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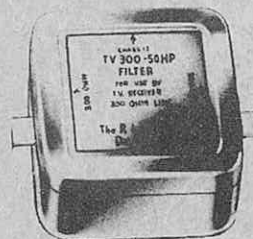
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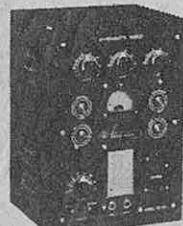
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July, 1951
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Carl Fowler

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6AK6	- 1.25	VR-105	- .90	1619	- .65
6B8	- .65	304TH	- 7.25	7193	- .30
6C5	- .75	446A	- 2.00	9004	- .50
6C8G	- 1.67	801A	- 1.60	9006	- .50
6F6	- 1.10	807	- 2.75	1N-34	- 1.75
6J5	- .90	813	- 9.50		
6J5G	- .80				
6K6G	- .80				
6K7	- .90				
6K7G	- .65				
6K8	- 1.50				
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AWARD FOR ACCOMPLISHMENT

Robert B. Dome, Electrical Consultant for the General Electric Receiver Division at Syracuse, receives the annual Morris Liebmann Memorial Prize, awarded by the Institute of Radio Engineers, in recognition of "his contribution to the intercarrier sound system of television reception, wide-band phase-shift networks, and various simplifying innovations in FM receiver circuits." The presentation was made by IRE President I. S. Coggeshall (standing, left) at the Annual Banquet in New York, March 21, 1951. Others present (seated, left to right) are: Donald McNicol, Consulting Communication Engineer; Alois W. Graf (Toastmaster), Patent Lawyer; J. Howard Dellinger, Radio Consultant and Advisor; Dr. Alfred N. Goldsmith, Editor, *Proceedings of the I.R.E.*; Dr. W. R. G. Baker, Treasurer of IRE, Vice-president of General Electric Company; and Dr. Ernst F. W. Alexanderson, Consulting Engineer, General Electric Company

See Page 21 of this issue

Vol. 4

SKYWIRE

No 7

Published monthly as

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Editor - Fenwick Job, VE3WO

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Type	Watts	D.C. Per Wndg.	Weight	Mtg. Centres
1703	15	70 M.A.	6 lbs.	2½"x3"
1705	30	100 M.A.	10 lbs.	3"x3½"
1707	60	140 M.A.	16 lbs.	3⅝"x4½"

CONNECTION DATA

Ratio Pri. to ½ Sec.	Plate	B	Plate	Grid	Bias	Grid
1.25:1	8	9-10	11	1	3-4	6
1.57:1	2	3-4	5	7	9-10	12
1.97:1	1	3-4	6	7	9-10	12
2.04:1	7	9-10	12	1	3-4	6
2.55:1	7	9-10	12	2	3-4	5
2.66:1	2	3-4	5	8	9-10	11
3.2:1	1	3-4	6	8	9-10	11
4.1:1	2	3-4	5	7	8-11	12
5.1:1	1	3-4	6	7	8-11	12
6.3:1	8	9-10	11	1	2-5	6

PRACTICAL APPLICATION

Driver	Mod.	Ratio Pri. to ½ Sec.
PP6A3	PP809	2.1:1 for 100 W — 1.97:1 for 145 W
"	PP811	3.2:1 for 175 W — 2.66:1 for 220 W
"	PPTZ40	1.57:1 for 225 W — 1.57:1 for 250 W
"	PP805	1.57:1 for 200 W — 1.25:1 for 370 W
PPP6A3	PP810	1.57:1 for 590 W — 1.25:1 for 725 W
PP6L6	PP809	4.1:1 for 100 W — 3.2:1 for 145 W
"	PP811	4.1:1 for 175 W — 3.2:1 for 220 W
"	PPTZ40	2.04:1 for 225 W — 2.04:1 for 250 W
"	PP805	2.55:1 for 300 W — 2.04:1 for 370 W
"	PP810	1.57:1 for 590W — 1.25:1 for 725 W

500 Ohm line to Mod. Grids — Connect Line to 7 and 8 — join 7 and 11, 8 and 12 — connect grids to 2 and 5, join 3 and 4 for "C" bias.

Driver Plates to 500 ohm line — same connections except plates connect to 2 and 5.

Above ratios are correct only when driver transformer is used in the circuits and at the voltages shown in circuit in the next issue

Ratios may be computed for other modulator tubes by dividing required modulator peak grid to grid volts into voltage developed across pri. of universal Driver Transformer.

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CHIEF CONTROLLER CALLING.....

In the near future each amateur station licensee will receive a letter from the Controller of Telecommunications, Department of Transport which will request the cooperation of each and every one of us hams in guarding against loose talk over the air on matters which may affect the national security. Page 7 of our April issue gives you the general idea why—but we don't think the reason needs to be spelled out in words of one syllable.

What is sometimes overlooked is the fact that even though your contact is within North America, or a local 'crosstown, propagation conditions may be such that your transmission may be intercepted many thousands of miles away. It's not the fellow you're working so much as the fellow who may be listening that you have to consider in this situation.

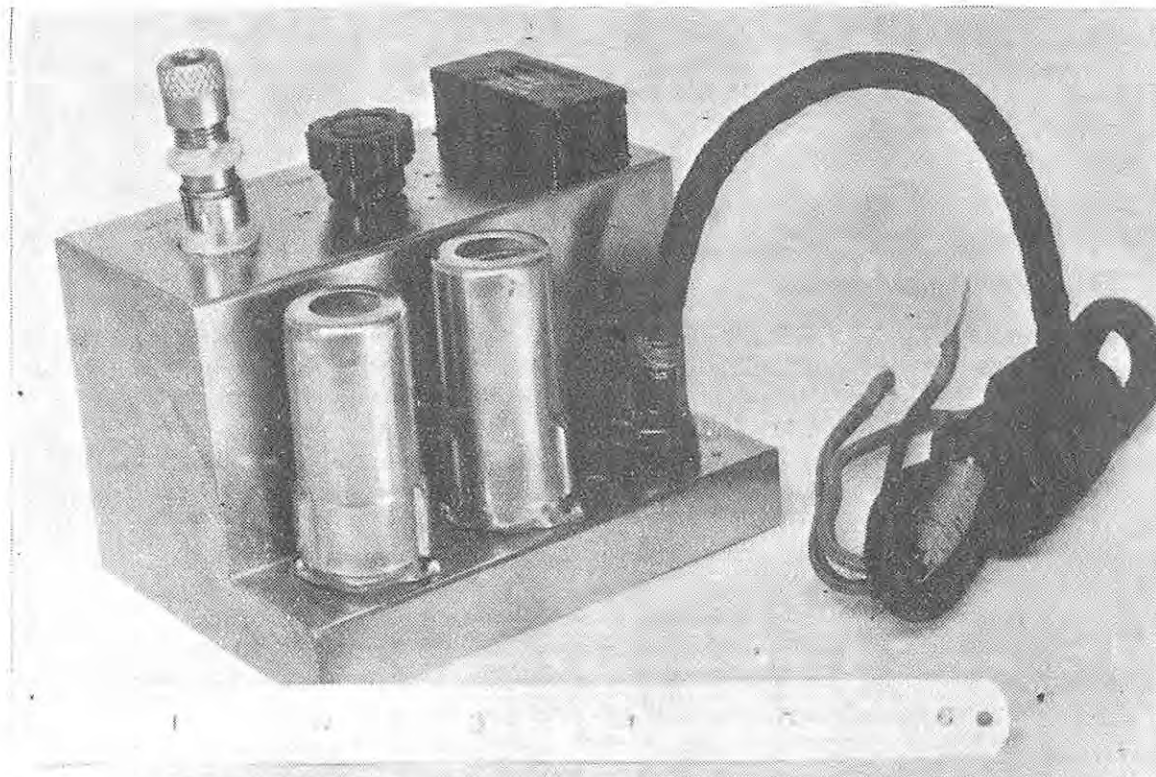
Now none of us in Canada, or any other free democratic country, likes the idea of regimentation or the restriction of individual freedom of action. Yet we must, in the interests of our society and form of government, agree to observe certain regulations in the common good—and we do. Familiar examples of this may be found in our acceptance of municipal by-laws governing matters of health, schooling, traffic, etc. One of the chief attributes of the true ham is that he is a rugged individualist with an enquiring mind. Largely because of that characteristic, amateurs have contributed so considerably to the advancement of the radio art. And may they always stay that way! But individualism is an asset only when coupled with a sense of responsibility.

It isn't a case of weighing every word you send by key or 'phone but just a matter of avoiding discussion over the air of matters which may provide one of the missing pieces in the jigsaw picture which unfriendly powers are continually trying to construct of our state of defense preparedness. No specific and detailed rules can be issued on what can and what cannot be said. Reliance must be placed on your discretion and co-operation. So let's receive that letter from DOT in the spirit in which it was originated. Not as a piece of bureaucratic bump but as an appeal to our good sense, judgment and citizenship.

Guest
Editorial

EAD. Hutton VE3AX,

Chief Controller, AFARS.



CC Marker Unit for Two Metres

Simple Calibration Oscillator

By M. D. MASON

THE unit to be described has been developed for the express purpose of supplying 500 kc marker points in the 2-metre band.

In order to make the most of the 144-146 mc frequency lists now available, it is essential to have an accurately calibrated converter or receiver. Most converters and receivers acquire a certain amount of frequency error due to drifting or mechanical shocks, so a suitable frequency standard to check this point from time to time adds up to better operating efficiency.

With a 500 kc crystal, five marker points are provided in the 2-metre band; these are useful for making a suitable calibration chart

—to be modified as necessary as more and more fixed-frequency stations are identified. When the calibration is completed and can be relied upon, stations not already listed can be measured and their actual operating frequencies filed or sent forward for future listing.

The unit was designed to be really accurate all the way from 500 kc to 150 mc. The power consumption is so small that it could probably quite safely be taken from an existing receiver. With 100 volts HT and 6AK5 valves, the 145 mc harmonics are strong enough to be picked up with only a few inches of wire connected to the calibrator output terminal. The physical size has been deliberately kept as small as possible only for the convenience of tucking the unit out of the way in some corner to be switched on as required.

