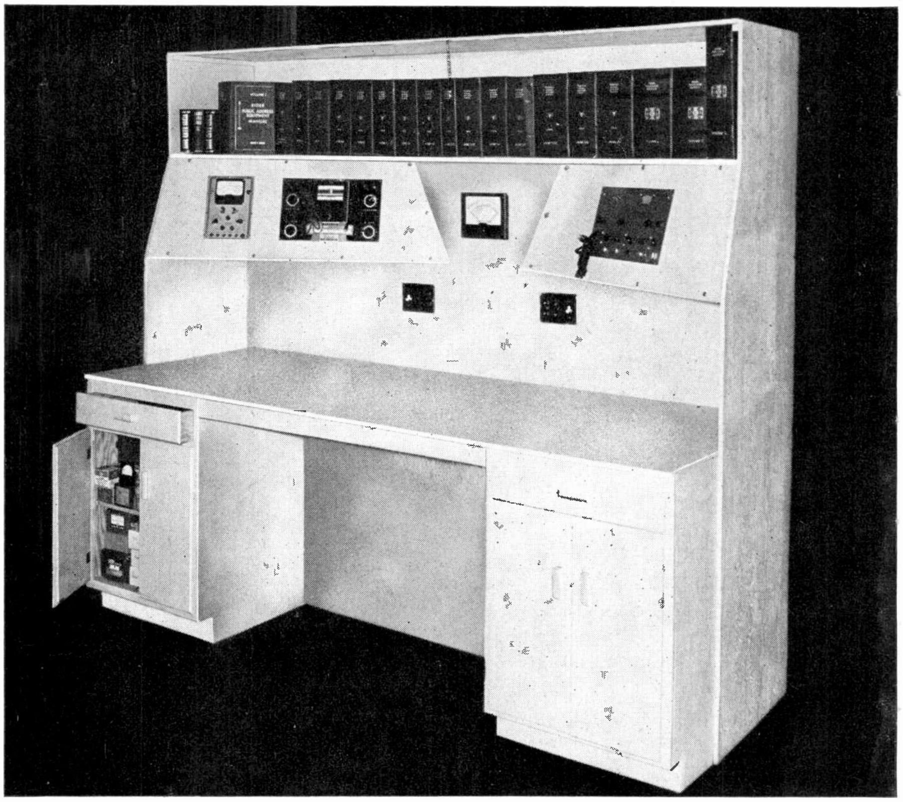
How to CONSTRUCT the 1950 MODERN SERVICE BENCH



complete plans, parts list, and instructions for building this custom designed service bench

By The Staff of
Radio & Television Maintenance

IN 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

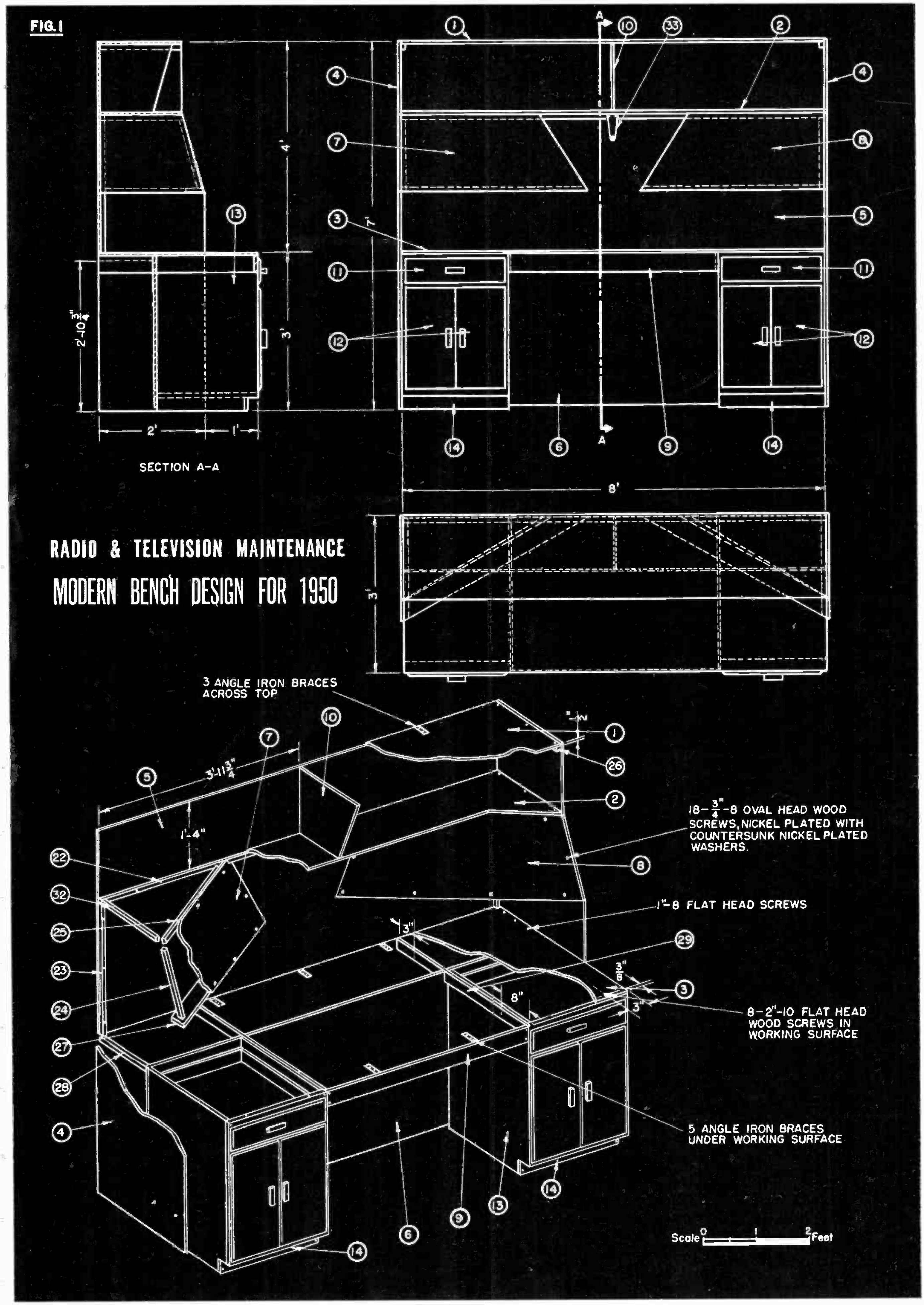


FIG. I
SECTION A-A
RADIO & TELEVISION MAINTENANCE
MODERN BENCH DESIGN FOR 1950
3 ANGLE IRON BRACES ACROSS TOP
18-3/4"-8 OVAL HEAD WOOD SCREWS, NICKEL PLATED WITH COUNTERSUNK NICKEL PLATED WASHERS.
1"-8 FLAT HEAD SCREWS
8-2"-10 FLAT HEAD WOOD SCREWS IN WORKING SURFACE
5 ANGLE IRON BRACES UNDER WORKING SURFACE
Scale
Feet
8'
7'
4'
3'
2'
1'
2'-10 3/4"
3'-11 3/4"
1'-4"
8"
3"
3/8"

