MODIFYING THE ORIGINAL "VANGUARD"

FOR 100 WATTS AM PHONE ON THE HF BANDS

From Notes by **G3SZC**

The Vanguard was one of the earliest transmitter kits put on the U.K. market, originated by the now very well-known firm of K.W. Electronics, and first offered to the British radio amateur in 1957. The original Vanguard —as a 50-watt AM/CW transmitter for the 10-160m. bands—was reviewed, as a home-constructor kit, in "Short Wave Magazine" for March 1958. Since then, a great many Vanguards have taken the air and a large number are still in service. This article discusses some interesting practical modifications to give the Vanguard a much bigger carrier output on the HF bands. Whether or not you possess a K.W. Vanguard (or decide to acquire one through our small advertisement columns) these ideas will be useful, because they reflect basic thinking in the AM phone context—in which mode there is still a great deal of amateur activity, in spite of the advent of Sideband.—Editor.

HAVING come into possession of a rather decrepit original Vanguard, and requiring something to give more than the 35 watts then being used at G3SZC, it was decided that something better could be done with the Vanguard. Its Geloso exciter was the sort that would provide ample RF excitation to drive "two of something"—such as a pair of 807's in a new PA stage. Accordingly, the Tx was stripped of everything except for the Geloso VFO unit and the loading and tuning condensers in the PA section.

Looking first at the circuitry of Fig. 1, this is the re-built speech-amplifier/modulator, with everything following normal audio practice, with two 807's (V4, V5) in Class-B zero-bias. The driver transformer T1 for V4 V5 is actually the original Vanguard modulation transformer reversed, and it works very well, as this particular component is of good make. A new modulation transformer is required, T2 in Fig. 1, and this should be of the type having two secondary windings (one for the PA plates and the other for their screens) as found in the Collins ART-13 transmitter available as surplus. Any usual modulation transformer capable