Circuit

The oscillator circuit is not at all critical and once it has been well constructed with good components (the most important being the crystal) no further adjustment is required

other than to zero the crystal beat-note with one of the WWV transmissions or Greenwich on 2500 kc. The particular components specified are correct for a QCC Q5/500 crystal. Should some other make of crystal be used it may be necessary to change the values of the 22 $\mu\mu\text{F}$ and 500 $\mu\mu\text{F}$ condensers (C1, C3) slightly in order to have an equal amount of frequency correction either side of zero beat. The frequency correction is adjusted by the variable 100 $\mu\mu\text{F}$ condenser, C2. Several crystals were tried in this circuit including a 1000 kc bar, and all worked very well.

The valve complement can be quite varied—types 9001, 9003 (EF91, EF92 with wiring modification) and 6AK5 are all suitable. The 6AK5 gives the strongest harmonics, but the 9001 is good enough.

There are no particular tuning adjustments other than to peak the oscillator plate circuit on either 3 or 4 mc. This can be checked by listening for maximum signal on the regular communication receiver adjusted to 3 or 4 mc. The three-turn output coil L2 is peaked for the strongest signal by listening on 145 mc. By-pass condensers can be any value between .01 and .005 μF . The coil formers are small polystyrene type. The 200-turn coil L1 can be either wave- or scramble-wound and doped to keep in place. The output coil is three turns of 24 SWG enamel.

The chassis size of this unit is 4 in. long by

ONE way to be certain that you have an accurate signal source for alignment purposes is to employ a crystal oscillator.

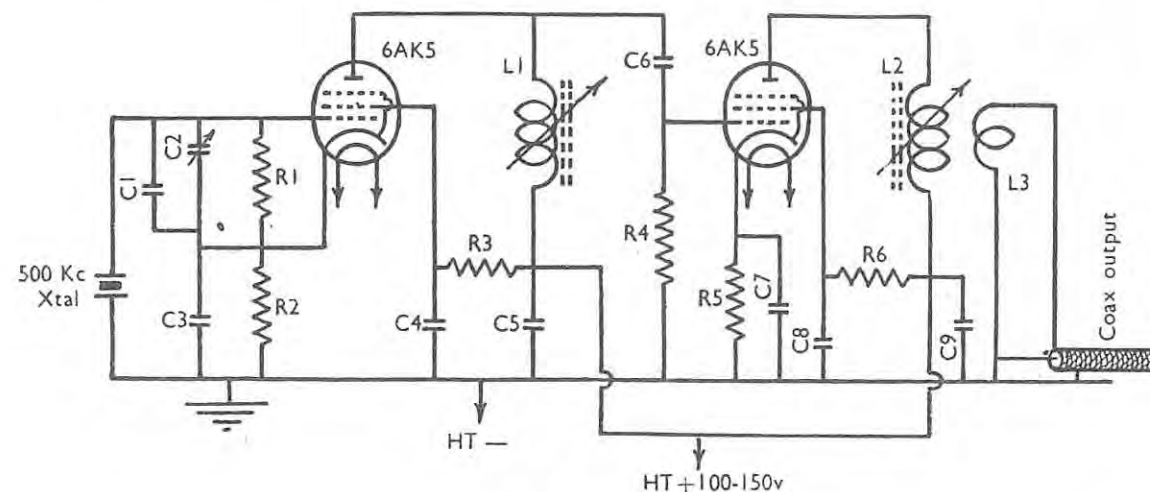
The circuit diagram of Fig. 1A covers a simple, single-tube instrument which can be easily built and will prove to be a useful tool

3 in. high and 3 in. wide. Actual size is not important as long as grid and plate leads are kept to 1 or 2 in. Once constructed, it will be found essential for its purpose, and it is cheap and easy to build.

Table of Values

CC Marker Unit

C1	= 22 $\mu\mu\text{F}$
C2	= 100 $\mu\mu\text{F}$, variable
C3, C7, C8, C9	= 500 $\mu\mu\text{F}$
C4, C5	= .003 μF
C6	= 80 $\mu\mu\text{F}$
R1	= 500,000 ohms
R2, R3, R6	= 10,000 ohms
R4	= 100,000 ohms
R5	= 220 ohms
L1	= 200 turns, 40 SWG, on slugged polystyrene former
L2	= 3 turns, 24 SWG, on slugged polystyrene former
L3	= 2 turns coupled to L2
6AK5, 9001, 9003 (see text)	
500 kc bar	



Circuit of the Marker Unit

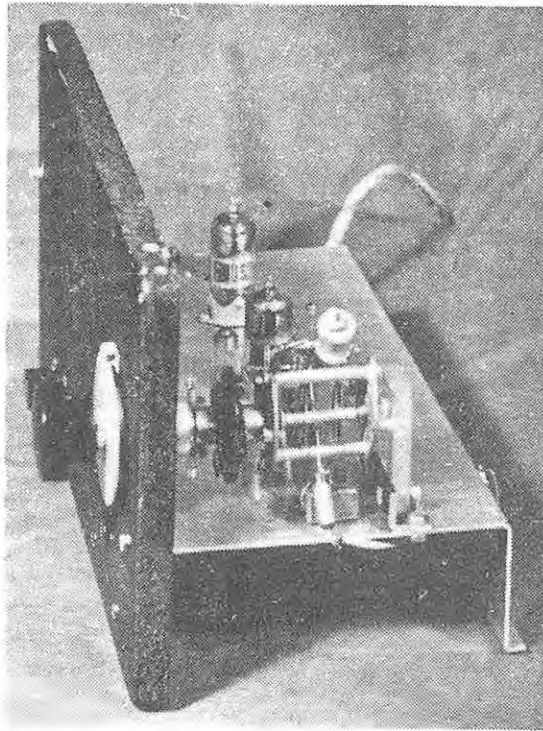
Triode Converter for Two

Design using 6J6's, with Performance limited only by Aerial Noise

By W. J. CRAWLEY

Simplicity and Stability of the Push-pull Converter

For purposes of comparison about half a dozen different versions of this receiver have now been constructed, and without exception every one worked first time without the slightest sign of trouble. Indeed, despite the rather complicated appearance of its circuitry, this converter is simpler to construct and to get working than any other type. Its perfect balance makes it inherently stable; the only possibly tricky adjustment is that of neutralising the RF stage, but if the instruc-



Top side of the converter built up on the locally fabricated chassis, using surplus parts. The oscillator coil and tuning condenser are right in the foreground.

The author has already made a number of very useful contributions to these pages. Since the receiver is still one of the main considerations at every VHF station, we are glad to present here details of his latest converter for the 145 mc band—and the quest for better converters must go on unceasingly. This one is giving exceptional results and can be recommended as an extremely effective practical design.—Ed.

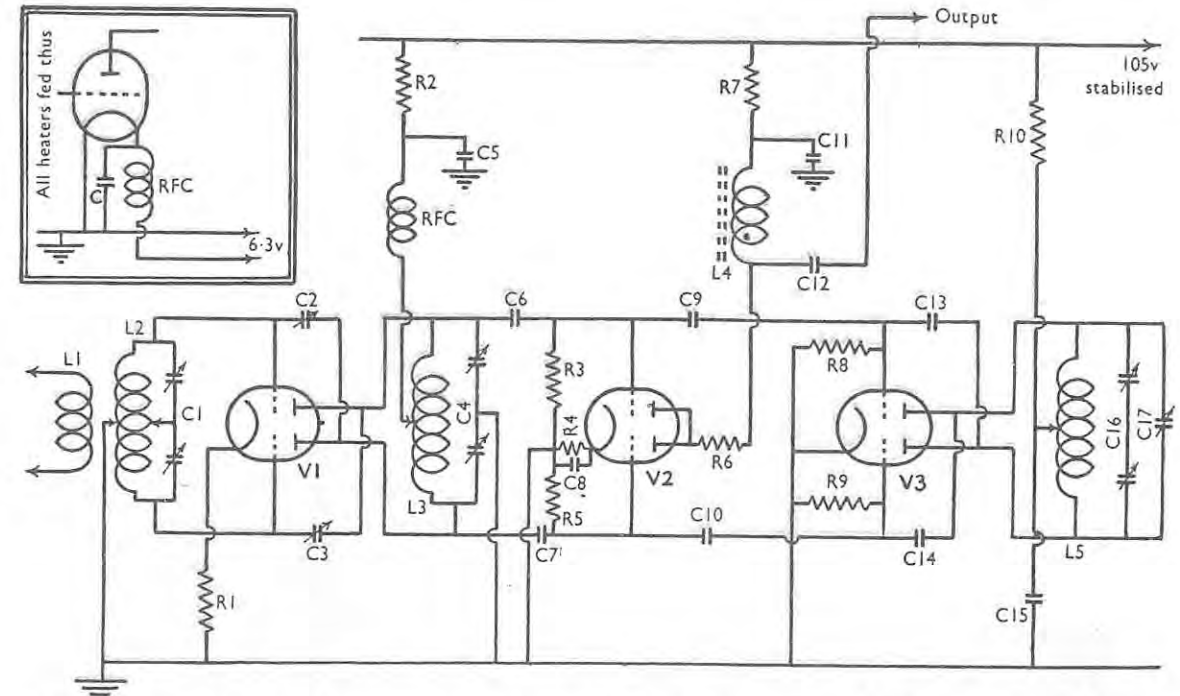
tions are carefully followed, this will present no difficulty. Compared with receivers using a pentode RF stage such as the 6AK5, this converter is as docile as a lamb, gives slightly higher gain, and much better signal-to-noise ratio!

