



- High-Voltage Regulation
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In this issue, *NRI Journal* veteran James Crudup draws on his vast technical servicing experience to explain High-voltage control. In addition, the ear doctor, Harold Kinley calls again to discuss more Citizens Band servicing case histories.

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# HIGH-VOLTAGE REGULATION

by  
James D. Crudup

The current drawn by the crt in a color television is not constant. It fluctuates widely with variations in brightness levels on the crt screen. It's rather easy to realize this when you consider that the crt screen sometimes goes from a very dark condition to a very bright condition. And since other circuits such as the convergence circuits, the sweep circuits, the focus circuit, and the burst circuit, depend upon the high voltage for their operation, it's necessary that the high voltage be made independent of brightness variations by some means of regulation.

Poor high-voltage regulation in color television receivers can produce such obvious symptoms as poor vertical linearity, narrow picture, blooming, and poor focus. In addition, with increased high voltage, there is a possibility of X-ray radiation. In most cases, the cause of these problems can be traced to the high-voltage regulator.

Pinpointing high-voltage regulator problems isn't difficult at all if you understand how the circuit is supposed to operate. Once you know what to expect, it's a simple matter to check for the proper voltages, waveforms, and resistances. Basically, there are three popular methods of regulating the high voltage in the color set: shunt regulation, pulse-type regulation, and bias regulation. Let's take a look at these three types of regulation. We'll start with shunt regulation since this is the oldest method of high-voltage regulation.

## SHUNT REGULATION

First, let's go through the simplified block diagram of a shunt regulator circuit (Fig.1) before we tackle the real thing. As a starting point, we know that the horizontal oscillator produces the signal which drives the horizontal output stage. The amplified signal from the horizontal

output stage is then fed to a flyback transformer where it is increased in amplitude. Several other voltages (or signals) are taken from the flyback transformer. However, the one that we will be talking about in our discussion is the boost voltage shown in Fig.1. The high-voltage pulse output from the flyback transformer is fed to the high-voltage rectifier. The output of the rectifier is a dc voltage of approximately 25 kV. This is the high voltage that is used to operate the crt. Notice in Fig.1 that a regulator is connected from the output of the high-voltage rectifier to ground. Therefore, it's in shunt with the crt and it is quite appropriately named a shunt regulator.

## HOW IT OPERATES

The regulator plate is connected to the crt anode supply, the cathode is connected to approximately 400 volts B+, and the regulator grid is connected to a potentiometer which connects to the boost supply voltage.

The key to the operation of the circuit is that the boost voltage varies with the amount of current being drawn by the crt from the high-voltage supply. Therefore, the boost voltage can be used as a control voltage for the shunt regulator. The shunt regulator presents a constant load to the high-voltage supply. By holding the cathode voltage to the regulator constant, and varying the grid voltage, the characteristics of the regulator can be controlled. Notice that the crt also connects across the high-voltage supply and presents a variable load to the rectifier as the brightness of the crt varies. If, for example, the scene brightness caused the crt to draw more current and if the high voltage weren't regulated, a large voltage drop would occur across the power supply impedance.

The boost voltage is a high positive voltage taken from a tap on the flyback

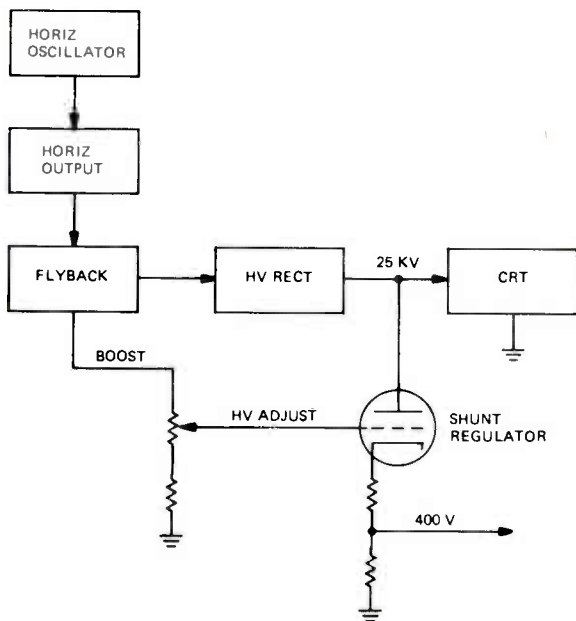


FIGURE 1. SIMPLIFIED SHUNT REGULATOR.

transformer. The boost varies inversely with the amount of current being drawn by the crt from the high-voltage supply. If the crt draws more current, the boost voltage goes down and the regulator grid becomes more negative. This reduces the regulator current. If the crt draws less current, the boost voltage goes up and the regulator current increases. Therefore, it can be seen that the total current supplied by the high-voltage rectifier (and hence the voltage) remains practically constant during crt load variations.

In actual operation, the regulator tube will be drawing minimum current when the crt is adjusted for maximum brightness, and it will be drawing maximum current when the crt is cut off (black). The result is a constant load on the power supply and a regulated output, regardless of the crt brightness. Now that we have gone through the basic operation of the shunt regulator, let's take a look at the horizontal section of a typical color television which uses a shunt regulator.

## MAGNAVOX T951

An example of a high-voltage regulator circuit using a shunt regulator tube is shown in Fig.2. This is the circuit used in the Magnavox T951 color television chassis. Notice that the plate of this shunt regulator is connected directly to the output of the high-voltage rectifier, while the grid is connected to the voltage divider from the B+ boost of 800 volts. The cathode is connected through a 1k-ohm resistor to +405 from low-voltage power supply. As you have learned, the purpose of this tube is to respond as a variable load so that the total current and the loading on the horizontal output stage remains constant.

During normal operation, the regulator plate voltage will be 24,000 volts and the grid will be at 380 volts which is adjustable by the high-voltage adjust potentiometer in the grid circuit. Let's suppose that the picture tube circuit draws more current, which should increase the load

on the horizontal output stage and cause the high voltage to decrease. However, the shunt regulator prevents this because a reduction in the plate voltage at the regulator will decrease its plate current. In addition, an increased load on the horizontal output stage lowers the boost voltage, so that the grid becomes less positive and more negative to the cathode; it will also cause a decrease in plate current. This results in a reduction in the plate current of the shunt regulator (which is almost equal to the increased current drawn by the crt), thus holding the load on the horizontal output circuit constant and keeping the high voltage fixed at 24,000 volts. So as you see, the operation of the shunt regulator is fairly simple. You may be wondering about some of the components shown in the shunt regulator circuit of Fig.2. For example, the 0.01  $\mu\text{f}$  capacitor connected from the cathode to the grid is nothing more than a small filter capacitor for the boost voltage. The spark gap capacitor is

a safety device for the tube. It prevents grid-to-cathode arcing which could cause tube damage.

A special feature of this shunt regulator circuit that older receivers do not have is the arrangement of diode D1, the 0.001  $\mu\text{f}$  capacitor, and the connection to the winding on the horizontal output transformer. These components prevent the high voltage from exceeding a given value when the picture-tube current is very low. A pulse from the winding on the horizontal output transformer is rectified by diode D1 to place a negative charge on the diode side of the 0.001  $\mu\text{f}$  capacitor as shown. The 4.7 megohm resistor and 0.001  $\mu\text{f}$  capacitor provide filtering for this pulse. Simultaneously, the +405 volts is coming from the cathode of the shunt regulator, so that the negative voltage from the rectified pulses adds to or subtracts from this positive voltage.

When the picture tube is relatively dark and draws very little current, loading on

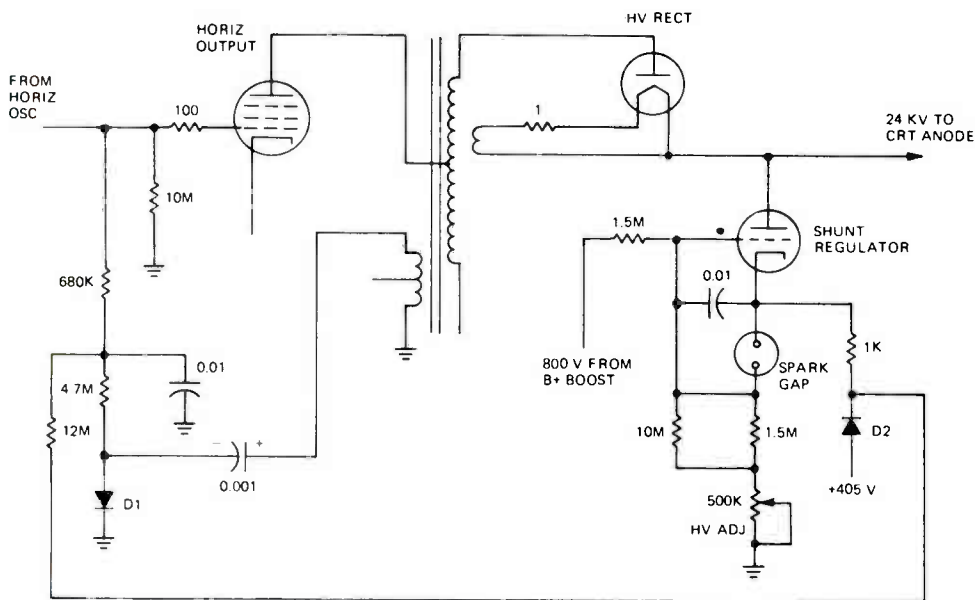


FIGURE 2. SHUNT REGULATOR CIRCUIT IN MAGNAVOX T951 COLOR TELEVISION CHASSIS.

