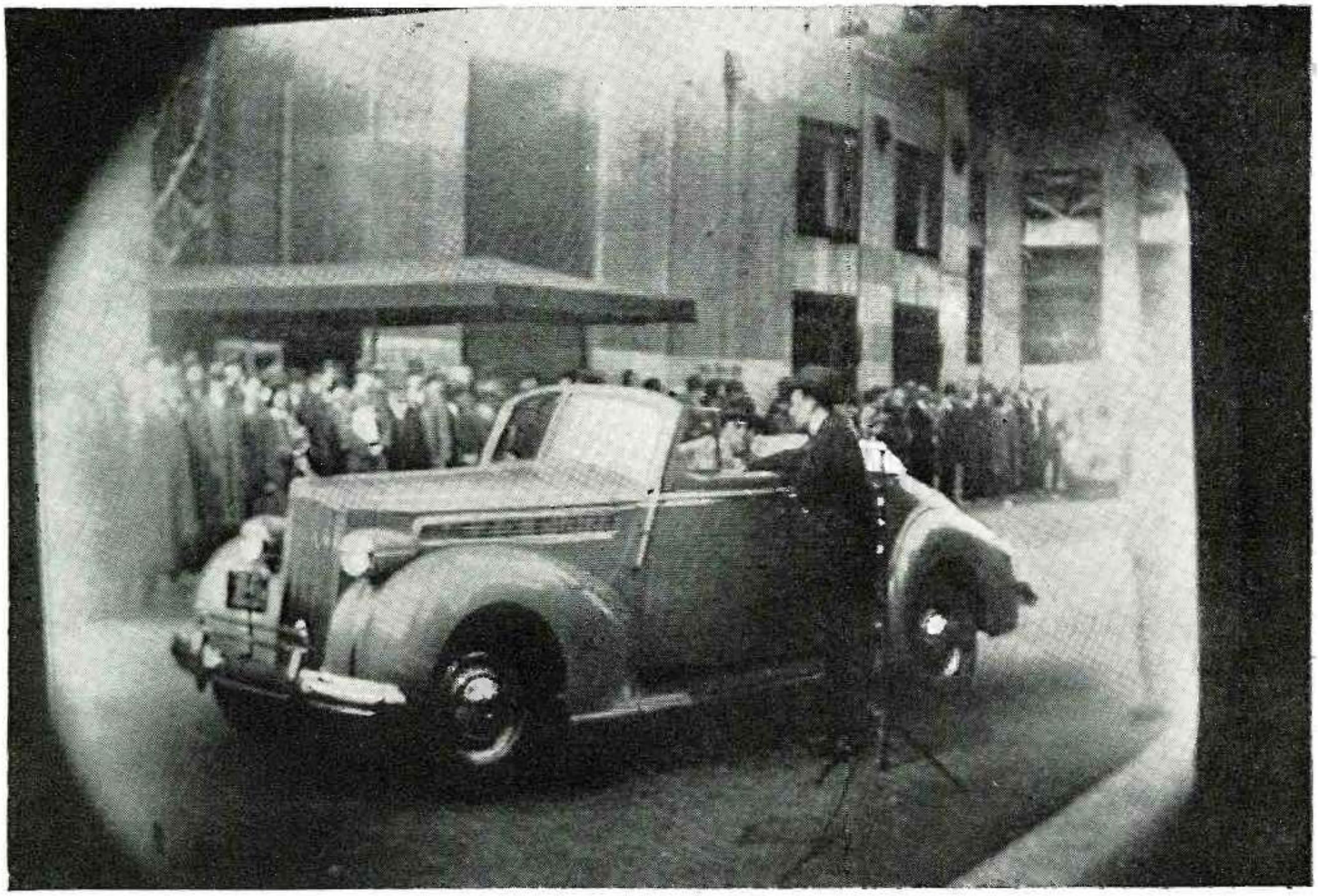


An example of perfect reception which may be expected from a good television skywire.

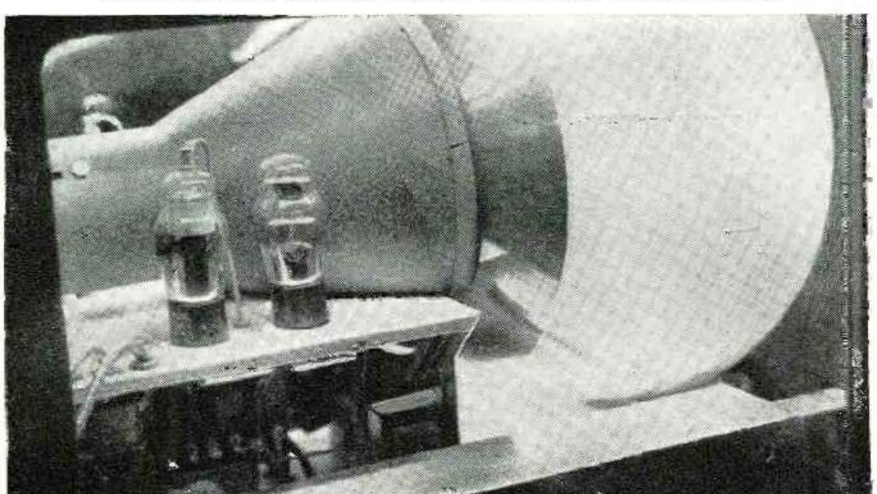
Building TELEVISION

By M. W. THOMPSON
Television Engineer, Chicago, Illinois.

