The Sun

Television Data Sheets

Compiled by RALPH R. BATCHER.

COMPONENT PARTS

A common query of radio experimenters who are following this series of data sheets concerns the possibilities of home construction of television receivers. In Great Britain the British Broadcasting Corporation is sponsoring television programs and a number of commercial equipment concerns have made available sets of the necessary parts. An appraisal of the results being obtained from such home-assembled receivers is being sought from an independent observer and will appear in these sheets.

At present there seems to be a general reluctance on the part of all commercial organizations developing television in this country to enlist the amateur and experimental radio organizations in the investigation of reception conditions and other matters. However, a few experimental stations are transmitting programs frequently enough to arouse amateur interest and provide an incentive for setting up practical circuits.

Cathode ray tubes are useful in many fields of endeavor besides television. We will therefore give in these data sheets accurate information on oscillographic circuits in addition to numerous varieties of, and arrangements possible, in the construction of the equipment items listed on sheet 210.1. To give a complete picture these alternate arrangements are included to permit some latitude in construction methods and to fit in with the requirements for a number of cathode ray tube sizes. These circuits will be laboratory tested before publication, the work being a few of the experimental projects that are a part of a television course at the West Side Y. M. C. A., where the apparatus is tested under actual working conditions by members of the class.

The use of standard parts of reputable makes will be incorporated wherever possible to facilitate duplication of the apparatus. It is our intention to describe several types of receivers, scanning oscillators, &c., followed by photographs of each item.

Sheet 400.2.

The Sun
Television Data Sheets

Compiled by RALPH R. BATCHER.

AN EXPERIMENTAL PROGRAM

Numerous inquiries have been received concerning the best method of getting started with a television receiver. While the basic theories of the component parts have mostly been covered in these sheets, a co-ordinated assembly plan can be outlined in which those parts that are the most difficult to get to working properly are built first.

Assuming that those interested have only a certain amount of time and money available with which to do the work, the following plan is recommended:

1. Set up a small inexpensive receiver by which the television band can be located by its sound program. From this the operating schedule and reception data can be checked. Also the special antenna installation requirements can be investigated. A receiver for this purpose is not expensive and can be used later for sound program reception along with the regular vision receiver. Until the time comes when several television programs are available on the air, the problem of double tuning (setting for sight and sound programs on two separate receivers) is not difficult and separating the receiver functions will eliminate some of the problems encountered. For purely monitoring purposes a type of super-regenerative receiver, frequently used for amateur reception, is simple and inexpensive and will be described first.

2. Using item 1, then determine best design and location for the antenna. (Date Sheets have been prepared to cover this matter.) Except for short ranges the usual antenna arrangement will not supply a satisfactory signal, and even slight changes in an antenna may reduce the cost in the receiver considerably.

3. Set up a video receiver, the layout and sensitivity of which depends upon the results obtained in the particular location used in testing item 1. This item usually gives the most trouble to experimenters working without laboratory equipment.

4. Set up the cathode ray tube and its associated circuits last. This latter is straight-forward procedure and without major complications and while this portion of the equipment is the most interesting and spectacular to the beginner, it should present no unusual difficulties.

The Sun

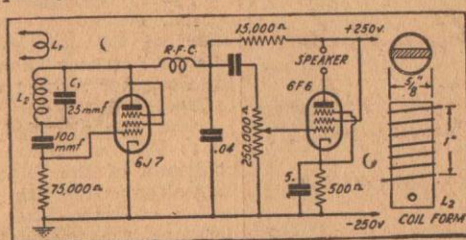
Television Data Sheets

Compiled by RALPH R. BATCHER.

AN EXPERIMENTAL PROGRAM

The "sound" receiver, mentioned on sheet 400.3, can be rather simple if desired, using two tubes, since it is to serve only temporarily for monitoring service while the main television receiver is under construction. At a later period it can be enlarged or combined with the video receiver in order to improve its fidelity and sensitivity. However, the circuit shown in the figure below is capable of receiving the Empire State transmissions with loud speaker volume at a distance of ten or fifteen miles, or "headset" reception at longer ranges, probably to the full transmission range of the transmitter.

However, it is not recommended that this receiver be used if the distance is greater than about fifteen miles, since with low signal strength these receivers (the super-regenerative type) have a high background noise or hiss which can become very annoying, but which is hardly noticeable when the signal carrier is greater. A simple super-heterodyne receiver will be described in a later sheet which will give better quality with weak signals.



The constants of the various items connected with the two-tube super-regenerative receiver given herewith are not critical. The inductance coil, L_2, consists of seven turns of No. 14 copper wire (bare) wound on a ½" round rod and then slid off and "screwed" onto a notched bakelite strip 3/16"x⅝"x1½", shown at the right in the figure. The turns will have enough natural tension to stay in place. The coil L_1 consists of one or two turns of wire, preferably mounted so that the coupling between it and L_2 can be varied. A representative mounting arrangement for the parts of this receiver will follow on a later sheet. The tuning condenser C_1 is a Cardwell Trimair, type ZR25AS, and covers the range from 40 to 70 megacycles. The RFC coil consists of about fifty-five turns of No. 30 enameled wire closely wound on a non-metallic rod (such as wood) ¼" in diameter.

Sheet No. 400.4.

(To be continued.)

The Sun
Television Data Sheets

Compiled by RALPH R. BATCHER.

SIMPLE RECEIVER FOR TELEVISION SOUND

Many experimenters doubtless have a short wave receiver available that will pick up signals in the amateur 5-10 meter bands, which can be used for receiving the sound program of a television station. The circuit shown on sheet 400.4 will enable others to make preliminary tests along this line without incurring much expense, since only two tubes are involved. The actual mounting and wiring of the parts shown do not need special precautions and a wide variety of cabinet sizes and styles can be used if available. The chassis, cabinet and speaker from a discarded a. c.-d. c. set have been used in one instance.

A chassis and panel layout that is particularly convenient and compact is shown on sheet 400.6, consisting of two pieces of aluminum, the panel and the base. The latter has two very simple bends only, and with the exception of two sets of holes for octal sockets, but few additional holes which might deter home constructors.

The main tuning condenser, a 25 mmf variable condenser, is mounted away from the front panel so that both rotor and stator are insulated from ground. This condenser also has the 100 mmf fixed condenser and the grid leak resistor mounted on it, together with the inductance L2, which is supported by its own leads. The antenna coupling coil consists of two turns of No. 14 wire self supporting, the ends of which are soldered to lugs at the end of a short strip of bakelite. This strip is mounted on an angle bracket, and arranged so that the distance between the two coils can be adjusted.

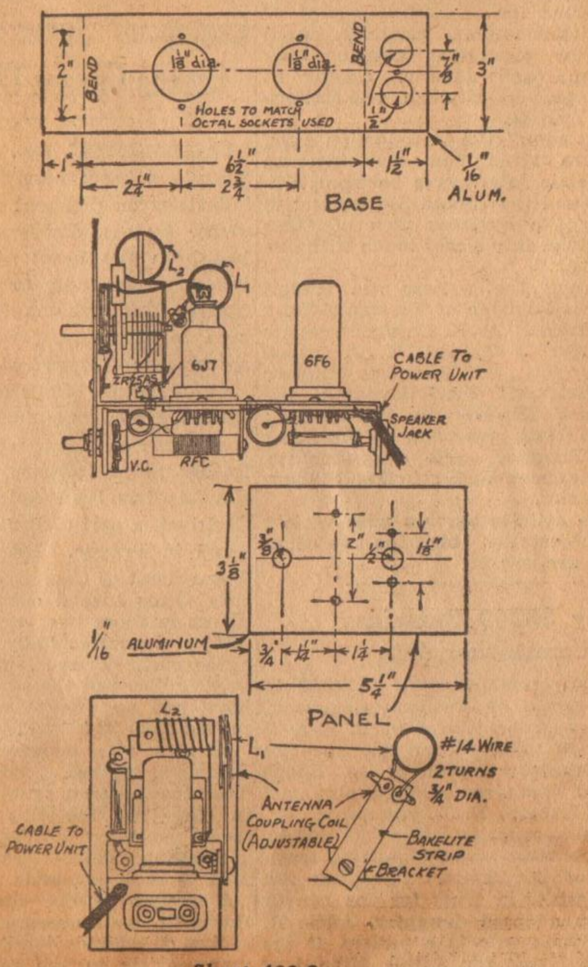
The shell of the 6J7 tube should be grounded by means of its regular terminal on the base, and in addition it is desirable that a second ground wire be soldered to the side of the shell and run direct to the cathode terminal on the socket. This may prevent the rapid changing of tubes, but the improved grounding circuit generally gives a much more stable operation. If desired a metal strip may be wrapped around the shell and tightened by a screw and nut to eliminate the need of soldering a wire to the shell itself.

There are no critical values for any of the circuit constants listed on sheet 400.4, although in some cases a different value of grid leak resistance (having values up to several megohms) might be tried. A permanent magnet dynamic speaker may be used with this set.

The Sun
Television Data Sheets

Compiled by RALPH R. BATCHER.

SIMPLE RECEIVER FOR TELEVISION SOUND



The Sun
Television Data Sheets

Compiled by RALPH R. BATCHER.

CATHODE RAY TUBE CHARACTERISTICS—FOCUSING

With such a variety of cathode ray tubes available that are especially developed for television, tubes can be selected according to their characteristics. One particularly important factor is its focusing capabilities under the rather exacting conditions of television scanning. The perfection of methods whereby highly exhausted tubes can be accurately focused is the most important advance in cathode ray tube development in the last decade. These principles permit the separation of the focusing and modulation functions.

In brief, the heated cathode is shaped so that the active emission area is rather closely confined to a small spot. The emitted electrons are quickly accelerated to a rather high speed, which may be 5 to 10 per cent of the speed of light, but at the same time this acceleration is directed along a particular path. This path leads the jet through a series of small orifices, which may be located in the anode, or in the intermediate focusing and modulating electrodes.

Electrons by nature carry a negative charge, and following one of the common principles of physics are repelled by electrodes carrying a negative potential. If the latter electrode completely surrounds the stream of electrons the latter will be squeezed into a slender stream, which is just what is needed to produce focusing. Generally speaking, the faster the electrons travel under the attractive influence of the anode the greater the focusing force that must be applied, since the electrons are under the repelling influence for a shorter time. The tube designer is able to shape the focusing electrodes so that they are closely coupled to the electron stream, or they may be more spacious with less influence, but no matter which is done there should be a particular voltage that can be applied to the electrode which will bring about focusing, where this voltage is measured as a per cent of the voltage applied between cathode and anode. In many designs, at least in the RCA-Radiotron series, the focusing voltage is arbitrarily set at a value approximately equal to 20 per cent of the anode voltage. In other tubes this may be 50 per cent, so that it can be connected directly to the center tap of a voltage-doubling rectifier circuit. It has been shown in some German tubes and in other designs that with certain electrode arrangements this electrode can be given a charge that is the same as the cathode voltage; that is, they can be considered as a fixed focus tube. These tubes have not been reported commercially available in this country as yet.

(To Be Continued)

The Sun

Television Data Sheets

Compiled by RALPH R. BATCHER.

CATHODE RAY TUBE CHARACTERISTICS—FOCUSING

(Continued)

With good designs the object is to get the maximum percentage of the emitted electrons to pass through all of the electrode orifices and reach the fluorescent screen. This is done by shaping the cathode emitting area properly, by correct sized electrodes, and above all by extremely accurate alignment of the central holes, so that they all are located on the exact axis of the ray. These factors are all dependent upon the precision of tube construction.

However, in laying out the circuit that develops the voltages that operate the tube the user can easily disrupt the focusing. The matter of applying wrong voltages to the electrodes is one matter. Care must be taken in the connections so that the voltages applied to the modulation electrodes, commonly called grids, do not exceed the manufacturer's limits. The electrodes are sometimes slightly magnetic in some tubes, and strong fields applied near them may leave a trace of magnetism in the metal. Such fields will easily prevent proper focusing. The deflecting fields (when used with the tube) should not overlap the electron gun to any great extent for the same reason. Improperly filtered power supplies will also cause a widening of the electron ray, and in high voltage tubes the customary filter, consisting of a condenser only, may not be enough. Due to the cost of high capacitance, high voltage condensers, it may prove more economical to use a high inductance choke coil in conjunction with one (or two) smaller sized condensers, to provide adequate filtering.

One frequent trouble occurs when variations in the modulation grid voltage affect the velocity with which the ray strikes the screen. In order to completely shield the control grid from the focusing electrode, a shield grid (sometimes called the No. 2 grid) is interposed between them. This electrode is given a fixed bias of around one or two hundred volts positive. Television tubes of the larger sizes, and operating at several kilovolts anode potential, are generally supplied with such an electrode, and improved focusing and scanning are apparent.

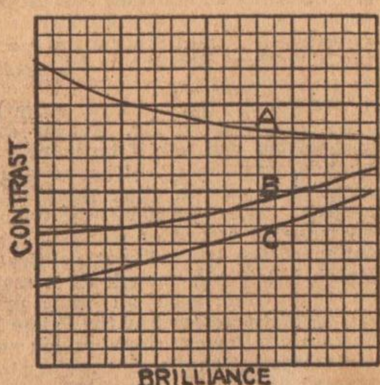
In many tubes the cathode is connected internally to one of the heater coil leads. Care should be taken that the power supply terminal, intended to be connected to the cathode, does not go to the wrong heater lead, because the a-c bias of a few volts would then be introduced into the modulation circuit, causing whole sections of the televised pictures to be dimmer than the opposite sections.

The Sun
Television Data Sheets

Compiled by RALPH R. BATCHER.

CONTRAST AND BRILLIANCE

Controls are available on the front of most television receivers marked Contrast and Brilliance. The former takes care of the range of illumination intensities that make up the picture, the darkness of the shadows and the intensity of the highlights. The Brilliance knob takes care of the overall illumination and can be compared with the turning up of the lights in a dimly lighted room while reading. In a television receiver operation, the two controls are rather closely interlinked, especially if the receiver is not sensitive enough to give a strong signal at the location where it is installed. If the signal output is only half as strong as it should be it is necessary to reduce the average brilliance to a lower value in the case of a dark viewing room. It is not possible to give absolute rules as to the optimum adjustment of these two knobs as certain other factors are important as well. The intensity of the room lighting, as mentioned above will affect the position of the best setting.



Generally the lighter the illumination in the room the more the Brilliance control should be turned up, as shown by the curves in the figure below. Here A, B and C represent three conditions of room lighting, with curve A the darkest room, and C a room with considerable illumination from lamps or the sun. These curves show the apparent illumination contrast ratio for a 10 volt video signal applied to the cathode ray tube. Normally at least 30 volts are required at this point for best results. However, even with a stronger signal it is desirable to keep the room illumination down to obtain the best results as to picture contrast, unless it is found that the eye strain is increased thereby. In the later case the brilliance of the picture can be reduced and still provide plenty of contrast in the darkened place.

The Sun

Television Data Sheets

Compiled by RALPH R. BATCHER.

SCREEN ILLUMINATION PROBLEMS

Television development has largely been dependent on the improvements in the design of cathode ray tubes. From the very beginning it has been the capability of these tubes that has established the level of the entertainment value of television reception. It happens that this is still true and in spite of the many improvements that have been incorporated in their design there is still need for new ideas.

The two most outstanding factors that merit consideration are the reduction of cost and an increase in the light output. The former factor is largely a matter of demand; when sales increase to a point where automatic production methods can apply the cost will come down.

The second factor—that of increasing the light output—is being given much attention and many angles of attack are being studied. Since all tubes at present use fluorescent screens for the production of light the properties of fluorescent materials are receiving much attention. The matter of the colors of fluorescence is less important, however, since the rules for production of materials giving white light, or in fact any other colors, have been worked out. It now seems improbable that important discoveries will be made that will greatly increase the efficiency of such screens to a point where a large increase in the light output for a given input wattage would be produced. Attention is given, however, to the development of materials (and the methods of their application) that will handle really large amounts of power; hundreds of watts or even a few kilowatts. Electron beams are now used in some experimental tubes that have accelerating voltages of 80,000 or 100,000 volts, delivering some 300 or 400 watts of energy to the screen. In this design the fluorescent material is coated on a metal sheet but on account of the heat developed these plates must be artificially cooled. The application of these "front" coated screens requires that the electron ray be projected from an angle. The use of incandescent screens in cathode ray tubes was suggested many years ago but their inefficiency (compared to fluorescent screens) discouraged their development.

A screen of this type may consist of a thin coating of resistive material (a metal film, layer of carbon, &c.) on a thin backing plate, such as mica. This film is heated to incandescence by the electron ray but cools immediately after the ray moves to another spot. Since a great deal of the heat was conducted away by the backing plate the efficiency was quite low in the earlier designs.

On the other hand at higher energy levels fluorescent screens fall off in efficiency, especially if the increased wattage is produced by increasing the beam current rather than the beam voltage. This accounts for the need for high velocity rays and high accelerating voltages rather than high currents and lower voltage rays.

Sheet 410.6.

(To be continued.)

The Sun
Television Data Sheets

Compiled by RALPH R. BATCHER.

SCREEN ILLUMINATION PROBLEMS

The light output limitations of fluorescent screens was taken up in the preceding Data Sheet, 410.5. Although incandescent screens have no such limitations, other difficulties have been encountered in their use. One of these has been the elimination of the supporting base plate for the heatable surface, so that heat dissipation is reduced. This matter required some study since it is necessary to control the heat loss in a definite manner, preferably so that each area retains its luminosity for one frame interval, one-thirtieth of a second.

A screen which consisted of a film of refractory metal, heated to incandescence by the impinging rays was disclosed by Langmuir, in an early cathode ray tube design. In another tube (developed by Clinker and Davis) the screen was made of a thin layer of finely divided carbon (soot) which became white hot from the cathode ray.

A more recent and improved development along this line was by Farnsworth. Many readers doubtless remember the gas-mantle age which existed before the use of the incandescent electric lamp became so widespread. These Welsbach mantles consisted of an oxide-coated "bag" inverted over the gas flame, made from a thin cloth sack thoroughly impregnated with various materials and then burned in such a way that the cotton cloth was destroyed leaving the residue which retained the original contour of the bag. This mantle was capable of giving much greater light output than the uncovered gas jet itself.

In the Farnsworth tube a screen of fabric is impregnated with special salts and likewise burned away. The screen structure remaining, although quite fragile, consists of a stretched screen of a material that gives an intense illumination whenever struck by an electron ray.

In the same manner that the Welsbach mantle improved gas-light illumination, this screen improves over the principles used in the older cathode ray tubes with incandescent screens. In carrying out this principle of design, the present Farnsworth tube uses a small screen so that the impinging energy is concentrated in a small space, but the brilliance is great enough to permit the illuminated area to be projected on a larger wall screen, in the manner of home movies. The smaller screen size also increases the factor of safety as well, since the screens are somewhat fragile. The use of incandescent screens in television tubes has one advantage: since the color of the picture is identical with that used in ordinary lighting it has a "natural" tint.

SHEET 410.7.

The Sun
Television Data Sheets

Compiled by RALPH R. BATCHER.

PICTURE CONTRAST AND GAMMA.

One of the undetermined problems which is still being investigated with a view of standardizing television procedure is that which controls the contrast values in the picture. The over-all brightness of a picture is under the control of the operator of the receiver controls, as it should be, by means of an adjustment of the bias on the cathode-ray tube. It is the relative gradations between maximum and minimum values that is giving concern to development engineers. A curve might be drawn showing the relative brightness of the received picture in relation to the brightness of the original studio (or filmed) scene. The term "gamma" refers to the slope of such a curve—and if the reproduced scene has the same contrast ratio as the original, the "gamma" is said to be unity.

Present television receivers have a "contrast" adjustment also, so that both brilliance and contrast may be set by the user. In fact the effective contrast depends to a large extent on the initial illumination in the room, upon halation effects in the glass screen surface of the tube and upon the extent of false background illumination caused by stray electron currents reaching the screen at points separated from the spot.

It might seem that the ideal arrangement would be to attain "unity gamma" duplicating the original but individual preference generally indicates that a greater-than-unity ratio is desirable if obtainable, sometimes as high as 2:1. This procedure is also used in motion picture work. The matter is rather difficult to evaluate, however, since original scenes are in colors and the television system must first convert color tints and shades into equivalent values of light and dark values of white light, and this is one of the psychological factors of vision. In addition the iconoscope itself is far from linear in regard to the output at various colors.

The present problem for every receiver owner is—what to do about it. With two controls to set a wide variety of contrast effects are brought about, and the average person usually feels the urge to do something about it, resulting in a continual juggling of the Brilliance and Contrast knobs.

Before making any decision as to whether this practice is necessary or unnecessary, an analysis must be made of the effect of several of the most important factors involved, one of which is the picture tube control circuit that is found in the receiver in question. In fact it can be shown that with some circuits an entirely different gamma ratio is obtained, than with others.

(*To be continued.*)

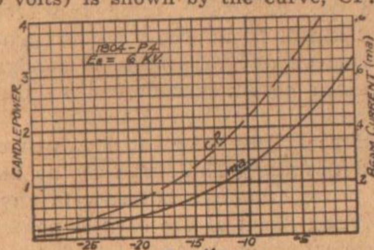
The Sun
Television Data Sheets

Compiled by RALPH R. BATCHER.

PICTURE CONTRAST AND GAMMA.

There is one fundamental difference in various receiver circuits that affects the picture contrast and the "gamma" factor described on the previous sheet. In some circuits the tube is maintained at maximum brilliance with no signal and the spot intensity is modulated downward. In other receivers the initial intensity is set at the threshold value—where the scanning field becomes just visible when no picture signal is applied.

An investigation of modulation curves for a typical picture tube, (see graph) shows that the luminous output is far from a linear function of the modulation signal voltage. The beam current in a tube (curve ma) is an expontial curve, approximating the 3/2 power. However, this curvature is reduced somewhat by the relation between beam current and light output per relation between beam current and light output per unit current, the latter falling off at the higher beam currents. The resulting output in candlepower (at 6,000 volts) is shown by the curve, CP.



In a receiver of the second type above there, the resulting "gamma" of the whole system has a chance of being greater than unity, in spite of the characteristics of some of the transmitting stations which may have a "gamma" of somewhat less than unity, although it is current practice to keep the gamma value of the transmitter close to unity.

The output characteristics of the pickup tube and its associated circuits are likely to have a gamma factor less than unity unless special correction circuits are applied to the video amplifiers in the transmitter system.

The problem of how much of the brightness/signal level ratio should be altered at the transmitter and how much at the receiver is a matter still to be settled, but no matter what happens the intelligent use of the controls will bring about suitable contrasts in the received scenes.

(To be continued.)

SHEET 410.9.

The Sun
Television Data Sheets

Compiled by RALPH R. BATCHER.

PICTURE CONTRAST CONTROL

One process which can be used in adjusting the picture Contrast and Brilliance controls of a television receiver is to set the latter before the modulating signal comes on the air. In many rooms it may not be desirable to use the same setting from day to day especially if the receiver is used during the daytime when room lighting conditions differ widely from night operation.

There are several circuit arrangements in use in the video amplifier part of the circuits, some of which have been described in previous data sheets:

1. Condenser coupled video stages with d. c. insertion. In these receivers the modulation grid can never become positive by misadjustment of the Brilliance control or a failure of a video amplifier tube. The RCA models (as for instance the TRK-9 and 12) and the Du Mont receivers are of this type.
2. Direct coupled video stages where the drop in the plate load of the final amplified tube is counteracted by a corresponding voltage from the Brilliance control so as to secure the desired initial picture tube bias. The Andrea KTE-5 model, as one example, uses such a circuit.

In the first system the modulation grid of the picture tube becomes more positive when the modulation signal appears, so that the "no-signal" adjustment is close to the point of the threshold of Brilliance.

This means that for the no-signal condition the screen illumination is just below the visible point, with the room illumination at the level to be used when the pictures are to be viewed. It is always desirable to keep the room lighting at a low value. In making adjustments while the television signal is being received the Contrast control can be turned to minimum value (counter-clockwise) first. Then set the Brilliance control to the threshold lever and turn up the Contrast until greatest clarity results.

Too much Contrast gives pictures with the black portions too black, the white portions too light and with little or no halftone effects (or shading) visible. The Brightness control will rarely need readjustment when set in this manner.

At some receiving locations it may be found that the Contrast control must be turned to full value to get the best results. This condition gives a warning that the signal strength should be increased somehow, such as by readjusting the "Fine" tuning control or in some cases by improving the r-f or i-f gain. It is often easiest in this case to alter the antenna's location or design to improve its pick-up.

(To be continued)

Sheet 410.10.

The Sun
Television Data Sheets

Compiled by RALPH R. BATCHER.

PICTURE CONTRAST CONTROL

(Continued)

In the preceding Data Sheet details were outlined as to the adjustment procedure of the Brilliance and Contrast controls for certain types of television receivers which have indirectly coupled video stages. In another Contrast control arrangement, exemplified in the Andrea KTE-5 receiver, described last year in these pages, a different procedure must be used. The video signal connections apply negative signals to the grid of the picture tube, which reduce the spot brilliance. Therefore the initial bias on the latter tube must be adjusted for maximum brilliance when the incoming signal is missing, or when the Contrast control is set at minimum.

This setting is more difficult to make since it is a matter of opinion just what maximum brilliance is. As in the other systems, the brilliance setting depends on the "ambient" lighting in the room and will vary considerably between daytime and night use, in most cases. If it is assumed that the normal signal strength is great enough to modulate completely the picture tube, the Contrast control will bring in full blackness in areas where such shades are required, otherwise the setting of both the Brilliance and the Contrast must be juggled together.

The problem is complicated considerably when insufficient signal level is to be had, since then the black level is never attained unless the initial brilliance is reduced. This does not always mean that the bias must be altered to give a lower value of maximum brilliance. Inspection of the modulation curves of typical picture tubes show that with a given modulation potential a wider range of light values (increased contrast) is obtained when a lower anode voltage is used. A somewhat lower anode voltage accompanied by a corresponding decrease in the initial bias may not produce a noticeable decrease in the overall picture brilliance but may improve the contrast considerably.

However, it is always recommended that the antenna system be improved first so that sufficient modulating signal be available to give best picture contrast (indicated by getting best results with the Contrast control set at a value less than the maximum).

Increased signal strength will also improve the synchronizing pulse level so that whenever the noise level increases there is less chance of accidental disruption of the scanning process. A signal strength of approximately one millivolt per meter is generally needed for fairly good freedom from noise interference although many of the more elaborate television receivers are capable of giving a complete range of contrast control voltages with an input of 150 microvolts.

Sheet 410.11.

The Sun

Television Data Sheets

Compiled by RALPH R. BATCHER.

POWER SUPPLY UNITS

The power unit supplying operating potentials for the cathode ray tube is the one essential piece of equipment required for an oscillograph, and is a fundamental unit for the television receiver. A number of makes and sizes of cathode ray tubes are available for oscillographic use at present, and some of these tubes will doubtless serve in television work. It will be advisable therefore to lay out the power supplies that will serve any of these tubes without major changes.

Since gas-focused cathode ray tubes are not well suited to television purposes, this unit, sheet 420.2, is arranged to fit (with minor changes in the mounting tube socket, &c.) any of the present RCA-Radiotron, DuMont, National Union or Western Electric high vacuum types that are provided with screens three inches or more in diameter. It will give an operating potential on the anode in steps from one to about three thousand volts. The model built for tests used in this series is shown in Fig. A, with a list of actual items used.

However, if it is decided that a three-inch tube will be sufficient as to size, a maximum of not over fifteen hundred volts is permissible, and the arrangement as shown in Fig. B is advisable. At a later date the filter can be revised at little additional cost and the voltage stepped up if new tubes become available.

It is usual with cathode ray oscillograph equipment to ground the positive side of the high voltage supply, so that the cathode and heater circuits are at a high potential with respect to ground. The danger attached to these circuits if not properly insulated and shielded from accidental contact cannot be overemphasized. The use of the usual push-back wire in wiring up the various items is unsafe, unless each wire is additionally protected with a good grade of spaghetti pushed over the regular insulation on the wire.

The 2.5 volt filament transformer winding provided to operate the heater of the cathode ray tube is needed only if the cathode ray tube is to be used experimentally for oscillographic work, or when making preliminary tests and checking the various controls. In the final television receiver it will be disconnected and the heater potential obtained from another source.

The Sun
Television Data Sheets

Compiled by RALPH R. BATCHER.

POWER UNITS FOR C. R. TUBES

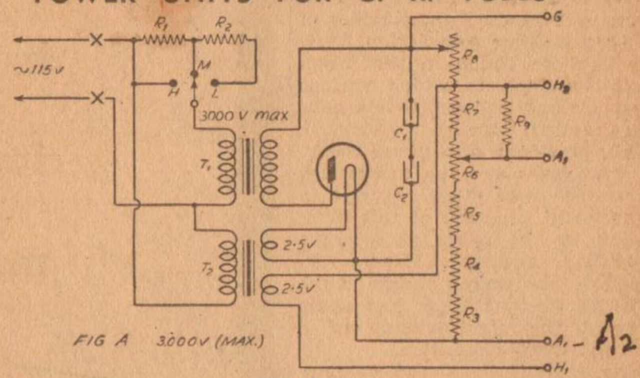


FIG. A.

R1, R2—500 ohms, 7 watts, type 991 Aerovox
R3, R4, R5—.5 meg., 1 watt
R6—.5 meg., 2 watts "Ex-Stat"
R7—.4 meg., 1 watt
R8—.1 meg., 2 watts, "Ex Stat"
R9—1.0 meg., 1 watt
T1—2000 volt, .018 amp., transformer, Thordarson Type CC
T2—Type T5338 Thordarson
C1, C2—1 mfd., type 2005 Aerovox

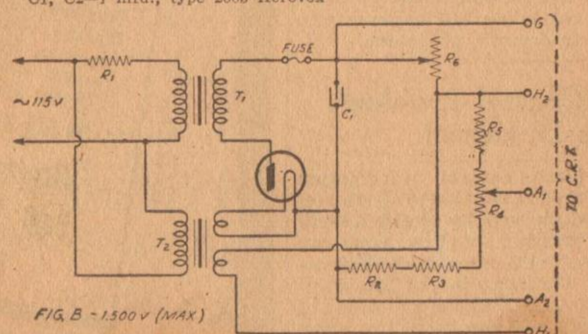


FIG. B.

R1—1000 ohms, 7 watts, type 991 Aerovox
R2, R3—.5 meg., 1 watt
R4—.5 meg., 2 watts, "Ex-Stat"
R5—.1 meg., 1 watt
R6—.1 meg., 2 watts, "Ex-Stat"
T1—Same as T1 in Fig. A
T2—Same as T2 in Fig. A
C1—mfd., type 2005 Aerovox

1 or 2

The Sun

Television Data Sheets

Compiled by RALPH R. BATCHER.

POWER SUPPLY UNITS

In the circuit shown on Sheet 420.2, where half-wave rectification is used, the filter consists of a single capacitance. This is permissible since the current drain is small and the capacitance has ample storage to carry over between the charging intervals from the supply transformer. The rectifier tube in either of the circuits is the Type 879 (RCA or DuMont).

In operation the two major controls, R-6 and R-8 in Fig. A, are mounted so as to be accessible from the panel and are designated, respectively, "Focus" and "Brilliance." Similarly in Fig. B the same designations are given to the controls, R-4 and R-6. The types of controls specified have well insulated shafts and may be mounted in holes without insulating bushings.

In connecting to the cathode ray tube, reference may be made to the following socket connections, which refer to a few of the commoner types of tubes used in oscillographic work. It is to be noted, however, that manufacturers of these tubes make no claims (so far) as to their operating characteristics and capabilities in television applications (see Sheet 210.3).

SOCKET CONNECTIONS
(Bottom Views)

RCA 905-907 DUMONT 94-8H

RCA 906-908 DUMONT 34H

W-E-325-326

It may be of interest in this regard to note that as soon as television programs were made available to British experimenters, tubes with screens 10" and 12" in diameter were immediately introduced by at least four or five manufacturers at prices approximately equivalent to $60 to $75. These tubes have characteristics acceptable for television purposes.