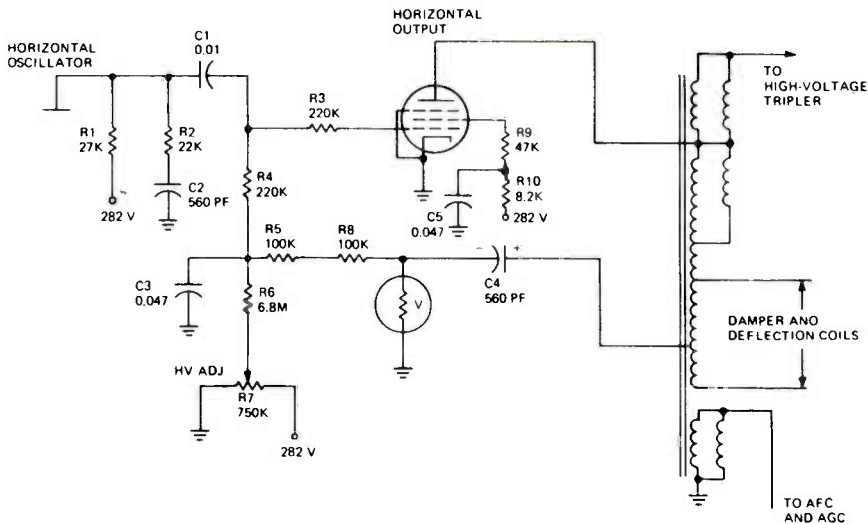


FIGURE 3. HIGH-VOLTAGE REGULATOR CIRCUIT OF SYLVANIA COLOR TELEVISION CHASSIS.

the horizontal output circuits is at its lowest so that the pulse to be rectified is at its greatest amplitude. The negative voltage that is produced, when added to the positive cathode voltage of the regulator, causes the grid of the horizontal output tube to go in a negative direction. This increased negative grid voltage reduces the horizontal output, therefore limiting the high voltage.

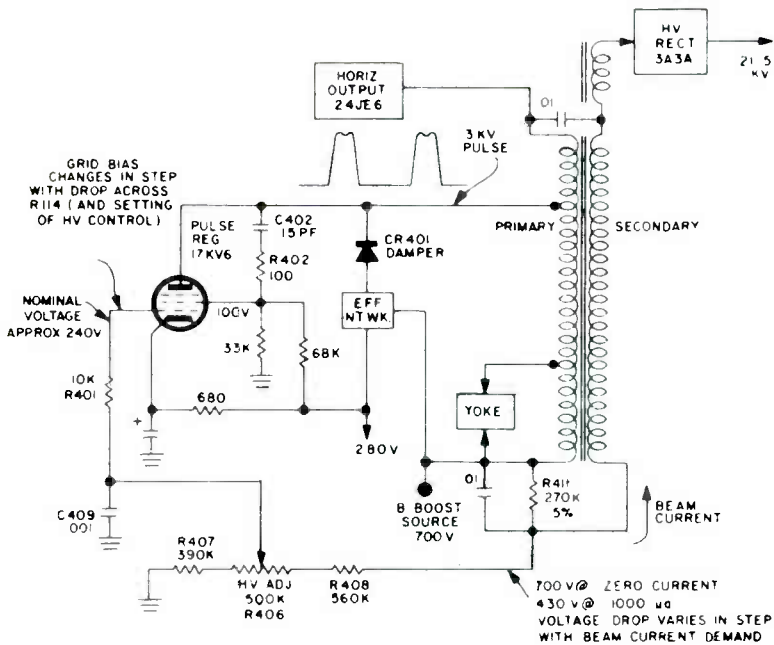
As I said earlier, shunt regulators were the first type of regulator used in color TV receivers, and it was soon discovered that they had some undesirable features. Since the shunt regulator tube is connected across the high-voltage output, it must withstand the high voltage. Therefore, it is prone to arcing between its plate, grid, cathode, and filament. It also adds additional current loading to the horizontal output circuit. The high voltages it must handle make it a source of unwanted X-rays. Most of the disadvantages of the shunt regulator have been overcome by using a feedback method of regulation which we will discuss next.

## THE SYLVANIA D16-2

In Fig.3, we have shown the high-voltage regulator circuit of the Sylvania color television chassis D16-2. The high voltage is regulated by feedback to the grid of the horizontal output stage.

A positive pulse from the output transformer supplied to capacitor C4, the 560 pf capacitor, and the voltage dependent resistor (V). The voltage dependent resistor, V, decreases in resistance as the voltage across it increases. The high amplitude (1000 to 1200 volts) pulse then causes this resistance to be low, and the 560 pf capacitor charges to this peak value. Between pulses, the resistance is high and the capacitor cannot completely discharge, so it holds its charge. The resistor side of the capacitor is negative, as shown, where the high-voltage adjustment potentiometer provides a positive voltage. The result of these two voltages is a slightly negative voltage across the 0.047  $\mu$ f capacitor, C3, and it is used to alter the bias of the horizontal output tube.





Courtesy RCA

FIGURE 4. SIMPLIFIED PULSE REGULATOR SYSTEM.

If, for some reason, the high voltage for the picture tube decreases, (because the picture tube is drawing the high current and loading down the horizontal output stage), the pulse supplied to the 560 pf capacitor will be smaller. The capacitor will then charge less, resulting in less negative voltage to cancel the positive voltage across C3. This means the grid of the horizontal output tube will be less negative so it can provide more drive and a greater output to the transformer. Circuit regulation is therefore achieved without the shunt regulator tube and its many disadvantages. The high-voltage adjust potentiometer permits setting the output grid bias for the high-voltage output specified by the manufacturer.

## PULSE REGULATION

The third type of high-voltage regulation that we will discuss is pulse regula-

tion. The RCA CTC22 was one of the first color sets that I noticed using pulse regulation. Let's discuss the operation of the CTC22 horizontal output stage and we will see how pulse regulation is achieved. As we did with shunt regulation, let's use a simplified diagram as shown in Fig.4. As you can see from the simplified diagram, the pulse regulator is connected in the primary section of the flyback transformer. It is the constant loading and unloading of the pulse regulator on the flyback primary winding that controls the high voltage.

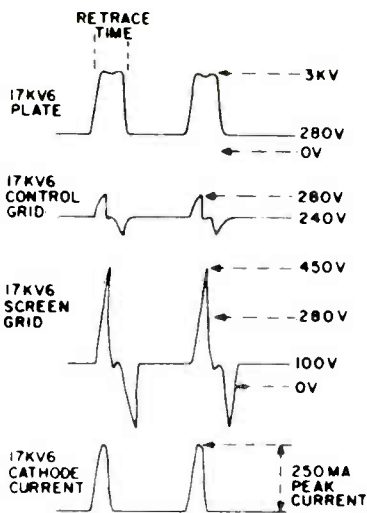
To do a good job of regulating the high voltage, the pulse regulator tube must draw more ac current from the horizontal output transformer when the high-voltage rectifier is drawing less, thus maintaining a constant load on the sweep circuit and stabilizing the high voltage. This circuit is unusual because the regulator control is achieved by sampling the picture tube current by means of a special winding on

the flyback and using the resultant voltage drop which is developed across the resistor to control the regulator grid circuit.

Let's go through the operation of this circuit. The cathode voltage of the 17KV6 is maintained at 280 volts during the trace and retrace time of the horizontal output section. The trace time is the period in which the beam is swept from the left side of the screen to the right side of the screen. And, of course, the retrace time is the period when the beam is returned from the right side of the screen to the left side of the screen. During the trace period, the screen grid of the 17KV6 is biased at 100 volts, regardless of the beam current being drawn by the picture tube. The voltage divider consisting of R411, R408, R406, and R407 determines the grid bias which is directly dependent on beam crt current. For example, a typical value of 300 microamps of beam current would cause grid bias of 240 volts.

During the trace period, the damper (CR401) conducts and holds the plate of the 17KV6 to 280 volts. As you may recall, the cathode is also at 280 volts. This would mean that the tube is completely cut off during the trace period because the screen grid and also the control grid are negative with respect to the cathode. At the start of the retrace period, the damper then becomes reverse biased and the voltage on the plate of the 17KV6 begins to rise. This increasing voltage is coupled to the screen grid through C402 and R402. Although less obvious, this increasing voltage is also coupled to the control grid through the interelectrode capacity in the tube.

