HW-17A RECEIVER SECTION MODIFIED FOR NBFM

DETAILS OF AN EFFECTIVE CIRCUIT

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FOR some months it has been a struggle to work stations using NBFM, even with the station being received at reasonable strength on the HW-17A, using "slope" detection. It was decided to modify the HW-17A for NBFM reception.

First considered was using a ratio detector transformer, but finding a transformer of this type at 2 MHz would be difficult, and the work involved in fitting it would be equally tiresome. It was therefore decided to use the TAA570 integrated circuit. This IC (with 39 semiconductors and 43 resistors) was originally intended for TV/Rx design as a limiting amplifier, FM detector and audio pre-amp. This was considered ideal, as it could readily be adapted to the HW-17A Rx since the IF bandwidth is sufficient to allow very good reception of NBFM.

Circuit Considerations

The TAA570 is a six-stage IF limiting amplifier with a quadrature detector and audio pre amp stage. The IC is designed to operate with an IF input of 6 MHz. This was found to be due only to the external tuned circuit for the quadrature detector. Given the information on the data sheet for the valves of the quadrature detector components for 6 MHz, then using a similar L-C ratio, a coil was wound for 2 MHz; this consisted of 56 turns of 32g. enamelled close wound on a 5/16in. former. The capacitor in the Rx is 432 pF, but it may not be the same for all receivers as the HW-17A is home-built and therefore not all of them may have exactly 2 MHz IF's. Therefore it was decided to make the greater part of the capacitance fixed at 390 pF, 2% silver mica, and use a miniature compression trimmer of 140 pF, a standard component.

The resistor across the quadrature detector was omitted as this was only required for FM reception and not NBFM.

Next point to be considered was the input and output of the IC. The data sheet shows the final IF transformer secondary above ground, but on the HW-17A Rx it is grounded at one side. To remove the ground connection is not an easy job, so it was retained and the input to the IC was taken *via* a 75 pF capacitor from a *Veropin* inserted at the junction of the demodulator diode D201 and the final IF secondary T4, then to the slide switch, *see* Fig. 3. The diode was left connected as this operates the AVC line and hence the S-meter and the squelch gate. As leaving the diode in circuit made no difference to the performance of the IC it was considered that there would be no point in losing the advantages of the AVC, S-meter and squelch. The only loss was the ANL but as it was being converted to NBFM it was unnecessary. The 100-ohm resistor R1 across pins 8-9 of the IC was to offer low impedance and bias for the IC, as omitting it caused instability at a moderate input levels.

The output was next to be considered. This was taken from pin 3 of the IC via C9, 0·22 μF, to the switch, Fig. 3; the bias supply being by R4. At full drive the output level of the IC is too high for the input of the AF stages of the HW-17A, so this was reduced to 4K7 (R2) to make it compatible with the volume in the AM mode. The supply required is shown on the data as 7·5 to 14 volts, but if the IC is supplied direct off the 12-volt rail in the HW-17A the quadrature detector drives too hard and beats with the final IF in the Rx, producing oscillation as the receiver is tuned through signals—so it was reduced to 9·1 volts stabilised by Z1 and R3. (This also is of help as the 12-volt rail is unsteady at moderate volume levels).

The only remaining point is the de-emphasis capacitor C2, this is shown in the data as ·015 μF but the noise when not receiving a carrier was rather high so it was increased to ·033 μF, offering a much lower noise level of the carrier but also made much better copy on NBFM reducing the noise to almost *nil*.

Layout

Fig. 2 shows the layout for the IC and external components. This was made up on a small piece of plain *Veroboard* but could of course be on a printed circuit board. This is mounted on the inside of the back

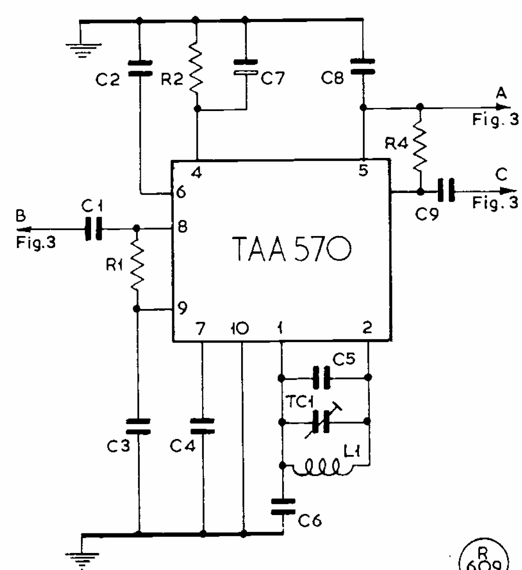

Fig. 1. Circuit for the NBFM modification, using the TAA570 (or SAA570) integrated circuit. Valves required are: C1, 75 pF, silver-mica; C2, 033 mF; C3, C4, C8, 0.1 mF, poly.; C5, 390 pF, 2% s-m; C6, .01 mF, poly; C7, 10 mF elect.; C9. 0.22 mF, poly; TC1, 140 pF compression trimmer; R1, 100 ohms, low-noise; R2, 4.7K; R3, 100 ohms, 2w.; R4, 5.6K. L1, 56 turns 32g. enam. close-wound on 5/16in. former. Mount on 0.1 pitch plain Veroboard.

