A 6-METRE SPECTACULAR—Part III

"BONUS 100-WATT" TRANSMITTER

Almost any dictionary will tell you that the word "BONUS" means, "Something given in addition to what is usual." By employing an extra tube, plus a few dual-range tank circuits and parts, this "Bonus 100-watt Transmitter," developed by W2ZAB for Part III of the G-E HAM NEWS 6-meter Spectacular, also puts you on 2 meters with the same power. Front panel controls for all normal tuning, circuit metering, crystal changing and switching, permit this rig to be buttoned up in a complete TVI shield if necessary.

—Lighthouse Larry

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Most amateur transmitters for 30 or 144 megacycles follow the same frequency range pattern in the first stages of the exciter. Why build two separate units, practically identical, when one exciter can handle both 30 and 144 megacycles?

And while we're at it, why not design the final amplifier to cover both bands? Of course, the amplifier tube selected would have to be one which works effi-
ciently on the 144-megacycle band, such as the GL-828B. This tube can be run from relatively inexpensive power supplies and plate modulators. 30-megacycle tubes are marketed in this 100-watt power class. If you're one of the owners of one of these rigs, you can borrow plate and modulator power from it for this "BONUS 100-watt Transmitter." This unit also makes a good exciter for one-kilowatt amplifiers to help extend VHF working range over what you have installed a rotary \( \text{b} \)-wave antenna and a low noise receiver for each band.

**CIRCUIT DETAILS**

After glancing at the schematic circuit diagram, shown in Fig. 1, you may think that Lighthouse Larry has fallen into a rut by using this pi-network overtone crystal oscillator circuit for the third time in as many pages. But—that's no rut—that's just a good versatile oscillator circuit. One half of a 12ATT2-triode oscillator uses 24 to 27 megacycles by tuning C5. Mica \( \text{p} \)-adder capacitor \( \text{C} \) controls the feedback to any one of four \( 8,000 \) to \( 8,122 \) to \( 8,354 \) to \( 8,600 \) megacycle crystals. This permits your local network or calling frequency and one or other frequency to be covered in each band. The fifth position on crystal oscillator switch \( \text{S} \) permits output from an external \( 8 \) to \( 12 \) megacycle variable frequency variable oscillator connected to \( \text{J} \), to be fed into the grid of the oscillator tube, which then operates as a tripler or doubler, respectively.

Tank circuit \( \text{L}=\text{C} \) in the plate circuit of the other section of the 12ATT2 doubles frequency to the 48-34-

megacycle range. A two-band-pair network circuit ap-

pears in the plate circuit of the 3736 tripler-amplifier stage. Output from the 144-megacycle plate circuit (in the 144-megacycle position) connects the output side of coil \( \text{L} \) to leading capacitor \( \text{C} \), in the grid circuit of the GL-2840 144-megacycle amplifier. When \( \text{S} \) is placed in the 50-megacycle position, \( \text{S} \) is placed in series with \( \text{L} \) and leading capacitor \( \text{C} \) matches the output of this large inductive reactance to the amplifier input. This circuit is tuned on both bands with \( \text{C} \) and \( \text{M} \) mica parallel-series tuned. For a 144-megacycle amplifier: The 144-megacycle tank circuit in the plate circuit of the GL-2840 consists of \( \text{C} \) and \( \text{L} \). To increase capacity, you can use your own \( \text{DC} \) series connecting leads to provide a series-tuned screen grid neutralisation circuit for this stage. This tube is biased by removing screen voltage and grid excitation when \( \text{S} \) is in the 144-megacycle position. The 144-megacycle position also increases the grid circuit resistance of the 3736 tripler stage in the 144-megacycle position and transfers the RG-321 \( 14 \)-ohm flexible-film \( \text{DC} \) link in link in the grid circuit of the GL-828B amplifier to either the 50-megacycle output in the 50-megacycle position or the 144-megacycle output from \( \text{L} \) in the grid circuit of the GL-828B. The screen grid of this tube is biased on those stages to keep the plate-dispersion influence within limits with the various connections.

