CONVERTING THE BC-342 RECEIVER

Though the BC-342 Signal Corps short-wave receiver has not appeared in quantity on the surplus market, the BC-312 has been widely available. Either is considered an ideal piece of equipment that can be readily modified and used very nicely as a communications receiver. Either can be made to perform comparably with receivers that sell on the current market for three and four times the price.

The BC-342 is designed to operate on 115 volts ac, 50 or 60 cycles. The direct current version of the BC-342 is the BC-312 (12 volts, dc). Since the major part of the BC-312's conversion is identical to that of the BC-342, only a small part will be devoted to it under a separate title with general reference directed to this article.

Among the most recent models of the BC-342 and BC-312 appearing on the market are the "M" and "N" models. Since the later models are not greatly different from the earlier models, the converting procedure can apply to all of them without regard to the slight variations. The most apparent variation is the omission of the Crystal Filter on the later models of the BC-312.

As is immediately apparent, these Signal Corps receivers were built for service rather than for beauty. Even though it is not as pretty as the modern communications receiver, the ham can be reasonably assured that this receiver is one of the most rugged, both mechanically and electrically, that has ever been built. It has relatively high sensitivity and good stability. Its frequency range is 1500 to 18000 kc. thereby not covering the broadcast band or the 10-meter band. Converters for the high-frequency bands work nicely with this receiver, since direct coaxial coupling to the antenna input is provided on the front panel of the receiver.

The BC-342 has the following tube line-up with the respective functions:

2 ea 6K7 (VT-86) 1st & 2nd RF amplifiers
6C5 (VT-65) RF oscillator
6L7 (VT-87) 1st Detector
2 ea 6K7 (VT-86) 1st & 2nd IF amplifiers
6R7 (VT-88) 2nd Detector, AVC, 1st Audio amp.
6C5 (VT-65) CW Oscillator
6F6 (VT-66) Audio output amplifier
5W4 (VT-97) Rectifier

The r.f. oscillator stage has been well stabilized, making the drift and dial calibration quite accurate. The frequency coverage of the receiver is accomplished in six bands, with directly calibrated, fast and slow vernier knobs. Since the military requirements were not those generally required for ham use, the following modifications and refinements will be covered:

(a) Modification for the RF Stages
(b) Modifying the Crystal Filter
(c) Backlash Improvement in the Tuning Mechanism

(d) Reducing the Audio Hum Level
(e) Connection for the "send-receive" Switch
(f) Improvement for the Audio Section
(g) Additional Circuit Refinements
(h) Optional Refinements and Suggestions

(a) Modification for the R.F. Stages

Since the r-f stages are operated with a higher than rated grid bias and lower than rated screen voltage, the receivers have a noticably lower signal to noise ratio than is expected in good communication receivers. Increasing the gain of the r-f stages materially improves this condition.

The existing cathode resistors of the 1st and 2nd r-f stages, R_1 and R_7, are 500 ohms. These should be reduced to 250 ohms. The screen resistors, R_3 in the 1st r-f stage and R_9 in the 2nd r-f stage, should be reduced from the original value of 40,000 ohms to 20,000 ohms. These changes give a grid bias of about -3 volts relative to the cathode and a screen voltage of approximately 130 volts. Another recommended feature is the removal of the 1st r-f stage from the manual r-f gain control permitting this stage to operate at maximum gain when using the MVC. This change provides optimum signal-to-noise ratio when the manually controlled gain is reduced to the desired listening level.

To make the above alterations it is necessary to remove the shield plate at the rear of the chassis behind the mixer and the r-f amplifier tubes. The screen resistors are located underneath the plate on the mounting strip and are identified from the schematic diagram as R_3 and R_9. An easy way of making the change is to shunt the existing 40,000-ohm resistors with similar and equal resistors thus giving a value of 20,000 ohms.

The existing cathode resistors are located at the sockets of the tubes requiring the removal of the tube mounting plate. Substitute 250-ohm, 1/2-watt resistor for R_1, soldered between the cathode pin and pin No. 1 (ground). R_7 is replaced with a 250-ohm resistor between the same points as the original resistor.

The increase in gain from the above changes should show a definite peak noise by tuning the trimmer on the 1st r-f stage with the antenna disconnected.

(b) Modifying the Crystal Filter

The crystal filter, which is electrically located just before the 1st i-f stage, is a crystal tuned bridge circuit intended to give greatly increased selectivity. Since the military version seriously reduces the signal level, its operation is not considered up to the requirements to warrant its use; however, the following modification will give radical improvement.