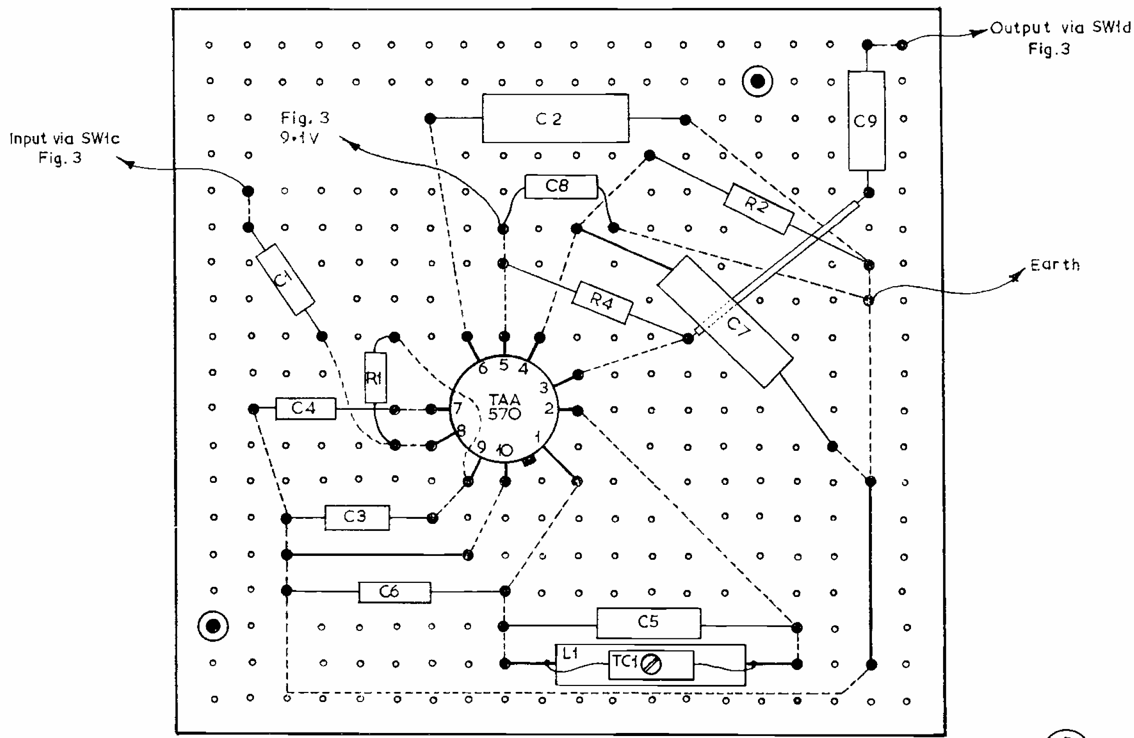

Fig. 2. Veroboard layout

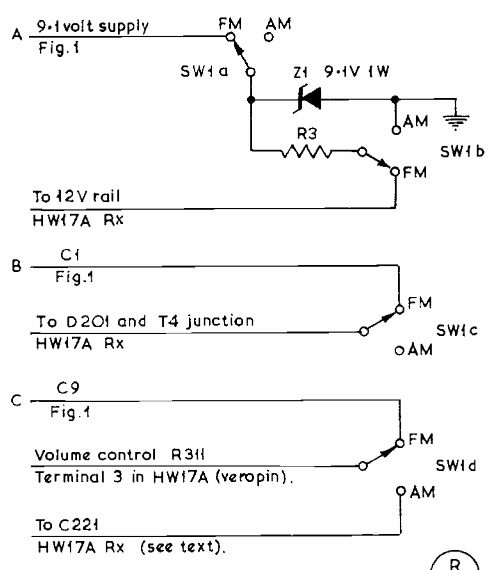

Fig. 3. AM to FM Switch Diagram

plate of the HW-17A, above the Rx board near the pins for the volume control, the coil L1 being at the bottom of the board. The 4-pole 2-way slide switch is mounted to the right (looking from the front) of the FM board, thus making any wiring very short; no screening was required. It was decided not to mount the switch on the front panel as a matter of convenience, but there is room for it if required on the front panel. This of course would require some of the leads to be screened.