TABLE I			
PARTS LIST			
Detail No.	Name	Material	Quantity
1.	Top	1/2" Plywood	1
2.	Bookshelf	1/2" Plywood	1
3.	Working Surface	1/2" Plywood	1
4.	Side	1/2" Plywood	2
5.	Upper Back Panel	1/2" Plywood	1
6.	Lower Back Panel	1/4" Plywood	1
7.	Left Instrument Panel	1/8" Tempered Masonite	1
8.	Right Instrument Panel	1/8" Tempered Masonite	1
9.	Front Brace	1/2" Plywood	1
10.	Top and Shelf Brace	3/4" White Pine	1
11.	Drawer Front	3/4" White Pine	2
12.	Door	3/4" White Pine	4
13.	Cabinet Side	1/2" Plywood	4
14.	Foot Board	1/2" Plywood	2
15.	Horizontal Door Frame	1 1/4"x3/4"x2' White Pine	4
16.	Horizontal Drawer Frame	2"x3/4"x2' White Pine	2
17.	Vertical Door Frame	1 1/4"x3/4x2' 7 1/2"White Pine	4
18.	Cabinet Shelf	1/2" Plywood	4
19.	Drawer Bottom	1/2" Plywood	2
20.	Drawer Side	1/2" White Pine	4
21.	Drawer Back	1/2" White Pine	2
22.	Brace	3/4"x3/4"x3'-11" White Pine	2
23.	Brace	3/4"x3/4"x3' White Pine	2
24.	Brace	3/4"x3/4"x1'-2"White Pine	2
25.	Brace	3/4x3/4"x2'-4" White Pine	2
26.	Brace	3/4"x3/4"x1'-6"White Pine	2
27.	Brace Panel	3/4"x3/4"x3' White Pine	2
28.	Brace	3/4"x3/4"x11" White Pine	2
29.	Brace, Surface	3/4"x3 3/4"x2' 11 1/2"Wh.Pine	2
30.	Drawer Slide	1"x3"x2' White Pine	4
31.	Shelf Support	3/4"x3/4"x2' White Pine	8
32.	Brace	3/4"x3/4"x1'4"White Pine	2
33.	Shelf Bracket	6"x8" Steel	1

TABLE II		
LIST OF MATERIALS TO BE PURCHASED		
Quantity	Material	Use (Detail numbers)
5½ sheets	8'x4'x1/2" Plywood	(1-2-3-9-14-4-13-18-19-5)
1 sheet	8'x4'x1/4" Plywood	(6)
1 sheet	4'x3'x1/8" tempered masonite	(7-8)
1 sheet	16"x15"x3/4" White Pine	(10)
9½ ft.	1'x3/4" White Pine	(12-11)
18½ ft.	1 1/4"x3/4" White Pine	(15-17)
4 ft.	2"x3/4" White Pine	(16)
12 ft.	3"x1/2" White Pine	(20-21)
43 ft.	3/4"x3/4" White Pine	(22-23-24-25-26-28-31-32)
12 ft.	3-3/4"x3/4" White Pine	(27-29)
8 ft.	1"x3" White Pine	(30)
6	Door Pulls	
8	Kitchen Cabinet Hinges	
8	3/4"x3"x3/16" Angle Iron Braces	
32	½" - No. 8 Flathead angle Iron Brace Screws	
18	3/4" -No. 8 Oval Head Screws, Nickel Plated	
3	1"-No. 12-24 Flathead Machine Screws, Nuts, and Washers	
8	1-3/4"-No. ¼-20 Flathead Machine Screws, Nuts and Washers	
12	3/4" - No. 8 Flathead Screws	
4	Friction Catches	
180	1" - No. 8 Flathead Screws	
12	3/4" - 8 Flathead Screws	
42	2" - No. 10 Flathead Screws	
16	1¼" - No. 8 Flathead Screws	
18	Countersunk Washers, Nickel Plated	
1	Stanley 796-J (6"x8") Bracket	(33)

extensive testing it was concluded that shelf space with doors was more convenient for radio parts storage than drawer space, with the top drawer being used in both cases for the storage of tools.

In the preliminary design of the bench, the test equipment panels went straight across the bench, at a 30° angle with respect to the vertical, beginning at a normal distance of two feet from the front.

When a 16″ teleset is placed diagonally on such a bench, however, its sides would protrude considerably over the edges of the bench. This liquidated that type of panel design. The next design was a tapering panel, with a table top one foot deeper. 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.