The problem of working the GL-828B stage on both 30 and 144 megacycles is handled by substituting long lamp cords for lamp cords used by operating capacity-loaded half-wave-

length line grid and plate tank circuits for 144 megacy-

cles (\( \text{L} \) and \( \text{L} \)). Then, small split coils (\( \text{L} \) and \( \text{L} \)) were tapped onto the lines on the 144-megacycle RF ground point. The windings of these coils was ad-

justed to resonate at 50 megacycles with the tube, circuit and tuning capacities. The rotor of plate circuit butterfly variable capacitor \( \text{C} \) is not grounded. Other-

wise, the 0.030-inch pin gap with which this capacitor is supplied would not be sufficient to withstand positive plate modulation peaks with a 200-volt amplifier plate supply. Variable link \( \text{L} \) must not come into contact with the 50-megacycle output in a 50-megacycle coaxial cable. A larger coil will result in a 50-megacycle pass without introducing 30-megacycle action. A combination dump-tube and keying circuit in the plate circuit of the GL-828B is furnished by the \( \text{V} \) and \( \text{V} \) tubes. When the GL-828B is drawing grid current, the \( \text{V} \) is biased on and screen current flows through the \( \text{V} \). Lack of amplifier grid currents be-

cause of no driving power or removing the grid bias from the \( \text{V} \) by keying circuit jack \( \text{J} \) permits this tube to draw plate current.

The extra voltage drop through the 30,000-ohm adjustable screen resistor causes the \( \text{V} \) voltage regula-


tube to stop conducting. The GL-828B screen voltage then falls to zero, reducing the plate current to a very low value.

**SERVICING CIRCUITS**

In positions \( \text{A} \) to \( \text{E} \), a 3-pole, 6-position rotary tap switch \( \text{S} \) controls a 0-1-milliammeter in series with a 30,000-ohm resistor across shunting resistors placed in series with circuits where current metering is desired. This range meter now costs no more than those with larger current ratings and simplifies the selection of shunting resistors. The 400-ohm shunts in positions \( \text{A} \) and \( \text{B} \) provide a 0.1-milliamperes full scale reading for the 3736 and GL-3216 grid currents. Position \( \text{C} \) measures current to 100 micromilliamperes full scale across the 30,000-

\( \text{V} \) plate resistor in the GL-3216 plate circuit. The GL-828B grid current is (read in position \( \text{D} \) across a 100-ohm resistor. Two 10-ohm, 1-watt resistors in parallel provide a full scale meter reading of 250 milliamperes in the GL-828B grid circuit. In the sixth position \( \text{F} \) the meter is placed in series with the plate resistor in the 3736 tripler stage to measure the amplifier plate supply up to 800 volts. This position, the 0.030-inch pin gap with which this capacitor is supplied would not be sufficient to withstand positive plate modulation peaks with a 200-volt amplifier plate supply. Variable link \( \text{L} \) must not come into contact with the 50-megacycle output in the 50-megacycle coaxial cable. A larger coil will result in a 50-megacycle pass without introducing 30-megacycle action. A combination dump-tube and keying circuit in the plate circuit of the GL-828B is furnished by the \( \text{V} \) and \( \text{V} \) tubes. When the GL-828B is drawing grid current, the \( \text{V} \) is biased on and screen current flows through the \( \text{V} \). Lack of amplifier grid currents be-

cause of no driving power or removing the grid bias from the \( \text{V} \) by keying circuit jack \( \text{J} \) permits this tube to draw plate current.

**MECHANICAL DETAILS**

The entire RF unit is mounted on an 8 x 12-in 3-inch deep aluminum chassis, drilled as shown in Fig. 2. The 8 x 14-inch cabinet panel and chassis front are drilled with matching holes. Location of most critical parts is marked on this illustration. The tuning controls for the exciter were mounted along the front edge of the chassis. Space was left at the right side for the GL-828B amplifier and associated tank circuits. The special septum socket (Johnson 122-103) used for this tube has provision for crooked No. 12 plastic insulated insulating wires to run from the grid connections through small holes in the ceramic washer. They extend up the sides of the tube, forming one plate of capacitor \( \text{C} \), with the tube plates forming the other. The 21/4-inch diameter hole for this socket was made with a circle cutter. Or, it can be "nibbled" out with a pair of small tin shears if a starter hole is first made with a center punch.

Amplifier plate tuning capacitor \( \text{C} \) mounts on a 1-inch thick block of polystyrene measuring 2 1/2-inches wide and 15 1/2 inches high. Three 6-32 x 1-inch deep

Fig. 3—Side view of GL-427B amplifier.
Fig. 4—Chassis top view. Shield box removed to show the GL-210B tank circuit.

