Modifying The R-390A/URR

BY JOHN W. DELL,* WØAXQ

The R-390/URR and R-390A/URR are beginning to find their way into the MARS Program and have shown up in limited quantities on the surplus market. This article outlines modifications for the R-390A to improve reception of s.s.b. and c.w. signals.

MODIFY the R-390A/URR? How can you possibly improve on a receiver that offers such outstanding operational characteristics as rockbound mechanical stability, 0.5 to 32 mc continuous frequency coverage with direct reading Veeder-Root frequency dial, 300 cycle reset accuracy, selectable i.f. bandwidths of 0.1, 1, 2, 4, 8, and 16 kc, built in 2, 4, 8 and 16 kc Collins mechanical filters, adjustable a.v.c. time constants of 0.015, 0.3 and 5 seconds, metered 600 ohm line audio output, *etc.*

With all of these fine features, the receiver does not offer the optimum for reception of s.s.b. signals. It can do an acceptable job; however, use of the a.m. detector for s.s.b./c.w. limits receiver performance in these operating modes. For military s.s.b. applications, the R-390A employs a companion s.s.b. converter having 44 tubes (CV-157).

At first, any thoughts concerning modification of such a well designed and functional receiver were rejected. It was only after many hours of riding the gain on SSB roundtables that the decision was made to install a product detector. At the same time this modification was undertaken, an IF noise limiter was installed and provisions made to accommodate a Q multiplier.

Product Detector

The 7360 product detector used in fig. 1 is an adaptation of a previously published circuit[1] Study revealed that no major chassis rework or circuit changes would be required to mount the new detector in the i.f. sub-chassis. First, the RT-150 current regulator tube was relocated between tubes V_{502} and V_{506}. The 7360 was installed in the original current regulator tube socket. This location was ideal both from the standpoint of wiring and isolation of the b.f.o. from the i.f. string. A hole is then drilled in the i.f. sub-chassis front panel to accommodate the mode selection switch S_1, a 5 pole, 3 position, two wafer, miniature steatite switch. This hole was drilled midway between and ¾ of an inch below the bandwidth and b.f.o. control shafts.

It was decided not to extend the shaft of S_1 through the receiver front panel. Easy access to the switch can be gained by reaching over the top of the receiver. If the receiver is enclosed, it will be necessary to provide for front panel control. Switch S_1 operating positions include A.M., S.S.B./C.W. and S.S.B./C.W.-N.L. Variable capacitor C_5 was mounted beneath C_{538} on the left side of the sub-chassis and to the front of the b.f.o. unit. Mounting and adjusting holes were drilled in the sub-chassis. The deflection balance potentiometer, R_6, was located on the underside of the sub-chassis and directly beneath S_1. This location permits ease of access for adjustments. Control R_6 should be as small as possible due to the limited space available. Components C_1, C_2, C_3, C_9, L_{502}, R_1, R_4, R_5, R_7, R_8, R_{10} and R_{11} are mounted on S_1. Without this extra mounting aid, it would be almost impossible to properly install and secure all components. Care must be taken to insure proper layout and dressing of components and circuits. Space is very limited and care should be taken in the layout to prevent shorting of components. High voltage for the 7360 was taken from the r.f.-i.f. switched B plus line at the junction of R_{525} and R_{551}.

Adjustment

Adjustment is accomplished by setting C_5 to give a maximum of 10 volts r.f. peak-to-peak

15 Crescent Lane, Colorado Springs, Colorado, 80904.

[1]Vance, H. C., "S. S. B. Exciter Circuits Using a New Beam Deflection Tube", *QST*, March, 1960, p. 33. Filipczak, J. M., "Using The 7360 in The HBR-16", QST, Dec., 1960, p. 36.