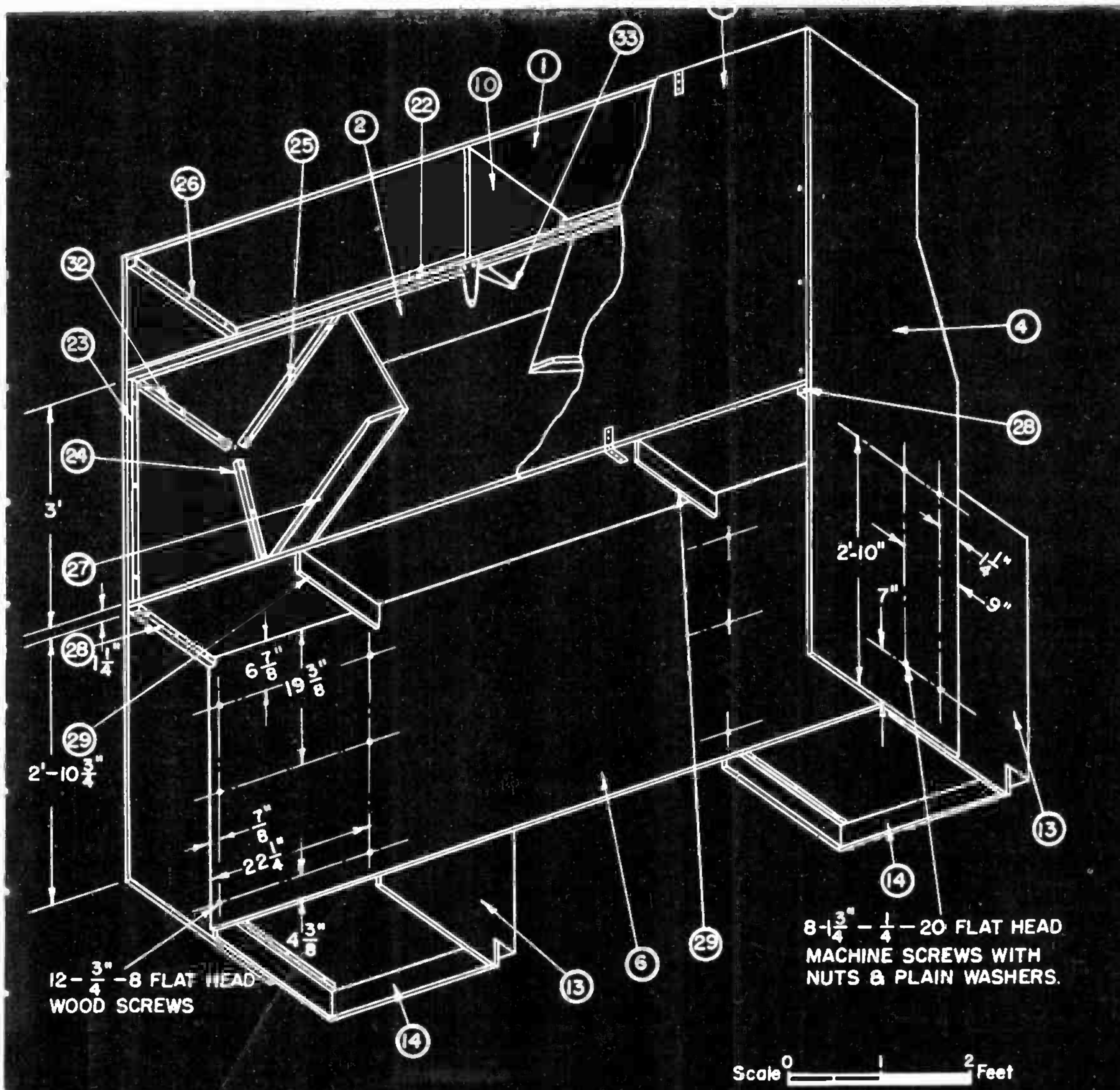
Visibility

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 too 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 im-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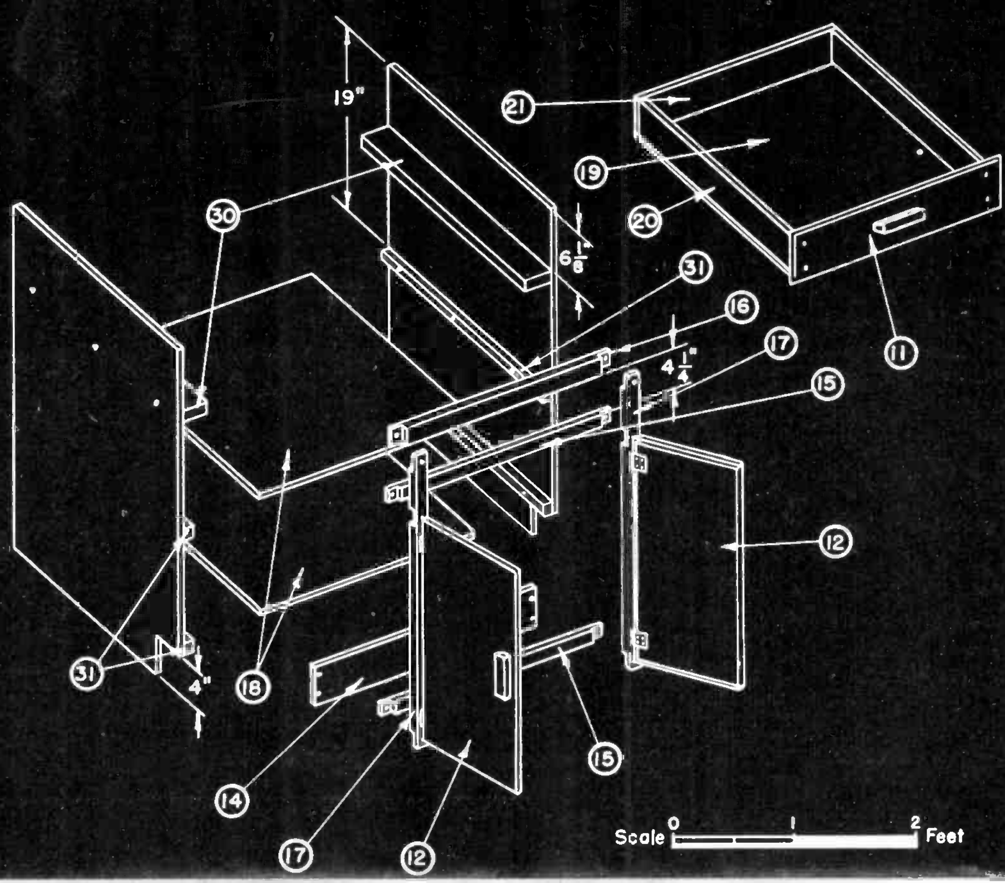
14
3'
2'-10"
1/4"
7"
9"
6 7/8"
19 3/8"
1 1/4
2'-10 3/4"
7/8"
22 1/4"
4 3/8"
12 - 3/4" - 8 FLAT HEAD WOOD SCREWS
8-1 3/4" - 1/4 - 20 FLAT HEAD MACHINE SCREWS WITH NUTS & PLAIN WASHERS.
Scale 0 1 2 Feet

FIG. 3


19"
21
19
30
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11
6 1/8"
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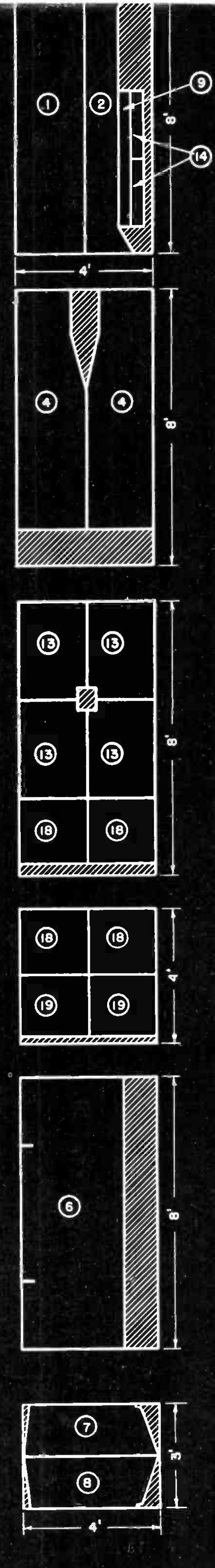
Scale 0 1 2 Feet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proved, and its height reduced, by fashioning the top in book case style, with detail #4 cut down six inches, and its front upper corner rounded with a radius of approximately three inches; as well as detail #5 cut to 3′ 6″ from its 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 difficult 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 indicated in Fig. 4, and then cut in half lengthwise, leaving the small cuts (where the top of the superstructure is cut back) to be made by hand.