As it is, switching the filter in and out changes the shunting capacitance across the secondary of the i-f transformer to such an extent that the stage is considerably detuned, thus reducing the sensitivity. To avoid this radical change in capacitance at the switching point, which is done by a switch on the capacitor shaft, the switching point should be changed me-

chanically to close when the phasing capacitor is at minimum capacitance.

The best method of doing this is to force the switch blade around 180 degrees on its collar. Since all switches are not conducive to this treatment without breaking it may be necessary to solder the blade to the collar in its new position. After this change is made and functioning properly it is necessary to readjust the alignment of the i-f transformer secondary in which the crystal filter operates. This adjustment is made at the top of the first detector transformer. It is preferable to align it on noise with the crystal switch out. Now the signal strength should be the same with the filter out, or peaked on the noise when it is in. The crystal selectivity is not too great but considered good for ordinary operation.

A refinement frequently made to make the crystal filter tuning less critical, is to reduce the capacitance of the variable phasing capacitor. This is done by removing (breaking) approximately half of the stator plates from the capacitor. Since it is not necessary to remove the filter assembly for this operation, it is an easy refinement to add.

(c) Backlash Improvement in the Tuning Mechanism

Generally backlash is not considered as being too bad in these receivers. However, it is always the general desire to minimize this condition. The largest part of the backlash occurs between the worm gear and its mating gear on the capacitor shaft. To tighten the mesh of these two gears is a major operation generally not recommended since it requires considerable dismantling of the mechanical tuning assembly. However, in most cases improvement can be obtained by reducing the amount of end play on the worm-gear shaft. This is done by increasing the spring tension on the worm. To do this, loosen the collar, pressing it lightly against the spring, and retighten it in its new position.

(d) Reducing the Audio Hum Level

Frequently a relatively high hum level is present in these receivers. It is generally due to insufficient power supply filtering and use of the output stage for headphone reception.

If insufficient filtering in the power supply is apparent, it is recommended that midget 8 mfd. filter capacitors be shunted across the existing filter capacitors C89 and C90 in the power supply section.

Modification of the audio section as discussed under section (f) of this article will give definite improvement in the hum level for headphone reception.

(e) Connection for the "send-receive" Switch

The "send-receive" switch does not operate the receiver since it is connected into the external plug on the front of the receiver. To make it operate in the normal fashion, it is necessary to remove the leads from the switch and connect one terminal of the switch to the chassis (ground). Disconnect the high-voltage center-tap lead from the negative terminal of the filter capacitor in the power supply and connect this lead to the other

side of the "send-receive" switch. This lead is brown in color and long enough to reach the switch through the grommet in the power supply case. The "send-receive" switch should be kept in the center tap lead so as to keep it in the low-potential side of the "B" circuit thus avoiding high voltage at the switch and also eliminating switch "pops" that occur when switching in the high-potential side.

(f) Improvement for the Audio Section

Since this set is capable of supplying adequate audio volume for headphones at the output of the first audio amplifier stage, it is advisable to shift the lower phone jack connection to the output of the first audio stage. This stage is the triode section of the 6R7. Hum and noise which may normally be picked up by the additional audio output stage is reduced considerably.

This change can be accomplished by connecting the lower jack, at the right side of the front panel and labeled 2nd audio phones, to the grid (pin No. 5) of the output tube, the 6F6. In some models this modification will not be necessary since one of the jacks is already connected in the first audio output and labeled accordingly.

To improve further the above modification, it may be preferred to replace the existing jack with an open-circuiting type jack which opens the grid circuit to the output tube when the headphones plug is inserted. This is normal practice in most communication receivers since it removes the speaker output when the headphones are used. If the speaker is not connected, the open-circuiting jack removes the possibility of very high voltages that may be developed at the plate of the output tube with large signals when the circuit is not loaded. These voltages can easily be high enough to arc between the electrodes in the output tube or break down the insulation in the output transformer.

Transformer T_1 is an audio interstage transformer that is used in some models for headphones output from the first audio amplifier. In other models, the transformer is connected to the external plug on the front panel and serves no purpose in the normal operation of the set.

