A 6-METER SPECTACULAR—Part I

"TECHNICIANS' DELIGHT" TRANSCEIVER

Part I is a complete 6-meter station in one package from the bench of W2GYV that features a simple six-tube circuit, 4.5 MC fixed-frequency superregenerative detector, speaker doubling as a microphone and a novel "pi-network" overtone oscillator circuit. The next issue will feature Part II, the "Simple-sixter Serious Converter", and the November-December issue will present Part III, the "Bonus 100-watt Transmitter."

—Lighthouse Larry

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Have you ever wondered how much more than one germanium diode would work in a crystal receiver. Well, I found out when tests were made on these entries I received recently. Fig. 1 is a full-wave detector using a split coil and a 2×4×7 tuning capacitor, which can be any old broadcast type ranging from about 10 to 40 turns. As shown, the coil is wound around the middle of a 6-inch long, 1½-inch diameter form. L1 and L2 each have 148 turns wound in tight parallel and spaced 1½ inch from L3. All coils are wound in the same direction. The series antenna capacitors, $C_x$, a 15-2000-μuf variable, and $C_y$, a 500-μuf fixed, help resonate most any antenna and ground system. Lee True, W2DXV, of Clyde, N. Y., submitted the first of several full-wave circuits received.

The circuit shown below makes use of a bridge-type detector circuit which, when tested, showed greater selectivity than a single crystal connected across the plate tuned circuit. The audio output voltage was about the same for either detector. The selectivity becomes greater and sensitivity decreases as the spacing between the coils is increased. The two vari-loop sticks may be placed either end to end or parallel with about ½-inch spacing centered to center. J. L. Knaus of Glassport, Pa., submitted this circuit.

The simplest two-crystal circuit I have received came from R. J. Baker, W2JJA, North Industry, Ohio. Several of the local farms glanced at the circuit and said me, "Impossible! There's no ground return path." So, try it yourself. It only takes a couple minutes. If you have more than one local broadcast station, the two crystals can be used in series as shown. The variable capacitor shown in the solid line in Fig. 2, high output was obtained with only a few feet of wire for an antenna.

W2JJA also submitted a design with one crystal and high selectivity, shown in Fig. 3. The coils are wound on a G-E tube carton 1½ inches square. L1 is 50 turns of No. 26 wire, L2 is 25 turns spaced ½ inch from L1 and L3 is 60 turns spaced ½ inch from L2. All the variable capacitors are separate—and for simplicity the two in the antenna circuit could be the mica-packing type.

All ideas submitted before December 1, 1955, will be eligible for publication in the OPERATION CRYSTAL column. Use 6-8 MARK NEWS for your model. Subscribers of the three ideas published in each issue receive certificates for $10 in G-E Electronic Tubes. Be sure to give complete construction details for home-built coils. All material submitted must be free from patent restrictions and becomes the property of 6-8 MARK NEWS.

---Danny Diode---
This simple transceiver has many possibilities as a general-purpose 6-meter rig for Technician class ama-
ateur radio operators who want to take advantage of their recently-granted privileges on this band. It should par-
cularly interest those simple circuits that call on minimum power supplies that can be left running with the TV, and that do not require a great deal of room or time for testing and evaluation.

The original idea was that of a low SWR single-tube transceiver. After studying various units and mulling all the time for a little private communications network. When the first transceiver came into working order, it was well above expectations and the rig seemed to be able to drive for the above-mentioned purposes.

The reliable working range between two of these units over fifty feet was never before heard of. A simple ground plate antenna at 10 feet height seems to be at least ten miles. This set would also be used for FD communications installations located where only one-way radio units are needed. As the power require-
ments were tailored to fit the popular 300-1000-
milliwatt vacuum-tube type power supply, it will run for many hours on one "batt" of a storage battery. The heater power requirement is only 2.6 amperes at 6.3 volts. Total plate power drain at 300 watts is 50 ma on the "receive" position and 100 ma on the "transmit" position. The high efficiency G.E. 2AM NEWS Mobile Portable Power Supply described in Volume 9, No. 2, would be ideal for powering this rig from 6 volts.