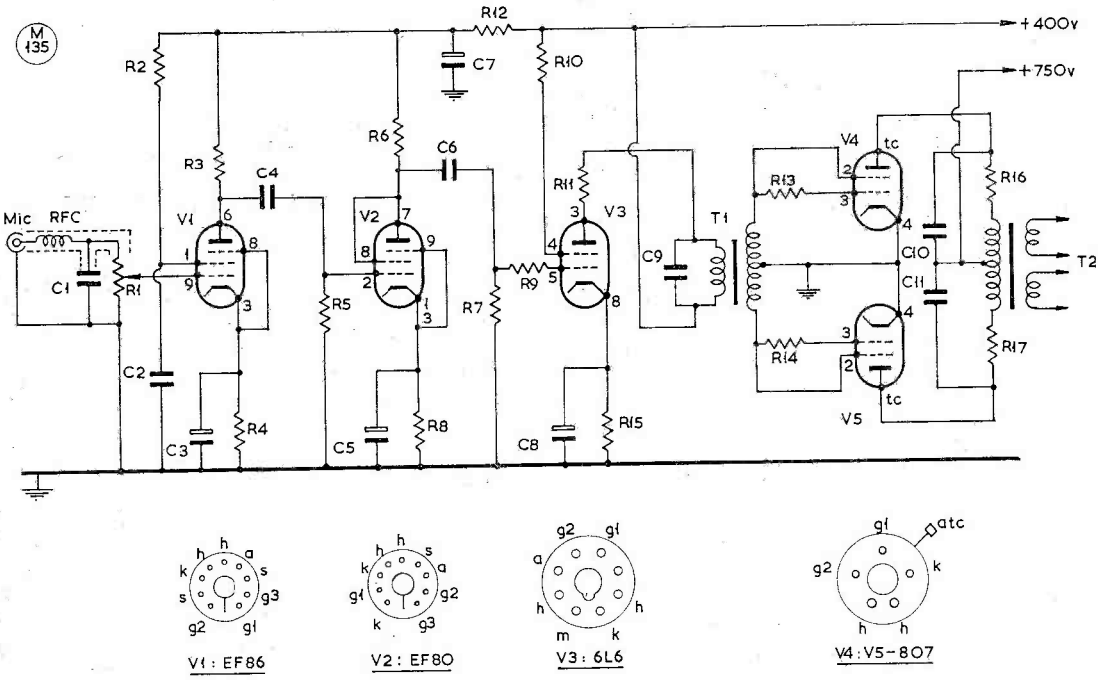

Fig. 1. The speech-amplifier/modulator as built by G3SZC for his modified Vanguard transmitter. Two 807's are used in the Class-B zero-bias connection, to give ample power for modulating a pair of paralleled 807's in the rebuilt PA (see Fig. 2). Since full plate-and-screen modulation is used, T2 should be of the type having split secondaries — see text. The transformer at T1 is the original Vanguard mod. xformer reversed, to function as the driver for the output 807's. Good quality audio with plenty of power is given by this speech layout. Values are in the Fig. 1 table opposite.

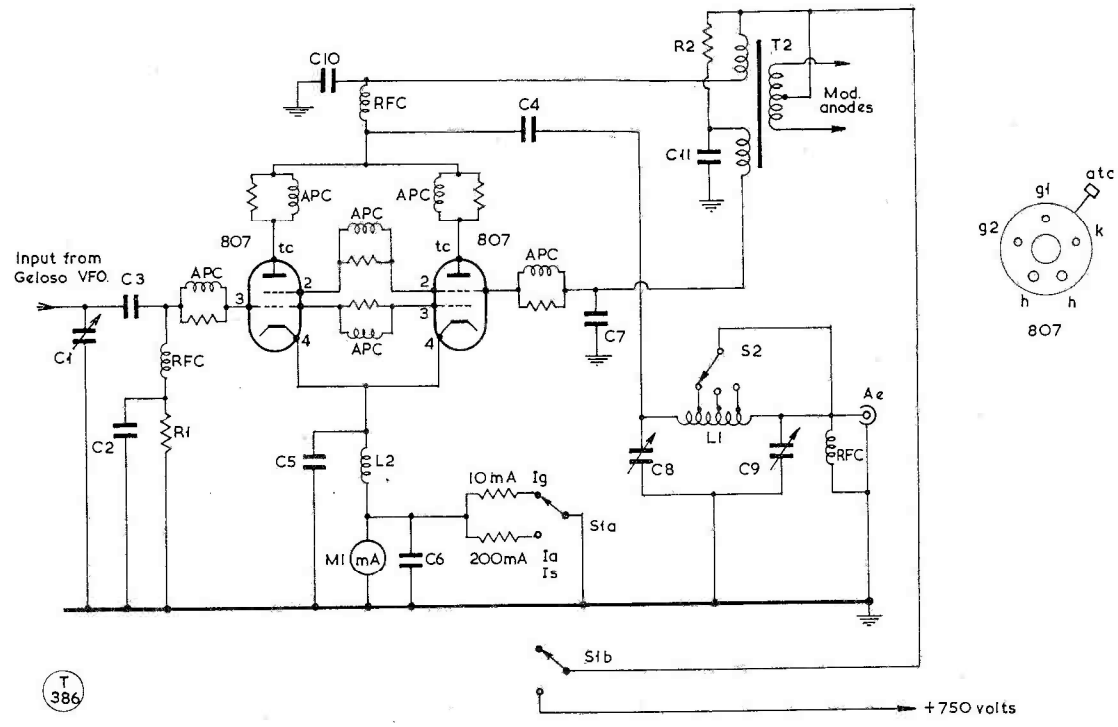

Fig. 2. The Vanguard PA stage, as rebuilt for 100-watt working. Driven by the existing Geloso VFO — which gives sufficient output for the paralleled 807's, run at 750v.— the frequency coverage of the Tx as modified is 10-15-20m. only, though 40-80m. could be included by making L1 plug-in, as suggested in the text. (There is insufficient room in the PA compartment for a suitable all-band tank coil for the much higher-powered PA, though condensers C8, C9 are as original, and are quite satisfactory at the higher HT voltage.) Note the liberal use of APC's and the meter switching arrangement, S1A-S1B ; the meter is as in the Vanguard original.

of handling 100 watts of audio may be too big to fit into the chassis space, so that some sort of double-secondary mod. xformer rated at 100w. and 750v. should be obtained—the point here is that it will permit very full modulation, and full use can be made of the G3SZC speech compressor described in the February '65 issue of SHORT WAVE MAGAZINE.