While complete information has been given in the drawings for the construction of the two storage cabinets, 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 available with a single drawer and doors, or with several drawers. If commercial 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 panels may be cut to size, with the exception 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. Countersinking 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 woodscrews, inserted from the inside.
2. Fasten the shelves (#18) in place. Fasten the lower shelf and then the upper, using six 1″ #8 flathead wood screws for each.
3. Fasten all the front cross pieces (#14, 15, 16, 17) in place, using 1¼″ #8 flathead screws.
4. Assemble the drawers, using the parts indicated on the detail drawing (#11, 19, 20, 21), using 1″ #8 flathead wood screws.
5. Mount the doors, using kitchen cabinet door hinges and ½″ #8 flathead screws, or those supplied with the hinges.
6. Mount the working surface supports (#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 ¾″ #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 surface 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 1¾″-#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 flathead wood screws.
11. Place the working surface in position, and fasten it with eight 2″ #10 flathead screws and six 1″ #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 1¼″ #8 flathead 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 1″ #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 ½″ #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 1″ #12-24 machine screws for the back of the shelf brace (#33).
21. Mount the lower test equipment panel brace (#27), using 2″ #10 flathead screws, two in 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 panels. 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

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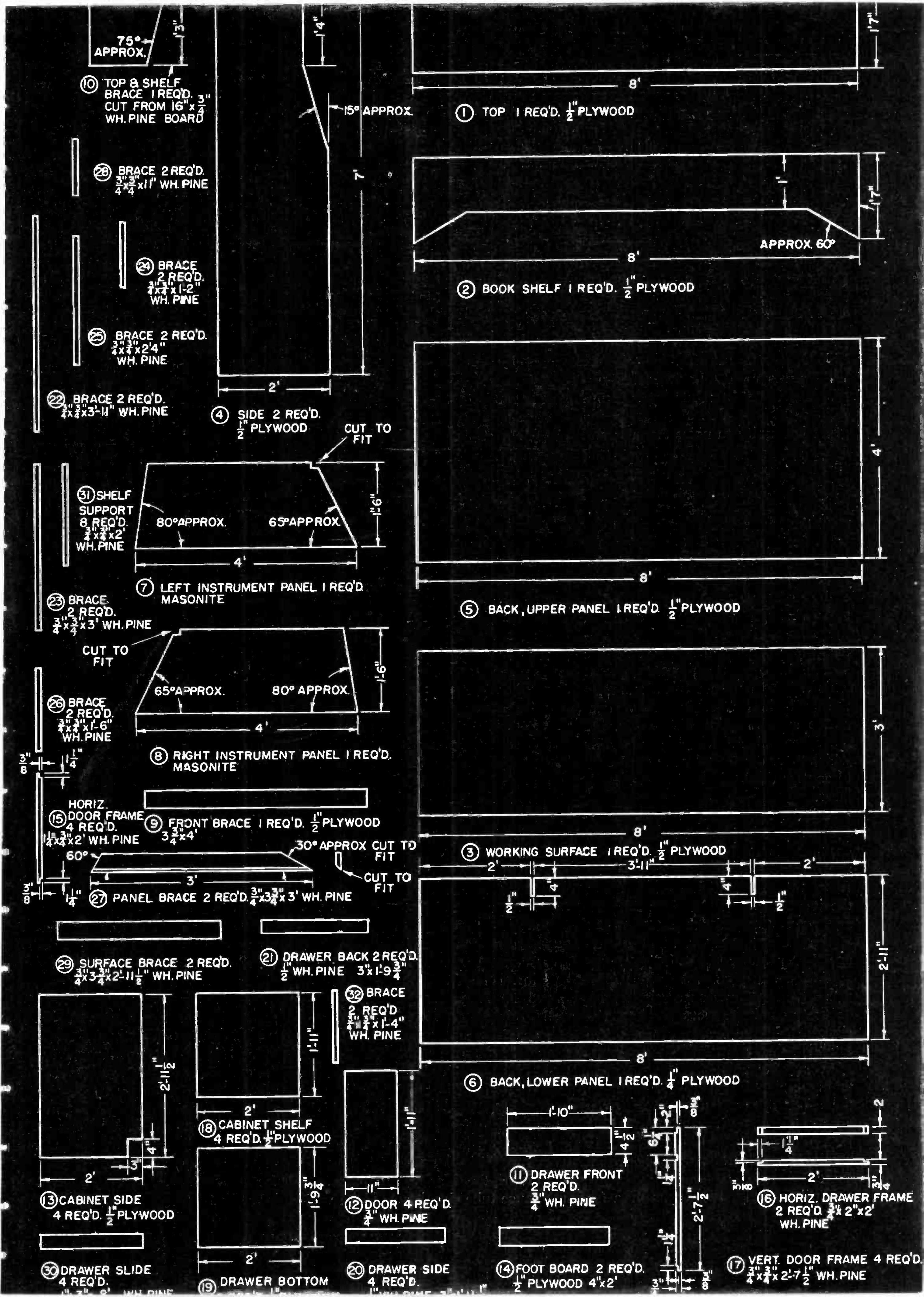