Wiring the board and switch into the HW-17A receiver is a simple job. A wire from SW1 is taken to the *Vero pin* adjacent to diode D201, the other side of the switch to the IC board capacitor C1, terminal B. Connections for the output require the 10 μF capacitor C221 negative wire in the Rx to be disconnected and a *Veropin* inserted; a wire from this is taken to the switch slider, a hole being drilled in the P.C. board, and a pin is inserted. C221 negative wire is connected and a lead to SW1 AM position; a wire is then taken from SW1 FM position to C9, terminal C on the IC board.

The wiring for the supply is self-explanatory, one pole being used for supplying the IC board, the other as a convenient means of connecting Z1 and R1. When the modifications have been completed and with the switch in the FM position a loud hiss will be heard from the speaker when switched on, but tuning into a carrier will cause the hiss to disappear completely. TC1 is peaked for best audio output level, this course being carried out on an NBFM signal. In the AM position the set is returned to normal and no adjustments are required.

Results

The modifications described are well worth carrying out, as stations that were not readable at all before, on slope detection are a good R5 with no noise in the background. Also, the trouble with QRN from vehicles or other man-made noises are reduced to such a level as not to be heard unless listened for, as the AM rejection for the TAA570 is 55dB for 10 mV input and 40 dB for 1 mV input.

It only remains now to make the Tx side NBFM too which is now in hand, as this will cure the local hi-fi interference trouble near the home QTH, and also enable operation with a mode that is second to none if properly received.

One final point: there is no reason why this **IC** could not be used at other IF's with a suitable modification to the L-C ratio on the quadrature detector tuned circuit.

MODIFICATION FOR THE G3FCW KEYER

IMPROVED PERFORMANCE

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"YOUR callsign sounds familiar OM, but I am not sure why. . . . "

This remark has prefaced so many QSO's since the "Practical Electronic Keyer" appeared in SHORT WAVE MAGAZINE for May 1972, that the writer concludes that the unit has at least had a certain appeal. It is true that many have commented, over the air, on its successful operation. Perhaps it is also a tribute that it has evoked such a *small* amount of correspondence.

If you construct a piece of equipment to a published design, and it works first time, you just accept this as normal, or thank your lucky stars, according to your previous experience. Either way, you do not usually write to the author in congratulation. Only if it does *not* work, does the urge to correspond well up. Only about half a dozen of the latter sort have been received, but together with discussions over the air, it seems one snag has tended to recur.

Fault Condition

This has appeared in various guises. Sometimes, a failure for characters to be self-completing. Or for the keyer to work on *dots* but not on *dashes.* Again, for everything to appear normal, except below about 15 w.p.m., when the last character of a series is lengthened—in one case, to the keyer remaining on continuous mark at the slowest speed, until the speed control was advanced.

All these were traced to a common cause, and to respond to a simple remedy.

Circuit Operation

Fig. 1 shows the relevant part of the original circuit. The pulse generator is switched via Tr3, which is normally "on" because its base is at +5v. through R2 and R7. (All values Fig. 1 are as in the original circuit, p.160, May, 1972).

If the paddle is moved to *dot*, the case of Tr3 is earthed (0v.) through R2, and switches "off." In use, with the paddle released before the character ends, self-completion occurs *via* D1 and the NOR gate in IC2. But with D1 in circuit the junction of R2 and R7 is about +·3v. due to the forward voltage drop across the OA91 junction, and Tr3 base is no longer at Ov.

Worst case condition occurs when dashes are self-completing through D3 and D2 in series, giving about +·6v. on Tr3 base. If this puts the case beyond the knee voltage for the particular transistor used, then it will not switch "off." This erratic switching is the cause of the trouble.

Circuit Modification

Fortunately the cure is a simple one. Referring to Fig. 2, if a silicon diode is placed in the emitter lead of Tr3, the forward voltage drop across the diode will put the emitter about +·6v. relative to earth, offsetting the voltage produced by the switching diodes. The resulting base/emitter voltage is cancelled, and Tr3 switches normally. The diode to use seems quite uncritical, for example type 1N914, BA100 etc., being suitable.

See you down the low end of the band. . . .

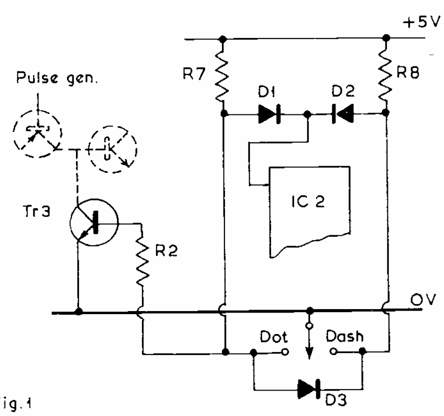

Fig.1

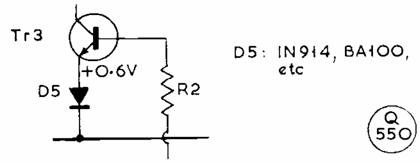

Fig. 2