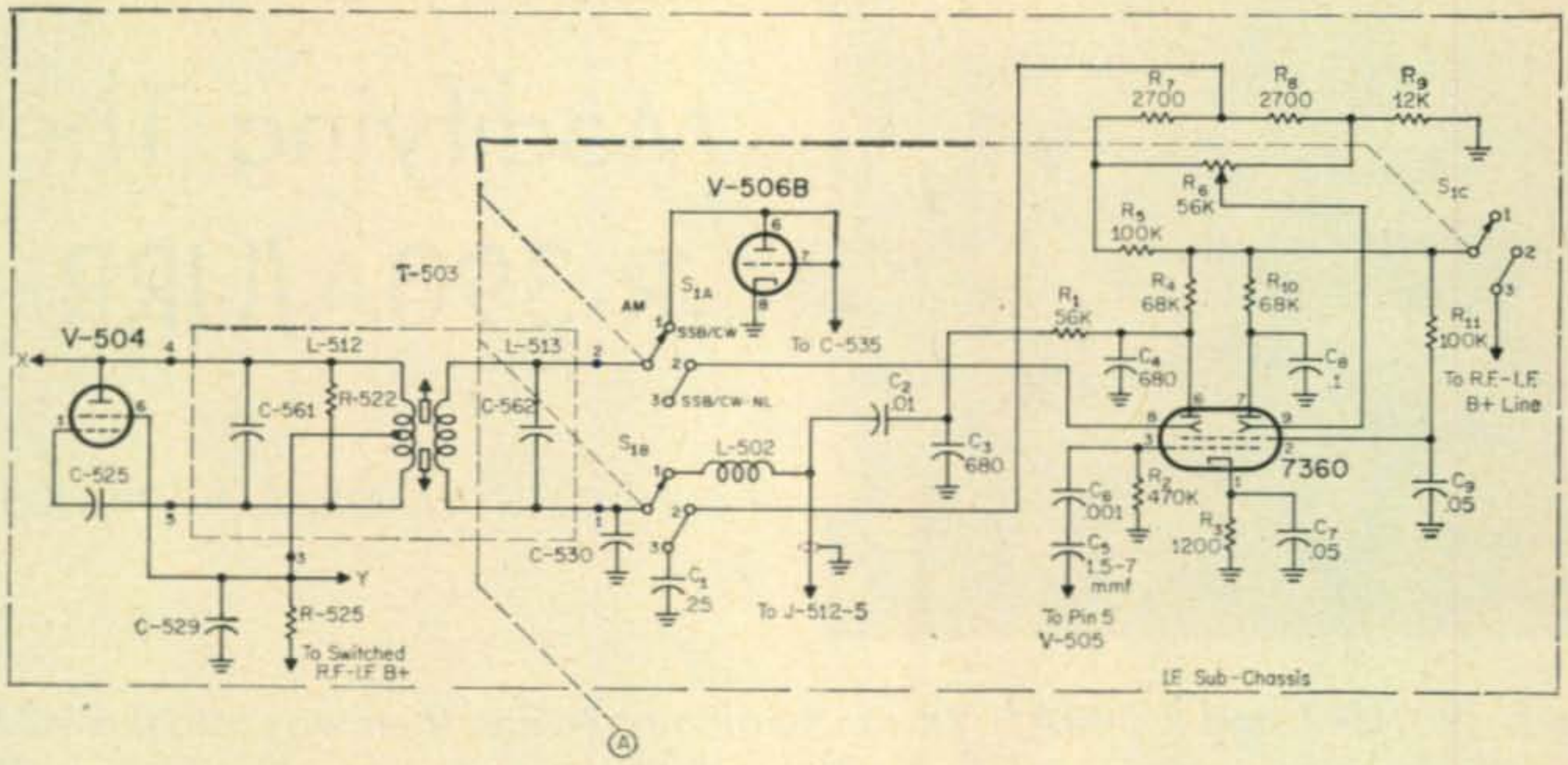

Fig. 1—Circuit of the product detector added to the R-390A/URR receiver for improved s.s.b. and c.w. reception.

(3.5 volts r.f. r.m.s.) to No. 1 grid of the 7360. Setting of balance control R_6 should be made for minimum audio output with S_1 in the S.S.B./C.W. position and the b.f.o. off. Signals from a commercial broadcasting station can be used for this adjustment. Transformer T_{503} should be touched up for best reception with the product detector switched into the circuit.