RECEIVER CIRCUIT
The schematic diagram, Fig. 1, shows that only six tubes are required for this transmitter, with the audio section serving a dual role as plate modulator and receiver audio amplifier. The receiver section uses a 1AE7 mixer-oscillator with the IF output at 454 megacycles. The high frequency oscillator tunes on the low side of the 50 to 55 megacycle signal frequency to minimize image difficulties in areas where TV chan-
nels 2 to 6 are in use. Mixer grid circuit tuning capacitor (C3) was not ganged to oscillator capacitor (C5) to eliminate tracking problems. Normally, C5 will only have to be slightly adjusted when more than a half megacycle freq-eray change in the oscillator is desired.

A standard 45 megacycle television broadcast carrier with a 20-kilocycle deviation is used in operation at 454 MHz. The low-pass filter circuit at the IF output is designed to select the carrier while the first IF filtering at 454 MHz is designed to reject the carrier while the second IF filtering at 454 MHz is designed to reject the carrier. The first IF filtering at 454 MHz is designed to reject the carrier. The second IF filtering at 454 MHz is designed to reject the carrier. The third IF filtering at 454 MHz is designed to reject the carrier. The fourth IF filtering at 454 MHz is designed to reject the carrier. The fifth IF filtering at 454 MHz is designed to reject the carrier. The sixth IF filtering at 454 MHz is designed to reject the carrier.

The high-efficiency oscillator design incorporates a high negative charge which decreases at a slow rate through the high voltage receiver supplying the oscillator's operating point. In a normal regenerative detector, further ampli-
fication is required to raise the oscillating current. The superregenerative detector can oscillate at the signal frequency without a significant signal applied. This is due to the grid being an obstacle beyond cutoff. Thus, the regeneration can be greatly increased with an large amount of amplification resulting. A signal of one volt 1AE7 handling this function, the second section being used as an audio voltage amplifier. A 6V6 beam-power audio output stage provides plenty of drive for the 45-dan voice coil, 53-inch FM speaker.

TRANSMITTER CIRCUIT
The transmitter section uses a 3AD7 as an overdrive crystal oscillator and frequency doubler. The doubler action provides good output power with reasonable current drain. A 600-ohm speaker is used to provide feedback for encouraging third-overone operation of any crystal grid for fundamental operation between 823 and 900 KC. Variable audio capacitance tunes the network to the 25 megacycle output frequency and mini capacitor C16 allows easy and precise adjustment of the proper amount of feedback necessary for overdrive out-
put from highs active or extremely sluggish crystals. Tests indicate that this circuit is much simpler to adjust than more conventional types in which juggling a col-
tap or separate feedback coil is required. Feedback is at a minimum when the grid is at maximum capacity.

The other half of this 1AE7 in a conventional fre-
quency doubler provides about 3 ma grid current for the 5735 Class C power amplifier. Another pi-network tank circuit is used for plate amplifier output, to simplify the problem of providing mechanical means of varying the antenna loading. Parallel feed is used to isolate the plate voltage from the output circuit. A conventional pi-network tuned tank circuit with a balanced line output might be more desirable for feeding the grid into a 300-ohm two-wire line. The unbalanced output circuit can use a fixed antenna or a line balancing balun made from coaxial cable. A variable antenna coupling for the receiver input also handled more easily with the unbalanced circuit. An ordinary coupling through cathode bias is provided on each transmitter grid to keep the plate diapason within reason when no crystal is plugged in or the tank circuits are off an antenna.

PROVISION for inserting the doubler and grid amplifier currents, the ammeter cathode current and the plate supply voltage is made by placing appropriate resistors in these circuits. Leads from these resistors connect to an oval socket installed in the rear of the chassis. The same test meter used with the G.E. 1AM NEWS 6-meter C.D. transmitter (see page 8, also Volume 1, No. 1 for details) can be plugged into this socket when tuning for proper grid bias or plate voltage. A 6AB5 miniature-tube version would suffice.