75° APPROX.
1'3"
(10) TOP & SHELF BRACE 1 REQ'D. 3" CUT FROM 16"x3/4" WH. PINE BOARD
1'4"
15° APPROX.
7'
2'
(4) SIDE 2 REQ'D. 1/2" PLYWOOD
8'
1'7"
(1) TOP 1 REQ'D. 1/2" PLYWOOD
1'
1'7"
APPROX. 60°
8'
(2) BOOK SHELF 1 REQ'D. 1/2" PLYWOOD
(28) BRACE 2 REQ'D. 3/4"x3/4"x11" WH. PINE
(24) BRACE 2 REQ'D. 3/4"x3/4"x1-2" WH. PINE
(25) BRACE 2 REQ'D. 3/4"x3/4"x2'4" WH. PINE
(22) BRACE 2 REQ'D. 3/4"x3/4"x3'-11" WH. PINE
4'
8'
(5) BACK, UPPER PANEL 1 REQ'D. 1/2" PLYWOOD
CUT TO FIT
(31) SHELF SUPPORT 8 REQ'D. 3/4"x3/4"x2' WH. PINE
80° APPROX.
65° APPROX.
1'-6"
4'
(7) LEFT INSTRUMENT PANEL 1 REQ'D. MASONITE
(23) BRACE 2 REQ'D. 3/4"x3/4"x3' WH. PINE
CUT TO FIT
65° APPROX.
80° APPROX.
1'-6"
4'
(26) BRACE 2 REQ'D. 3/4"x3/4"x1'-6" WH. PINE
(8) RIGHT INSTRUMENT PANEL 1 REQ'D. MASONITE
3'
8'
(3) WORKING SURFACE 1 REQ'D. 1/2" PLYWOOD
3/8"
1 1/4"
HORIZ. (15) DOOR FRAME 4 REQ'D. 1 1/4"x3/4"x2' WH. PINE
(9) FRONT BRACE 1 REQ'D. 1/2" PLYWOOD 3 3/4"x4'
30° APPROX CUT TO FIT
60°
3'
CUT TO FIT
(27) PANEL BRACE 2 REQ'D. 3/4"x3 3/4"x3' WH. PINE
2'
3'-11"
2'
4"
4"
1/2"
1/2"
2'-11"
8'
(6) BACK, LOWER PANEL 1 REQ'D. 1/4" PLYWOOD
(29) SURFACE BRACE 2 REQ'D. 3/4"x3 3/4"x2'-11 1/2" WH. PINE
(21) DRAWER BACK 2 REQ'D. 1/2" WH. PINE 3"x1'-9 3/4"
(32) BRACE 2 REQ'D 3/4"x3/4"x1'-4" WH. PINE
2'-11 1/2"
4"
3"
2'
(13) CABINET SIDE 4 REQ'D. 1/2" PLYWOOD
1'-11"
2'
(18) CABINET SHELF 4 REQ'D. 1/2" PLYWOOD
1'-9 3/4"
2'
(19) DRAWER BOTTOM
1'-11"
11"
(12) DOOR 4 REQ'D. 3/4" WH. PINE
(20) DRAWER SIDE 4 REQ'D.
1'-10"
4 1/2"
(11) DRAWER FRONT 2 REQ'D. 3/4" WH. PINE
(14) FOOT BOARD 2 REQ'D. 1/2" PLYWOOD 4"x2'
2'-7 1/2"
1 1/4"
2'
(16) HORIZ. DRAWER FRAME 2 REQ'D. 3/4"x2"x2' WH. PINE
(17) VERT. DOOR FRAME 4 REQ'D. 3/4"x3/4"x2'-7 1/2" WH. PINE
(30) DRAWER SLIDE 4 REQ'D.

New Circuits

Late receiver model introduces new

FLYWHEEL SYNC CIRCUITS

by Morton G. Scheraga

Allen B. DuMont Labs.
Co-author *Video Handbook*

A review of flywheel sync circuits found in earlier telesets and a discussion of the improvements which have been made in G-E's TV model 820

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 osillator 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

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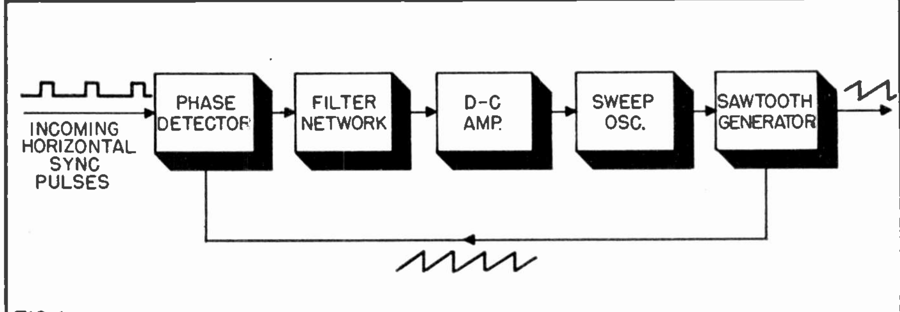