Since the output transformer, T_2, has an output impedance of approximately 3000 ohms, it is not considered practical for normal use. It is generally desired to replace this transformer with a standard output transformer matching the 6F6 to the desired voice coil impedance. This works out nicely with a 6 or 8 inch PM speaker. When changing output transformers, it is possible to select the physical size which can be squeezed into the original position of T_2. The secondary leads can be brought out as before to the speaker jack with the jack labeled accordingly.

If the changing of output transformers is not desired, the existing output of transformer T_2 can be fed directly into another output transformer having a primary impedance of 3000 or 4000 ohms when connected to the speaker voice coil. This method has been used satisfactorily and will eliminate the work in changing transformers.

Additional refinements considered advisable, especially if more audio volume is desired, are changing the following circuit components in the audio section of the receiver.

Replace the 6R7 detector first audio tube with the high mu 6Q7. This is an easy change since the socket connections are the same and only the cathode resistor, R_{28}, must be altered for the proper bias. This is easily done by shunting the existing resistor, R_{28}, with a 300-ohm, 1/2 watt resistor.

The diode filter resistor, R_{49}, is a relatively high value, being 0.5 megohms. Considerable increase in volume can be obtained by reducing this value to normal proportions. This can be conveniently done by shunting the existing resistor with a 100K 1/2-watt resistor.

It will also be noted that the grid resistor, R_{33}, of the output stage is considerably lower than normally used. This resistor should be increased from the existing 50K to 250K.

The above changes will give much increased audio volume which will be more than adequate for speaker and headphone operation.

(g) Additional Circuit Refinements

Noise Limiter:

To bring your receiver up into the top class of communication receivers, the addition of the suggested noise-limiter circuit will be well worth while. This is a series-type limiter using the 6H6 diode with an IN-OUT switch. The schematic diagram should be self-explanatory as shown in fig. 1.

If desired, the entire limiter, tube and all, can be encased in an old i-f transformer can. This will give a professional appearance to the installation, and the assembly may be easily mounted inside the receiver on the chassis.

"S" Meter:

Since many hams do not consider the communication receiver complete without a signal-strength meter, the circuit shown in fig. 1 is recommended. This circuit is standard and considered quite satisfactory.

It is generally considered inconvenient to mount even a small meter on the front panel of the receiver. This is true because of limited space and the thickness of the panel which makes cutting of the hole rather difficult. In most cases, the meter is mounted externally on a bracket to the receiver case.

Separate R.F. Gain Control:

An optional feature that is sometimes desired, is separate and individual r-f and a-f gain controls that are not switched in and out with the AVC switch, SW-12.

This control, as in the military version, consists of the tandem potentiometers, R-34 and R-35. To separate them it is necessary to disconnect one, preferably the a-f, R-34, and add an additional 500K potentiometer to the panel for the new a-f gain control. After this is done, the