F U R N I T U R E C I R C U I T S
Plate and screen supply of the final amplifier was felt to be more desirable for this type of transmitter, with no provision being made for regulation of overdrive grid bias. A provision for lower efficiency of output stage bias modification. The 6V6 driving grid stage is provided for inserting into the appropriate socket, as the TDB-6A8 carrying sets up to 315 volts in this application. If the rig is to be run at 250 volts instead of 285, the TDB-6A8 miniature-tube version would suffice.
PARTS LIST

1. Midget closed-circuit 'phone jack.
2. Chassis-type coaxial cable jack.
3. #6-18 x 1/2" machine screw.
4. 1/4" inner wire of #36-38 wire.
5. #22" inner wire of #46-48 wire.
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connected from this circuit. The cathode current of this stage then supplies the required microphone current. B, is assigned a great variety of tasks and handles the plate supply switching job easily when constant biasing is used. In the "receive" position it connects the anode to the mixer grid coil, applies plate voltage to the mixer, oscillator and detector. Also, it connects the speaker to the audio amplifier output. In the "transmit" position, it connects the antenna to the final amplifier, applies plate voltage to the oscillator-detuner, applies modulated voltage to the final amplifier plate and screen and when using the speaker, as a microphone.

CONSTRUCTION

The entire plate circuit is neatly housed in a Box 8 x 5 x 3-inch utility box. If metal portable work is planned with this unit, the amplifier box could be made from a part of a kitchen exhaust hood, and prefabricated to a steel one, weighing about two pounds less. All parts mount on either the removable front panel or a 4 1/2 x 8 x 1 1/2-inch open-ended aluminum chassis, drawn so as shown in Fig. 1.

The mounting plate furnished with T, is used as a drilling and filing template to cut identical holes in the chassis and is then discarded. The transformer is then fastened directly to the chassis with the furnished spring clip.

The lower panel edge is located 1 1/2 inch down from the bottom of the chassis and marking 1 3/4-inch holes are drilled for all parts except the crystal socket. A 1 1/2 x 4-inch panel cutout allows the crystal to be plugged in. Holes for C1 and B1 are located 1 1/4 inches down from the panel top edge, with C1 2 1/2 inches inside from the side. B1 is centered on the panel and C1 centers 1 1/2 inches directly below it. C2 is mounted 1 1/2 inches from the panel edge and 1 1/4 inches below C1.

A piece of thin aluminum, 4 x 4 inches, bent into an angle bracket and fastened to the front of the chassis, provides a good RF ground path for C5, C6, C7 and R9. C8 mounts on another small aluminum angle bracket fastened with the same screws which hold the larger bracket.

A 1-inch diameter hole for the speaker is bored through the panel with a 1-inch cutter centered 1 3/4 inches down from the top edge of the panel and staggered with a small square of perforated steel for aluminum mounting.

All parts can now be fastened to the chassis front edge with sheet metal screws. The transformer cutout from 3 1/2-inch OD tubing are slipped over the 3 1/2 x 3 1/2-inch transformer mounts. The discriminator tube, having a spiral element, is cemented into a 1 3/4 x 1 1/2-inch long machined slot as shown in the bottom view, Fig. 3. The mixer-cathode valve socket is inserted to allow short RF leads plugged into the top view, Fig. 4. The larger capacitors and resistors are mounted on a 4 x 4 and a 6-terminal tie-point fastened under convenient mounting screws. The power terminal strip, microphone jack, meter socket and antenna connector mount on the rear of the chassis and matching holes are cut in the back cover of the utility box to clear these parts.

Power and antenna wiring connections are to be made and run through two rubber grommets near 7A and along the upper chassis so as not to interfere with the switch, to avoid the RF circuits. All cords are wired-on and mounted direct on the chassis using insulated terminals. One end of B1 is connected to a tie-point terminal as that the 1000-ohm microphone input plate load voltage is off. A short lead connects the antenna transformer switch at the 1000-ohm microphone input plate load terminals and the two tie-point terminals. A short lead from the 38-80Uv cathode plate connects the switch and antenna socket.