FIG. 1

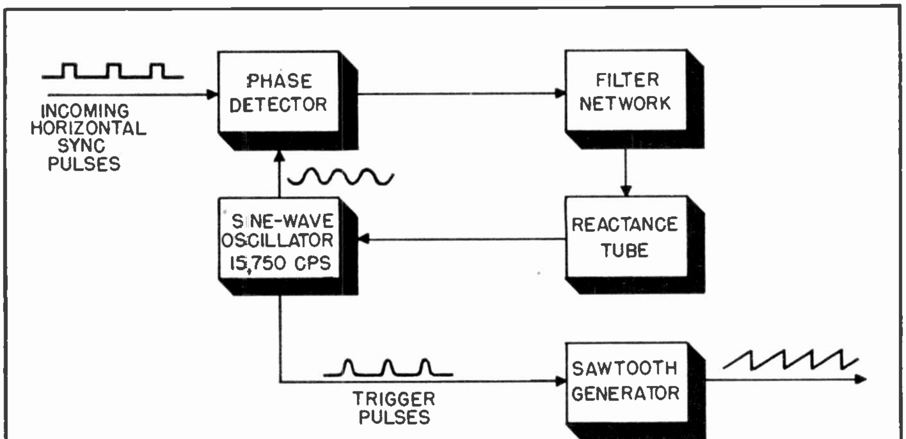

FIG. 2

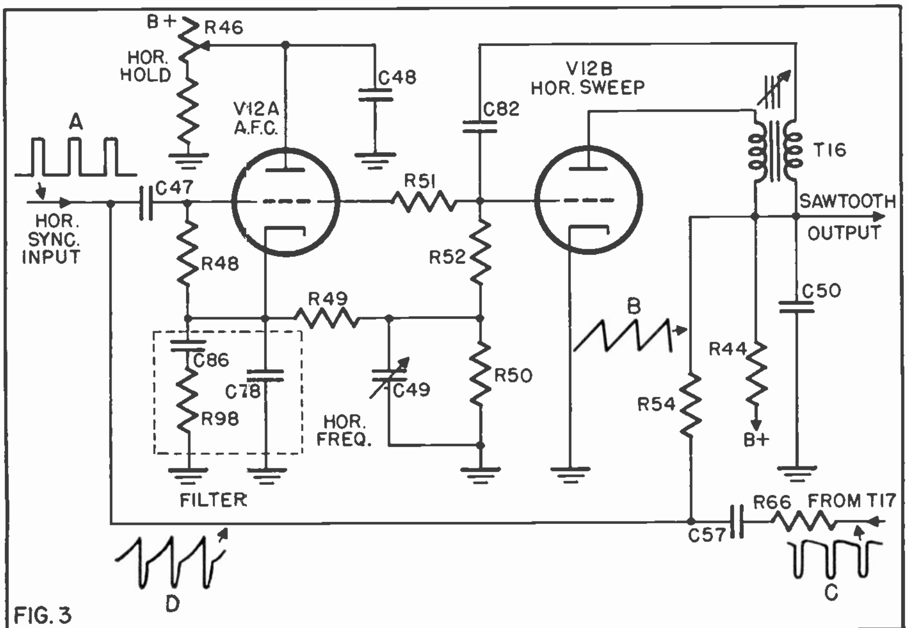

FIG. 3

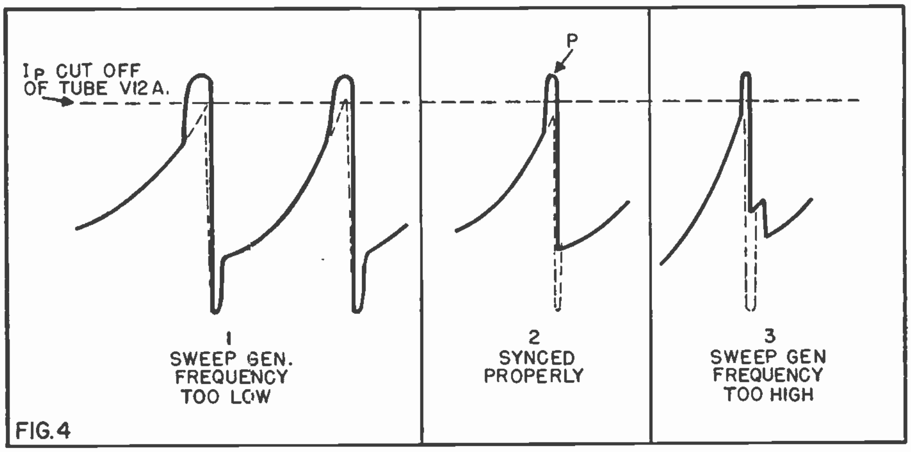

FIG. 4

Fig. 1 Block diagram of the first a-f-c sync system.

Fig. 2 Block diagram of a later version of flywheel sync circuits. Phase comparison voltage is sine wave, generated by Hartley oscillator.

Fig. 3 Schematic diagram of latest sync circuit, as it appears in G-E's Model 820.

Fig. 4 Three different phase conditions of signals in a-f-c circuit. Each condition is indicated in diagram.

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 10⅛" 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 convention 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. ✔✔✔

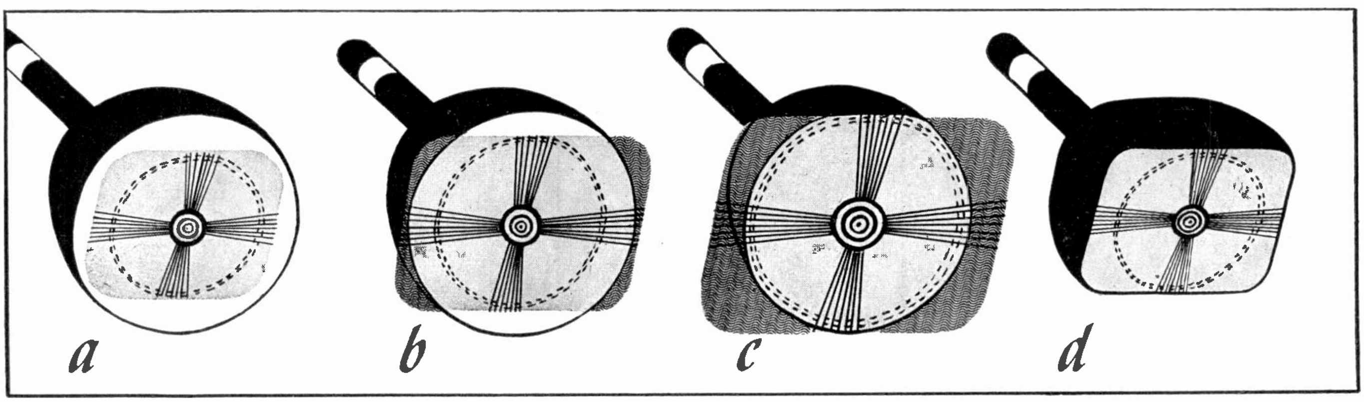

Fig. 1 Reproducing rectangular transmission on circular screen. A) 25% of tube face area lost. B) 14% of face area, corners of picture lost. C) Tube face area completely utilized, 38% of picture lost. D) No loss of tube face or picture area

Business Management

How to set up a

PERPETUAL INVENTORY SYSTEM

by Betty Lee Gough

Accurate records make for good management. Here's an efficient system to make you a better businessman

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 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 few quick notations give a complete picture of your reserve stock situation at all times; and it can be used as a efficient pricing tool. An inventory which does all these things should be pretty complicated. But in practice is it 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.

ITEM Compak Portables

Sold by P. Smith

Stock no. 82-B

Maximum	20
Minimum	10
Mark-up	30%

No. & Date Purchased (1)		No. & Date Drawn out (2)		Total on Hand (3)	Cost (4)	Unit Cost (5)	Ext. Cost (6)	Selling Price (7)
20	5/28/49			20	240	12.00	12.00	15.60
		2	5/29/49	18				
		11	6/1/49	7				
13	6/2/49			20	162.50	12.50	12.30	15.99

Fig. 1 Here's how perpetual inventory card looks when in actual use. At one glance you obtain all information necessary to keep your supply problems well managed

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 ın Main Street.

Joe's present volume of sales runs lose to six figures yearly. He keeps . sizeable stock on hand, and specializes in low-profit, high volume sales. Since he has changed to the perpetual inventory system, he finds that ıe does not "run out" of his fast noving items as he formerly did vhen he looked around the store to lecide when orders should be sent to he jobber.

Portable radios are his fastest sellng line. They move so fast that he ıas to keep at least 10 on hand at all imes. His normal inventory is about 20. So on the perpetual inventory card 20 was marked in the "maxinum" box and 10 in the "minimum." The portables cost him $12.00 and ıe expects to get a markup of 30% ɔn them. So 30% goes into the narkup indicator. The selling price, vith 30% markup added, is $15.60.

On June 1 the records indicated hat 18 portables were in stock. On that date Mr. Brown took out 11 to replenish his low floor stock. The record now showed 7 left in reserve, ess than the minimum he wanted on ıand. So an order for 13 was telephoned to the wholesaler, bringing the reserve back to 20.

When the sets arrived, he discovered that the price had gone up to $12.50 a piece.

Extending his unit cost by averaging the costs of the 7 sets he had ɔn hand, and the 13 he had just ordered, he found that the average (or extended) unit cost of his total stock was $12.30. So $12.30 was entered n column six. Marking up this figure by 30% gave Mr. Brown $15.99 for his new selling price. The $15.99 allowed a fair markup on the new stock, and increased the markup on he old only enough to give him a fair selling price for the total stock. In this way he made sure that his price would be competitive, yet still allow him a reasonable profit.