Some Advantages of the Push-pull Triode

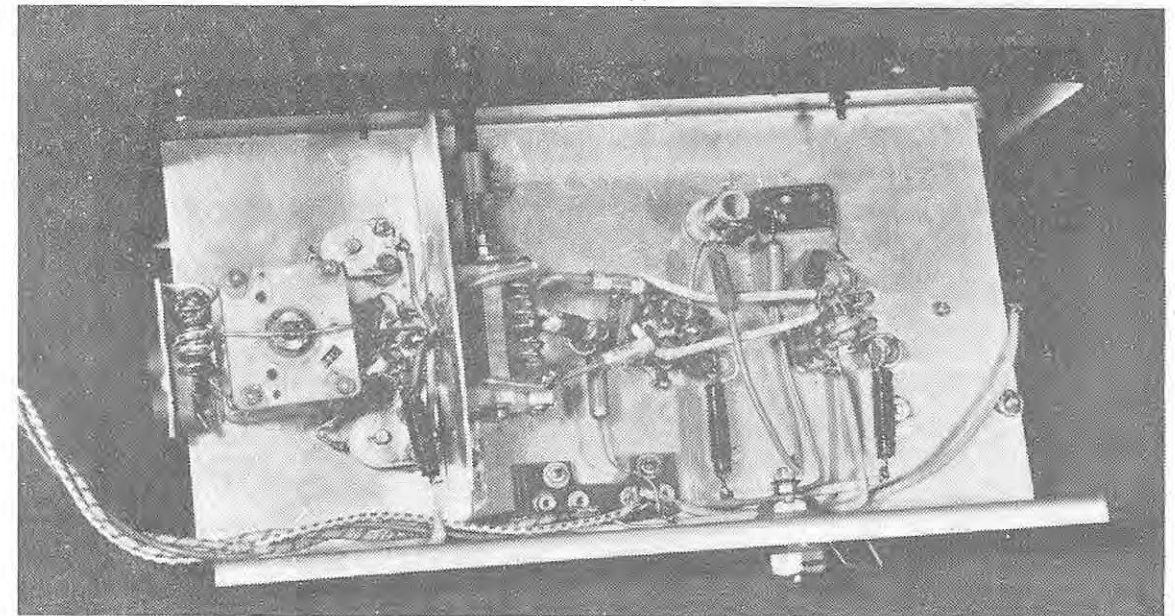
The main advantage of the triode over the pentode in VHF RF amplifiers is that it has no screen. The noise energy in pentodes is higher than in triodes of similar characteristics because of the added noise caused by the screen current. A pentode is usually between three to five times as noisy as a triode producing equivalent amplification. For example, the Equivalent Noise Resistance of a 6AK5 is approximately 1,500 ohms, whereas that of the 6J6 is only about 400 ohms. However, in single-ended circuits, full advantage of the triode superiority cannot usually be taken. In the push-pull mode, however, the triode demonstrates its superiority because of the following factors: The push-pull connection

Table of Values

- C1 = $8 \times 8 \mu\text{F}$ "Butterfly"
- C4 = $15 \times 15 \mu\text{F}$ "Butterfly"
- C2, C3 = $1/4 \mu\text{F}$ trimmers (see text)
- C5, C8, C15 = $500 \mu\text{F}$ mica
- C6, C7 = $30 \mu\text{F}$ Ceramicon
- C9, C10 = See text
- C11 = $0.01 \mu\text{F}$ mica
- C12 = $50 \mu\text{F}$ mica
- C13, C14 = $10 \mu\text{F}$ Ceramicon
- C16 = $5 \times 5 \mu\text{F}$ split-stator
- C17 = $30 \mu\text{F}$ trimmer (Philips)
- R1 = 56 ohms $\frac{1}{2}$ watt
- R2, R7, R10 = 2,000 ohms $\frac{1}{2}$ watt
- R3, R5 = 100,000 ohms $\frac{1}{2}$ watt
- R4 = 470 ohms $\frac{1}{2}$ watt
- R6 = 56 ohms $\frac{1}{2}$ watt
- R8, R9 = 15,000 ohms $\frac{1}{2}$ watt
- All RFC = 20 in. of 26 SWG enamelled on $\frac{1}{2}$ -watt resistor or $\frac{3}{8}$ in. former
- L2, L3 = 6 turns $\frac{1}{2}$ in. diam. centre tap
- L1 = 2 turns over centre of L2
- L4 = 7 mc IF coil
- L5 = 4 turns $\frac{1}{2}$ in. C.T.



The circuit complete of G2IQ's two-metre converter, using 6J6's and with a neutralised RF section. It is a low-noise high-gain job, easy to build, and should give exceptional results on Two. The by-pass condenser C in the sketch inset can be $500 \mu\text{F}$.

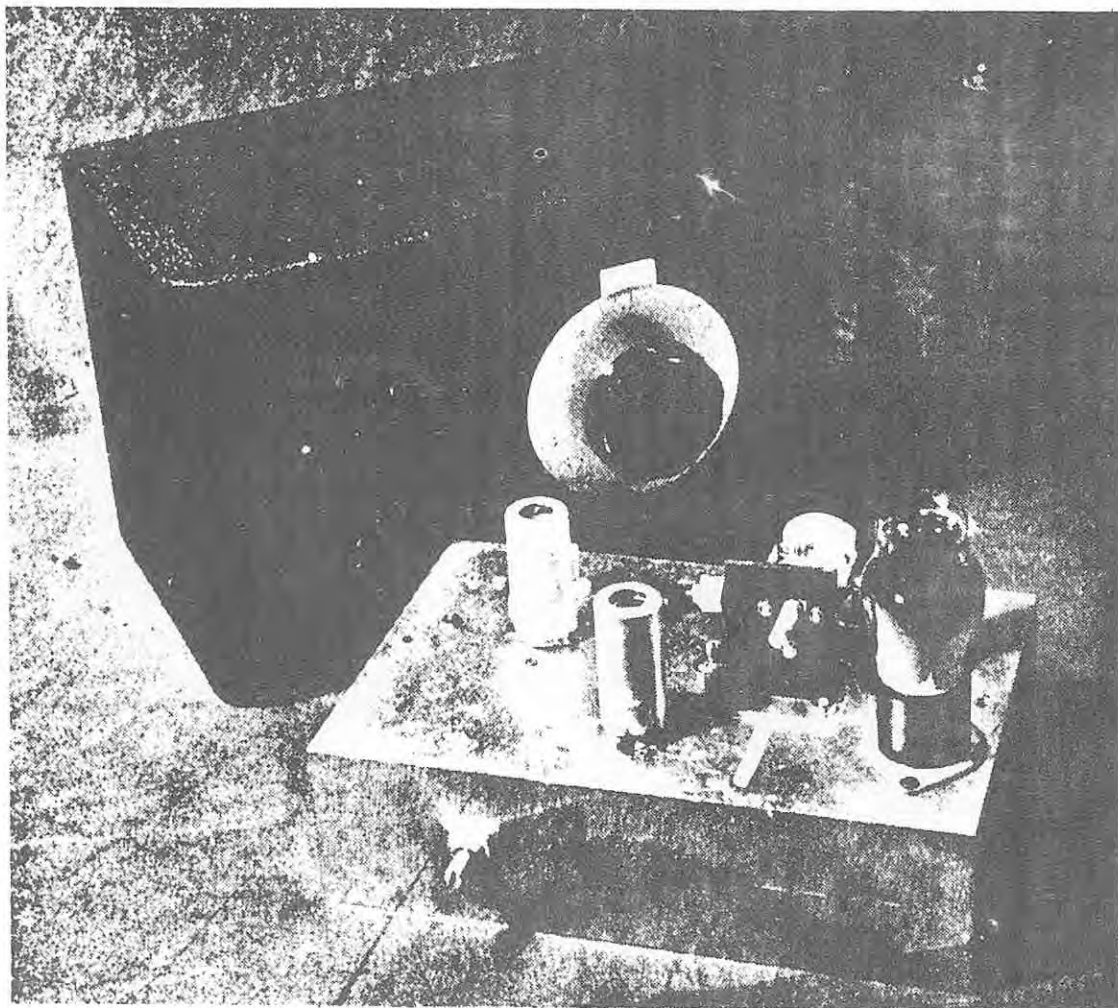


Underneath the converter constructed from surplus components. The grid coil is across the butterfly condenser, and the screen divides the grid and plate sections of the push-pull RF stage. The mixer injection condensers are the two parallel wires in the centre (white sleeving).

halves the input capacity (it becomes here only 1 μF), making it possible to use a comparatively large inductance in the grid circuit, a step-up aerial transformer and a truly balanced input circuit. In addition, the input resistance is doubled so that the damping of the grid coil is halved with consequent improvement in the gain. In point of fact, the input resistance of a properly neutralised 6J6 is better than 10,000 ohms at 145 mc, whereas that of the 6AK5 is as low as 3,000 ohms. One further big advantage of the push-pull 6J6 is that this valve has only one cathode, common

to both triodes. In the push-pull Class-A mode no RF current flows in the cathode lead; in other words, the cathode is cold to RF and consequently the evil effects of cathode lead inductance are eliminated.

When added together the foregoing advantages make a properly designed push-pull 6J6 RF amplifier approximately 5 to 6 dB better than a well-designed 6AK5 stage on the score of signal-to-noise alone. This may not look much on paper, but consider to what lengths we are willing to go to get another 6 dB gain from our beam aërials! Moreover, the gain



The second (and more "decent") converter referred to in the text.

we are getting from the 6J6 is better than that we could get by increasing the beam gain by 6 dB because it represents pure signal gain without any additional noise. Increasing the beam gain also increases the noise component to some extent!

Construction of Two Units

The photographs illustrate two versions of the same circuit. One is the logical development of a study of the circuit diagram and the components are spaced across the chassis in "chronological order," starting with the RF grid circuit and ending with the oscillator plate tank. This type of construction has the necessary symmetry and is, perhaps, easier than the second type. Both converters, however, have identical noise factors. The first was constructed almost entirely of surplus components on a home-made chassis: the second (also photographed) uses well-known types of components, and a commercially made cabinet and chassis. In order to get everything into the commercial chassis it was necessary to use a different layout, but the balance has not been impaired.

The input circuit in both converters uses a pre-set butterfly type condenser. The input circuit is sufficiently broad-band to allow the grid condenser to be tuned to the middle of the band and left there. The neutralising condensers lie on each side of the tuning condenser, making the grid leads as short as possible. The neutralising condensers are brought to each mixer grid pin and looped once around the $\frac{1}{4}$ -in. of resistor lead. The mixer does not appear to be unduly critical as to oscillator power, and varying amounts of injection have been tried with little or no variation in the noise factor.

There is no need to stress that the oscillator depends for its stability on the mechanical strength of its parts. Short, rigid leads are particularly vital here. The coil should be wound with not less than 18 SWG wire, and its centre should receive added support by a short rigid wire from the centre tap to the by-pass condenser. The tuning condenser requires a rigid supporting bracket and should be connected to the slow-motion drive by a flexible coupling. Use a concentric condenser for trimming the oscillator as this type may be

rigidly supported in the wiring. If desired, the VR105/30 stabiliser may be mounted on the same chassis with no ill effects.