Fig. 5—Chassis bottom view.
At the neutral 3-26ES capacitor $C_5$ is adjusted
until there is no fluctuation in grid current as plate
voltage capacitor $C_5$ is rotated. If this stage will not
neutralize with a straight lead from the socket
screen terminal to $C_5$, a small loop in this lead may be
necessary. The plate and screen voltage lead to this tube
is now connected and $R_5$ is moved to position "C." The
turning of $L_3$ is used to adjust so that $C_4$ resonates
with this coil near 15 of maximum capacity. Tuned coil
$L_4$ is then inserted at the end of $L_3$ attached to $C_4$. After
setting $B_5$ in position "D," $C_5$ and $L_5$ are adjusted for
maximum grid current on the 2GL-88B. Length of the
grid wire, however, should be kept to the minimum
capacity setting of $C_5$. Should be established by
adjusting the spacing of the perforated paper
by moving the pushing cone insulation in its fas-
tening slots, shifting the tucking ends to the $C_5$
stands
and changing the length of the flexible straps on
the plate caps, if necessary. The tank circuit should
be in place after each adjustment, as this added
capacity to ground lowers the resonant frequency about
10 megacycles.

For 50-megacycle operation, $B_5$ and $R_5$ are set in
tag position, turned to position "A" and the plate and screen voltage is removed from the 2663
voltage. The oscillator and doubler re-tuned and out-
put capacitor $C_5$ is set near maximum capacity. The
576 stage is neutralized by adjusting $C_5$ for no grid
current fluctuation when $C_5$ is rotated. Some adjust-
ment of the 1-turn loop from $C_5$ to the tube socket may be
necessary for complete neutralization. After again
connecting plate and screen voltages to this stage, $B_5$ is
set at position "D" and both $C_5$ and $L_5$ are adjusted for
maximum grid current on the 2GL-88B. Suitable
driver power should be provided with the same setting
of $L_5$ used for 144 megacycles. Inductance of both $L_5$
and $C_5$ occurs near the maximum capacity settings.

If the amplifier is controlled by a transformer from
the amplifier may result if the tank circuits are
inductively placed in the grid-cathode circuit, a suit-
able screen voltage dropping resistor should be set
about 500 volts on pin 2 of the OBI regulator when
the amplifier is running at the normal 660-volt, 170-
ampere output. The measured plate circuit efficiency of the
2GL-88B on 144 megacycles is approximately 50% and was
led into a laboratory-type RF wattmeter. Apparently
the amplifier efficiency dropped to 60% or 90 megacycles.
For com-
trary, a 10-megacycle amplifier was con-
struted using conventional 30-megacycle tank circuits and
driven from the same exciter. The measured effi-
ciency of this amplifier was at 65%. This slight
difference in efficiency will not be noticeable when the
transmitter is put on the air. In conclusion, the saving in
parasitic costs of being able to utilize this transmitter
on 2663 widely separated bands where normally separate
euts are used was considered to be well worth the slight
efficiency reduction mentioned above. For final "hind-
trapping" $B_5$ Johnson type 115-megacycle line-indicator diodes were
used. Three of these 107-116-24-24 condensers which fit the $C_5$
high voltage socket on the chassis were placed in
Panel marking and dial decals label the controls and frequency ranges covered.
If all of my Log Form QSL cards (see this column in Volume 4, Nos. 3 & 4 issues of G-E-HAM NEWS, for details and illustration) that were printed in the first press run were placed in a single pile, the resulting stack of cards would equal the size of a radio amateur's average living room. I think it would be almost 300 feet high! The final orders we have received for these cards is still increasing and I can expect another large number of requests have arrived for 600, 900, 1200, 1500 and in one instance, 2000 cards!

If you have the need for an inexpensive QSL card on which you can copy information in the same order that it appears in your station log, simply write me at the tube Department, General Electric Company, Schenectady, N. Y. Packages of 100 cards, or any multiple of that number, will be delivered to you, postpaid, for a consideration of one dollar per 300 cards. At this price, we cannot accept requests for C.O.D. shipment or billing at a later date. The above address applies only to radio amateurs in the United States, Canada, Alaska, and the Panama Canal Zone. In other countries, write: Lighthearted League, International General Electric Company, 570 Lexington Avenue, New York, N. Y.

Incidentally, before you write, check through your file of back issues of G-E-HAM NEWS. If you are unsure, just tell me which copies you tend and I will gladly send them to you as long as my supply lasts.

One of the first orders for my Log Form QSL card was received from a true "Hamman" family. In fact, both the OM and XYL are "C. W. Ham." I really mean Carl W. Hamm, W6SWH (Old Works Hard) and Charlotte W. Hamm, WPWPGY (Until Next Year), of Milwaukee, Wisconsin. They also have an eight-year-old junior, Jeffrey C., who may be labeled "Junior Class," when he gets his ham ticket. Carl works 7-megacycle CW and phone and 28-megacycle phone. Charlotte can listen in the 7-megacycle novice band. They are now looking for a contact with W7YV, Betty, New Orleans, Louisiana. Why? He is Clyde W. Ham!