Of course, the perpetual inventory can never completely replace the "count 'em" method of keeping inventory. But it can make the countng less of a chore, and one that can safely be done not more than once a year. The physical inventory serves as a check on the perpetual inventory setup. It is vitally necessary to make this physical check once every year, because doing so is the only

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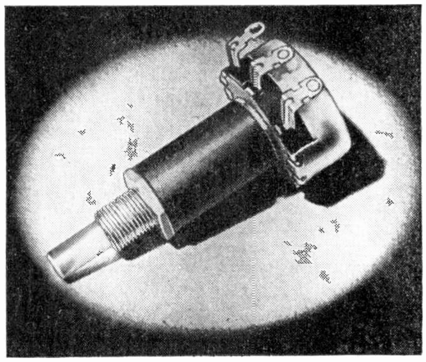
the INDUSTRY *Presents*

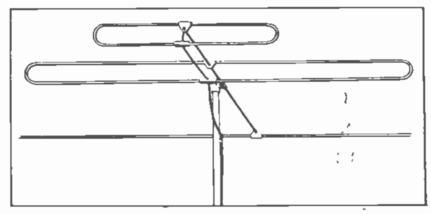


HIGH VOLTAGE COUPLER CONTROL

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.**

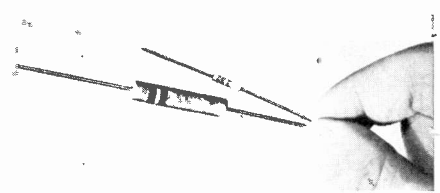
3"-OSCILLOGRAPH

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 10⅞" x 8⅛" 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.**



NEW ANTENNA LINE

Cornell-Dubilier has just introduced the first model of its Skyhawk antenna line. It's called the Skyhawk Strate-Line, 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 ⅓ watt and 2-watt units. Type BTR at ⅓ 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. **International Resistance Co., 401 N. Broad Street, Philadelphia 8, Pa.**

;weep Generator

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erence frequencies)

Note how the TV band is covered vithout the use of bandswitching, liminating a possible source of eratic operation, and at the same time educing the cost of the unit. For ase of operation, the dial is cali›rated in terms of TV channel num›ers. The sweeping effect is proluced as follows:

The fixed frequency oscillator is uned by means of a flat open wound piral coil (L3), mounted on a bakeite plate. The plate is mounted on he chassis close to a unit which is ssentially a PM speaker with a netal membrane attached to the cone. Che membrane is free to follow the 'oltage variations in the voice coil ınd will thus vary the frequency of he oscillator at a rate determined by he frequency of the voice coil voltıge and by an amount (sweepwidth) letermined by the amplitude of the ıpplied voltage.

The control voltage is tapped from he 6.3-volt filament winding and ap›lied to the voice coil through R3 ınd R2. R3 serves to limit the maxinum voltage applied to the coil at ıny setting of R2, and thus prevents :xcessive excursions of the metal nembrane. R2, which is accessible from the front panel, then functions ıs the sweepwidth control.

The design of the modulator unit ıllows a sweepwidth of up to 30 Mc, vhich is more than adequate for use vith any single channel. By using he full 30 Mc sweep, it is possible o compare the relative gain of sev:ral channels. For example, by set:ing the main frequency control to channel 3 and the sweepwidth to naximum, 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 teleset or the 'scope connecting leads. Failure to use shielded test leads for the oscillograph, neglect of proper

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Block Diagram

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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.

However, there is one complication. Practically all of the 7-inch sets, and several larger ones, even though designed for a-c operation only, do not use transformers to energize the tube filaments. Instead, the filaments are hooked up in a series-parallel circuit across the line. For example, in the Motorola VT 71, the filaments are connected as shown in Fig. 3.

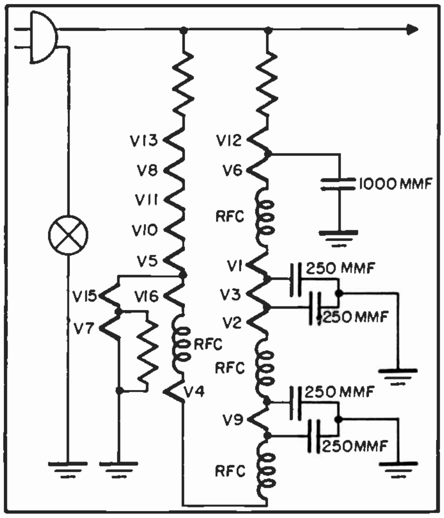

Fig. 3 Filament hook-up in the Motorola VT-71. Filaments are hooked up in series parallel circuit across line

This, apparently, throws the block diagram out of the window. One filament opening up can knock out several other stages in various sections of the reeciver or even all other stages (if, for instance the filament of V15 opens) and make the block diagram appear to be useless for troubleshooting purposes. But the reverse is true. It is only necessary to keep in mind the servicing situation of the ordinary ac-dc superhet. When the set is turned on and no tubes light, an open filament is suspected (since the filaments are in series). Once all the filaments light and there still is trouble, the standard procedure is followed: Find the defective stage, locate the faulty component.

The same approach is used in the transformerless type of teleset. The first step will be to check if all filaments are lit. If all or some are out an open filament would be suspected (In Fig. 3, an open r-f choke or ballast resistor could also open up one string of filaments). Once the filaments are lit and there still is trouble, the standard servicing approach outlined here is followed.

An increasing number of larger receivers are using the intercarrier sound system. With this system sound is usually not taken off and fed to the audio strip until after the video amplifier stage. Therefore, a larger number of stages are common to the video and audio i-f signal. Where there is a raster, but no sound or picture, not only the front end but also the common stages would be suspected and further checks made there too.

To sum up: knowledge of the block diagram of the receiver being serviced, which includes the arrangement of the low voltage supply and the filaments, is one of the best insurances for quickly locating the defective section. ✓✓✓

Flywheel Sync •

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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 larger portion of it falls down into the trough of waveform D, as shown in curve (3). This conditon results in the shortening (narrowing) of the conducting 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

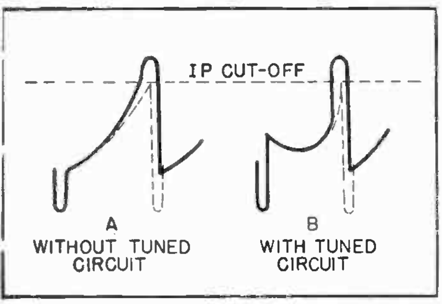
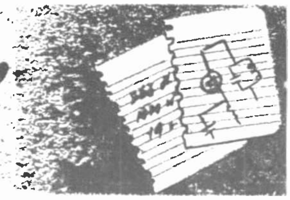


Fig. 5 Comparison of a-f-c waveshapes, with and without additional tuned circuit in plate of blocking oscillator.