Putting the Converter into Operation

There should be no difficulty in getting the converter working satisfactorily in a short time. The first step is to peak up the IF coil, and this may be done by turning up the main receiver gain and trimming the IF coil for maximum hiss at the frequency chosen. The next step is to trim the oscillator coil to approximately 138 mc—that is, 145 less the intermediate frequency. With the HT to the RF valve temporarily disconnected, rock the RF plate tuning condenser. Two positions of increased hiss in the receiver output will be noticed corresponding to frequencies of 131 mc and 145 mc. The latter is the correct one, that is the one using less capacity. Now apply HT to the RF valve and in all probability (unless you have been very lucky) the receiver will become distinctly unstable! With the neutralising trimmers at maximum, reduce the capacity of each uniformly, a little at a time, until tuning the grid coil into resonance does not produce self-oscillation in the RF stage. When the receiver is properly neutralised tuning the grid coil should produce a slight increase in hiss at resonance but the tuning should not be sharp, neither should the increase in hiss be pronounced. Pronounced hiss and sharp tuning denote that the receiver is working on the threshold of instability, and whilst the gain will be higher the signal-to-noise ratio will suffer. If this condition exists it is as well to experiment with the neutralising condensers until the RF stage becomes more docile. When properly adjusted, the stage should remain stable even with the aerial disconnected.

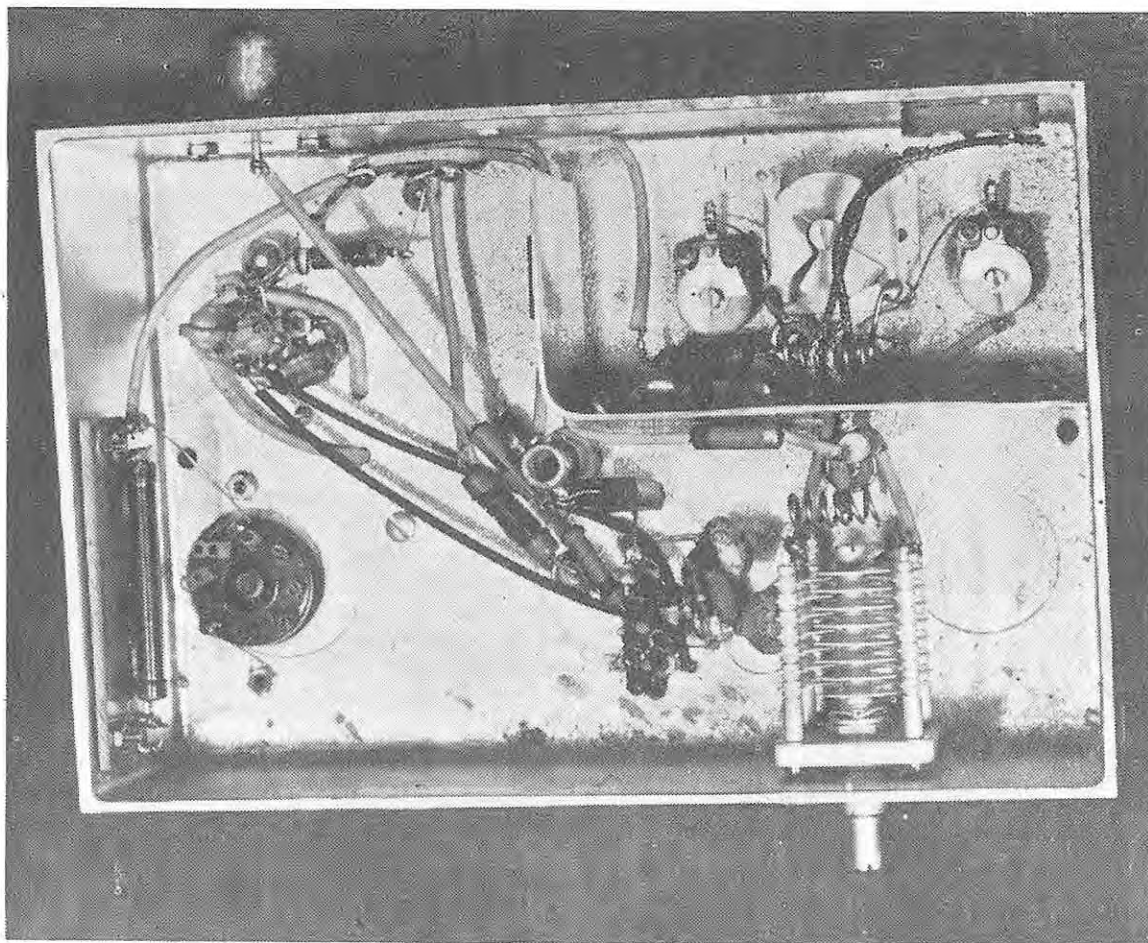
The Input Load

The converter works better with a balanced aerial system with an impedance of between 300 and 600 ohms. The use of coaxial cable with one side of the aerial coupling coil earthed upsets the balance somewhat. Many VHF workers are coming to the conclusion that symmetrical feeders are to be preferred to coaxial (asymmetrical) lines, but for those who

are using the latter the following suggestion may be of help: it is not always recognised that when the aerial is used for reception its function is reversed and the receiver becomes the load and the aerial the generator. Therefore matching the aerial to the receiver must be done at the receiver end. In this case the 70-ohm coaxial line may be matched to the 300-ohm input of the converter by means of a quarter-wave matching transformer of 150 ohms impedance, and the need to earth one side of the input coil is obviated. This transformer may take the form of two lengths of 70-ohm coax 13 in. long (*i.e.* 20 in. times the velocity factor) with the outer braid connected

together at each end and the inner conductors connected to the aerial feeder and receiver input. Alternatively, two lengths of 300-ohm twinlead, each 16 in. long, may be used in parallel to effect the desired balance. Attention to small points like this are well worth while and will help achieve the near-perfect reception of which this type of converter is capable.

Do not be disappointed, during the first few hours' work with this receiver, at its apparent lack of liveliness. Its abnormal quietness is not due to insensitivity, as it will soon demonstrate when a signal appears on the band.



On the tidy theme, this is looking underneath the converter as constructed on an Eddystone chassis. The RF grid section is almost completely screened from the rest of the set. The mounting of the neutralising condensers is clearly visible.

HAMADS

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SELL AT BARGAIN - Hallicrafters HT-17 transmitter. 15 watts output on 80 thru 10 meters. In perfect shape, complete with coils for 80, 40, 20, and tubes. 25 or 60 cycle. Price - \$45.00. VE1OL/3, A. Urquhart, 58 Tranby Ave., Toronto, or phone KINGSdale 1768.

FOR SALE - Radiovision Commander receiver almost new. Speaker and phones included. 60 cycle, easily converted - \$200.00. E.L. Wurtele, 1107 Avenue Road, Toronto, phone MAYfair 4403.

NUMBER NINETEEN ARMY TRANSCEIVER for sale - what offers ?? VE5AX, 660 Sask. Crescent, E. Saskatoon, Sask.

SELL HOWARD 430, the portable mans favorite receiver, .54 through 32 Mcs., in good condition, spare tubes - make offer. VE5MS, Mike, LaFleche, Sask.

FOR SALE - HRO-W with 115V60 and 6VDC power supplies, nine sets coils for complete frequency coverage - price \$250.00. Also DB22A preselector, 540 kc to 45 Mcs, \$50.00. Millen transmitter 90810 with all tubes including 829B - \$100.00. Millen exciter-transmitter 90800 with tubes, \$35.00. Marconi Police transmitter, converted to ham bands with Millen plug - in coils - suppressor grid modulated 802 in final 25 watt rating in cabinet - price \$100.00. New war surplus 813's, limited quantity, \$10.00 each. VE1HI, Keith Rogers, 3 Grafton, Charlottetown.

TORONTO AREA HAMS - Have Westinghouse side oven type electric range, suitable for cottage, or switching to electrical cooking economically. In good condition, \$35.00 or trade. Also have BC-696, brand-new, covering 3 to 4 mcs direct - \$20.00. BC-457, fine for 10 meter mobile conversion - new - \$18.00. VE3WO, 86 Invermay Avenue, Wilson Heights P.O., Ontario.

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VE3BCB Print 204 Ranleigh Ave., Toronto
SAMPLES ON REQUEST

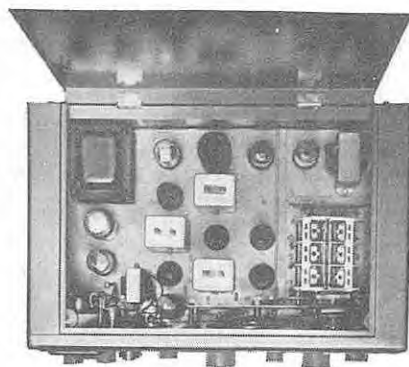
FOR SALE - BC-348 perfect \$115.00. LM-8 Navy version of BC-221, with modulation, \$75.00. Q5'er Command receivers and transmitters, \$20.00 each. Power supply, \$35.00. Enquire, VE3BVX, 60 Albert South, Lindsay, Ontario.

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performance . . . the new NC-125

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builds
like
this?

with built-in Select-O-Ject

When you compare frequency range and types
of reception possible — when you compare selectivity
and sensitivity — when you compare wanted
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so much at such moderate cost!

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S-meter. AVC, ANL, ant. trimmer. Variable CW pitch control. Separate
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for phono or NFM adapter. Audio essentially flat to 10,000 c.p.s.