Now, let's refer to Fig.5 which shows the 17KV6 pulse voltages. Notice that at the start of retrace, the plate and screen have both been driven positive with respect to the cathode. Also, the control grid has become less negative with respect to the cathode. These conditions allow



NOTE CATHODE VOLTAGE @ 280V DC

Courtesy RCA

FIGURE 5. PULSE VOLTAGE WAVEFORMS ON THE 17KV6 PULSE REGULATOR.

the tube to begin to conduct. Notice that the pulses for the screen and control grid are short duration pulses. Thus, the screen is positive with respect to the cathode, and the control grid is close to cathode potential for only a short time. This allows the tube to be driven into conduction for two to four microseconds, at the start of retrace and then cut off.

Now, as the beam current varies, a corresponding voltage is developed across the voltage divider consisting of R411, R408, R406, and R407. It is applied to the control grid of the pulse regulator. These changes at the control grid of the pulse regulator cause an increase or a decrease in the conduction which keeps the high voltage constant.

Let's assume that for average beam current, (which means normal brightness through the picture tube), the voltage at the bottom side of R411 is 540 volts. Again, let's assume that this allows approximately 240 volts to be felt at the grid of the regulator tube through the

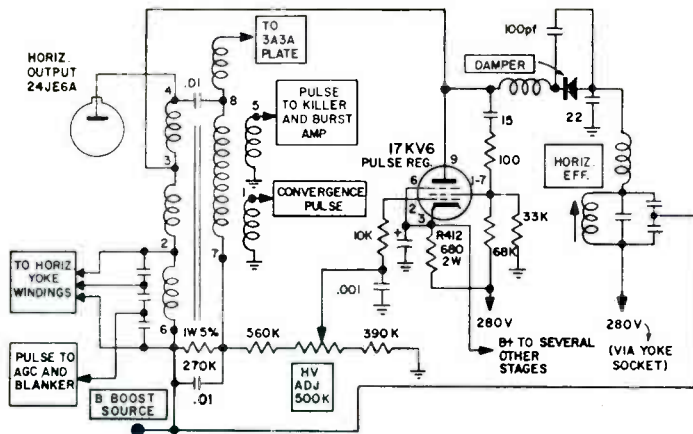


FIGURE 6. HORIZONTAL DEFLECTION—CTC22.

voltage divider network. Then, let's say the brightness of the crt is reduced which would tend to off the crt beam current. This means the high voltage, under less load, would try to increase. However, the voltage drop across R411 is decreased and the full B+ voltage, which is approximately 700 volts, is available at the voltage divider. This causes less grid bias or a positive-going signal at the grid of the regulator, which causes its conduction to increase, placing more load on the flyback pulse. This action prevents the second anode voltage from increasing; therefore, regulation is achieved.

Of course, the reverse occurs when the picture tube load increases. Beam current causes a proportional drop across R411 which supplies the control grid of the regulator with a negative-going voltage, something less than the 240 volts that was mentioned under average conditions. This means the load presented to the flyback pulse decreases and the pulse tends to increase and again the high voltage is regulated.

In essence, it can be seen that the regulating action is continuous and simultaneous in this type of system. Certain advantages are achieved with pulse regula-

tion. The regulator tube operates at lower voltages; therefore, the possibility of X-rays is reduced. Also, since the high-voltage rectifier conducts only on demand from the picture tube, its life expectancy is prolonged. Reduced operating voltages at the regulator also eliminate the need for shielding around the tube. This is a space saving advantage.

The actual schematic of the pulse regulator circuit used in the CTC22 is shown in Fig.6. From this schematic, we can see from the various signals that are taken from the high-voltage (flyback) circuit the importance of good high-voltage regulation.

## CONCLUSION

We've discussed three types of regulation that may be found in color television receivers. Now that you are familiar with how these particular circuits operate, you should tackle repair jobs of this type with much greater confidence. You will also know what to expect when the brightness control is increased or decreased to verify that the high-voltage circuits are functioning properly.

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# The Ear Doctor Returns

A customer brought in a Royce 1-624 set and said that it had stopped transmitting but that it was still receiving fine. I hooked up my test equipment to the set

and turned on the power. I then pressed the microphone button while observing the rf power meter. There was absolutely no power output from the set. I checked my Sams CB manuals index, but Sams had no listing on the 1-624 model. I also have some Royce service manuals, but I did not have one on this set. I really don't like to work on a radio without the proper service information, but I decided to make an exception.

I removed the cover from the set and found that there were two boards. One was the synthesizer board and the other was the main circuit board. There was a socket on the synthesizer board and the wiring from the main board to the synthesizer board went through the plug and socket. This made it more convenient to remove the synthesizer board. Since there was no power output from the set, the first thing I wanted to know was whether or not the transmitter oscillator was working. To determine this, I placed

## **Kinley performs surgery on ailing CBs Prognosis: Excellent**

my own CB set near the 1-624 and keyed the 1-624. My set picked up a signal from the 1-624 and the "S" meter on my set showed about seven units.

This told me right away that the oscillator was developing the signal. The signal was being lost somewhere between the oscillator and the antenna connector. Now the problem was to find out where exactly the signal was being lost.

After removing the cover from the set and looking at the main circuit board, the layout of the parts looked a little bit familiar to me. I pulled out my Royce service manuals, skimmed through them, and found that the Royce model 1-601 was similar to the 1-624. Referring to the manual on the 1-601 I started my troubleshooting. I first used my CONAR vtm to check for the presence of rf voltage at the base of the rf output transistor. There was no rf voltage there. Checking at the collector of the rf driver transistor revealed that there was no rf there either. But wait! The schematic showed that both the driver and the final transistors were emitter followers. The rf output has taken off the emitters, and the collectors were being placed at rf ground by the

**by Harold Kinley, C.E.T.**

bypass capacitors. This is just a little unusual in that the vast majority of CB manufacturers use the common emitter configuration, in which the output is taken from the collector. Now I checked for rf voltage at the emitter of both the driver and the rf output transistor. Still there was no measurable rf.

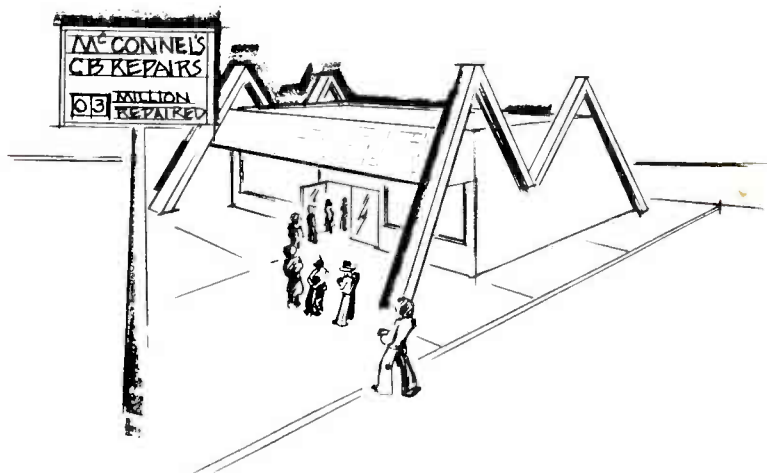
I removed the rf amplifier/buffer transistor and checked it. It checked fine so I put it back into the radio and took a few minutes to do some headscratching. The set had all the symptoms of a missing oscillator signal, but I had already confirmed that the oscillator was working. I admit I was a little baffled at this point and I was not sure what my next step should be. After some more thought, I decided to feed the output from my signal generator to the base of the rf amplifier/buffer transistor.

I turned the CB generator to Channel 19 and turned the output to maximum. I coupled the signal to the base of the transistor through a 0.001  $\mu\text{f}$  capacitor. With this signal fed into the base of the rf amplifier/buffer transistor, I keyed the transmitter and, to my surprise, the power meter read 3.5 watts. Now I was getting somewhere. This told me that the oscillator signal was not getting to the

base of the rf amplifier/buffer transistor. Since I had already confirmed that the oscillator was working, there had to be an interruption in the signal path from the oscillator to the base of the rf amplifier/buffer.

Tracing the wiring, I found that a shielded wire came from the oscillator board to the transmitter input on the main board. This shielded wire connected to the oscillator board through a plug and socket, as I mentioned before. I thought perhaps there might be a bad connection in the plug so I keyed the transmitter and wiggled the plug. The power came up and then disappeared again as the plug was wiggled. By placing pressure on the plug a certain way, the power output would remain steady. But when the pressure was removed from the plug, the output would disappear again.