Does your basement-level radio shack suffer from excessive noise? Here’s a line of AB-Acoustics, a recent addition to RCA news. The Advanced Series of AB-Acoustics, published by the Saint Paul (Minnesota) Mobile Audio Co., can help. They can help you do your best work, the true ham, or improve your equipment or basement a few degrees lower. The floor plan below shows the front view, which includes the door and rear view. As placing a few light bulbs in your equipment cabinets may be all that’s necessary to keep out the nasties, 1. An electric dehumidifier also will do a good job. Be sure not to make your equipment too close to the outside—some types release vast amounts of moisture into the air.

After recently receiving comments from a few fellows that they have been unable to buy the type 6CSAS audio power amplifier tube used in the HAM-SHACK INTERCOM described in the May-June, 1953 issue of G-E-HAM NEWS, I decided that the situation needed checking into. Result—you receiving tube sales section says that there is not a large replacement demand for this tube and it may not be readily available. Fortunately, the electrical characteristics are similar to the more popular 6BQ6, except for a lower power sensitivity. The similarity then, necessary to use this tube, therefore if the reverse connections to pin 1 and 2 on the 6CSAS socket and change the lead from output transformer to pin 1 to pin 2 is correct, I suppose you may now a number of these units may have been built using this tube that happened to be handy in the junk box. By applying the appropriate voltages, tubes 6AIQ, 665GT or 665GT might be used. Even a 6JIQ might be your best bet if the local QRM is high.

I asked the editor the other day why most recent gear built for G-E-HAM NEWS has included a small square of 40-tine stereophonic aluminum sheet. "Well," he said, "That particular type of aluminum has a pleasing decorative property, is easy to cut and bend with hand tools and makes a pretty good RF shield." Notice that a complete article on this material will be published in a future issue of G-E-HAM NEWS—and this material is used for shielding in several places, including the various HAM-SHACK INTERCOMS straight from Lighthearted League. Keep a sheet of that stuff handy in your workroom, if you intend to try to stand up in the competition for new designs. The box won’t rest until he used it all up!

The editor of one of the larger amateur radio club bulletins says that he is considering the possibilities of using the ---"Studebaker"--- name for his club. Want to know the source of the material? His 300-ohm feedline ought to get the power law answer.

Gang—just a reminder that the deadline for entering names in the Summer Annual Radio Hamateur Award is January 1, 1954. Complete data were published in the November 1953 issue of 6CSAS, page 8. Don’t forget to enter your club—see page 8 of this issue of the "Summer Annual Radio Hamateur Award Tentative"—now to the first line of "Summer Annual Radio Hamateur Award". The Hamateur Award Committee is keeping close watch on the rules by dropping me a note. The award markets are looking for a few leading competitors. Send those nominations in now to the Editor Association Committee, General Electric Company, Tube Department, Schenectady 6, N. Y. —Lighthearted League 7
Several interesting construction hints about the preparation of small to medium sized plastic boxes to house crystal radios have been passed along by S. B. Cole, W1AJP, of Stratford, Connecticut. Their transparency, shock resistance and low cost makes them almost ideal if the following precautions are observed.

When drilling holes in the plastic, small cracks may appear in that area. To avoid this, a wire or rod of the proper diameter is heated with a soldering iron or flame and passed through the plastic. This method can also be used for wire leads that must pass through the case. Larger holes for control shafts can be cut with a razor blade. Instead of using bolts (and nuts) to mount coil forms or small parts, cement them in place with household cement. Larger diameter coils can be wound directly on the outside or inside of the plastic box, with the turns cemented in place. Control knobs and terminals can be located on an unused side of the case.

"Where will your crystal set be when an emergency comes? On some forgotten shelf or buried in the junk box? Not mine!"—says H. G. Wein, Jr., K1AUA, of Schenectady, N.Y. "My crystal radio is patch-corded to the phone-input jack of the family television receiver. It is used almost daily to get news and other special radio programs from the local broadcast station. Being in constant use, I will have no trouble finding it and putting it to good use if and when the time comes—Remember—you can't use it if you can't find it!"

The bridge circuit detector plus diode network circuit shown above is your sheet if your latest rich Uncle Sparky bequeathed you a shocker full of crystal nodes. Increased output was measured when the headphones were connected as shown over that obtained when the 'phones were connected across the output of the bridge detector. Drop me a line if you have a good explanation. Any old broadcast type variable capacitor can be used for tuning across the vario-lepot coil, or you can substitute your favorite antenna input circuit for his, says Philip Benedict, ex-WN1KGR, of Columbus, Ohio.

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**E. A. Neal, W2IEK—EDITOR**

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**Denny B.**

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