MODIFIED AUDIO SECTION OF BC-342 & BC-312

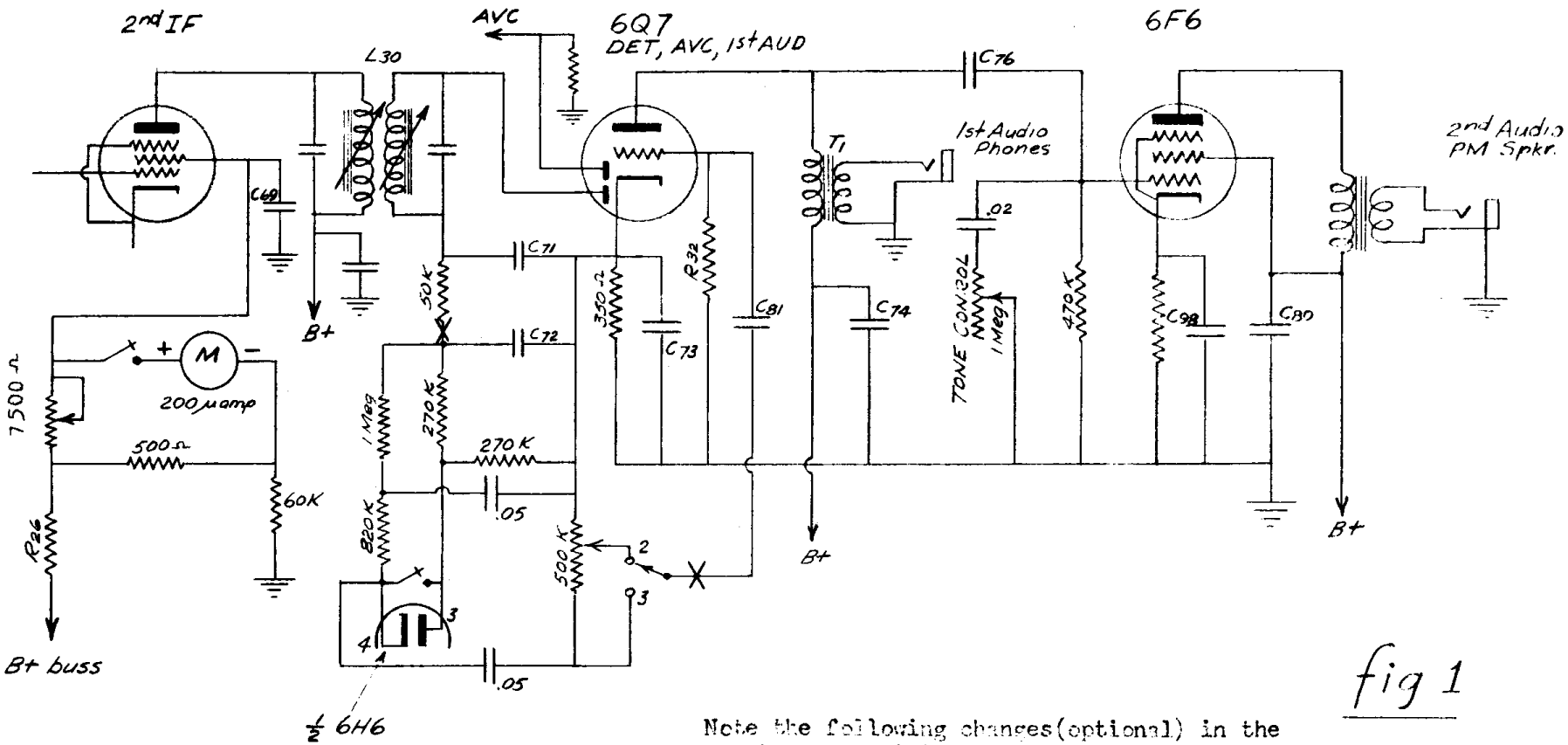

fig 1

NOTE- R25 replaced by S-Meter circuit resistor of 60KΩ. This value is adjusted for meter full scale sensitivity.

Note the following changes(optional) in the completely modified audio section.

1. Output transformer, Plate to Voice Coil
2. 6Q7 for 1st Audio Stage
3. Added "S"-Meter Circuit
4. Added Noise Limiter Circuit (between X's)
5. Tone Control Circuit
6. All indicated condenser and resistor values represent changed values.

leads to the two controls should be reconnected to by-pass switch, SW-12. With this change, the switch in the 2nd and 3rd position only controls the AVC circuit, being either ON or OFF.

Tone Control:

Occasionally a tone control is desired for listening ease and can be added to the receiver. This is quite convenient especially if the receiver does not have the crystal phasing control which is physically replaced with the dial light rheostat on the panel. Since the rheostat is useless in most cases, it can readily be replaced with any other desired control or in this case, the tone control.

A simple type of tone control circuit is shown in Fig. 1.

(h) Optional Refinements and Suggestions:

Among the many personal touches that may be added to the BC-342 and BC-312 for appearance and ease of operation, the following may prove to be advantageous or possibly stimulate new ideas:

The external plug, SO-1, located on the front panel was intended for use with other associated equipment of which the receiver was a component part. Ordinarily there is no particular need for this plug and it can be removed from the panel. The remaining hole can be plugged or used for added controls. The leads to plug SO-1 should be removed at convenient points in the receiver.

The small vernier tuning knob (1/4" shaft) can be replaced with a larger and more attractive knob which will facilitate fine tuning.

Rubber grommets, inserted in the slide fastener holes on bottom of the receiver case, will serve as a partial shock mount and will eliminate the possibility of sliding or scratching.

The unused jacks on the front panel can also be put to use as desired, such as a phono or audio input to the audio amplifier section. There may be other uses for the jacks that will apply the individual's particular needs.

As will be apparent to the average ham, a number of the above suggestions for conversion of the BC-342 or the BC-312 are optional and will be up to the personal requirements of the individual concerned. With the above conversions this receiver can be made very suitable for ham use with its performance comparable to the high priced communication receivers.