Receiver a.v.c. operation remains satisfactory when the product detector is in use. Best action is obtained in the MEDIUM A.V.C. positions. It was not considered necessary or worthwhile to modify the receiver a.v.c. circuit for s.s.b./c.w. operation.

I.F. Noise Limiter

Receiver noise limiter operating parameters are upset when the product detector is employed. This problem was solved by installing the i.f. noise limiter shown in fig. 2.[2]

There was not sufficient space for installation of all the i.f. noise limiter components in the i.f. sub-chassis. Components were installed in a small i.f. can and mounted on the left side of the receiver above the receiver bandwidth switch shaft. Five pieces of mini-coax cables were run between the limiter i.f. can and the i.f. sub-chassis. A hole was drilled in the sub-chassis just above the b.f.o. shaft to accommodate these cables. Connections are made as shown in the drawing with each of the individual coax shields tied together and grounded. Precaution must be exercised to prevent the coax shields from shorting out components under the sub-chassis.

The limiter is activated when S_1 is switched to the S.S.B./C.W.-N.L. position. Potentiometer R_{20} is adjusted to give the desired degree of limiting. Readjustment of the control should not be necessary once the position is found that gives the desired degree of limiting action. Touch-up of T_{503} should be accomplished.

Q-Multiplier

The capability to notch out annoying heterodyne carriers is considered a worthwhile addition to any receiver. A connector was installed at the rear of the receiver to accommodate a Heath Q-multiplier. Taps were made to provide necessary operating voltages (150 v. d.c. regulated and 6.3 v. a.c. filament supply). The coaxial lead between the 50 ohm IF output connector and R_{552} was removed and a new length of coax was installed between pin 5 of V_{502} and the 50 ohm output. Connection of the Q-multiplier coaxial connector is made at this point. Realignment of T_{501} is necessary.

Conclusions

Installation of these modifications has made the R-390A a top-notch s.s.b./c.w. receiver. The operational advantages gained by incorporation of these changes far outweighs the time and effort required for their accomplishment. One word of advice, take time to plan component layouts before beginning any wiring. For further information, send a stamped self-addressed envelope in care of the author at the above address. ■

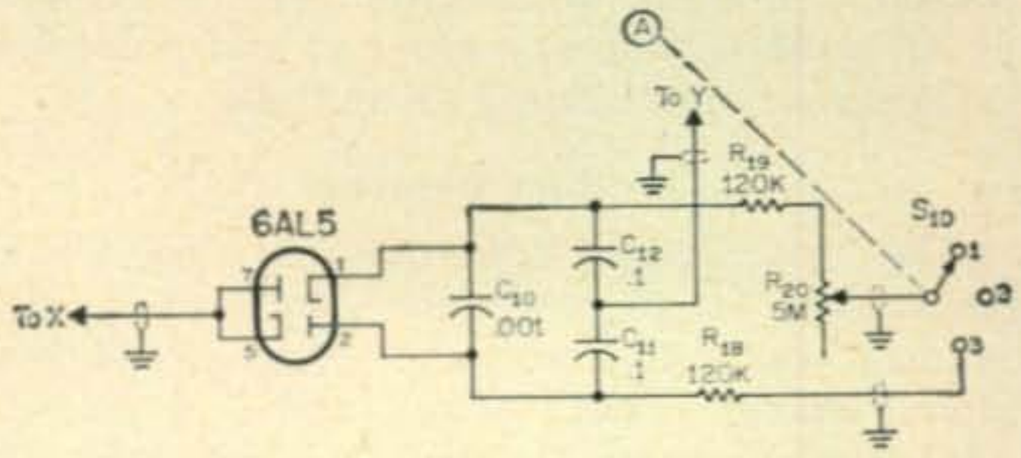

Fig. 2—Circuit of the i.f. noise limiter added to the receiver as described in the text. Switch section S_{1D} is part of the switch S_1 shown in fig. 1.

[2]Stiles, W. J., "I. F. Noise Limiter", *QST*, June, 1960, p. 16.