ALIGNMENT

The setup when the rectifier and the bias are set for the rectifier is completed so that any alterations can be made easily. Before plate power is applied, a calibrated grid-dip oscillator is very handy for adjusting the tuned circuits to the correct frequency range. With CA set at the proper point, CA should tune the oscillator between 4 and 5 megacycles with the constants shown. Switch B1, too, must be set at the "receive" position, with the mixer-cathode tube removed and plate voltage applied to the unit. With the volume control set at the mid-position, the 50,000-ohm potentiometer controlling the supervisory detector plate voltage should be advanced until a sharp hiss become noticeable. If no bias is present, a grid-dip oscillator or other signal generator should be closely coupled to the detector and tuned from approximately 4 to 5 megacycles. If a test-lose control can be wired so that the plate-voltage control is fully advanced. If this is the case, a higher resistance than the 10 megohm specified may be necessary to initiate a supervisory type oscillation. RFC4 and its associated bypass capacitor form a filter that keeps the quench oscillation out of the audio circuits.

If a signal generator is not readily available, two or three feet of wire clipped on pin 8 of the mixer tube socket should provide enough pickup of outside signals in the 3 to 5 megacycle range to check the operation of the mixer stage. One mixer-cathode stage then can be treated and the detector set to a radio frequency by tuning the detector for the 1000-ohm microphone input plate load. The mixer plate circuit switch on the top of the transformer should then be tuned until the detector goes out of oscillation when the resonant frequency is raised. Raising the detector plate voltage should again cause the detector to oscillate. With the detector grid circuit values specified, oscillation should begin when the plate-voltage control is advanced halfway. On the test model, a reading of 60 volts was observed at the center tap of the IF transformer secondary.

Calibration of the receiver oscillator can be done with harmonics of a crystal frequency standard or signals of known frequency.

TRANSMITTER ADJUSTMENTS

The test meter, drawn in Fig. 5, can now be plugged into the meter socket, with the selector switch set to position one. The 12AT7 audio doubler and 5763 amplifier tubes are inserted in their sockets and B1, turned to the "transmit" position. A fundamental test crystal between 25 and 27 megacycles is plugged into the microphone input plate load. The test meter set shows about two turns from maximum capacity and oscillator tuning is adjusted until an intense green needle is observed on the test meter. This turns the last-tube capacitor can be lightly adjusted for increasing capacity until oscillation stops. The final setting should be observed at the point just below maximum capacity from this point. The test meter should now read a set position of 80 to 100 volts, a sharp increase in amplifier grid current should noted when doubler tuning capacitor C2 is slowly adjusted.

The test meter is now set on position three, which becomes a tuned oscillator. By adjusting B1, the output can be increased. The test meter is used to check the tetrode cathode current, until the meter reads about 50 ma. At this condition, the meter is removed from the grid circuit, this indicates a plate input of 13 watts with a 200-volt plate supply. The test model delivered more than 7 watts output to a 33-ohm load when checked in the laboratory. Two self-inductance spacers drilled from the back cover to the rear of the chassis where the gear is placed in the "stop will make the unit rigid.
If you have thumbed through a recent receiving tube price list or characteristics handbook, several bewildering new type numbers may have come to your attention. Most of these additions are the result of tube manufacturers’ attempts to cater to the demands of the television industry for tubes that will handle special color TV applications as well as give better service in the longer life in any receiver.

With the introduction of 600-milliamper tube specifically in the home market, some confusion has resulted in regards to interchangeability with their prototypes. Also, the use of suffix A and B, in addition to the common ones of G and GT, has raised some questions as to their meaning.

The following is an attempt to clarify these questions.

One—All types that originally had 600-milliamper heaters which were used in series receivers were revived only to the extent of controlling the heater warm-up time. In these cases the suffix A or B may indicate such a feature, but to avoid confusion can be disregarded as all future production of such types will have only the new heater. Examples are the 584A and 587-6GTB.

Obviously, no problem exists in using any types in parallel-connected receivers but use of any old type tube numbers (e.g., 584A, 587-6GTA) in series-string receivers is not recommended.