One of the most important requirements for good television reception, is the antenna.

The third lesson in the television series for servicemen.

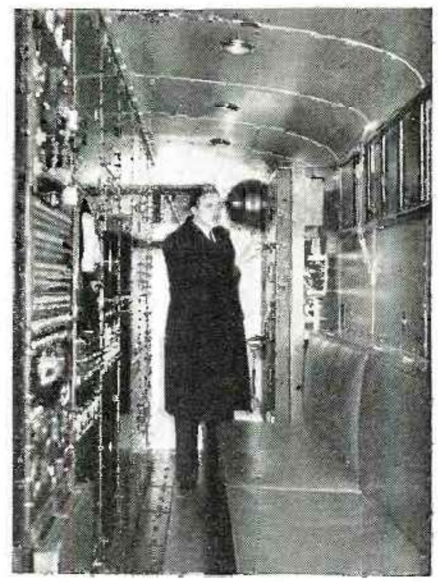
One of the newer television receivers with a large C-R picture tube.



HAVING, in the first article (RADIO NEWS, Feb. 1938), gone into features of television somewhat new to radio men, and, in the second (RADIO NEWS, Mar. 1939), explored the subject of *Iconoscope* tubes, scanning, amplification, etc., I believe it desirable briefly to consider the characteristics and somewhat unusual behavior of the frequencies assigned to television. While a group of channels between 156 and 294 mc. has been set aside for television use, it appears that, for some time to come, only lower frequency channels in the 44-108 mc. range will be used.

The *NBC* station on the Empire State building, W2XBX, has been given the use of the No. 1 channel, 44 to 50 mc. The *CBS* transmitter, high up in the Chrysler building, W2XAX, will use the No. 2 channel, 50 to 56 mc.

SKYWIRES



Inside the mobile television truck which is used to pick up spot news.

Why do they prefer these to the higher frequency channels? In part, because their effective service areas will be increased somewhat, due to the fact that attenuation, beyond the optical horizon, increases with the frequency. More important, the attenuation caused by large buildings placed close together is considered less for 44 to 56 mc. transmission than for 96 to 108 mc.

The frequencies above about 30 mc. (10 meters) are considerably different in many respects from those below that wavelength. They are not turned back by the ionosphere, and since the sky waves are eliminated, propagation results from the ground wave only. The ground wave, however, also attenuates rapidly beyond the horizon and fading begins to be noticeable. In this ultra-high-frequency zone, there is practically no natural static, but man-made interference is severe.

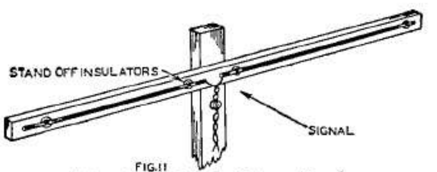
What is known as the "interference pattern" around any receiving location will usually produce some puzzling phenomena. The same antenna that produces a weak, unusable signal at one point on a roof, may very probably put quite an impressive "kick" into the receiver if moved only a few feet right or left, forward or back. It is imperative that one get his little half-wave doublet as high and clear as possible. Such an antenna, located on a one or two story building, down close to heavy traffic, may result in severe fluctuations of signal strength. Automobiles, trucks and elevated trains, if near low antennas, can, and will, cause a constant shift and change in the interference pattern, giving the effect of fading. Elevators and large steel doors can do this also.

The major interference, so far encountered both here and in England, is caused by automobile ignition systems. Airplanes can cause a similar series of clicks in the sound receiver and "snowstorms" in the video reproduction, but this would be most infrequent. Telephone exchanges have a definite, easily-recognizable effect above 30 mc., as do street cars.

In connection with locating one's antenna, bear this in mind: the range of transmission is roughly proportional to the square root of the height of both antennae (the telecaster's *and yours!*); also, the field intensity, at any point within optical distance, is directly proportional to the product of the two antennae elevations. Field intensity is the strength of useful signal arriving at your aerial.

While almost any piece of wire, from a hairpin to a phosphor-bronze hundred footer, will give reception on broadcast frequencies, an ultra-high-frequency (u-h-f) television antenna demands thought and care in its design, location and installation. First, it must be rigid, and neither the antenna or lead-in should sway in the wind.