Table of Values

Fig. 1. The SA/Modr. section for the Modified Vanguard

C1	= 470 $\mu\mu$F	R9	= 4,700 ohms
C2	= 1 μF	R10, R11	= 100 ohms, 2w.
C3, C5	= 25 μF, 25v.	R12	= 3,900 ohms, 5w.
C4, C6	= .005 μF	R13, R14	= 22,000 ohms
C7	= 16 μF, 450v.	R15	= 260 ohms, 2w.
C8	= 25 μF, 50v.	R16, R17	= 47 ohms, 2w.
C9	= .001 μF, 1000v.	RFC	= 2.5 mH RF choke
C10, C11	= .001 μF, 2.5 kV	T1	= Original xformer reversed (*see text*)
R1	= 500,000-ohm potentiometer, AF gain	T2	= Mod. xformer with double-wound sec. (*see text*)
R2	= 1 megohm	V1	= EF86
R3, R5, R7	= 220,000 ohms	V2	= EF80
R4	= 1,200 ohms	V3	= 6L6
R6	= 82,000 ohms	V4, V5	= 807
R8	= 1,000 ohms		

NOTE: The input side RFC, C1, R1 should be fully screened up to the grid of V1, to eliminate RF pick-up. It would be desirable to regard V1, V2, V3 as one unit, with T1, V4, V5 on a separate deck. T2 can be incorporated with V4, V5 or go in on the same chassis as the PA in any other sort of 150w. AM layout.

Table of Values

Fig. 2. Rebuilt Vanguard PA stage for 150 Watts

C1	= 25 $\mu\mu$F, grid tune	R1	= 18,000 ohms, 2w.
C2, C5, C6, C7	= .001 μF, disc ceramic	R2	= 65,000 ohms, 5w.
		RFC's	= 2.5 mH, rated 250 mA in plate
C3	= ex-Geloso VFO (*see text*)	S1A-S1B	= Ganged ceramic
C4	= .001 μF, 2.5 kV	S2	= RF type, ceramic, ex-TU, or similar
C8, C9	= As *Vanguard* original	T2	= As T2 in Fig. 1 (*see text*)
C10	= .001 μF, 2.5 kV	Valves	= 807
C11	= 2 μF, 1000v.		

COIL DATA

L1 — Eight turns of $\frac{1}{8}$in. dia. soft drawn copper tube, wound to 2$\frac{1}{4}$in. dia. by 2$\frac{1}{2}$in. long, tapped at 3t. for 10m. and 5t. for 15m., full coil for 20m., connected to S2.

L2 — To form RF choke: 20 turns 18g. enamelled, wound to be self-supporting.

APC's — In each screen, plate and control grid: 16 turns 20g. enamelled wound on any available 1-watt resistor body.

The RF Side

This is shown in Fig. 2, noting that T2 is as in Fig 1 and C3 is the DC blocking condenser out of the Geloso VFO unit—for some inexplicable reason, moving this capacitor from inside the VFO section to the grid side of C1 reduces, if it does not elimi-

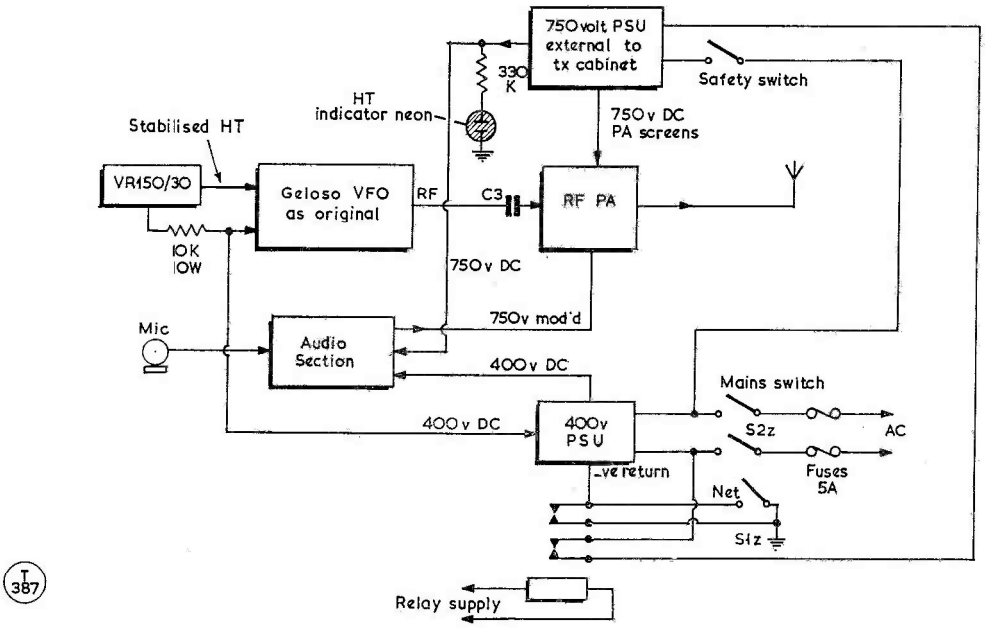

Fig. 3. Block diagram covering the final Vanguard layout, as modified. The Tx now gives 100 watts-plus AM phone, with a new speech-amplifier/modulator section (shown in Fig. 1) and a PA running a pair of 807's in parallel (Fig. 2). The original internal 400v. PSU is retained to run the VFO and low-level audio side, with an external 750v. 500 mA HT pack for modulator and PA supply. The work involves a complete strip-down of the original Vanguard, except for the Geloso VFO, the PA tank tuning assembly, and the 400-volt power supply unit.

nate, TVI! (For G3SZC, BBC-1 is on Ch. 5, and he has no trouble with TVI using the Tx as described here.)

It will be seen from Fig. 2 that APC's are used liberally in the plates, screens and grids of the 807's, with RF chokes and an inductor L2 in the cathode. These serve to keep the paralleled 807's under complete control on the 10-15-20m. bands on which the transmitter operates. A point to note here is that the RF choke in the PA plate is a standard 2·5 mH item, rated for 250 mA—it works better than the pi-section choke originally fitted.

To make room for the new and larger PA coil L1, the harmonic trap was stripped out of the PA compartment. The new coil L1, for the 10-15-20m. bands, is wound with 1/8th-in. copper tube, as shown in the coil table. This is to cope with the much greater RF output, for which the original meter switching has also been modified. As shown in Fig 2, the meter is now in the PA stage cathode line, with suitable shunts switched by S1A to read grid drive and full cathode current; S1A is linked with S1B in such a way that HT is off the PA when the meter is connected to read grid current only.

The new PA band-change switch S2 is a ceramic type, ex-T.U. unit, and will be found to fit into the original front panel orifice for this switch of the hole is reamered out slightly. The output socket for the aerial is fitted where the harmonic trap (now removed) was adjusted—but could just as well come out at the back of the Tx, as in the original.

As regards chassis work, a certain amount of re-drilling and holing will be necessary. Broadly, a suitable layout is, with the Geloso VFO in its original position, the parallel 807 PA worked into the RF output compartment, with the 807 modulators between the smoothing choke and modulation transformer. The speech-amplifier section can go in to the left of the VFO unit (looking down on the chassis), with the 400v. mains transformer at upper left.

PSU Points

In the original, the Vanguard incorporated a 400v. power supply unit, giving all the necessary LT and HT current outputs for 50-watt operation on CW or AM phone. This PSU is retained and used as shown in the block diagram Fig. 3, which indicates the final modification arrangement as worked out by G3SZC. The existing 400v. supply is used for the VFO and audio driver stages, it not having been found necessary to provide separate HT for the Geloso unit—under full modulation the 400v. HT line varies only about 5 volts between full audio output and resting carrier.

To run the modulator itself and the parallel 807's in the PA, an external 750v. supply is provided, obtained from a 375-0-375v. 500 mA transformer and 12 silicon diodes in a bridge arrangement, with switching for half or full secondary to give QRP or full-power conditions. The only other power supply is an external 12 volts for the change-over relays,

obtained from a *Woolworth's* 12v. 4 amp. battery charger (as suggested by one of the *D-Y-K-T* items not long ago).

Some General Comments

Vanguard owners who may be worried about whether the original tuning and load condensers—C8 and C9 in Fig. 2—will stand the gaff need not have any qualms. It has been found that they are quite capable of handling up to 150 watts input when the PA is driven full out.

The tank coil here specified for the PA is suitable only for the 10-15-20m. bands. If 40-80m. should be wanted, L1 in Fig. 2 could be made plug-in—for proper operating efficiency at 150 watts carrier input, there is not enough room in the PA compartment to accommodate a switched "all-band" tank coil.

Circuits for the PSU's are not shown, because anyone undertaking a modification of this sort will know what to do, since any PSU capable of giving 400v. at 100 mA and 750v. at 500 mA will meet the power requirements. The switching should be arranged to enable netting to be carried out using only low power on the Geloso VFO, and the relay change-over arrangement will depend on the station switching layout—but whatever that is, if the mains supply for the external HV pack is taken from the dead side of the main on-off switch within the transmitter, there should be no accidents. In other words, arrange it that the speech-amplifier/VFO drive must be on before the modulator/PA sides can be switched in, with the 750v. supply.

GOONHILLY AND EARLY BIRD

NOTES ON PERMANENT SHF COMMUNICATION LINK OPERATING BETWEEN U.S.A. AND EUROPE

Information by courtesy G.P.O.

This is another in our series of occasional general-interest articles, by which we seek to keep readers informed of the more important happenings in the world of radio communication outside the amateur bands. The material on which this article is based was supplied by the Post Office.—Editor.

AS is pretty well-known, we now have what is virtually a fixed-position satellite, Type HS-303 (called "Early Bird") at a distance of about 22,300 miles above our equator; it moves within a very small orbit of its own, but is always within range of Europe and the U.S.A. simultaneously.

Thus, it provides direct super-high frequency (SHF) linking between a U.S. earth station at Andover, Maine, and three European stations—at Goonhilly in Cornwall, Pleumeur Bodou in Brittany, and Raisting in West Germany.

The system capacity is 240 high-grade (meaning noise-free broad-band) telephone circuits across the Atlantic, available 24 hours a day, and also usable for two-way TV when required. An interesting point is that the path distance of about 45,000 miles means that there is a distinct speech lag on any telephone circuit routed *via* Early Bird, so that fast talkers may find themselves at some slight disadvantage.

Since at the European end the satellite can only work one station at a time (for a week each, in turn, is the arrangement) a considerable land-line and microwave relay tie-up has had to be installed between the three stations and their outlets into their own national telecommunications systems. Though expensive and complicated, the advantages of this plan on the European side are considerable—in that while giving a 24-hour service, one station is on stand-by, one out for maintenance, and the third in full traffic operation.

So far as the U.K. is concerned, broad-band microwave links have been (or are being) installed on the routes Goonhilly-London G.P.O. Tower *via* London-Bristol, then Bristol-Plymouth, and Plymouth-Goonhilly. This internal system will operate line-of-sight on frequencies of 5922-6425 mc and 6425-7110 mc (called the 6 Gc band), capable of carrying 960 telephone circuits, or TV in colour or monochrome. The contractors for the U.K. communications network are the G.E.C. and S.T.C.—and some extremely interesting and highly sophisticated equipment, much of it of entirely new design, is being provided to meet the G.P.O. specifications.

The notes following give some details about what is probably the most interesting part of the whole project—the G.P.O. Satellite Terminal at Goonhilly Downs Radio near the Lizard, Cornwall, this station having been entirely designed by the Engineering Dept. of the Post Office.

Meeting the Requirement at Goonhilly

The new satellite Early Bird differs from Telstar and Relay in many respects, and all the earth stations which took part in the earlier experiments have required considerable modification. Goonhilly, the G.P.O. earth station, has been out of service for several months, but is now in action again. The most obvious feature at Goonhilly is a high-gain, narrow-beam steerable aerial capable af tracking moving satellites with great accuracy. The optimum frequency range for broad-band radio transmission between satellites and the earth is in the 1,000-10,000 mc area, and it is internationally agreed that the frequency for transmission between the earth and the satellite should be in the 6,000 mc region, and that for satellite-to-ground working, frequencies near 4,000 mc should be used. Consequently, a high-powered