Two—All types that originally did not have 600-milliamper heaters but were desired for use in series sets had to be revoted as an entirely new type and as such will have the controlled heater warm-up characteristic regardless of its intended application. Consequently, suffix A or B may be used in the original registration. Example—6A29.

From the above it is apparent that use of suffixes A and B have no consistent meaning except as an indication of the order in which they were assigned numbers by the Radio Electronic-Tube Manufac-
turers’ Association. Their presence indicates a change has been made in the tube type but this change may be electrical, mechanical or both. The R.E.T.M.A. designa-
tion system for receiving tubes states: The letters A, B, C, D, E and F are assigned so that order indicates a later and modified version of a specific tube which can be substituted for any previous version but not vice-versa. As examples the 1B1HTA is merely a controlled heater warm-up version of the 1B1HT. The 2A15FIA is a short bulb version of the 5A4F while the 2IC6D-GB is an entirely new 21-watt version of the 2IC6-D with im-
proved electrical characteristics, controlled heater warm-up and a better over-all shelf life.

Generally speaking, there should be no problem in us-

ing later designs in old equipment. The only possible difficulty would be minor mechanical, such as base clamps or withdrawing shorter tubes from recessed sockets. Future equipments present no problem as no designer would specify an obsolete type and the present rate of consumption will soon eliminate inventories of old style tubes.

Through a request for back issues of Q-S HAM
NEWS, existence of a unique amateur radio club has come to my attention. J. G. McKinley, Jr., W3QD, secretary of the Maritime Mobile Amateur Radio Club, states that the club publishes a periodical newsletter, but never holds a membership meeting! Because a majority of the 150 members serve as Captains or Radio Officers on ships throughout the world, all club business has to be transacted by mail or amateur radio schedules. Instead of a "President" and "Vice-presi-
dent," they have a "Commander" and "First-comman-
dor." They are: J. H. B. van Westerlind, W5WR, Captain of the Gulf Phantom, and Kurt Carlson, W2-
XKM, Captain of the Flying Enterprise H, respectively.

W2XKM is the famous, "Captains Stay-put," who re-
mained alone aboard his storm-damaged ship off the coast of England until shortly before he sank, early in 1935.

From the log of

Would the attractive, two-color blank QSL card pictured above, designed around the standard ARPIL logbook form, interest you? They would be ideal for confirming those Field Day, VHF QSO party, Swampstakes or DX contest contacts; portable exhibition or temporary location QSO's. Ample space is provided above and below the form to imprint your own call letters, name and location either by hand or with a rubber stamp. No advertising will appear on this card. If enough of you fellows want these cards, I can arrange to make them available at three hundred for a dollar—delivered postpaid. Drop me a postal card, saying "Yes" or "No," as soon as you read this!

—Lighthouse Larry
Since the test meter for the 6-meter CD transmitter (see G-E HAM NEWS, Volume 2, No. 1, for details), may the metering requirements for this unit, the circuit, shown in Fig. 3, in being repeated for those who do not have access to this issue. A few of these meters may be available in the locations where these CD rigs are in use.

In switch positions 1 and 2, the resistor R9 causes the meter to read 0. A switch in position 3, resistor R8, makes the meter into 8.5 to 3 voltimeters; in switch position 4, resistor R6, a 4 volt meter with the range 0 to 600 volts; in switch position 5, the meter is used as 1 to 1 millimeter; in position 6 the meter is doubled (the recommended “off” position).

The following tabulation indicates the “current” and voltage which the meter reads when in position 1 to 6.

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<tr>
<th>Position</th>
<th>Current</th>
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<td>0 to 600</td>
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<td>6</td>
<td>0.1 m</td>
<td>8.5 to 3</td>
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Position 1: Full scale equals 10 ma final grid current.

Position 2: Full scale equals 30 ma final grid current.

Position 3: Full scale equals 100 ma final cathode current.

Position 4: Full scale equals 1000 volts plate voltage.

Position 5: Relative power output reading (Not used).

Position 6: Off.

For accurate scale readings, the resistors specified should be as accurate as possible. Strictly speaking, however, accuracy is not paramount, inasmuch as the metering system will undoubtedly be used mainly as a tune-up aid.