I decided to use the signal generator again to check the plug and socket connection. I fed the signal generator output to the point on the synthesizer board which connects to the shielded wire coming from the transmitter input. Now with the transmitter keyed, the output remained steady. This cleared the plug and socket connections. There apparently was a bad connection some-



where on the synthesizer board. By placing pressure on the plug and socket, the board was apparently distorted enough to make a good connection.

The board would have to be removed to get to the foil side to reheat the solder connections. Removing the board was not at all difficult. I removed the plug, three screws, and the channel selector knob. Then I was able to flip the board over to get to the solder connections. I examined the board very carefully but was not able to locate any potentially bad connections. I decided to reheat all the connections in the vicinity of where the oscillator unit connects to the board.

After doing this, I reassembled the board to the chassis. I keyed the transmitter and the output was 3.5 watts and steady. This time wiggling the plug had no affect on the power output. I didn't know which connection was bad, but I had apparently hit on the right one. I checked the set out thoroughly before reassembling it. After I was satisfied that the repair was good, I reassembled the set into the cabinet. There were no parts involved in the repair job so the only charge was \$12.50 for labor. The complete repair job took less than one hour so I still came out okay.

### BON SONIC CB 23

The owner said that he had lent his set to someone who he thought had hooked up the power connections backwards. The set would pop fuses instantly. At present the highest Sams manual that I had was # 114 and there wasn't a listing for the Bon Sonic set in the Sams index. I thumbed through the latest Sams manuals that I had until I came across one with a picture of a set on the cover that looked very similar to the Bon Sonic. The set was a RYSTL CBR-1800. I removed the cover from the Bon Sonic and compared the parts layout and circuit board detail to

the RYSTL shown in the Sams No.104 CB manual. The sets were identical.

The first thing that I noticed was that the red wire that connects the input line filter choke to the on-off switch, had the insulation melted off of it. Also, a red wire which leads from the switch to the circuit board was in the same condition. I replaced these wires before doing any checking with the ohmmeter. After replacing these wires, I checked the resistance across the power input terminals. It measured a low 0.2 ohm. I looked at the schematic and noticed that this set has a polarity protection-diode across the hot line to ground. I removed the diode and it fell apart in my hands. With the diode out, I now rechecked the resistance across the power input and the short was gone. I replaced the diode before going any further.

After replacing the diode, I applied power to the set to see if it would work. The lights came on. I turned the squelch open and the volume up, but there was only a very slight sound from the speaker. I had the signal generator feeding a modulated signal into the set, but this was not coming through at all. There was only a very slight hiss. The level on the signal that I had fed into the set was around 3 microvolts, but there was no indication on the radio's "S" meter.

I was examining the circuit board when I accidentally jarred the set. When the set was jarred, the modulated signal came through the speaker. Using a screwdriver handle, I started tapping lightly on the circuit board until I reached an area on the board more sensitive to the tapping. I turned the set over to the component side of the board and wiggled various components with an insulated tuning tool. I found that wiggling the first 455 kHz i-f transformer seemed to have the greatest affect. I turned the power off and reheated the connections around the transformer. I turned the set back on and now the intermittent was gone. The receiver



TAPPING THE P.C. BOARD  
TO LOCATE SENSITIVE AREA.

worked properly now.

Then I turned my attention to the transmitter. I keyed the transmitter to check it out. The power meter registered 4 watts. The frequency counter showed the signal to be on frequency. I whistled into the microphone, but the scope showed no modulation at all. Since I had the set out of the cabinet, I injected an audio tone at the microphone socket on the chassis. Now, with the transmitter keyed, the scope showed modulation

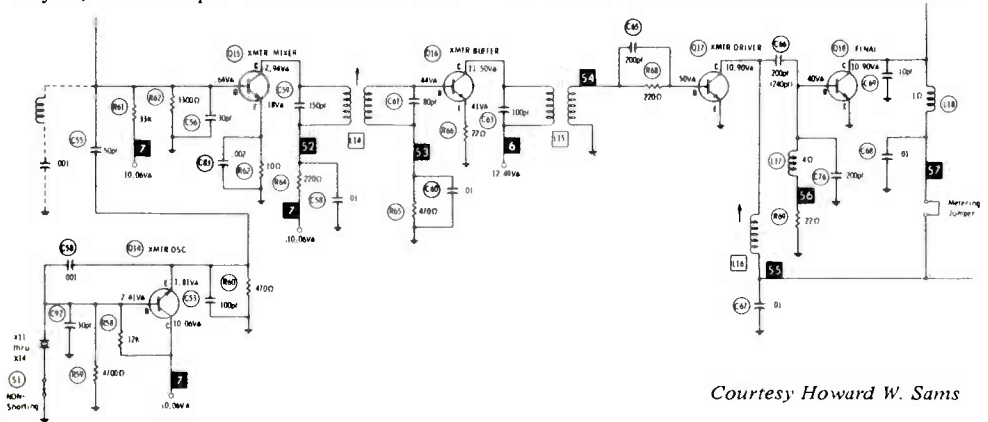
present on the carrier. The trouble had to be in the microphone itself.

I disassembled the microphone and injected an audio tone across the microphone cartridge. With the transmitter keyed, the scope showed modulation present. This pointed to the cartridge as the defective part. I removed it and installed a new one and this brought the modulation back to the transmitter. I reassembled the microphone and this completed the repairs.

Before replacing the cover on the set, I ran a complete check on the receiver and transmitter to make sure that everything was working okay. Everything checked out fine now. The last thing that I did was to get an on the air check on my shop antenna. After receiving good reports on the set, I replaced the cover and wrote out the repair bill. The total cost of the repairs came to \$24.50.

## BOBCAT 23B

A customer brought in a Pearce Simpson Bobcat 23B and explained that the car in which this set was installed was involved in an accident. The radio fell out of the car and into a ditch. He said that a little mud and water had gotten into the set and that he had cleaned out what he



Courtesy Howard W. Sams

FIGURE 1. TRANSMITTER CIRCUITS OF THE BOBCAT 23B.



could. He then tried to operate the set. He said that it would receive, but that it would not transmit.

I hooked the set up to my power supply and test equipment to make initial tests on it. The set was on Channel 15 so I turned my signal generator to Channel 15 and fed a 0.5 microvolt signal into the receiver. The modulated signal came through the speaker loud and clear. I then keyed the transmitter and the power meter indicated 4 watts of power. I whistled into the microphone while checking the pattern on the scope. There was no modulation at all from the set.

To determine whether the trouble was in the microphone or the set, I removed the cover from the set. Then I injected an audio tone in the set at the point where the microphone cable connects to the board. I keyed the transmitter and this time, with the audio tone injected, the carrier was modulated. This suggested trouble in the microphone, a Turner M+2.

I disassembled the microphone to check the battery. Upon removing the 4 screws and separating the shell, I noticed that the diaphragm had completely separated from the cup part of the ceramic cartridge. This was the obvious cause of the loss of modulation. I replaced the cartridge with one that I had on hand. I also removed the battery and cleaned the connector clips since they looked dirty. I replaced the battery in the clips and reassembled the microphone.

I now checked the modulation and there was plenty of it. As a matter of fact, the microphone gain had to be turned way down to keep the set from being overmodulated.

After getting the modulation restored, I decided to check the output leveling across the band. On Channel 23 the power was up to 5 watts and on Channel 1 it was down to only 2 watts. From past experience, I have learned that a large change like this one is usually caused by mistuning in one of the early stages of the

transmitter (oscillator, mixer, or buffer). I studied the schematic and decided to try tuning the transformer L14 between the transmitter mixer and buffer stages. I keyed the transmitter and with the set on Channel 1, the power meter read 2 watts. Now while watching the power meter I turned the slug in L14 very slowly (See Fig.1). The power started rising rapidly. When the meter showed 4 watts, I stopped tuning. Now I checked back on Channel 23 to see what output was there now. The power output leveling was now within 0.2 watt across the band from 1 to 23. This is quite acceptable.

Next I keyed the transmitter a couple of times on each channel to make sure that the oscillator wouldn't quit. If an oscillator is tuned to a critical point, it will become unstable and stop oscillating. However, since L14 was on the output of the transmitter mixer, it should not have too much affect on the oscillator.

Having satisfied myself that everything was now working okay, I closed the cover and wrote out a bill. The total came to \$15.50 and the customer complained about the charge. His complaint irritated me very much, because I felt that I had done a good job for a very fair price and I told him so. When dealing with the general public, one never knows what to expect.

## ROYCE 1-601

The customer said that he was not able to transmit and that he thought there were also times when he wasn't receiving. I decided to check the set in the vehicle before removing it for service. I hooked up the Johnson transceiver tester to the set and keyed the transmitter. There was practically no power output from the set; just enough to barely move the meter needle off its resting point. I then had the customer remove the set from the vehicle and leave it with me for repair.

