Improving the Signal to Noise Ratio of the Gonset Communicator

... a simple modification for a remarkable improvement

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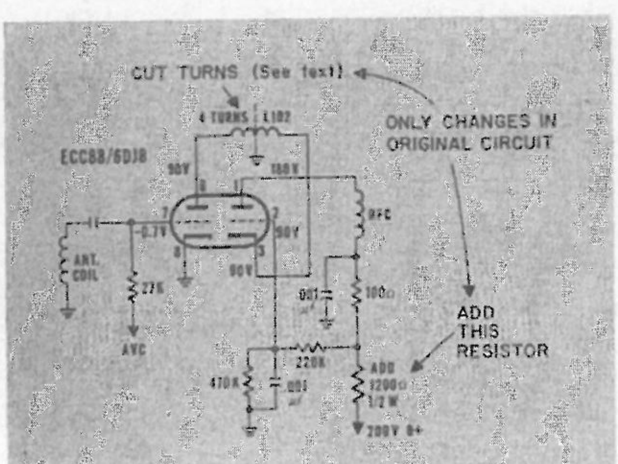
The Gonset Communicator is certainly one of the most versatile pieces of ham equipment ever mass produced. I've used mine just about everywhere and really enjoyed it. But, as probably happens to most engineers, the day comes when a professional look comes into the eye and some serious thought is given to hot-rodding it. This may be a natural phenomenon, or it may be a delayed result of reading about 417A converters and parametric amplifiers.

My Two Meter Communicator III was placed upon the operating table, disemboweled, and an autopsy performed on the front end. It became obvious that the designers knew what they were doing and that a major revision was not practical. There wasn't room inside for a parametric and it would be awkward to mount it outside, so I looked further. An easy way out came to mind: a better tube for the receiver's front end. The resulting improvement was beyond all expectations so I'm passing this along for the rest of you to try.

Since World War II, there has been an ever increasing pressure on tube designers for improvements because of the great and growing complexity of electronic equipment of all sorts and the competition of transistors. Tube designers have met this challenge and, even though there has been no real break-through in electron tube theory, there has been many startling new developments in design technology.

Fig. 1



RF Tubes

Better performance of rf amplifiers was brought about in recent years by miniaturization and improved electrode design by modification of prototype structures. The cascode circuit, such as in the Communicator III front end, employing two stages of triode amplification with a specially designed double triode tube seemed to be the culmination of engineering effort for garden variety equipment.

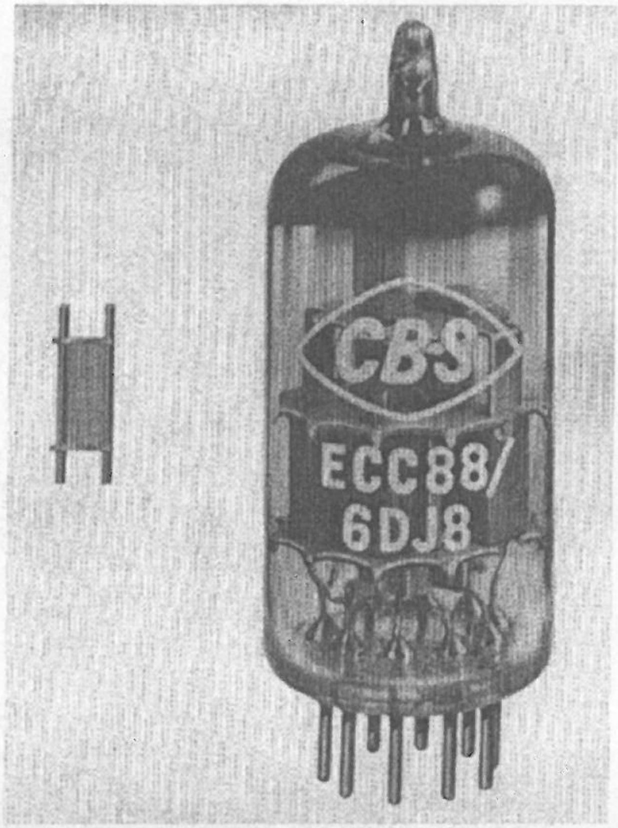
A good rf tube should have a high-gain bandwidth product and low noise which is a result of high transconductance, low interelectrode capacitances and low noise resistance. In tube design this means closer spacing of the grid to the cathode for higher transconductance and finer grid wires to hold capacitances and noise to low values. A practical limit is reached where the grid wires become so fine that they can no longer adequately support themselves and the spacing is too close for reliable service without shorts.

One approach to the grid problem is to support the grid wires on a rigid frame, thus, the grid wires themselves do not have to support the structure. This is called a frame-grid tube (See Fig. 2). With this type of construction it is possible to cut the diameter of the grid wires to one half that of the conventional tube and also the grid may be moved closer to the cathode.

A New Tube for the Communicator

One of the frame-grid tubes that is now readily available is the CBS ECC88/6DJ8. It is a double triode designed for cascode amplifier service. It will replace many conventional American tubes in this class of operation and provide superior performance.

The ESS88/6DJ8 is tailor made to improve performance of the Communicator III front end. It has a transconductance of 12,500 μmhos in typical operation with 90 volts applied, while the 6BZ8 originally used in the Communicator III has a transconductance of only 8,000 μmhos with a plate voltage of 125 volts. The lower plate voltage of the ECC88 indicates lower noise output. In comparison, if the voltage of the 6BZ8 were lowered to 90 volts to reduce noise its transconductance would drop down to about 6500 μmhos. In addition, the ECC88's frame-grid structure with its finer grid wires reduces electron shot noise caused by the random impact of electrons against the grid wires.



The ECC88/6DJ8 high-gain twin triode with true frame-grid construction is now available from CBS Electronics, manufacturing division of Columbia Broadcasting System, Inc. The grid itself is shown to the left of the tube.

To see what adjustments were necessary for substitution, when the characteristics of the ECC88/6DJ8 were compared to those of the 6BZ8 it showed that only the plate voltage had to be adjusted to obtain proper operating conditions. In other words, shifting the plate to a lower voltage brought all other parameters in line so that the grid biases were properly Class A without further adjustment. (Type 6BZ8 operates at Class A with 125v plate, —1.0 volts grid, and 10 ma plate current. Type ECC88 operates with 90 volts plate, —1.3 volts grid, and 15 ma plate current.)

Reducing the voltage of each section of the tube was simply accomplished by inserting one series resistor of 1200 ohms into the B plus power lead. This takes care of both sections of the tube as they are in series in the cascode circuit (See Fig. 1).

One unexpected difficulty arose in that instability and oscillations occurred in several places of the band. This was due to the slightly higher capacity of the ECC88/6DJ8. The resonant frequency of the plate to cathode connected neutralizing coil (L102) with the internal tube capacitances must be lower than the receiver frequency. The instable condition was easily rectified by reducing the size of coil L102 to about one half of its original size. L102 can be located going through the shield between tube socket pins 3 and 6. Either wind a new coil of 4-turns and ¼ inch diameter or cut the original L102. Further adjustment may be necessary by stretching the shape of the coil until no spurious oscillations are detected when tuning over the entire 2-meter band.

After these changes are made and the Communicator reassembled, the interstage rf transformer should be peaked with the rf trimmers accessible through the two front holes in the bottom of the case.

The noise level with the new tube is so much lower than originally that it may be a little difficult to tune to maximum on the noise level. If a noise generator is not available, then an incoming signal may be used, preferable a steady low level signal. It should be unnecessary to touch the input stage as it is an untuned-broadband circuit that is effected very little by slight differences in input capacity between the original tube and the new tube.

The completed conversion is so good from the noise stand point that most of the remaining noise is generated in the converter stage. It would now be appropriate to work out a reduction of noise in this area. 73