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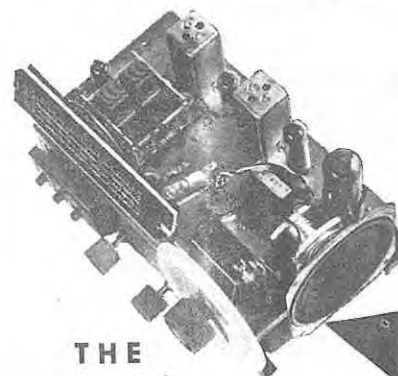


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THE
SW-54



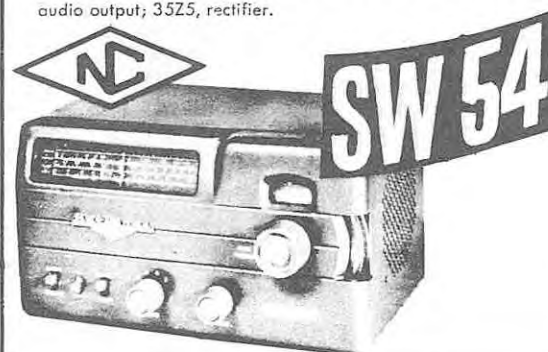
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USES MINIATURE TUBES
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New miniature tubes make possible new
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TUBE COMPLEMENT: 12BE6, converter; 12BA6, CW osc.
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COVERAGE: Entire frequency range from 540 kc. to 30 mc.
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Phones.

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Audiences have eyes only for the performer . . . are unaware of the *Tiny, Inconspicuous* NEW DK-1 Microphone

THE NEW ASTATIC DK-1 Crystal Microphone is a non-directional, high impedance unit. It offers the same high quality performance as full-size professional microphones, for studio and public address applications . . . PLUS tiny, inconspicuous exterior design that gives the user every advantage for full audience attention and appreciation. The reduced size involves no sacrifice of ability to transmit sound at highest levels of clarity, realism and full-toned richness. Yet, the interior elements have been made to conform to a miniature case, itself designed according to a basic principle of camouflage rather than ordinary requirements of microphone housings. Nothing ornate in design or decoration appears on the DK-1 to attract the eye. Similarly, the complete absence of hard, straight lines and flat, bold surfaces tends further to make the DK-1 blend into its surroundings. The non-glare, non-reflective brushed chrome finish also contributes to this single purpose.



Features

- 1 Output level, approximately -55 db.
- 2 Excellent frequency range, with rising characteristics between 2,000 and 5,000 c.p.s.
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- 4 Available with or without an off-on switch.

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Astatic Crystal Devices manufactured under
Brush Development Company patents.

DX PREDICTIONS

Prepared by C.B. McKee, Engineering
Division, CBC International Service

DX PREDICTIONS FOR MONTH OF AUGUST, 1951

Skywire frequency predictions are for amateur communications on various circuits to almost any part of the world. These tables are for five major areas in Canada, and amateurs who are operating reasonably close to the cities indicated will find these predictions quite adequate.

Figures shown are in megacycles and indicate the band to be used. They are for normal F layer transmission and don't consider Sporadic E which may provide unusual DX openings!

Sackville to: AST		01	03	05	07	09	11	13	15	17	19	21	23
Europe	7	7	14	14	14	14	14	14	14	14	14	14	7
Africa	7	-	14	-	-	-	14	14	14	14	14	14	7
Caribbean	7	7	7	14	14	14	14	14	14	14	14	14	7
S. America	7	7	14	-	-	14	14	14	14	14	14	14	7
Australia	7	7	7	7	-	-	-	-	-	-	-	-	7
U.S. - West	14	7	7	7	14	14	14	14	14	14	14	14	14
U.S. - Central	14	7	7	7	14	14	14	14	14	14	14	14	14
U.S. - South	14	14	7	14	14	14	14	14	14	14	14	14	14
Vancouver	14	7	7	7	14	14	14	14	14	14	14	14	14
Watrous	7	7	7	7	14	14	14	14	14	14	14	14	14
Toronto	7	4	4	4	7	7	7	7	7	7	7	7	7
Montreal	4	4	4	4	7	7	7	7	7	7	7	7	7

Montreal to: EST		00	02	04	06	08	10	12	14	16	18	20	22
Europe	7	7	14	14	14	14	14	14	14	14	14	14	7
Africa	14	-	14	-	-	-	14	14	14	14	14	14	7
Caribbean	7	7	7	14	14	14	14	14	14	14	14	14	7
S. America	7	7	14	-	-	14	14	14	14	14	14	14	7
Australia	7	14	14	7	7	7	7	7	7	7	7	7	7
U.S. - West	14	14	7	7	7	7	7	7	7	7	7	7	7
U.S. - Central	14	7	7	7	14	14	14	14	14	14	14	14	14
U.S. - South	14	7	7	7	14	14	14	14	14	14	14	14	14
Vancouver	14	7	7	7	14	14	14	14	14	14	14	14	14
Watrous	7	7	7	7	14	14	14	14	14	14	14	14	14
Toronto	4	4	4	4	7	7	7	7	7	7	7	7	7
Sackville	4	4	4	4	7	7	7	7	7	7	7	7	7

Toronto to: EST		00	02	04	06	08	10	12	14	16	18	20	22
Europe	7	7	7	14	14	14	14	14	14	14	14	14	14
Africa	14	-	14	-	-	-	14	14	14	14	14	14	7
Caribbean	7	7	7	14	14	14	14	14	14	14	14	14	7
S. America	7	7	14	-	-	14	14	14	14	14	14	14	7
Australia	7	14	14	7	-	-	-	-	-	-	-	-	7
U.S. - West	14	14	7	7	14	14	14	14	14	14	14	14	14
U.S. - Central	7	7	7	7	14	14	14	14	14	14	14	14	14
U.S. - South	14	7	7	7	14	14	14	14	14	14	14	14	14
Vancouver	14	7	7	7	14	14	14	14	14	14	14	14	14
Watrous	7	7	7	7	14	14	14	14	14	14	14	14	14
Montreal	4	4	4	4	7	7	7	7	7	7	7	7	7
Sackville	7	4	4	4	7	7	7	7	7	7	7	7	7

Watrous to: MST		22	00	02	04	06	08	10	12	14	16	18	20
Europe	7	7	7	7	14	14	14	14	14	14	14	14	14
Africa	7	7	7	14	-	-	-	14	14	14	14	14	14
Caribbean	14	14	14	14	14	14	14	14	14	14	14	14	14
S. America	14	14	14	7	14	-	-	14	14	14	14	14	14
Australia	14	14	14	7	14	7	-	-	-	-	-	-	-
U.S. - West	7	7	7	7	7	7	7	7	7	7	7	7	7
U.S. - Central	7	7	7	4	7	7	7	7	7	7	7	7	7
U.S. - South	14	14	14	7	14	14	14	14	14	14	14	14	14
Vancouver	7	7	7	7	7	7	7	14	14	14	14	14	14
Toronto	7	7	7	7	7	7	7	14	14	14	14	14	14
Montreal	7	7	7	7	7	7	7	14	14	14	14	14	14
Sackville	7	7	7	7	7	14	14	14	14	14	14	14	14

Vancouver to: PST		21	23	01	03	05	07	09	11	13	15	17	19
Europe	7	7	7	7	-	14	14	14	14	14	14	14	14
Africa	14	7	7	7	7	14	14	14	14	14	14	14	14
Caribbean	14	14	14	7	14	14	14	14	14	14	14	14	14
S. America	14	14	14	7	14	14	14	14	14	14	14	14	14
Australia	14	14	14	7	7	7	7	-	-	-	-	-	-
U.S. - West	7	7	4	4	4	4	7	7	7	7	7	7	7
U.S. - Central	14	7	7	7	7	14	14	14	14	14	14	14	14
U.S. - South	14	14	14	7	14	14	14	14	14	14	14	14	14
Watrous	7	7	7	7	7	14	14	14	14	14	14	14	14
Toronto	14	7	7	7	7	14	14	14	14	14	14	14	14
Montreal	14	7	7	7	7	14	14	14	14	14	14	14	14
Sackville	14	7	7	7	7	14	14	14	14	14	14	14	14

HOW'S UR OBS IQ?

Official Bulletin Nr 297, June 13, 1951. The record for two way communication on 144 Mc. was extended to approximately 1400 miles on June 10th, when W6WSQ, Pasadena, W6ZL, Glendale and W2PJA/6, Long Beach, California worked W5NQL, Texarkana, Texas. W5AJG, Dallas, also worked these stations for distance in excess of previous 1200 mile record. W6ZL also heard W5PDW, Biloxi, Mississippi, a distance of 1770 miles. Mathematical checks will be made for record details, but meanwhile it appears that W6ZL has it by a slight margin. The presence of high density E layer ionizations at the time, indicates that this is the probable propagation medium.

Official Bulletin Nr 298, June 21, 1951. Following a meeting in Paris on June 22, ON4QF, W6SAI, and W8PQQ will travel to Monaco where they will operate 3A2AC from approximately June 22 to July 6. It is not known what frequencies 3A2AC will use, but a large part of operations will be in the 14 Mc. band. After shutting down in Monaco, these amateurs plan to operate from Andorra if possible. The dates of any operation from Andorra and the call to be used are not known, but will be passed along via special W1AW Bulletin when such information becomes available.

Official Bulletin Nr 299, June 28, 1951. The Arctic Institute of North America Schooner Blue Dolphin will sail to northern waters this summer and will communicate with radio amateurs. Bruce Wald, W2BZD, will operate from the ship using his amateur call for maritime mobile work in the 80, 40 and 20 meter bands under special FCC authorization. Any additional details concerning the operating schedules of W2BZD/MM will be announced later from W1AW.

Official Bulletin Nr 300, July 6, 1951. With the assistance of amateurs who are active on 28 Mc., A.R.R.L. each year conducts a program of on-the-air code practice for persons wishing to learn the Continental code. Volunteers are needed for the new program currently being planned. Schedules may be arranged to suit the convenience of cooperating amateurs and will be published in QST. A combination of voice and code transmissions is considered to be most effective. Suggestions for conducting code lessons over the air are available from A.R.R.L. If you are operating on 28 Mc. and would like to assist in this program, send a postal or radiogram to the C.D., indicating your interest and complete details will be furnished immediately.



HEAT RESISTANT — NO WAX TO DRIP OUT with Plastic Moulded Capacitors . . . and heat from a soldering iron will not cause plastic case to melt or run. This means faster, neater soldering — more jobs finished in less time.



Sangamo Mica capacitors are used in more critical circuit installations . . . have greater stability.

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YAGI TELEVISION ANTENNA

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Get Wanted Channels Bright, Clear and Without Interference

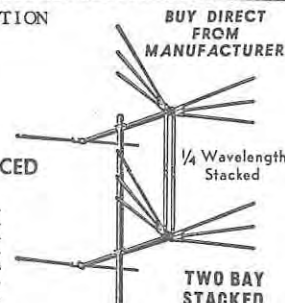
Highly directive and closely tuned to each channel. Cuts interference and noise to minimum. Five elements!