This particular symptom is most often

caused by a bad rf output transistor in the transmitter. This, in turn, is often caused by a defect in the antenna system causing a high SWR on the transmission line. A high SWR on the coax line will shorten the life of an output transistor considerably. As a matter of good practice, I always inform the customer that he should have his antenna checked after replacing an output transistor in his radio. If he is not willing to have his antenna checked, I will not guarantee the new output transistor, not even for a minute.

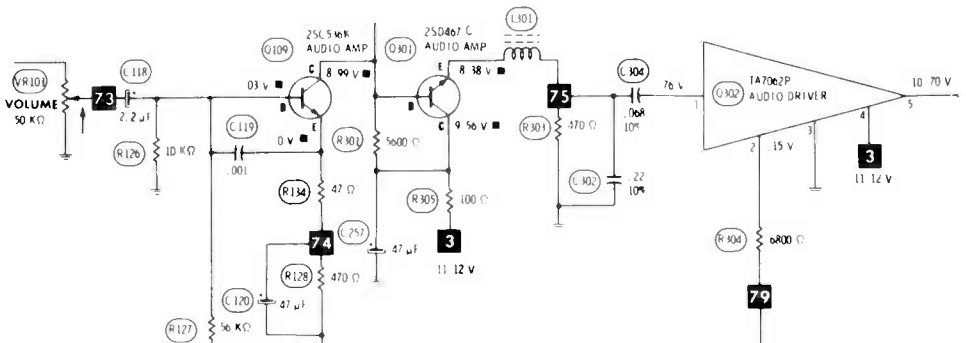
I pulled the cover from the set and removed the rf output transistor to check it. It was defective and I replaced it with an ECG195A Sylvania replacement. I then hooked up the set and keyed the transmitter to check the power output. On Channel 23 the output was 2 watts and on Channel 1 the output was 1 watt. I tuned the driver transformer and was able to even up the output across the band to 3.5 watts. I then checked the modulation and there was no modulation at all. I checked for audio output from the receiver and there was none.

I started my troubleshooting by the signal tracing method. I fed a 50 micro-volt modulated signal into the receiver and checked for the signal at the top end of the volume control (high side). The signal came through the tracer loud and

clear from this point. I checked at the collector of Q109 (Fig.2) and the signal was good there also. The next transistor in line was Q301, an emitter follower. The signal was good at the emitter as it should have been. However, at the input to Q302 (the audio driver IC) there was no signal. I moved the tracer probe to the junction of L301 and C304 and there was no signal there either. Since the signal was good at the emitter of Q301, coil L301 had to be open. I installed a jumper across L301 and the audio came through the set speaker loud and clear.

After finishing the repair on this, I studied the schematic and became a little confused on one point. Since Q301 is an emitter follower and the base bias current would have to come through L301 to forward bias the emitter-base, how did the signal tracer pick up any audio at the emitter of Q301? I didn't have a schematic on my signal tracer, but it should have its input dc isolated. And, if this were so, it could not have established forward bias on the transistor when connected to the emitter. The audio at the emitter of the transistor was less than at the base, but because the transistor was connected as an emitter follower I figured this to be normal.

There is another explanation for this condition which I think is probably the



Courtesy Howard W. Sams

FIGURE 2. AUDIO CIRCUITS OF THE ROYCE 1-601.

right one. The emitter-base junction could have been acting like a diode between the signal tracer and the collector of transistor Q109. To verify this, I did a bit of experimenting. I connected my signal tracer to my tone generator and noted the volume from the tracer. Then I connected a diode between the tone generator and the signal tracer. The tone still came through, though not as loudly. To go a step further, I used an audio transistor and connected the emitter-base junction between the tracer and the tone generator. The results were the same. This seemed to explain why the signal was present at the emitter of the emitter follower even though the coil was open.

Before considering the repairs complete, I checked the modulation. It was good now also. I replaced the cover on the set. The next day the customer came by to get the radio and at that time I checked the antenna on his car. It was a standard base-loaded antenna mounted on the trunk lid of the car. The SWR checked around 6:1 on Channel 1 and around 5:1 on Channel 23. I loosened the set screw on the whip and pulled it up as high as it could be extended and re-tightened the screw. Then I rechecked the SWR and this time it was 2:1 on Channel 23 and increased to 3:1 on Channel 1. This indicated that the whip was still too short, but there was no more adjustment left. He said that he only used Channel 19 and since the SWR was only a little above 2:1 on 19, I told him it would probably be okay to use the antenna like it was. The entire charge came to \$29.30.

### JOHNSON MESSENGER 123

The complaint on this set was that it would not transmit or receive at all. I hooked up my test instruments to the set and applied power. I turned the volume up and opened the squelch. There was some receiver hiss coming from the speaker. I fed a modulated signal into the set,

but the signal wasn't getting through to the speaker and there was no indication on the "S" meter. I keyed the transmitter, but the rf power meter showed no power output at all. In order to determine if the synthesizer/oscillator was functioning, I placed my own CB near the 123 and keyed the 123 while watching the "S" meter on my set. My set wouldn't pick up any signal from the 123 so apparently the synthesizer oscillator section was not functioning properly. The trouble symptoms were the same on all channels.

I removed the cover from the 123 and pondered over what I should do first. I figured that one of the oscillators was dead. Before I get into my troubleshooting procedure, I feel that a description of the general operation of the synthesizer circuit is in order. In the receive condition, a frequency from the local oscillator is mixed with a frequency from the synthesizer oscillator to yield a difference frequency at the output of the synthesizer mixer. This frequency would be 455 kHz lower than the channel frequency in the receive condition. This is necessary to obtain the 455 kHz i-f frequency in the receiver. In the transmit mode, the frequency at the synthesizer output would have to be equal to the channel frequency. Therefore, a different crystal is switched into the local oscillator circuit when the transmitter is keyed. Let's take the example of Channel 22. In the synthesizer oscillator, the 32.950 MHz crystal is selected. In the receive condition, we would need a frequency which is 455 kHz lower than the channel frequency at the synthesizer mixer output. For Channel 22 (27.225 MHz) we would need a frequency at 26.770 MHz, ( $27.225 - 0.455 = 26.770$ ). To obtain the 26.770 MHz signal, the 32.950 MHz signal is mixed with a 6.180 MHz signal from the local oscillator to yield a difference frequency 26.770 MHz at the synthesizer output. This 26.770 MHz signal is then mixed with the incoming

27.225 MHz signal in the receiver mixer to give the 455 kHz i-f signal. In the transmit mode, we want the synthesizer output frequency to equal the channel frequency. Therefore, a different crystal is switched into the local oscillator circuit in the transmit mode. The high oscillator frequency remains the same (32.950 MHz).

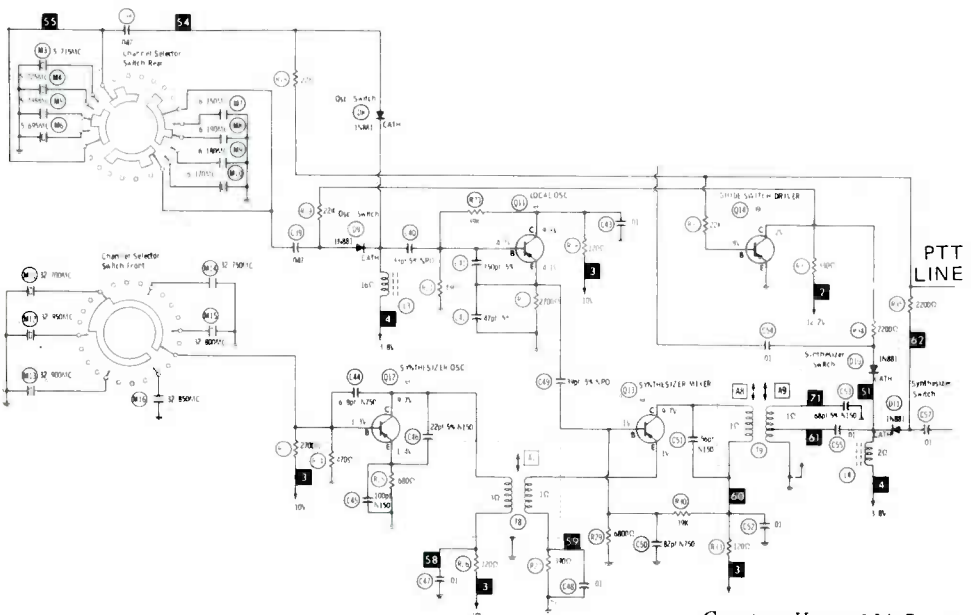
In the transmit mode, a 5.735 MHz crystal is switched into the local oscillator circuit. This is then mixed with the 32.950 MHz signal in the synthesizer mixer to yield the difference frequency 27.225 MHz, ( $32.950 - 5.735 = 27.225$ ). This is the correct channel frequency. This frequency is then amplified in following stages and fed to the antenna.