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.

THE *Notebook*



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 audi IF. Be sure these are good tube

f. Change the 6K6GT audio ou put tubes to 6V6GT. No circu change will be needed.

The above changes will improv audio sensitivity and output, but i is recommended on receivers wher the complaint is low volume on T in fringe area operation. It must b remembered that in some areas th TV transmitter is only deviating it audio transmission 7 to 10 kc ir stead of the allowable 25 kc, whicl will result in low audio volume a the receiver.

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

From Admiral Service Bulleti TV-44

Coupling Sweep and Marker Generators to Receiver

When using a sweep generator marker generator, and oscillograpl to check the i-f response curves o a television receiver, it is sometime difficult to obtain the correct bal ance between sweep output an marker output. This is particularly true when the ranges of the individ ual attenuators are limited. For bes results, the amplitude of the applied sweep voltage as well as tha of the marker voltage must be adjusted to a fairly critical level.

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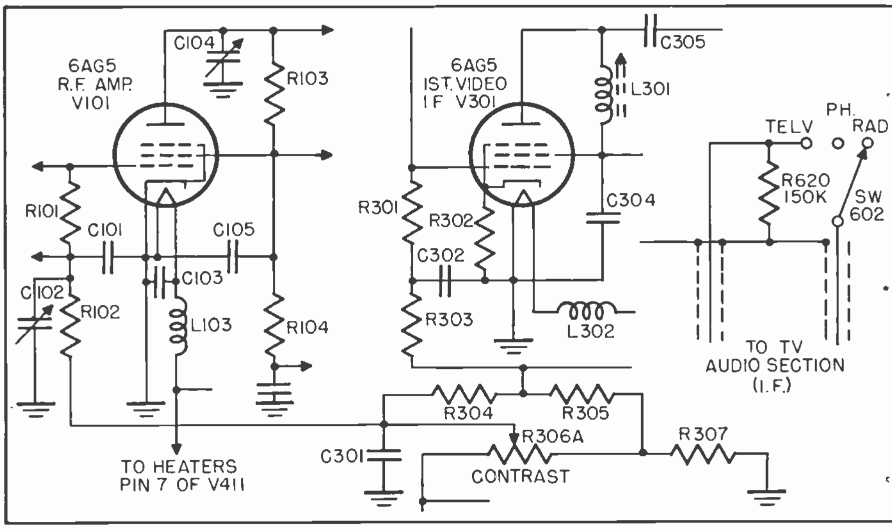


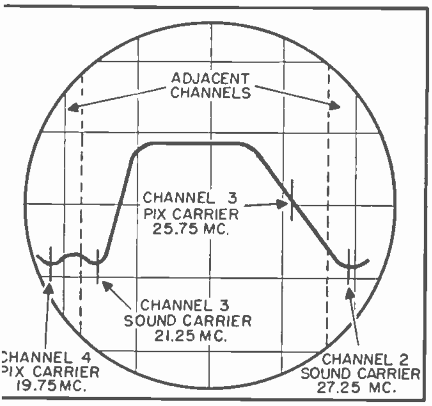
›weep Generator

· from page 33

rounding provisions, etc. are all robable sources of unsatisfactory esults. Finally, the sweep generator hould supply an extremely accurate gnal for marker pips. One answer ; to incorporate into the unit a varible frequency oscillator with exceponally high frequency stability and alibration. This solution would re-.ilt in high expense, which may not e necessarily justified.

requency stability

In the Model 360, the problem is net by providing a crystal oscillator lower half of 12AU7) and a crystal older mounted on the front panel. 'he most obvious procedure is to use rystals at the exact frequencies pecified for alignment. However, nis too can be a costly process. A imple and very effective alternative ; to use a crystal of *any* frequency nd use its harmonics to calibrate a tandard r-f signal generator, which nen becomes the marker generator. 'or example, assume that a frequeny of 21.25 Mc is required for sound :ap alignment. A 5000 kc crystal is vailable. The external r-f generator ; set to 20 Mc and checked against ne 4th harmonic of the crystal oscilator. If the external generator is out f calibration, it may be realigned.)r the amount of error may be noted nd allowed for when setting to the esired frequency. Naturally, a judiious choice of crystal is important. t reduces the amount of necessary nterpolation, and increases the efectiveness of this method.



ig. 2 Typical video i-f response curve

Inasmuch as most service organiations are equipped with a reasonbly high quality r-f generator, the rystal marker becomes a very desirble feature, increasing the versatility and utility of the instrument.

Industry Presents

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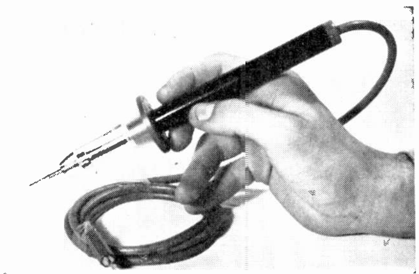
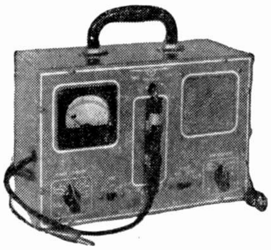


MULTIPLIER PROBE

This probe, known as the "Kilovolter", 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 8½" 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 1½" 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. 25 St., N. Y. C.**

Notebook

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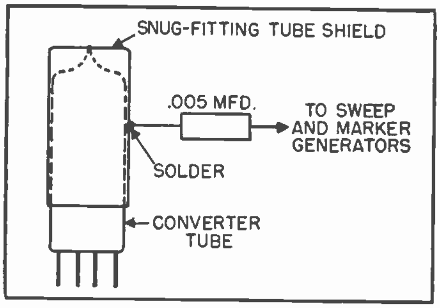
The coupling method shown in the diagram provides additional control of the sweep and marker voltages. By sliding the tube shield up or down on the tube, the capacitance between the shield and the tube elements is varied, and the coupling can be adjusted as desired. Another advantage of this method is 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 are 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.

Glueing

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

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

The plywood working surfac should be covered with a more dur able material to improve its appear ance and lasting qualities. Material which can be used, in order of pref erence are: hardwood tongue-in groove flooring, tempered Masonite and linoleum. Formica may also b used, but is quite expensive.

Painting

Two coats of paint (any color) are sufficient for a utility job to pro tect the surfaces. The first coa can be thinned out for priming pur poses. Where appearance is impor tant, the various wood ends and sur faces should be carefully sanded an the entire bench covered with a fir coat of Firzite.