For each channel 2 - 13

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High quality TV antennas designed for superior performance. Full-hard elements and all-aluminum construction provide maximum strength and eliminate excessive weight and rust problems. Gives broad band reception on all TV channels plus FM. High signal-to-noise ratio, excellent front-to-back ratio, matches 72, 150, or 300 ohm input impedance, ridged U-bolt mast clamp bracket set at proper balance point prevents antenna from slipping or twisting on mast. Fits masts up 1-1/2" O.D.

Our Yagi types can be stacked for higher gain if needed. Stacking bars and Yagis for every channel at prices far below anything you have seen. Try us and prove it!



BUY DIRECT FROM MANUFACTURER
1/4 Wavelength Stacked
TWO BAY STACKED CONICAL
1 & 4 bay in stock.

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\$27.50 TOP VALUE
IN BRAND NEW MERCHANDISE
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The Sylvania Modulation Meter is a unique instrument for monitoring the percentage modulation of an amplitude-modulated radio transmitter. Hum and noise in the unit are eliminated through the use of Sylvania Type 1N34 Germanium Diodes in place of the conventional tubes and AC power supply or batteries.

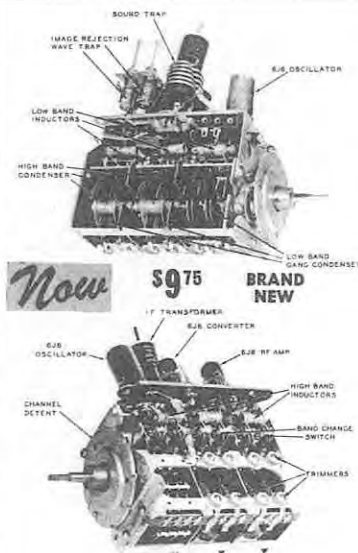
STOP GUESSING ABOUT MODULATION. THIS IS FINEST INDICATOR ON MARKET TODAY. ORDER DIRECT FROM VE3WO

SKYWIRE

THE CANADIAN RADIO AMATEURS' JOURNAL
86 INVERMAY AVE., WILSON HEIGHTS P.O.,
TORONTO 12,



I have some visitors in the shack but I doubt if I can persuade them to speak



Dear QM's:

SENSATIONAL VALUE

Since the appearance of our ad on this turret tuner last month, two things have happened. Perhaps the most important of these from the ham point of view is that we are now able to offer a bigger supply of these tuners at an even lower price - \$9.75 each. A refund is available for those who got theirs at \$11.50. Please be sure to call or write for it.

The second thing that happened was that after we shipped the turrets out, the buyers in many cases sent along their ideas on how they could best be used. And since this will interest those of you who were on the point of ordering your turret, or maybe two or three, here's the gen.

First, it's a cinch to hit six meters with the unit, and any standard communications receiver will provide the 21 mc I.F. frequency needed. So for less than ten bucks you have a six meter superhet that really does a job. The same converter idea can be used for two meters, too, using the tuner high-band channel coils. And because of the push-pull, noise-canceling circuit, performance on weak signals is tremendous. If you want some other ideas yourself, our writers suggestions have been in many cases to study the article in the latest issue of QST covering tuners like this and suit your own needs as shown.

Just take a look at those two views to the left - compare our price with any on the continent, and you'll find there's more turret for less money than you'll ever get elsewhere. When you get yours, the red lead is the B plus lead - black and brown leads, filament - white, gain control lead, and the green is for the I.F. output. This lead is hot and needs blocking. Order yours today - units shipped same day orders received so you won't be kept waiting.

Roy Lerner

DOMINION RADIO & ELECTRONICS CO.
424 ADELAIDE ST. W.
TORONTO WA.9700

THE NIAGARA PENINSULA AMATEUR RADIO CLUB is holding its Stag Weiner Roast on the farm of VE3FZ, Harvey Cox, at Beamsville, Ontario on August 25th, 1951. Prizes and refreshments. Starts around 8.30 p.m. on Saturday evening. Tickets - \$1.50 each. Strictly a stag for the OM. All welcome. Tickets now available from VE3DGE, 9 Peachdale Ave., St. Catharines, Ont.

THE MONTREAL AMATEUR RADIO CLUB WILL BE sponsors of a Hamfest to be held on September 22nd, 1951, in Victoria Hall, Westmount. A big event - this will be a Hamfest worth planning ahead for.

In last months' issue of Skywire, a printing error caused considerable confusion as to the price of the ARC5/T23 transmitter, advertised by Radio Electronic Supplies and Ashman Electronics. The correct price per unit is \$39.50 as now noted on page 28 of this issue. We regret the inconvenience this error caused our advertisers. The many who wrote, ordering these units are now advised that this error was due to defective type in printing. Skywire had been advised of the correct price and is responsible for the mistake.

DRY ELECTROLYTICS • MINIATURE & STANDARD
PAPER DIELECTRICS • MINIATURE METALLIZED
PAPERS • MICA DIELECTRICS • ETC.

This range of miniature capacitors is constructed for use where the space factor is of major consideration. A special blue transparent sleeve known as "Domalac" which is a cellulose film of very tough and non-inflammable material is placed around the capacitor for extra protection. This cover has a minimum electrical breakdown of 3000 V.D.C. and does not change its characteristics at temperatures up to 100° c.

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VANCOUVER WINNIPEG MONTREAL HALIFAX ST. JOHN'S Nfld.

SPECTRUM UTILIZATION IN COLOR TELEVISION

With the available spectrum, a comparatively large number of ways to transmit color-television pictures are possible. These require careful study in choice of system giving best promise

By R. B. DOME

Receiver Division, Electronics Department
General Electric Company, Syracuse, New York



R. B. Dome

THE 6-Mc television channel, now standard in the United States for monochrome or black-and-white television transmissions, may be used in a number of ways for color-television transmissions. It is the purpose of this article to describe some of these ways.

There are in general, for color television, three sets of data to be transmitted instead of the single set for monochrome. The three data may correspond to brightness, hue, and saturation, or to three proper primary colors, or to some linear transformations of the latter.

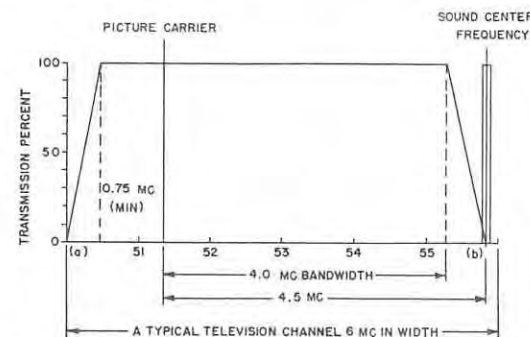


Fig. 1. U. S. standard television channel for monochrome transmission
(a). Transmission at lower edge of channel not greater than 0.1 percent
(b). Transmission of picture side band at sound carrier not greater than 0.1 percent

If each set of data were transmitted over separate 4-Mc channels, a total bandwidth of at least 12 Mc would be required. Such a transmission method would not fit in too well with the present VHF channel allocation plan. It would also cut in half the number of new channels which would be made available in any additional portion of the radio frequency spectrum opened up for television broadcasting. It is highly desirable, therefore, to see what can be done to utilize to best advantage the present 6-Mc channel for packaging color television signals.

FIG. 1 shows the present channel utilization in black-and-white transmission with the picture carrier located 1.25 Mc above the lower edge of the channel

and the sound carrier located 0.25 Mc below the upper edge of the channel. When due allowance is made for a guard band for sound carrier rejection circuits in the picture channel in a television receiver, an upper video frequency limit of 4 Mc is about the maximum that can be made available in a practical receiver. A simple calculation based on this bandwidth and on a frame rate of 30 frames per second shows that, neglecting blanking intervals, the number of picture elements making up the structure of the picture is 267,000. This may be used as a yardstick in determining the structural quality of pictures portrayed by any of the several color-television systems to be considered here.

The multiple data of the color signals must be multiplexed in some manner, and a careful examination should be made of any proposed method or system in order to determine whether efficient use is being made of the available spectrum. Use may be made, therefore, of the known techniques of time-division multiplex, of frequency-division multiplex, or of some combination of the two.

Time-division Multiplex

Time-division multiplex methods will first be examined. Since only one set of data is being dealt with

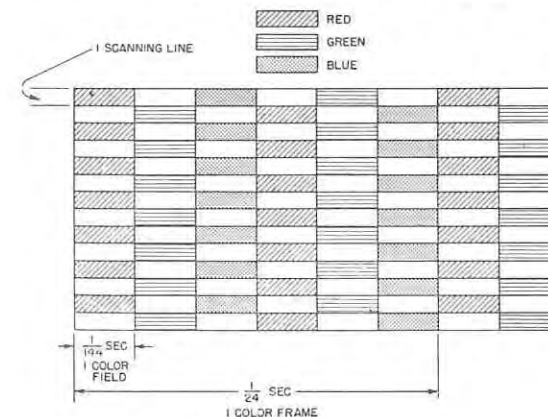


Fig. 2. Field-sequential color-television system

at any instant, the time allocated to one set of data, before shifting to a second set of data, must be decided upon. One logical switching point is at the beginning of each new field of scanning. Such a system is shown in FIG. 2. A second logical switching point is at the beginning of each new line of scanning. Such a system is shown in FIG. 3. A third switching interval may be at some small subdivision of a line. Such a system is shown in FIG. 4. These three methods of time-division multiplex color television may be recognized by their more familiar names of (1) Field-sequential, (2) Line-sequential, and (3) Dot-sequential, color-television systems.

The first two of these time-division systems—namely, the field- and line-sequential systems—can provide the same quality of picture resolution obtainable in monochrome providing the field rate is maintained the same as in monochrome, namely, 60 fields per second. However, if this is done, it will be found that flicker is a problem because it takes three times as many fields to complete a color cycle. To reduce flicker, it is necessary to increase the field rate; but when this is done, the number of picture elements for structural detail is correspondingly reduced so that the resolution becomes degraded as compared to present-day monochrome.

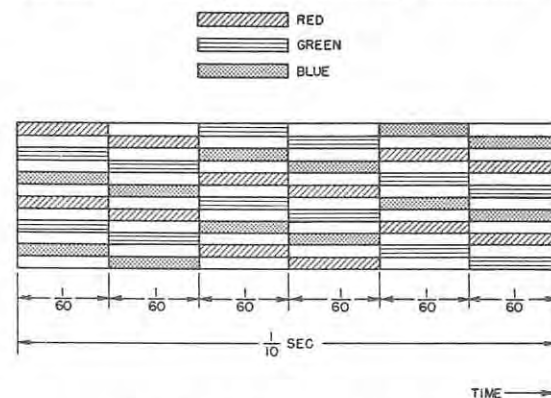


Fig. 3. Line-sequential color-television system

The third system, dot-sequential, when accomplished by the combination of sampling and the employment of mixed highs, offers advantages. The mixed-highs principle is that of combining the higher video frequencies associated with each individual color signal by addition and displaying this signal as shades of gray. The bandwidth gained by employing this principle is considerable when it is realized that the saving amounts to two of the higher portions of the three video frequency bands. Thus, if the mixed highs include frequencies from 2 Mc to 4 Mc, a saving of 4 Mc is obtained over a fully simultaneous system. Since a fully simultaneous system would require three 4-Mc bands,

or 12 Mc, the bandwidth is at once reduced to 8 Mc. The sampling of low frequencies when accomplished in horizontal interlace form saves an additional 4 Mc, so that the entire signal can be packed into a single 4-Mc band.

Frequency-division Multiplex

The second method of multiplexing is frequency-division multiplex. An obvious way to achieve this is to divide the 4-Mc channel into three parts as shown in

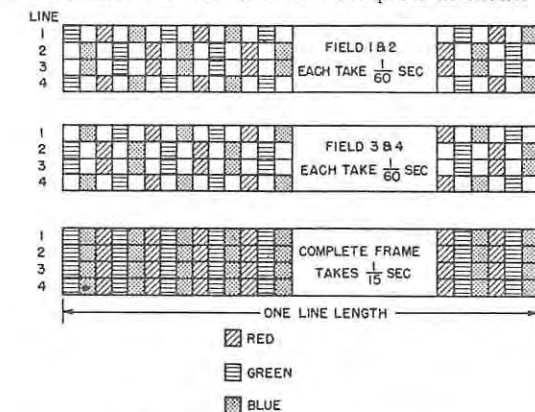


Fig. 4. Dot-sequential color-television system

FIG. 5. The green component of the image may be carried as direct modulation of the picture carrier while the red and blue components may be carried as modulation on two subcarriers. When no overlapping is employed, the theoretical maximum bandwidth per color (assuming equal bandwidths for each color) is 1.33 Mc, so that a considerable reduction in resolution results. When, however, the subcarriers are chosen to be frequencies of the less-visible type—that is, frequencies corresponding to odd multiples of half the line scanning frequency—overlapping may be employed with the result that resolution practically equal to monochrome may be realized. This last system may be recognized as that which has been named "Frequency Interlace." FIG. 6 shows how this has been done in an actual investigation of this system.

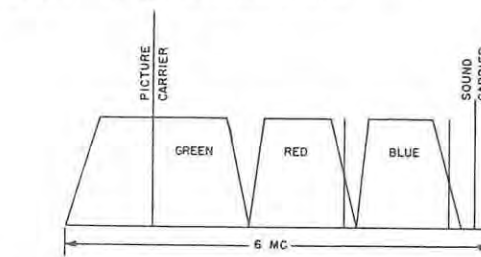


Fig. 5. Simultaneous system employing frequency-division multiplex with no overlap

The dot structure present in the reproduced picture in color systems employing complete overlap has led to variants of the dot-interlace and frequency-interlace systems in attempts to reduce dot structure. One such system is shown in FIG. 7. In this system, the 4-Mc band is divided so that 0-3 Mc is employed for the transmission of essentially the brightness signal, while two color-identifying signals are carried by modulation on a subcarrier at approximately 3.5 Mc by employing amplitude modulation of an inphase component of the subcarrier for one of the two required color-identifying signals and amplitude modulation of a quadrature component of the subcarrier frequency for the second of the two color-identifying signals. By this system upwards of 75 percent of the resolution of monochrome may be realized.

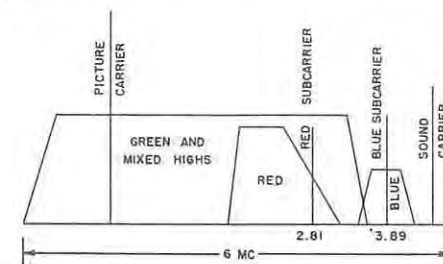


Fig. 6. Spectrum of frequency-interlace system with overlapping mixed highs and red modulated subcarrier

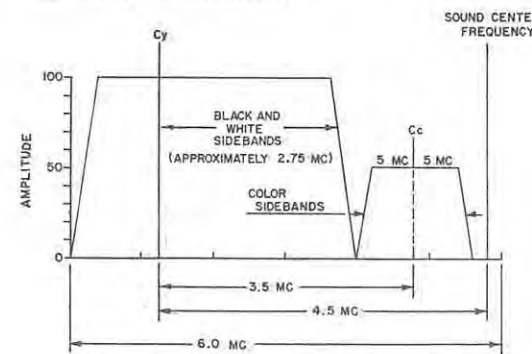


Fig. 7. Color modulation on subcarrier without overlap

Another variant of this system is now under investigation in which it is probable that vestigial sidebands may be employed for the transmission of the color-identifying signals so that an additional amount of band saving may be realized. This system is shown in FIG. 8. It appears that this system may yield upwards of 85 percent of monochrome resolution, which, for all practical purposes, is scarcely discernible from 100 percent. In this system, the carrier phase of one of the two color-identifying subcarriers is reversed in phase at the beginning of each new field of scanning; that is, on one field, the quadrature carrier would be displaced

90 degrees from the other carrier, but on the next field, it would be displaced 270 degrees.

These last two systems of color television are essentially non-band-sharing simultaneous systems inasmuch

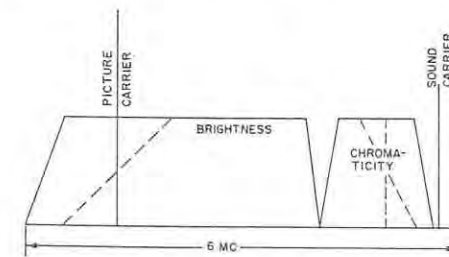


Fig. 8. Non-overlapping system with quadrature component of sub-carrier reversed 180 degrees in phase at end of each field

as either reduced overlap or very little overlap of color-identifying signals into the brightness signal part of the spectrum is contemplated. Another approach to the separation of color identifying and structural detail information so as to avoid the simultaneous use of any portion of the available spectrum may be achieved by combining frequency-division and time-division techniques. Two such systems have been investigated in the laboratories of the General Electric Company. One is known as alternating lows and the other as alternating highs.

Combined Techniques

The alternating-highs method may take on a wide variety of forms, one of which is shown in FIG. 9. During a first interval of time, such as a field or a line, green lows are transmitted as direct modulation of the

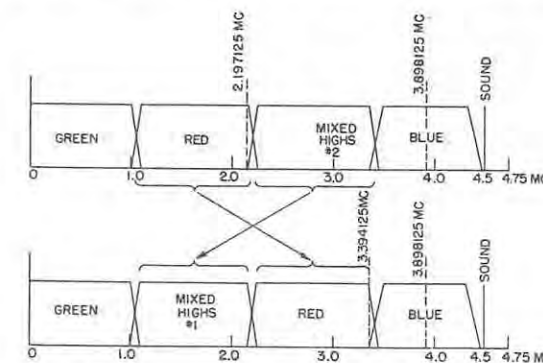


Fig. 9. Spectra of alternating-highs system for the two distinct intervals

principal picture carrier wave as are also the mixed highs of the band 1 Mc to 2.4 Mc. Red lows are carried as modulation of a subcarrier and occupy the 2.4 Mc to 3.6 Mc position in the spectrum. Blue lows modulate

a second subcarrier in the 3.6-Mc to 4.2-Mc position. Care is taken to see that no red or blue sidebands overlap into adjoining parts of the frequency spectrum. During a second interval of time, the green lows and that portion of the mixed highs previously omitted, namely, from 2.4 Mc to 3.6 Mc, are employed as direct modulation of the principal picture carrier frequency, while red lows modulate a new subcarrier so chosen that this subcarrier and its sidebands occupy the cleared channel from 1.2 Mc to 2.4 Mc. The blue lows occupy the same channel as before. It is clear that this system thus provides for the continuous flow of low-frequency color information for all three primaries, but provides for a discontinuous or sequential flow of mixed-high information. By this arrangement cleared channels have been provided for all color information so that the data of each channel may be well filtered to remove all traces of dot structure without fear of generating spurious cross-talk signals between color information and mixed highs. A disadvantage of this system is that on some lines certain kinds of high-frequency information will be lacking, although it may be possible by employ-

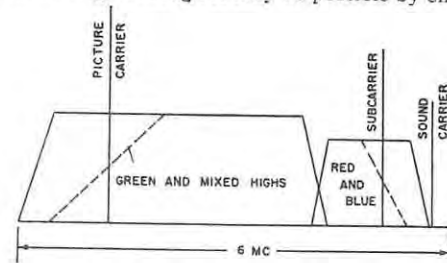


Fig. 10. Spectrum of alternating-lows with subcarrier employing vestigial sideband transmission

ing reversing sequences to collect all high-frequency data if four fields are employed in a complete cycle.

The second of the combination simultaneous and sequential systems is the alternating-lows method. This method is based upon the precept that since the eye is less acute for red or blue images than for green images, adequate color information may be produced by providing green lows and mixed highs on every line in the picture but limiting the flow of red and blue low-

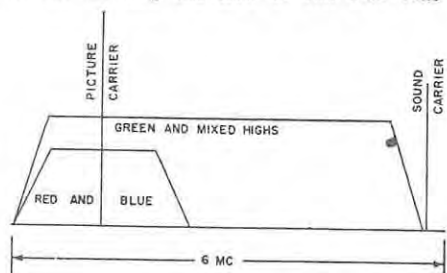


Fig. 11. Spectrum of alternating-lows with quadrature modulation of principal carrier wave by red and blue lows

TABLE I: SUMMARY OF UTILIZATION OF AVAILABLE PICTURE ELEMENTS IN COLOR-TELEVISION SYSTEMS

System	Detail Elements	Color Elements	Total Elements	Percentage Color to Total
Monochrome	267,000	0	267,000	0
Field-sequential (144 Fields/Sec)	111,000	222,000	333,000	67
Line-sequential (60 Fields/Sec)	267,000	533,000	800,000	67
Dot-sequential (overlapping)	267,000	133,000	400,000	33
Frequency Interlace (overlapping)	267,000	87,000	353,000	25
Alternating-highs (non-overlapping)	186,000	60,000	246,700	24.3
Dot-sequential (non-overlapping) color 0.5 Mc, detail 3.0 Mc	200,000	67,000	267,000	25
Alternating-lows with 4-Mc subcarrier and 3.5-Mc detail	233,000	33,000	267,000	12.5
Alternating-lows with 3-Mc detail and 4-Mc subcarrier	200,000	67,000	267,000	25
Alternating-lows with no subcarrier	267,000	50,000	317,000	15.8

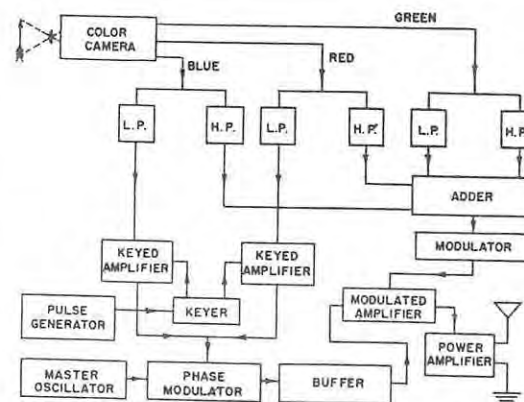


Fig. 12. Block diagram of single-carrier alternating-lows transmitter employing phase modulation for red and blue lows and simultaneous amplitude modulation for green lows and mixed highs

frequency components so that, for instance, red lows are transmitted for an interval of two lines followed by blue lows transmitted for one line. This cycle of alternating red and blue lows is repeated continuously; and since 3 is divisible into 525 without a remainder, a noncrawling pattern in these colors is obtained. At the receiver, the coarser line structure of the red and blue components may be taken care of on the tube or tubes

which display these colors by defocussing the cathode-ray spots or by employing very high frequency spot wobble in the vertical direction to give soft pictures in red and blue. The green display is kept sharply focused to provide high resolution in the customary manner.

The available frequency spectrum may be used in several ways to transmit color pictures when the alternating-lows principle is used. One method closely akin to that employed in some of the systems previously considered is shown in FIG. 10. A subcarrier in the 3.5-Mc to 4.0-Mc range is employed to carry the red and blue low video frequencies alternately. Vestigial-sideband transmission may be employed to conserve more spectrum space for mixed highs.

Another method of utilizing the available spectrum is shown in FIG. 11. No subcarriers are employed with this method. Since only two data are being dealt with at any one time, namely, green and red, or, at a later time, green and blue, it is possible to amplitude-modulate the principal picture carrier by the green and mixed-highs signals, and to simultaneously modulate a quadrature component of the principal picture carrier by the red or blue video signals to separately transmit such data. Alternatively, the red and blue signals may be employed to frequency- or phase-modulate the carrier wave instead of employing a quadrature carrier component. A transmitter block diagram of the latter method is shown in FIG. 12. A receiver block diagram for the phase modulation method is shown in FIG. 13.

Referring once again to FIG. 11, some advantages of this system will become evident. For one thing, an additional 0.75 Mc of frequency spectrum is opened up for use for data transmission not separately utilized in the other methods. The spectrum for the transmission of structural detail may thus occupy the entire band from 1 to 4 Mc.

Presented as a paper at the National Convention of the Institute of Radio Engineers, New York, N. Y., March 20, 1951.—Editor.

Table I summarizes in chart form, for comparison purposes, numerical values for the number of picture elements devoted to the transmission of structural

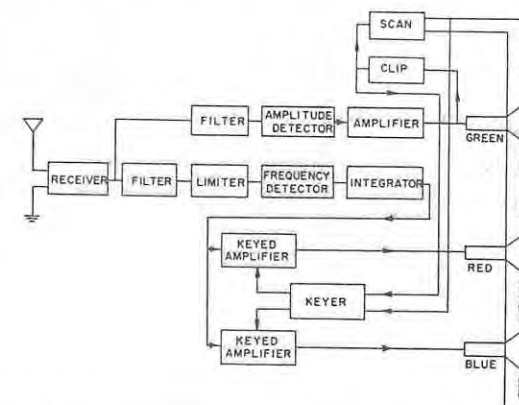


Fig. 13. Block diagram of receiver for the single-frequency phase-modulation alternating-lows color system

detail, the number of picture elements devoted to color data, the total number of picture elements, and the percentage of color elements to this total for several of the systems described.

In conclusion, then, it appears that the available spectrum may be used in a comparatively large number of ways to transmit color-television pictures. A careful comparative study of these methods should be conducted, taking into consideration such factors as flicker, crawl, dot structure, liability to interference, liability to multipath transmission effects, color fidelity, compatibility, and, last but not least, receiver complexity and cost, before deciding which system or systems offer the greatest promise.

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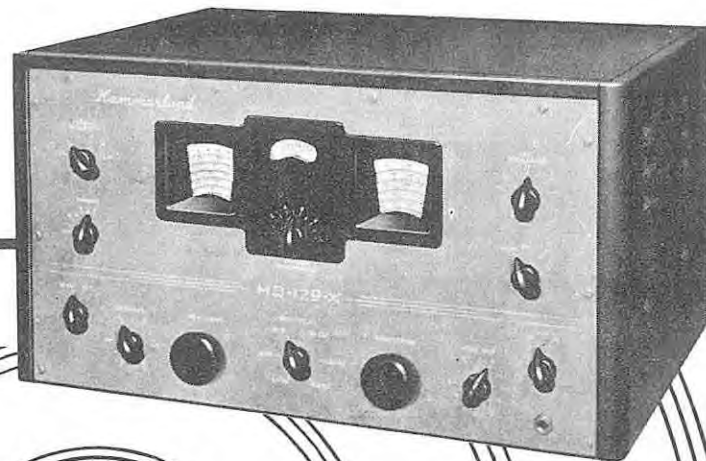
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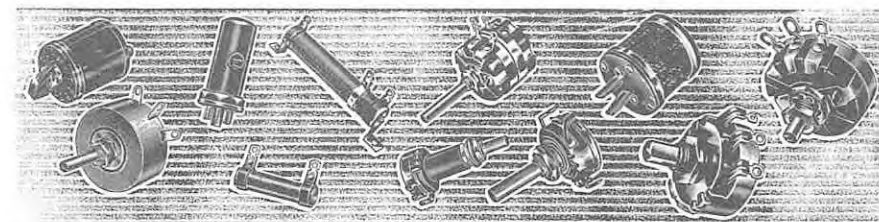
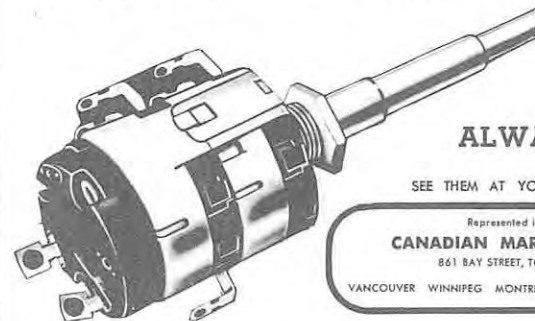
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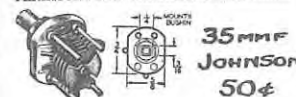
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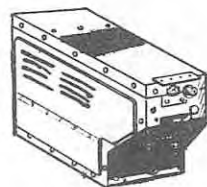
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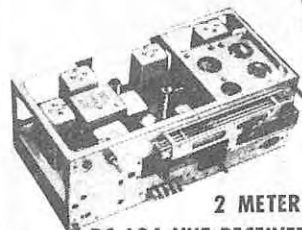
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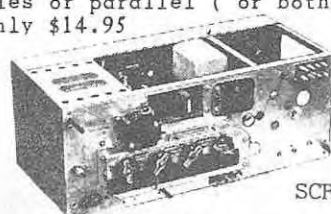
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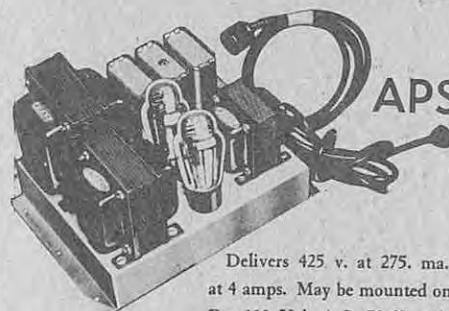
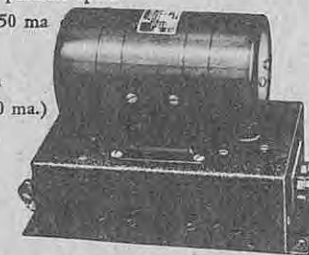
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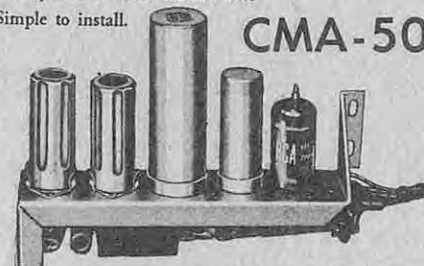


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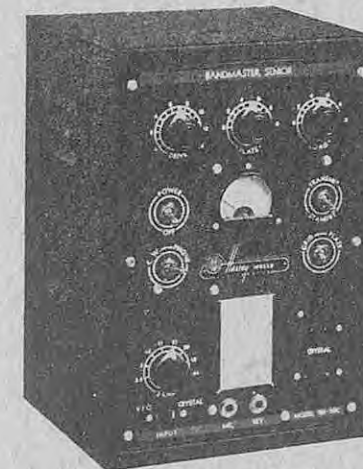
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