Now the trouble with this particular set was apparently somewhere in the synthesizer. Using my frequency counter, I checked at the emitter of Q13 (Fig.3). The 32.950 MHz signal was present there. This cleared the synthesizer oscillator from suspicion. I then checked the emitter of Q11 for the presence of the

6.180 MHz signal. However, at the emitter of Q11 the frequency counter read 32.950 MHz. Now this led me to believe that the local oscillator was not functioning. I decided to inject a signal at 6.180 MHz at the emitter of Q11.

Using my frequency counter I carefully tuned my variable frequency signal generator to 6.180 MHz. I then fed the signal to the emitter of Q11 through a 0.01  $\mu\text{f}$  coupling capacitor. When the coupling capacitor lead touched the emitter of Q11, the set started receiving the modulated signal that I had feeding the input of the receiver. This localized the trouble to the local oscillator. The next thing that I did was remove transistor Q11 to check it. The curve tracer showed signs of leakage in the transistor so I replaced the transistor with an SK3006 replacement. To my dismay, this did not clear up the trouble with the set.

After studying over the schematic, I was curious as to whether or not the switching diodes D8 and D9 were



Courtesy Howard W. Sams

FIGURE 3. OSCILLATOR AND SWITCHING CIRCUITS OF THE JOHNSON 123.

working properly. Using a jumper wire, I temporarily shorted out diode D9 and when I did, the set started working. I removed the jumper from D9 and jumped out D8. With D8 jumped out, the transmitter worked fine. I then checked both diodes and both were good so apparently the trouble was in the diode biasing. Here is a description of the diode biasing circuitry. In the receive condition, diode D9 is forward biased. This effectively connects one of the 6 MHz crystals into the local oscillator circuit. Also, in the receive condition, diode D8 is reversed biased. This effectively disconnects the 5 MHz crystal from the oscillator circuit.

Now let's take a closer look at how this switching is accomplished. It will be necessary here to think of the common ground as positive because in respect to the voltages shown on the diagram the common ground is positive. In the receive condition, the -12.2 volt supply voltage is fed from the PTT line through the 22k-ohm resistor R18 to the anode of D8. The cathode of D8 is at -3.8 volts. Since the anode is more negative than the cathode, diode D8 is reversed biased. This effectively disconnects the 5 MHz crystal from the circuit. Also notice that the base of transistor Q14 is connected to the PTT line through a 22k-ohm resistor R31. In the receive condition, the -12.2 volts is fed through the relay coil and R31 to forward bias transistor Q14. With Q14 forward biased the transistor is turned on hard and the collector potential is pulled down to a low negative value. This low negative value (0.2 volt) is fed to the anode of D9 through the 22k-ohm resistor R19. This forward biases D9 since its cathode is at -3.8 volts. Since D9 is forward biased the 6 MHz crystal is effectively connected into the local oscillator circuit.

In the transmit condition the situation must be completely reversed. That is, a 5 MHz crystal should be connected into the circuit and the 6 MHz crystal should be disconnected from the circuit. Let's

see how this is accomplished. When the microphone push-to-talk button is pushed, the PTT line is grounded. This also grounds the anode of D8 through R18. This forward biases diode D8. At the same time, the diode switching transistor Q14 loses its forward bias because R31 is now grounded through the push-to-talk switch. Or you might also say that the bias supply voltage has been killed. Either way the result is the same. Transistor Q14 now cuts off and the collector swings to a high negative value (-12.2 volts). This high negative value on the collector is fed to the anode of D9 through R19. This reverse biases diode D9. With diode D8 now forward biased and D9 reverse biased, we have switched out the 6 MHz crystal and switched in the 5 MHz crystal.

The trouble in this set seemed to be in the diode biasing circuit so the next thing that I did was to use my vvm to measure the voltages around the switching diodes. This is what I found. In the receive condition, the anode of diode D9 was a very low negative value, approximately 0.2 volt negative. The anode of diode D8 was at a high negative potential, -12.2 volts. However, at the cathodes there was no measurable voltage at all. The schematic shows that the cathodes are connected to the -3.8 volt supply through the choke coil L3. Apparently this choke coil was open.

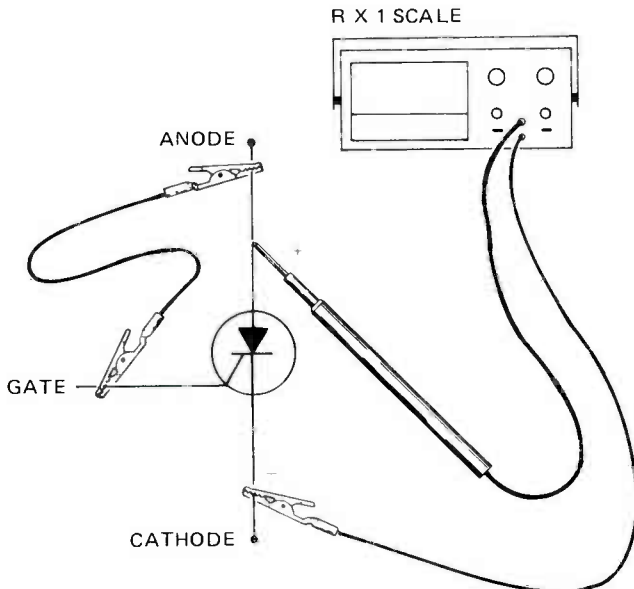
I removed the choke and checked it and it was completely open. I had a few chokes on hand, so I temporarily soldered one to the underside of the circuit board. With this choke installed, the set would receive and transmit fine. So I removed the choke and installed it permanently on the component side of the board. This completed the repairs on the set. I left the SK3006 replacement transistor in the set because I had some question in my mind about the condition of this transistor. The total cost of the repair job came to \$22. (A bargain in my mind!)

# Helpful Hints 12

The silicon controlled rectifier (SCR) is being used more and more in consumer electronic equipment. Therefore, it's only a matter of time before you will have to test one. Substitution with a known good device is, of course, the best test method. However, if a known good SCR is not available, an ohmmeter check will have a reasonable evaluation of the device.

**A Brief Review.** An SCR is simply a solid-state rectifier whose forward resistance is controllable. With no gate signal, the SCR acts like a rectifier with a very high resistance, both in the forward and in the back direction. When the proper gate signal is applied, the SCR will conduct in the forward direction like a conventional rectifier. It will continue to conduct until the anode voltage is removed. SCRs come in all types of packages, but always have three active elements: the cathode, anode, and gate.

**Testing.** To check an SCR, connect an ohmmeter as shown in Fig.1. The resistance between the anode and cathode should be very high regardless of the ohmmeter polarity. Then temporarily short the anode (connected to the positive ohmmeter lead) to the gate. The SCR should immediately turn on showing a low resistance on the ohmmeter, and should continue conducting even after the gate lead has been removed from the anode. Once the anode-cathode circuit begins conduction, the gate has no control. Now removing either of the ohmmeter leads, even for an instant, will turn off the SCR and it will return to its high resistance original condition.



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## HAM NEWS



By **Ted Beach** **K4MKX**

As this is being written (mid July), the FCC has still not released the newest Part 97 Rules and Regulations. These were supposed to be published in March (the first revised Part 97 was printed and released in March, 1976), and the word we get from the Government Printing Office is that, yes, there is a new publication, and yes, it is the March, 1977 edition, but no, it is not in print yet.

I do not know the legal aspects of all this, but I wonder if we are supposed to be bound (legally) by the Rules published last March? If it came to resolving a citation issued by the Candy Company, I'd bet against it. The "out," or disclaimer, in the volume printed last year clearly says that the newest rules changes will be printed in the Federal Register, and if it just so happens that you (or I) don't have access to the Federal Register, that's tough.

At any rate, instead of publishing the newest rules changes in their entirety as indicated in the last *Journal*, we will continue our "summary" as we did last time. Hopefully, we will have the new rules in hand before the next *Journal*, and we will do as promised last time, and print all the significant changes verbatim from the new Part 97.

When I was just getting into amateur radio back in the 1950's, I used to read *QST* with fervor, and went over every one of the various columns in the magazine. I used to be quite curious about the little cartoon figures interspersed throughout the magazine that exhorted one to "Switch to Safety." It was some time before I found out exactly what they were talking about.

In one issue, there was an article devoted to the Switch to Safety theme. The author went into great detail about the obvious need for precaution when working on transmitters which used fairly husky power supplies. This included all the standard cabinet interlock switches, grounding procedures, and everything else used when one delved into the innards of a transmitter. Toward the end of the article, there was some slight mention of safety requirements when working with receivers. However, this was a fairly short bit, and didn't stick in mind as did the gory things mentioned about the hazards of high voltages in transmitter power supplies.

Well, one of the things that I do remember that was mentioned about working with receivers is that one should have a good lightning arrestor system on

RULE CHANGE	DATE EFFECTIVE
1 Conditional Class License eliminated. Novice power limit upped to 250 W.	6/25/76
2 Technicians given Novice privileges.	7/23/76
3 No new distinctive Novice call signs, although Novices may sign "/N."	10/1/76
4 No requirement to sign "portable" or "mobile" except foreign operators using reciprocal licenses.	11/26/76
5 First "comprehensive" cw exam given in Washington D.C. office. No solid copy for one minute requirement.	1/1/77
6 Court case "temporarily" suspends all license fees.	1/1/77
7 New "interim" licenses issued upon upgrade of license class at an FCC office.	3/1/77
8 Secondary station licenses eliminated.	3/3/77
9 97.95(a)(2) deleted. No notification of new address required.	3/9/77
10 New emission purity standards. All spurious emissions down 40 db for transmitters operating below 30 MHz, down 60 db for transmitters of 25 watts or more operating between 30 MHz and 235 MHz. (97.73)	4/15/77

all feedlines entering the shack, and a *good* overall ground system if one wanted to stay on good terms with one's fire insurance carrier. Unfortunately, these warnings sort of slipped away from me when I installed the present vertical antenna on the shack roof a couple of years ago.

When the antenna was erected, I was unable to locate one of those very nice coaxial cable lightning arrestors, so I "made do" with what I considered to be a "good grounding system" instead. I have two, eight-foot ground rods right outside the shack, and a decent cold water ground line fairly nearby inside the shack. Surely this is more than adequate, thought I.

For two years everything worked fine. When the station was not in use, the antenna system was grounded by

installing the coax feedline connector into a shorted grounding jack and my 23 foot "lightning rod" went into service. Never did I have a problem.

No problem, that is, until it became a "bother" to have to look after connecting and disconnecting the coax plug from the ground system. Yep. The first time I left the antenna connected to the rig (lazy!), we had one dilly of an electrical storm. I guess I can color myself lucky that the only damage we had as a result was to the front end of the transceiver. It could have been the whole house!

I don't think the antenna took a strike, as there would have been a lot more damage than was done. Rather, I think that there probably was a good static buildup on the antenna that leaked off rather rapidly through the transceiver front end, taking with it the rf amplifier

FET and a couple of capacitors.

It could have been worse. The point is, don't think only in terms of high voltage in a transmitter when you think of safety procedures. Remember the antennas too! Ground everything when it is not in use, and don't operate during electrical storms unless it is an absolute necessity. Then, be sure that you have good arrestors on all feedlines, and ground all those you are not using. I still don't have an arrestor for my one antenna, but you can rest assured that the antenna is *always* grounded now when it is not in use!

After all those grim warning, let's see who we have heard from since last time. As always, those at the head of the list are students and graduates of our Amateur courses, while those at the other end of the list are from other NRI courses.

WINN, Wendell, does not appear on this list because only his call is new. Wendell made these pages sometimes ago as W1MAA, and wrote in to tell us of his new call. Sounds good on cw, I guess. You might also be interested in knowing that Wendell will have a short article on precise frequency calibration in the next issue of the *Journal*.

WB3ELK writes that he got his license last October, but didn't get on the air until this past February. At the present time, Art is using an FT101E, feeding an end-fire Hertz antenna through a home-brew antenna tuner. This arrangement gives enough freedom to work most bands, although Art says he hangs out mostly on 20 cw. Later plans include a two-element quad and some shoes for the transceiver. Art is planning to build the quad from scratch and already has most of the hardware for it. Then, as if all this were not enough, he is planning to take the Extra exam sometime this Fall. Best of luck, Art.

WB3HDJ had his Novice ticket only a month before he went down to take the General test. Unfortunately, Brother Nicholas couldn't quite make the 13 wpm, but was pleased to settle for the Technician for the time being. To celebrate, he got a Drake TR33C to go along with the new privileges, and enjoys working the two meter repeaters in the Pittsburgh area. He was planning to go back in August to take the code test again, and we'll let you know how things come out when we hear.

Dominick	WA2PID	N	Hopatoong NJ
Art	WB3ELK	A*	Luzerne PA
Bro Nicholas	WB3HDJ	T*	Pittsburgh PA
Jim	WA4ZAU	-	Conyers GA
John	WA6SWL	-	Cardiff-By-The-Sea CA
Dick	WD8DSE	A*	Grand Rapids MI
John	WB9RPY	G*	Des Plaines IL
Bruce	WB9WCE	A	Nenomonie WI
Gary	-		Lakeland FL
Ray	WA1YKH	-	Topsham ME
T.L.	WA4KKI	G*	Waycross GA
Robert	WB3HXI	A	Pasadena MD
Cleveland	WA4TLY	T	New Zealand
Ray	WB6HJQ	A*	Santa Maria CA
Donald	WB7BLQ	A*	Tacoma WA

\*Just upgraded -- congratulations!

WA4ZAU says that he wrote us last October about his new call, but somewhere along the line there must have been a mishap, as I never got the information. Sorry about that, Jim. Anyway, you've finally made it, and I'm sure the other matter you wrote about has been settled also. It appeared to be a bookkeeping oversight. At the present time, Jim says that he operates mostly on 80 meters, and loves to ragchew. He even signs RCC after his call so that those who answer will know that he wants more than a brief "in and out" QSO. If anyone needs a Georgia contact, look for WA4ZAU between 3705 and 3745 from 4:30 AM to 7:00 AM EST Monday, Tuesday, or Wednesday.

WA6SWL (what a call!) got his ticket just before Christmas last year, even though he had had an interest in amateur radio for many years. John says that it took retirement to give him the time needed to really get with it and do some studying. John uses a Heath DX60 with vfo, and an HR1680 receiver with a Swan vertical. As a backup station, he has a Heath TX1 and a Lafayette receiver. John is planning to move to Florida in the near future and wants to make WAS before the move. He presently needs Georgia, South Carolina, and West Virginia to complete his list. If anyone out there could help John with a schedule, write him at 1056 Nolby Street, Cardiff-By-The-Sea, California 92007.

WD8DSE writes that he is very pleased with his NRI course. Dick says that in the group that took the Advanced test with him, several blew the code and only about half passed the written test which he breezed through, thanks to his training. Many thanks, Dick — we are all very happy for you and wish you the best of luck when you go for the Extra license!

WB9RPY tells us that he was issued one of the first Interim General tickets in his area, and that it was five weeks to the

day that he received his "permanent" ticket. Although still studying the Basic Course texts, John is already on the air with an FT101E into a HyGain 18AVT vertical. He also bangs out a good signal on two meters with an Icom IC22s and Ranger antenna. Sounds like a real neat setup, John, and best of luck with your studies — don't stop now just because you have your license!

We had a nice note from one other student in the Amateur course, but Gary Parker hadn't yet gotten his ticket. He writes that he was planning to take the code test very soon, so perhaps he has his license by now. Gary was doing a bit of complaining about the fact that some of the regulations covered in the course were a bit outdated, as we mentioned in this column last time. We do try to keep things as up to date as we can, Gary, but it is virtually impossible, as you can imagine (with people enrolling daily), to know just who has gotten what material. So anyway, keep your eye on the most recent rules as carried here in the *Journal*, and you should stay pretty well on top of the rules.

WA1YKH writes that he enjoys reading the Ham News in the *Journal* up there in Maine. Thanks, Ray. At the present, he is mostly on two meters since his job as Electronics Branch Chief in the Navy keeps him busy most of the time. Ray is a Chief Petty Officer in the Patrol Squadron and that sounds mighty impressive to me.

WB3HXI says that he is an "upgrade" from CB. I hadn't heard that one before, but it sounds pretty good. Bob says the code was the only thing he stumbled on, otherwise he would have had a General call instead of Technician right off the bat. As it is, he went back three weeks later and sat for the General and Advanced and passed both! Fine business, Bob. He is using the Heath SB101 and wonders just how much power one really needs to communicate reliably. Well, I

don't know that there is any simple answer to that question, but short of getting clobbered by the big guns running the kilowatt-plus rigs, 180 to 200 watts PEP should get through to most places at most times, providing one has a good antenna system. Just remember that a 3 db change in power gives about one S unit difference at the receiving end, so going from 100 watts to a kilowatt (+10 db) would make a difference of perhaps three S units at the other end. Under most circumstances, the results do not justify the added problems of the linear. But, every person to his own poison I always say.

WA4TLY got his ticket back in June, and is operating as ZL2THN from Wellington, New Zealand at the present time. Cleveland says he is mostly on two meters. However, he hopes to upgrade real soon although it is somewhat of a problem because of the distance to the nearest FCC office. Hang in there, Cleveland, I understand that under some circumstances the FCC will still issue Conditional licenses. If you're on an extended tour overseas, I would certainly write the FCC to find out if it would be possible to take the test with a volunteer examiner

(assuming you can find one in New Zealand!).

WB6HJQ is taking our Communications Course and asked a few questions about the two meter transceiver he will be building as part of the course. Well, Ray, I may be prejudiced, but I think it's a pretty darn good rig! It has a minimum power output of 20 watts (most units will make 25 watts). There is a low power position which gives between 1 and 2 watts output and it will cover any 2 MHz segment of the two meter band in 5 kHz steps. There are three transmit modes: simplex, repeater-high, and repeater-low. In addition, all major circuit boards plug in for easy adjustment and repair and the circuits are easy to adjust using simple equipment. The seven-segment display shows up in all lighting situations. Also, the experiments prepare one for working with any type of vhf communications equipment. All in all, the rig is a very good one which will serve everyone quite well, both as a training medium and as a useful, working, two meter station (mobile or base, with the ac supply).

Well, we are about out of space again, so until next time, very 73. Ted - K4MKX

## Give Heart Fund

American Heart Association



### Job Ops

**APPRENTICE TECHNICIAN NEEDED IMMEDIATELY:** NRI Graduate or advanced student preferred. For a personal interview, call 271-6580 between 8:30 a.m. and 5 p.m., Monday through Saturday. Ernie's Radio-Television Service, 809 W. St. Bernard Highway, Chalmette, Louisiana 70043.

**REPAIR SHOP SPACE NEEDED:** An NRI graduate, with 10 years of television servicing experience, desires busy appliance store in which to locate independent TV/Radio repair shop. Contact Thomas J. Bush, CET, 8520 Lake Atkinson Drive, Tallahassee, Florida 32304. Telephone (904) 575-4486.

## DIRECTORY OF ALUMNI CHAPTERS

**DETROIT CHAPTER** meets at 8 p.m. on the second Friday of each month at St. Andrews Hall, 431 E. Congress St., Detroit. Chairman: James Kelley, 1140 Livernois, Detroit, Michigan. 841-4972.

**FLINT/SAGINAW VALLEY CHAPTER** meets 7:30 p.m., the second Wednesday of each month, at Andy's Radio and TV Shop, G-5507 S. Saginaw Rd., Flint, Michigan. Chairman: Dale Keys. 639-6688. Chapter phone is 694-6773. Visitors please call to verify date.

**NEW YORK CITY CHAPTER** meets at 8:30 p.m., the first Thursday of each month, at 1669 45th St., Brooklyn, New York. Chairman: Sam Antman, 1669 45th St., Brooklyn, New York.

**NORTH JERSEY CHAPTER** meets at 8 p.m. on the second Friday of each month at the Players Club, located on Washington Square in Kearny, New Jersey. Chairman: Al Mould. 991-9299 or 384-8112.

**PHILADELPHIA-CAMDEN CHAPTER** meets on the fourth Monday of each month at 8 p.m. at the home of Chairman Boyd A. Bingaman, 426 Crotzer Ave., Folcroft, Pennsylvania. LU3-7165.

**PITTSBURGH CHAPTER** meets at 8 p.m. on the first Thursday of each month in the basement of the U.P. Church of Verona, Pa., corner of South Ave. and Second St. Chairman: James Wheeler.

**SAN ANTONIO (ALAMO) CHAPTER** meets at 7 p.m., fourth Thursday of each month, at the Alamo Heights Christian Church Scout House, 350 Primrose St., 6500 block of N. New Braunfels St. (three blocks north of Austin Hwy.), San Antonio, Texas. Chairman: Robert Bonge, 222 Amador Lane, San Antonio, Texas. All San Antonio area NRI students are always welcome. A free annual chapter membership will be given to all NRI graduates attending within three months of their graduation.

**SOUTHEASTERN MASSACHUSETTS CHAPTER** meets at 8 p.m. on the last Wednesday of each month at the home of Chairman Daniel DeJesus, 12 Brookview St., Fairhaven, Massachusetts 02719.

**SPRINGFIELD, MASSACHUSETTS CHAPTER** meets at 7:30 p.m. on the second Saturday of each month at the shop of Chairman Norman Charest, 74 Redfern Dr., Springfield, Massachusetts 01109. (413) 734-2609.

**TORONTO CHAPTER** meets at McGraw-Hill CEC, 330 Progress Ave., Scarborough, Ontario, Canada. Chairman: Branko Lebar. For information call Stewart J. Kenmuir, (416) 293-1011.



Fourteen members attended the May 14 meeting. With 14 paid up members, the treasurer reported that the Chapter had \$192.75 in the treasury.

Outgoing Chairman Preston Atwood was congratulated by the Chapter for the fine job he did as chairman for the last two years. Chairman Atwood has often helped the Chapter with new ideas on solid-state circuitry and with solutions to many problems he has encountered in his service work.

That evening, he told the Chapter of a visit he made to repair a 25 inch Zenith TV which had vertical roll as well as a curtain effect two inches wide on the bottom of the screen. Moving a 0.01  $\mu\text{f}$  ceramic capacitor solved that problem, although to this day, he still wonders why. The color set has been running perfectly ever since. The 0.01  $\mu\text{f}$  capacitor was in the grid circuit of the vertical oscillator.

Chairman Atwood complimented the members for their attentiveness, and said he hoped they would feel the same respect for the newly elected officers. Norman Charest will take over the duties of

#### NRIAA OFFICERS

J.B. Straughn . . . . .	President
Eldred M. Breese . . . . .	Vice President
Branko Lebar . . . . .	Vice President
Joseph A. Crusco . . . . .	Vice President
Les Lederna . . . . .	Vice President
Tom Nolan . . . . .	Executive Secretary

## Alumni News

chairman beginning with the September meeting.

Also at this meeting, two new members talked briefly about their appreciation of receiving the *NRI Journal*. They find it interesting, informative, and friendly.

George Lewonchuk brought in an NRI voltmeter with a problem in reading the voltage on the 300 volt scale. He was advised to bring a schematic to the September meeting where members will try to solve the problem.

The meeting adjourned at 9:30 p.m. with coffee and doughnuts served by Norman Charest.

The annual picnic for members and their spouses was held June 25 at the home of Mr. and Mrs. John Park of Ware, Massachusetts.

### NORTH JERSEY CHAPTER ENTERTAINS EXECUTIVE SECRETARY

The North Jersey Chapter heard Tom Nolan, Executive Secretary of the NRIAA, speak about CB's at their May 22 meeting. Refreshments were served after a discussion between Tom and the members.

### PITTSBURGH CHAPTER HEARS CB LECTURE

Tom Nolan, Executive Secretary of the NRIAA, lectured the Pittsburgh Chapter at their meeting June 2. His topic was "CB Installation and Servicing."

After the meeting, Tom held a question and answer session. A great deal of information was brought forward.

### DIAGNOSTIC MEETINGS CONTINUE AT DETROIT CHAPTER

At the April meeting, Tom Tishler gave a talk and demonstration of a troublesome transistor circuit. The collector current could not be controlled with different bias voltages low enough to cause saturation. The problem was traced to a defective transistor.

In addition, Ed Quinn checked through the circuits of a CONAR tvom which had stopped operating that a visitor had brought in. With helpful comments from the members, he discovered that it had a bad FET.

At the May meeting, The Chapter had a request from a gentleman looking for a

6 volt vibrator for his old Ford (Philco) car radio. F. Earl Oliver volunteered to supply him with one. No problem!

Another visitor brought in a GE portable color TV that reproduced good sound, but had no raster. There was no output of any kind beyond the horizontal oscillator stage. It turned out to have a burned out thermistor due to an overload in the horizontal output section.

All members have been participating in diagnostic procedures with various pieces of equipment. They also learn to understand the theories behind the procedures at the same time.

At the June meeting, John Nagy spoke about the Consumer Electronic and the Sound and Light Shows he attended in Chicago. He explained many of the uses of electronic blocks in practical applications, such as building circuits, reading test panels, and experimentation. He then discussed home computers and their potential for the service technician in the future. Folders on these devices were distributed.

Tom Tishler gave a talk board discussion of a problem circuit with a bipolar power transistor involved. Jim Kelley followed with a practical demonstration of the circuit using an operational transistor circuit board he built and a bench-type vtm so all could see the output readings.

Don Hughes pinpointed leakage in the original transistor of the problem circuit as the problem in his new transistor tester. It was solved with a new transistor.

Asa Belton and Gilbert Sager brought in an old radio to be used for practical training experiments. The one that Gil brought in was a 1946 vintage RCA table model which suffered from constant hum. The trouble was quickly traced to a defective combination electrolytic filter capacitor. Separate capacitors were installed because the original was not available.

The annual election of officers and committee members was held at the meeting. Those elected were: James

Kelley, chairman; Ray Berus, Vice-Chairman; Tom Tishler, Secretary; F. Earl Oliver, Treasurer; Prince Bray, Librarian; and Bruce Rittenhouse, