14 and 21-mc Bandspread For the BC-348

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Already a good basic receiver, each improvement to this popular surplus unit enhances its operating utility.

HERE ARE TWO simple modifications for the popular BC-348 receivers that really "pay off" in added utility and convenience. The BC-348 is noted for its sensitivity and stability; however, it has certain limitations in the amount of bandspread available, particularly at 14 mc, with the result that it becomes difficult to tune the receiver under crowded conditions when crystal selectivity and outboard i-f

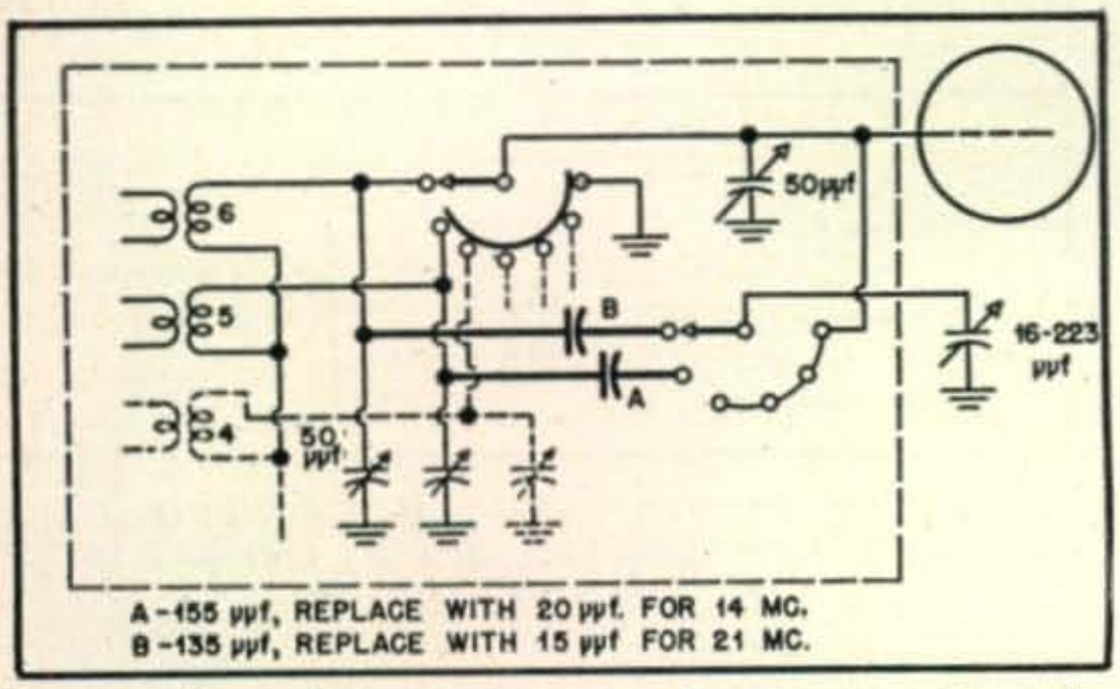

Fig. 1. Essential components of antenna, r-f, or detector assembly for bands 5 and 6, showing modifications for 14 and 21-mc bandspread, respectively. Typical for BC-348 models except J, N and Q.

amplifiers are brought into play. This condition is aggravated, of course, by the slightest amount of backlash. A second major limitation may be foreseen in the fact that the receiver does not cover the proposed 21-21.5 mc band.

Figures 1 through *4* show how the front end tuning assemblies for bands 5 and 6 may be altered to provide 14 and 21-mc bandspread operation. The changes shown for band 5 will convert its range from 9.5-13.5 mc to roughly 13.8-14.7 mc, thus providing excellent bandspread for 20-meter reception (about 50 turns of the dial to cover the band) at the loss of a tuning range that is not required for amateur reception. With the 14-mc coverage of band 6 no longer required, it then becomes practical to carry out a similar procedure for this band to include the 21-21.5 mc range. Having applied one or both of these modifications, the user will probably be pleasantly surprised to find how easy it has become to make those fine adjustments in tuning that are required in the battle against interference.

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One additional wiring change is recommended as shown in *Fig. 5*. With the new small values of padder capacitance, the oscillator frequency is more dependent on trimmer and tube capacitances than before, with the result that the apparent signal frequency is seriously affected by operation of the r-f gain control or the b-f-o switch. These variations may be traced to changes in the mixer screen voltage due to changes in the total screen current. Placing the mixer screen on the regulated supply that normally feeds the oscillator eliminates these variations.

Before going further, it must be mentioned that the circuit changes described here are applicable to all models of the BC-348 series except the BC-348J, N and Q. These models are substantially different from the others, and their arrangement of trimmer and padder capacitances in the front end is such that it is not practicable to apply these procedures.

The circuit changes are perfectly straightforward, involving only the replacement of one or two fixed condensers in each coil assembly by condensers of new values. A few notes on procedure will, however, simplify the job considerably.

Mechanical Procedure

Before starting work, be sure that there are available (1) a soldering iron with a long thin (pencil) tip, and (2) an Allen wrench that fits the set-screws

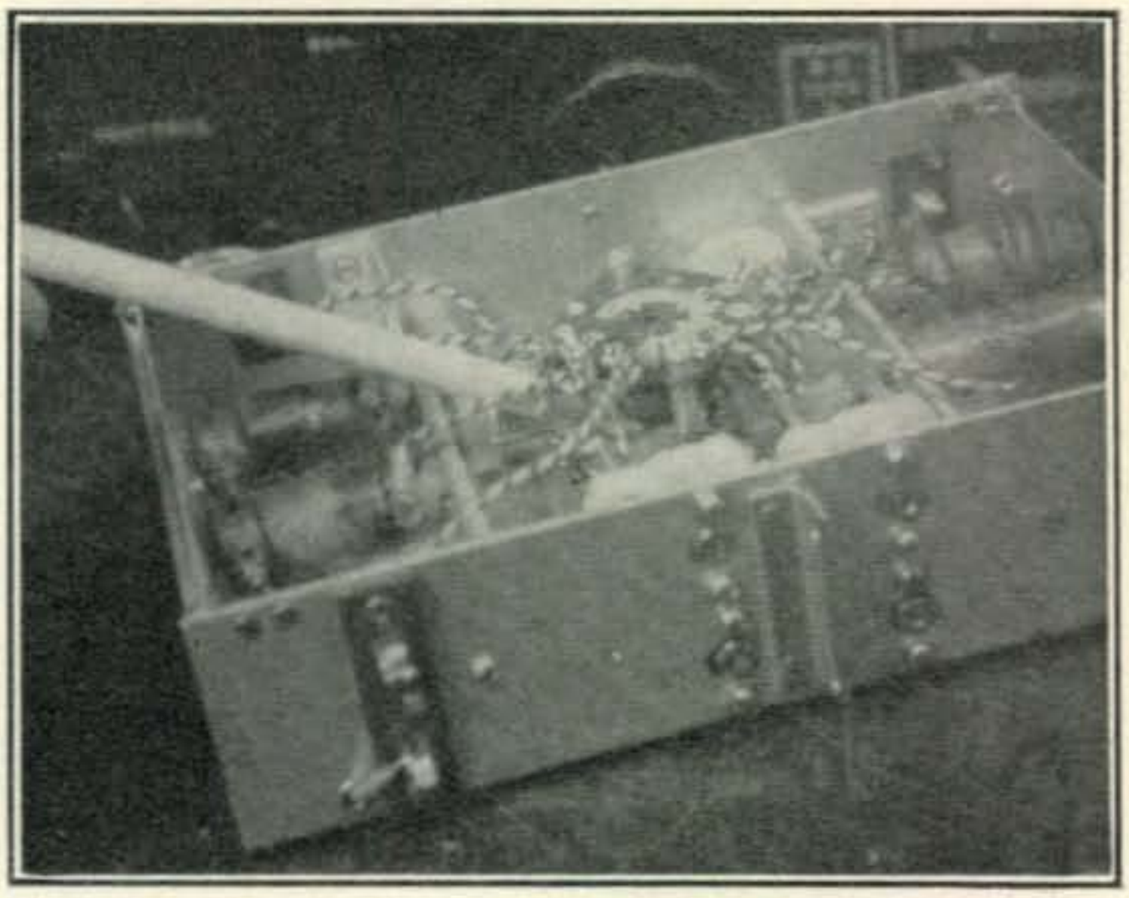

Fig. 2. Photo of antenna tuning assembly. Condensers to be replaced are located between the switch wafers, as indicated.

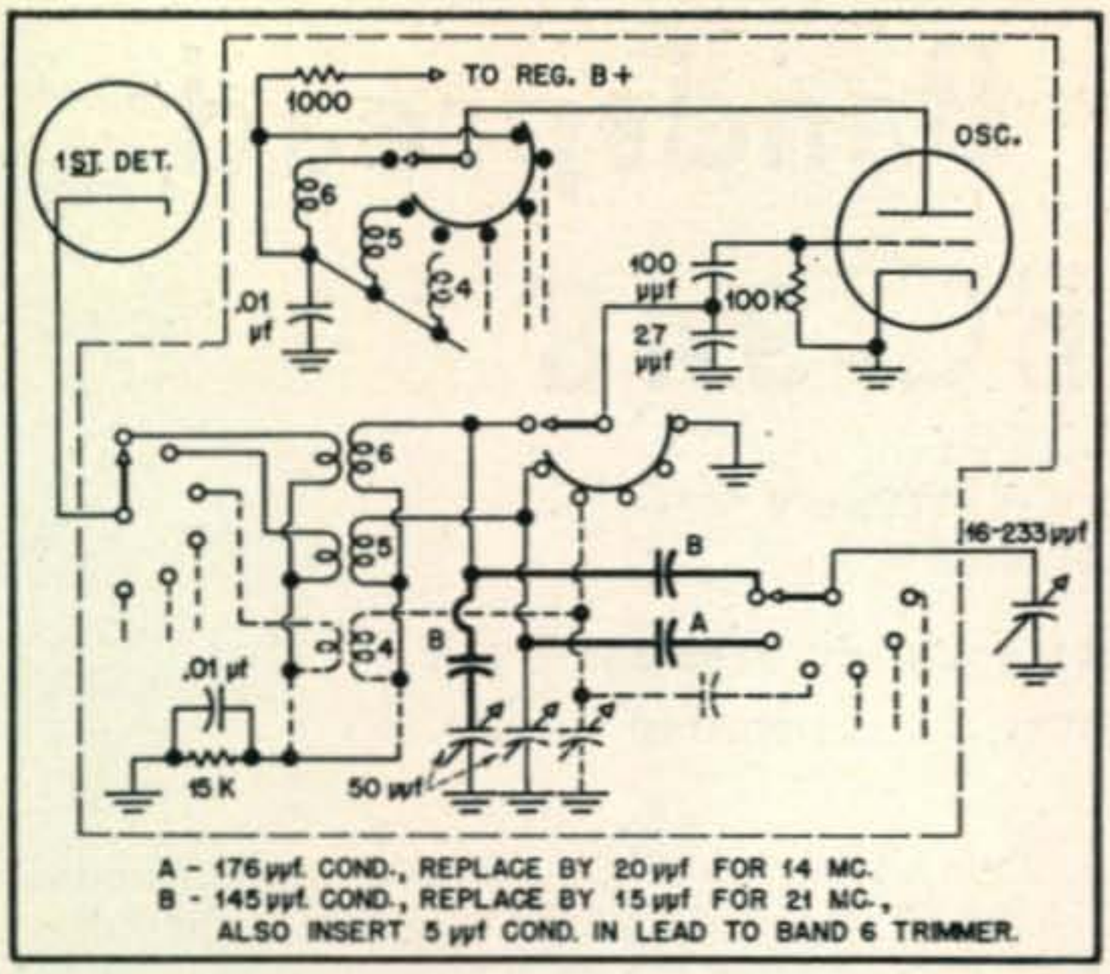

Fig. 3. Essential elements of oscillator assembly for bands 5 and 6, showing modification for 14 and 21-mc bandspread, respectively. Typical for BC-348 models except J, N and Q.

in the panel knobs. The former will greatly facilitate the wiring changes at a minimum of disturbance to other components. The wrench is required to remove the antenna tuning control shaft extension so that the antenna coil assembly can be removed. As for material, it should not be necessary to emphasize that the condensers used as replacements should be of good quality. Zero temperature coefficient ceramics or silvered mica capacitors are recommended.

The first step in removal of the front-end assemblies is to remove the band switch shaft. This shaft is released by removing one set screw (the only one with a standard screwdriver slot) in the right angle drive for band change. Before actually removing the shaft, it is suggested that the band switch be set to band 5 or 6 as an aid in identifying the particular condensers to be replaced. The shaft is removed by simply sliding it out from the far end.

The four cans will slide out easily when all mounting screws and ground straps have been removed, wires disconnected, and the antenna tuning control

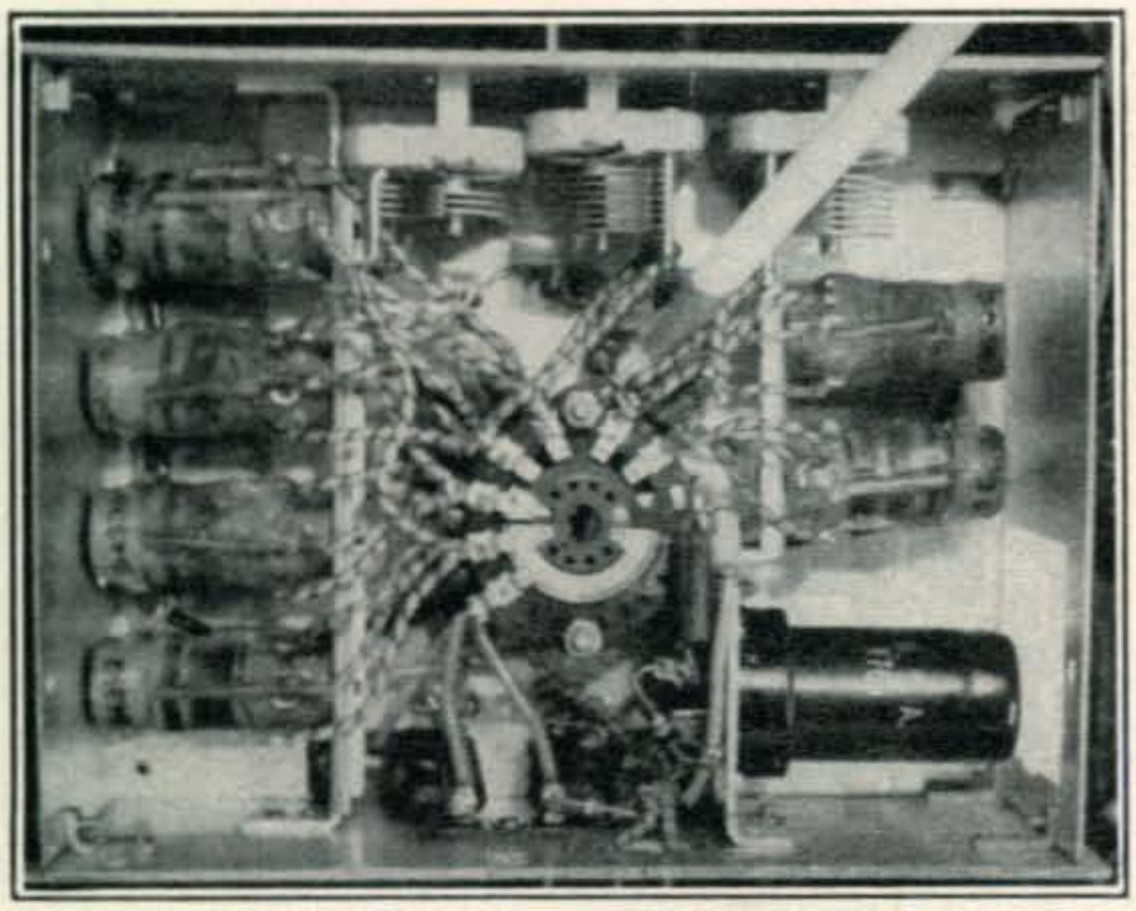

Fig. 4. Photo of oscillator tuning assembly. Condensers to be replaced are mounted at the point shown between the first and last switch levels.

extension removed. Incidentally, removal of the shield plate on the main tuning condenser will simplify the matter of disconnecting the wires leading thereto.

When working on the tuning assemblies, existing apparatus and wiring should be disturbed as little as possible. In this connection, it is better to cut the pig-tails on condensers being replaced rather than to attempt to unsolder them. It is also important not to turn the switch wafers, otherwise it will be difficult to replace the band switch shaft.

The modification in the mixer screen circuit is very easy to make. Removal of the panel plate in front of the r-f tube shelf will reveal a 10,000-ohm resistor connected to *pin 4* of the 6J7 (mixer) socket. The *other* end of this resistor should be clipped free and wired over to the left-hand (positive) lug on the neon tube regulator.

Re-alignment

After the receiver has been reassembled, alignment is simple and straightforward. On band 5, even without readjustment, the front end should be well enough in line to receive strong signals. The lower portion of the familiar 20-meter spectrum will probably appear near the top of the dial, and this

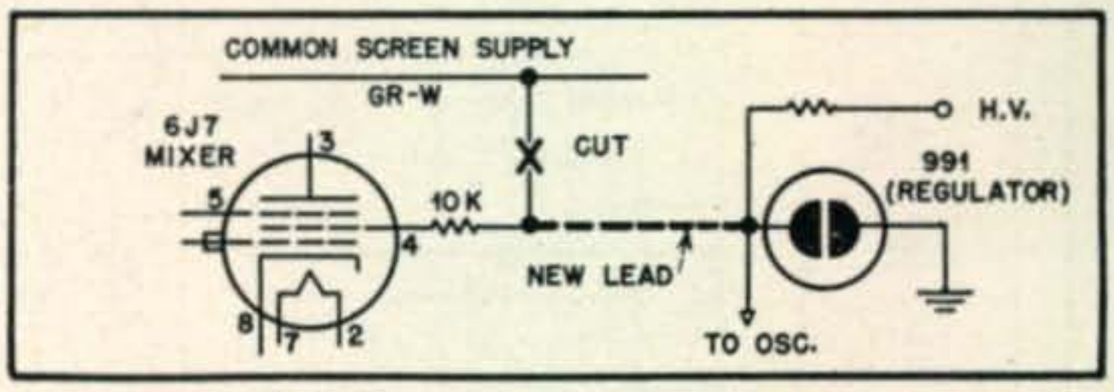

Fig. 5. Modification of mixer screen supply to eliminate frequency variations due to changes in total screen current.

can be confirmed by setting the transmitter oscillator or some other local signal source at 14.0 mc. Then, by means of alternate adjustments of the band 5 oscillator trimmer and the main tuning control, the appearance of the 14.0-mc signal may be worked down to the lower part of the dial, say the 10.0 mark. The oscillator trimmer adjustments must be made carefully in small steps, because this condenser now has a large effect upon frequency. Alignment of the front-end stages is completed by tuning to a point where there is no signal and adjusting the remaining band 5 trimmers for peak noise.

Band 6 is a little harder to align because of image difficulties, but the 21-mc region may be found near the top of the dial again through the use of a transmitter oscillator harmonic. To determine whether or not some received signal is an image, turn on the crystal and b.f.o. and observe at which side of zero beat the maximum signal occurs. Then switch to band 4 and observe that maximum signal occurs on the opposite side of zero beat; if this is not the case, the signal received at 21 mc is an image. Once a bona-fide 21-mc signal has been located, it may be spotted on the dial by means of the oscillator trimmer as indicated above. It is best to align the remaining front end stages on this signal rather than

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Variations on the antenna mounting sketched can easily be devised to fit different situations as, for instance, the case where it is desired to mount the supporting pole directly on the ground. This can be done without any particular trouble because the angle of the guy-wire radials is not at all critical.

Electrically, this arrangement has low angle radiation and a good impedance match, because drooping the radials tends to raise the center impedance as compared to the approximately 30-ohm center impedance of the conventional ground plane antenna. This makes the center impedance of this array a pretty close match to the 50-ohm surge impedance of the RG8/U.

If one wants to worry about more exact figures, use 95% of a free-space quarter wave for the vertical section and 100% of a free-space quarter wave for the radial wires at your favorite frequency. For 10 and 11-meter operation cut the elements for 28 megacycles.

A lot of loading troubles can be eliminated and physically loose coupling between the antenna and tank coil maintained if series tuning of the antenna pickup coil is used. A small variable condenser of 50 or 75 $\mu\mu$f may be used as the voltage is low with up to medium power. On 10 meters the ordinary 2 or 3-turn coil usually has enough inductance to hit resonance within the range of the condenser. If resonance is not achieved with the plates fully in, a larger link or some added series inductance is in order. The added inductance or rather large pickup coil is certain to be needed on 20 meters.

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on noise to avoid image difficulties. When the mixer trimmer is adjusted, it will be necessary to retune the receiver slightly to retain the signal, since the mixer trimmer affects the oscillator frequency.

The matter of calibrating the new tuning ranges is left up to the individual. The simplest procedure is to prepare a chart or curve showing the important frequencies in the band concerned plotted against the corresponding settings on the band 5 or 6 dial plate. This method of calibration is employed occasionally in commercial communications receivers and has proven quite satisfactory for the author's requirements. The provision of more elaborate dial arrangements for the new frequencies is limited only by the ingenuity of the builder.

REFLECTION AT 144 MC

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tions were placed along the same azimuth, a station 20 miles removed in either direction could hear stronger or considerably weaker signals depending upon the distance of the DX station and the point of incidence. The situation is further complicated by the addition of the third dimension to this picture, spreading the inversion over a much greater area.

It is also to be noted particularly, that this warp-