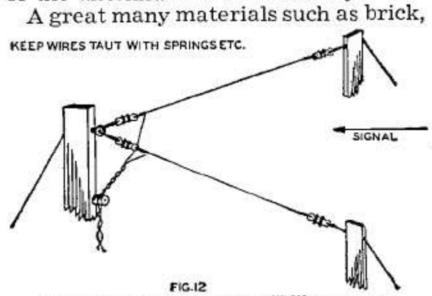
Second, because of reflection of waves from buildings and metal struc-



A horizontal television dipole.

tures, there may be *multi-path reception* at some locations. The signal will arrive (1) directly from the transmitter, (2) as reflected from a small rise in the ground between the station and the receiver, (3) from the side of a nearby large building, or possibly (4) from a gas tank. The result is blurring, double images and other undesirable picture abberations. Changes in the design, location and orientation of the antenna will be necessary.

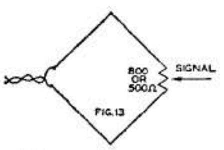
A great many materials such as brick,



A high-gain television "V" antenna.

stone, paving material, etc., are excellent reflectors of television frequencies at certain angles of incidence. Occasionally, where one cannot get a clear "line of sight" path to the transmitting antenna, because of a tall building, it will prove possible to get excellent reception via the reflection from some surface on another nearby structure.

Third, the antenna and its transmission line must be so constructed and terminated that reflections from the receiver end of the system do not bound back to the antenna and there be reflected so that they re-enter as a delayed (reflected) signal.



Diamond antenna.

Multi-path reception is considerably less when using horizontal polarization (doublet or di-pole parallel to ground) than when employing vertical polarization; the horizontal receiving antenna responds less to disturbances from automotive ignition systems. Both transmitting and receiving aerials must be for the same polarization, and the aerials so far erected on the Chrysler and Empire State buildings are for *horizontal* transmission, and *not* vertical as is generally supposed.

A brief explanation of blurring, double-images and cancellation is, perhaps, in order here. In a 12-inch *Kinescope* the spot on the screen travels horizontally at a speed of approximately 2½ miles per second. The radio wave, bringing the television program, travels at 187,000 miles per second, the ratio of these speeds being about one to seventy-five thousand. While the spot is traveling, let us say, 6/100th-inch on the screen, the radio wave will have travelled 400 feet.

If now, both the direct wave and an equally-strong reflected wave (which has travelled 400 feet further) arrive at your antenna, two images will appear, one displaced (offset) about 1/16th-inch from the other. There will be a blurring of vertical lines, and, possibly, black lines repeated as white, or white as black.

Most of the doublet receiving antennas so far used in television research, and by the amateurs, for u-h-f work, have been made of brass or copper rod or tubing, usually copper tubing with the ends plugged. Recently, telescoping rods have appeared on the market that can be adjusted to various lengths. If copper tubing is used, it is recommended that each half of the doublet be anchored at its inner end, and another supporting bracket be secured near each outer end; quarter or three-eighths inch tubing is suggested (see Figure 11).

Sufficient accuracy in design will be secured if one merely divides 300 by the frequency in mc. to get the wavelength, then multiplies by 39 to put this in inches, divides by 12 to have feet, and divides by 2 for over-all length of a half-wave dipole. If one wished only to get the New York CBS transmissions, the procedure would be: center of the 50-56 mc. channel is 53, and this divided into 300 is 5.66 meters. Multiplied by 39 the result is 220.74, divided by 12 is 18.4 feet, and divided by 2 is 9.2 feet, which would be the proper length for such a dipole (overall). For use with these half-wave doublets, twisted pair transmission line is used, having a surge impedance of 90 to 120 ohms.

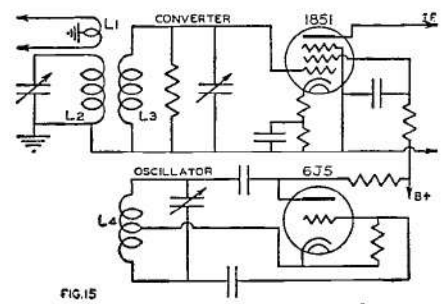
Should one prefer to design only for the adjacent NBC channel, the center frequency of which is 47 mc., the same arithmetic is followed to arrive at a length of 10.37 feet. Obviously, should the television set owner desire to get both channels, he would choose the center point of the 44-56 mc. range, start his calculations from 50 mc. and arrive at 9.75 feet or 9′9″. Leaving a 2-inch gap at the center between rods, each half of the doublet should be 4′9½″ long. Such an antenna should be placed so that it is at right angles to the direction of the transmitter.

For some months, many owners of television sets will have only one transmitter to which they can tune and the situation frequently may be such (due to distance or intervening obstacles) that insufficient signal reaches a doublet for satisfactory operation.


How fading television signals look.

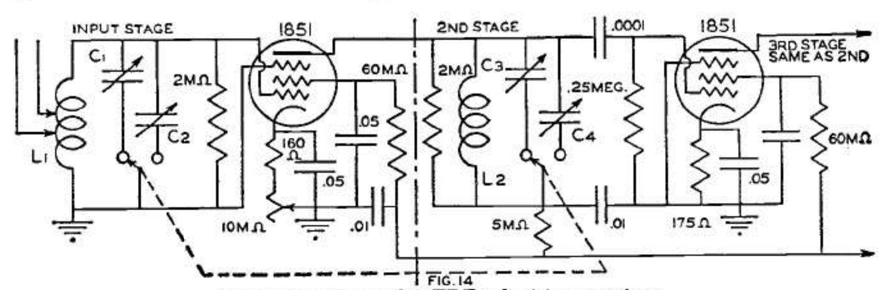
For reception from but a single station, a Vee-Beam antenna, each leg of which is a full wave length long, has much to recommend it (see Figure 12).

Presuming we wish to receive W2XBX, the NBC station, we cut two wires 20′9″ long (one wave length) and lay them parallel and on a line pointing toward the transmitter. The end of each which is furthest away from W2XBX is secured to a small insulation block corresponding to the center block of a doublet. The end of each wire nearest W2XBX is now moved away from the direction line until the wire *forms a 52° angle* with the line. Thus we have a 104° "V", the open end of which faces the transmitter. Means must be provided for keeping the wires taut. The transmission line couples to the point of the "V."

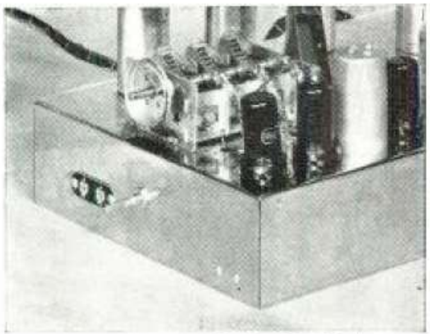


Low-gain input stage to superhet.

The better antenna for two or three-channel pick-up, near the borders of the transmitters' effective service ranges, would be a diamond or rhombic (Figure 13). The open ends of two "V's" are brought together, and, at the apex toward the transmitters, one places a 500 to 800-ohm noninductive resistance. Each of the 4 legs is a



The input stage of a TRF television receiver.



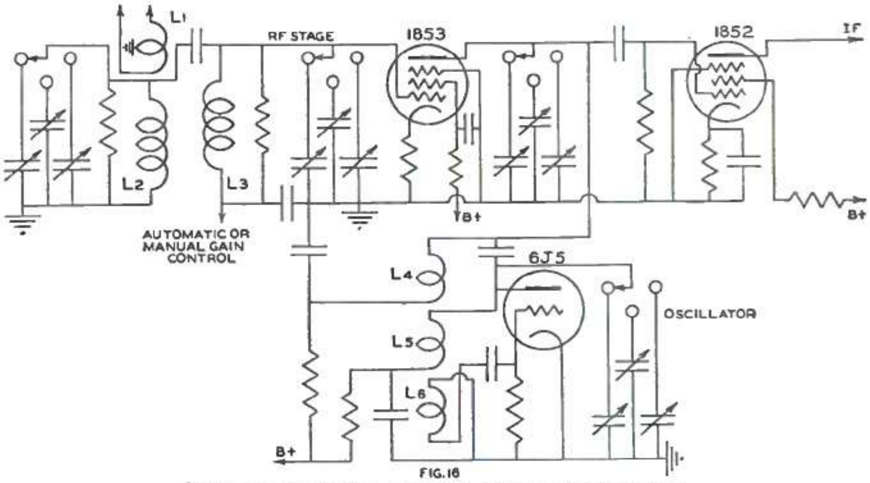
The business end of a TRF job.

wavelength long, the angle at each apex is 104°, the transmission line must present an impedance of 500 to 800 ohms. Other arrays will come into use to meet various conditions; double-doublets show good results. With half-wave doublets it is possible to place "directors" in front of the actual antenna; these can be a taut wire or rod slightly shorter than the antenna. Behind the antenna, one places wires or rods equal to, or slightly longer than the aerial proper, and known as "reflectors." So much for antennas.

Since, in television, the limit of the service area is reached rapidly, and there will be many set owners in areas of marginal field strength, radio frequency input circuits will have to be given extremely careful attention, so the remainder of this article will be devoted to them. There is one important point to be brought out at once; whereas in *sound* reception the input circuits must be constructed to be tunable to a large number of channels (broadcasting), or a wide choice of frequencies (amateur), television transmission will be on only *seven* channels for many months. For 1939, what telecasting there is will probably be confined to but two channels—the 44-50 and 50-56 megacycles.

This condition lends itself excellently to station pre-selection; construction such that one need only flip a switch or push a button to transfer from station to station. You set the r.f. input, the converter input and the oscillator circuits when the receiver is put into operation, and no more "tuning" is necessary.

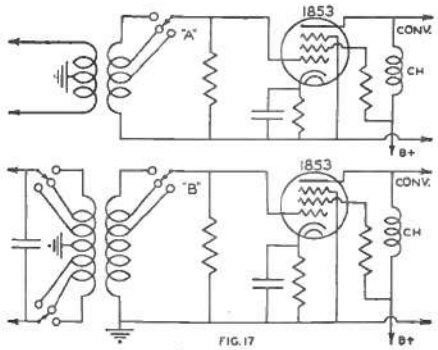
While the above discussion has all been in terms of superheterodyne construction it must not be inferred that only "supers" can be used for television reception. If one is looking forward to active participation in this new field primarily as a service man, his thinking should be in terms of superheterodynes. Manufacturers of complete sets are developing their products around this circuit. If one has the means to build a more elaborate receiver, and has considerable test equipment at his disposal, the thinking should be "super."



High-gain television superhet receiver input stages.

On the other hand, if parts' and tube costs must be carefully watched, the good old tuned r.f. circuit of early radio days is a fairly satisfactory answer. A 5-10 meter "ham" receiver (see Radio News, March, 1939, page 21) will take care of the audio transmission sent out with the video, and a comparatively simple video receiver can be concocted around some easily-made coils and inexpensive resistors. Varying amounts of expenditure between these two extremes will be found in a dozen different possible designs.

Getting into circuits, I wish to point out that, at this point in my series of lessons, comparatively little exact data

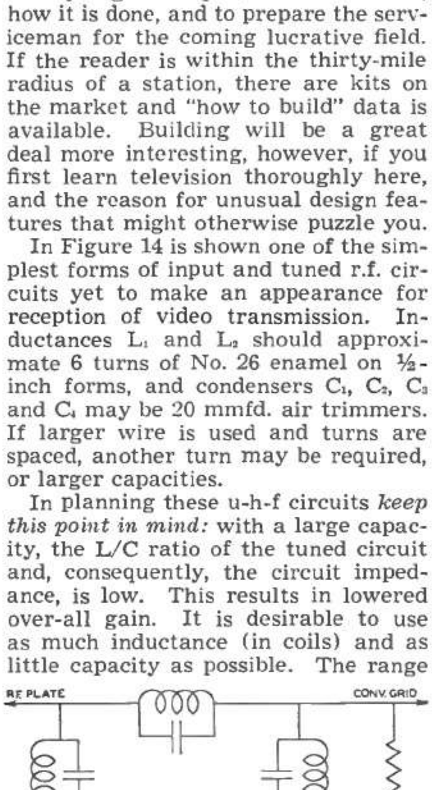


Extra high-gain input.

will be given. Only a small portion of the country, either by area or population, is as yet being served by telecasting stations, and this series is primarily a general picture of television, how it is done, and to prepare the serviceman for the coming lucrative field. If the reader is within the thirty-mile radius of a station, there are kits on the market and "how to build" data is available. Building will be a great deal more interesting, however, if you first learn television thoroughly here, and the reason for unusual design features that might otherwise puzzle you.

In Figure 14 is shown one of the simplest forms of input and tuned r.f. circuits yet to make an appearance for reception of video transmission. Inductances L_1 and L_2 should approximate 6 turns of No. 26 enamel on ½-inch forms, and condensers C_1, C_2, C_3 and C_4 may be 20 mmfd. air trimmers. If larger wire is used and turns are spaced, another turn may be required, or larger capacities.

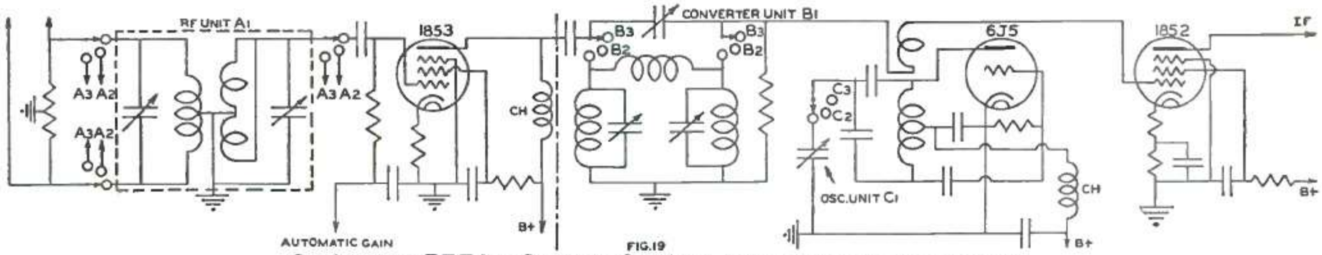
In planning these u-h-f circuits *keep this point in mind:* with a large capacity, the L/C ratio of the tuned circuit and, consequently, the circuit impedance, is low. This results in lowered over-all gain. It is desirable to use as much inductance (in coils) and as little capacity as possible. The range



Band-pass filter.

of 44 to 56 megacycles is a comparatively narrow one; try to build and adjust inductances so that television channels I and II are brought in when condenser plates are about one-eighth to one-fourth in mesh. This goes whether a "super" or a tuned r.f.

(*More television lessons, page* 44)



Combination RF-Filter-Converter-Oscillator stages of a television superhet.

Television

(*Continued from page 9*)

In the preceding paragraph you will note I explicitly spoke of inductance "in coils." Inductance in other parts of the circuits is most undesirable—that means leads to coils, to capacities, to resistors, to tube pins. Although it will probably not be so stated in "how to build" articles you read, every set designer is trying to obtain reduced and stabilized values of input conductance. Even relatively minute lengths of inductance in cathode circuit leads are sufficient to cause appreciable increase in the input conductance; so also, do inductance values in the grid leads. The importance of short, heavy, low-inductance leads cannot be too strongly emphasized.

The schematic of Figure 14 shows only the input and 2nd r.f. stages; the third stage is a duplicate of the second. It is presumed that gang switching will be employed, and that condensers C_1 and C_3 will be set for the 44-50 mc. channel, and C_2 and C_4 adjusted for the 50-56 mc. channel. When a third channel comes into use in your locality, a few 10 to 15 mmfd. capacity air trimmers and use of another contact point in each switch will make it available.

The 2000-ohm resistor across the tuned circuits is something new to radio practice, and it does just what you think it will—broadens the tuning. Remember, we are tuning to a 4-megacycles wide sideband and trying to handle the whole width uniformly. The better we do this, the better the picture detail. Aside from these resistors, this diagram of three r.f. stages is not unusual.

While this circuit, in an efficiently-planned layout, will bring in television signals over a distance of a few miles, it must be understood that the two goals we are seeking cannot both be obtained 100% with it. Impedance or conductive coupling, such as this, has a strong tendency to "peak" and, while the resistors flatten this considerably, the resulting gain per stage, even at the top of the broadened "hump" is none too great. Were a narrow channel being tuned-in, we could adjust all humps to the same frequency and have fair over-all gain; if, however, we do this on a 2.8 mc. to 4 mc. sideband, there will be adequate gain on but a small percentage of the band width and a sad falling-off on the rest.

In actual practice, the tuned circuits are brought to slightly different resonance peaks which tends to level the over-all response curve for more uniform performance from 0 to 2.8 megacycles, and the total over-all gain will be much less than it would have been for the narrow channel reception. For a limited distance and a good "line of sight" location, these tuned r.f. sets will give good reception and fair detail, but do not ask too much of them.

At this point, I would like to insert a discussion of vertical and horizontal detail and its relation to width of sideband. Vertically, there can be 410 picture elements (we lose 31 in vertical blanking). Since the aspect ratio is 4 to 3 there may be 547 elements horizontally. Since a maximum-detail cycle consists of a dark element and a light element side by side, this means 273 cycles. Now, a horizontal line must be transmitted in 0.85 of 1/13,230 second. The computation $273 \times 13{,}230 \times 1/0.85$ indicates the necessity, theoretically, of 4.25 mc. per second for maximum detail.

In actual practice, vertical detail may be figured as something less than 410, and it is found that equal horizontal and vertical resolution, using a 441-line system, is secured if we multiply 4.25 by the factor 0.80, and utilize a band width of 3.4 mc. Thus it will be seen that the wider the passband, the greater the detail horizontally; the wider the passband, however, the more difficult is receiver design and construction. Satisfactory entertainment value seems to result if we compromise on trying to do a good job of getting equal response on all frequencies up to 2.8 megacycles.

Getting into super-het input circuits, one should first get, in his mind, a very clear picture of what we are going to do with our 44-50 or 50-56 channel signals. Taking, as an example, the lower one, it should be recalled that the video carrier is at 45.25 mc. and we are using the sideband extending *upward*. This will be approximately flat to 48 mc. and then attenuates rather sharply, to disappear at 48½ to 49. The sound carrier is at 49.75 mc.

Now, if we mix into this a 58 mc. frequency, the resulting video i.f. carrier is 12.75, with a sideband extending *downward* which will be approximately flat to 10 mc. and attenuating to, perhaps, 8¾ or 9. At 8.25 mc. is the i.f. sound carrier.

If one is but six to ten miles from a station, and the situation is not complicated by another transmitter on the next channel, the circuit of Figure 15 can be recommended. Here, an 1851 is used as the converter and a 6J5 as the oscillator. The inductance unit would be developed on a ½-inch tube or rod with a single-turn antenna coil coupled tightly to L_2 (6 turns, tuned by 20 mmfd.), which is in turn rather loosely coupled to a similar coil (L_3) and capacity. Rather loosely coupled to L_3 is L_4, tuned by a 20 mmfd. trimmer. Presuming the 6J5 is oscillating at 58 mc., we will have two frequencies appearing at "i.f.", one for video and one for sound. The 8.25 mc. signal can be disregarded if a separate 5-10 meter receiver is being used for sound; or, this carrier can be fed into an all-wave set handling this frequency. Television receiver manufacturers are including at least a one-stage i.f., a second detector and an output stage for sound.

To secure greater gain and selectivity, an r.f. stage must be inserted between the antenna and the converter. Shifting the inductance unit of Figure 15 (minus L_4), so that it is in front of an 1853 tube, as shown in Figure 16, we will develop our first tuned circuit by inserting a resistor across L_2 and adding one switch of a gang, to throw in any one of three condensers for a choice of three channels. The second tuned circuit is broadened with a resistor and, likewise, provided with a switch and condensers for channel choice.

Between the r.f. tube and the converter, the coupling is produced by a switch, three condensers and inductance L_4. Coupled to L_4 is the plate inductance of the 6J5 oscillator, L_5, and coupled to this, in turn, is the grid inductance L_6. The oscillator is transferred from channel to channel with a fourth switch and a trio of condensers tuning L_5. This is an excellent circuit but its L/C ratio in each channel, and the flatness of response between r.f. and converter, are not as good as the design which follows.

For the development of a highly-sensitive, more even response "super," our discussion can start with Figure 17A, the schematic of an r.f. stage. It is shown simply for comparison with 17B. It provides an untuned primary, and a tube input circuit which utilizes the approximately 25 mmfd. capacity to be found in the wiring. The resistor across the secondary is 1800 to 2000 ohms, and switching from channel to channel is done by varying the turns of inductance. It is attractive because of simplicity, but when a check-up of gain is made between 17A and 17B, it is found that 17B provides *double the gain* of 17A. It is advantageous then to provide some means of tuning the primary, preferably by varying turns of inductance as shown.

The type 1853 tube is selected for the r.f. stage because of (1) its extended cut-off characteristic, and (2) its 57-to-1 signal-to-noise ratio as calculated in the plate circuit. An even better ratio would be good but, among the various tubes considered, the 1853 presents the best combination of features for this usage.

To couple this stage to an 1852 converter, one thinks first of the usual single-tuned, shunt, plate-grid circuit such as was used in Figure 14. If, however, we develop a band-pass filter which will utilize the output capacity of the 1853 and the input capacity of the 1852 as shunt elements, *double the gain* will be secured at this point, and gain prior to the converter is very important.

Such a band-pass filter is shown in Figure 18; if but one station is to be received, one such unit can be designed, shielded and adjusted, then let alone. Combining our r.f. stage, the filter, a converter and an oscillator into what should be a top-notch input arrangement, we have Figure 19. Here, r.f. unit A_1 is placed in its can, so that its air trimmers may be adjusted for the 44-50 mc. channel, and leads brought out to gang switches. For the 50-56 mc. channel, *another* such unit is to be similarly constructed which would be unit A_2 (not shown).

Between the 1853 and the 1852, a band pass filter is to be constructed for the lowest frequency channel (B_1, shown) and another for the next channel, B_2. Here again, the gang of switches permits quick transfer from channel to channel. At the oscillator, we need only one switch in the gang to transfer from C_1 (pre-set for channel I) to C_2 (pre-set for channel II) which tune the tuned-plate oscillator. This oscillator circuit is chosen for stability against voltage fluctuation, while its method of coupling (single-turn in converter grid lead, tightly-coupled) will not adversely affect the band pass filter termination.

The circuit of Figure 18 will give just about maximum possible gain to the point marked "To i.f.," will have as much selectivity as is necessary for television, and will produce exceptionally uniform response, up to 2.8 mc., of the side band.

Correlated Reading

AN EFFICIENT DIPOLE AERIAL
Television & Short Wave World (London)—November, 1938.

THE PROBLEM OF SYNCHRONIZATION IN CATHODE-RAY TRANSMISSION
F. J. Bingley
Proc. I.R.E., Volume 26, No. 11—November, 1938.

THE FINE STRUCTURE OF TELEVISION IMAGES
H. A. Wheeler & A. V. Loughran
Proc. I.R.E., Volume 26, No. 5—May, 1938.

THE TELEVISION PICTURE AND INTERFERENCE
Television & Short Wave World (London)—November, 1938.

A FOUR-VALVE SUPER-HET FOR TELEVISION SOUND
Television & Short Wave World (London)—December, 1938.

Short Wave Flashes

(*Continued from page 43*)

to 5:30 and 9 to 11:45 a.m. and on Sundays 5:30 to 7 and 9 to 11:30 a.m.; on 4.8764, weekdays noon to 3:45 p.m. and on Sundays noon to 3:20 p.m.

UNITED STATES—W2XE of New York City, now operates as follows: Mondays through Fridays, on 21.57, 7:30 to 10 a.m. and on Saturdays and Sundays, 8 a.m. to 1 p.m.; on 15.27, Mondays through Fridays 1 to 3 p.m. and on Saturdays and Sundays 1:30 to 2:30 p.m.; on 11.83, Mondays through Fridays, 3:30 to 6 and 6:30 to 10 p.m. and on Saturdays and Sundays, 3 to 6 and 6:30 to 11 p.m.; on 9.68, Mondays through Fridays, 10:30 to 11:30 p.m. and on 6.17, Mondays through Fridays, 12 mid. to 1 a.m. and on Saturdays and Sundays, 11:30 p.m. to 1 a.m. . . . W8XAL of Cincinnati, Ohio, operates as follows: Sundays, 8 a.m. to noon, Tuesdays, Wednesdays and Fridays, 5:45 a.m. to noon and 11 p.m. to 2 a.m., Mondays, Thursdays and Saturdays, 5:45 a.m. to 2 a.m. and on Wednesdays, 9 p.m. to 2 a.m.

Frequency Changes

CHILE—CD1190, Valdivia, to 11.91; CB970, Valparaiso, to 9.725.

COLOMBIA—HJ3CAX, Bogota, to 6.02: HJ6ABB (not using new call of HJ6FAB yet), Manizales, to 6.054.

COSTA RICA—TILS, San Jose, to 6.165; TIEP is jumping between 6.69 and 6.696.

CUBA—COCM, highly variable, near 9.805.

DENMARK—OZH, Skamlebak, operates Sundays, 8 a.m. to 1:30 p.m. on a new frequency of 15.32.

DOMINICAN REPUBLIC—HI2G, Trujillo City, to 9.295; HI1S, Santiago, to 6.625.

ECUADOR—HC2CW, Guayaquil, to 9.35.

EL SALVADOR—YSP, now in vicinity of 10.4.

GUADELOUPE—FG8AH, Pointe-a-Pitre, to 7.435.

GUATEMALA—TG2, Guatemala City, to 6.195.

HAITI—HH2S to 5.955.

INDIA—VUD2, Delhi, to 4.96 to 4.975; VUM2 to 4.92; VUB2 to 4.885; VUC2, Calcutta, to 4.83.

PARAGUAY—ZP14, Villarica, to 11.72.

PERU—OAX5C, Ica, now in the clear, on 9.39.

PHILIPPINES—KZIB, Manila, now 9.49 to 9.495, to get out from under VK3ME.

SPAIN—"Radio Nacional de Espana" to 7.66.

U. S. A.—W3XAU, Philadelphia, to 15.27, daily 3 to 7 p.m.

VENEZUELA—YV1RL, Maracaibo, to 4.86; YV3RA, Barquisimeto, to 4.99; YV5RM (ex-YV5-RD), after an experimental sally down to 5.01, is now back on 6.163.

Data

ALASKA—K7XFS (8.09), Fairbanks, broadcasts weather reports, and contacts other Alaskan stations, some of them on the same frequency, intermittently between 12:30 and 9 p.m.

ALBANIA—ZAA (7.487), "Radio Tirana," operated by the Directorate General of Posta and Telegraphs, with studios in the Tirana City Hall, is on the air from 2 to 3 p.m. and closes with the announcement "Radio Experimental Tirana," followed with the national anthem.

ARGENTINA—LRX (9.66) verifies with a pale blue on white card; interval signal is 4 vibraphone notes.

AUSTRALIA—VK6ME (9.59), Perth, verifies with a red, black and grey QSL card with a map of Australia in the center. . . . VK9MI (6.01), the S.S. Kanimbla, signs-on with "Sweet Dreams" and God Save the King.

BRITISH GUIANA—VP3BG (6.13), Georgetown, operates weekdays from 10:15 to 11:15 a.m. and daily from 3:45 to 7:45 p.m.; gives world news, tides, shipping, mails, market quotations etc., at 4 p.m.; signs-off with the "Good Night Song."

CANADA—CJRX (11.72) and CJRO (6.147), Winnipeg, operate Saturdays from 6 p.m. to Sundays at 4 a.m. . . . CFCX (6.005), Montreal, operates weekdays from 7:45 to 1 a.m. and on Sundays from 9 a.m. to 11:15 p.m.

CHILE—CB970 (9.725), "La Voz de Chile para toda la America," relays CB76, from 11 a.m. to 11 p.m. and occasionally to 1 a.m. Reports should be sent to La Cooperativa Vitalicia, Lira No. 543, Valparaiso. . . . CD1190 (11.91), Valdivia, operates from 6 or 7 to 10 p.m.

CHINA—XGAP, not XUD (9.56), verifies promptly, also sending 8 beautiful scenic postal cards. This station controls all broadcasting in North China. Send reports to S. Yoshimura, Director, Peking Central Station, Hsi-chan-an Chieh, Peking. . . . XGRV (11.4), "The Voice of China," Chungking (replacing XTJ, Hankow), broadcasts daily from 1 to 1:30 a.m. in Chinese and Japanese, and from 8 to 8:30 a.m. in English and French. Send reports to H. K. Tong, China Information Committee, Box 90, Han-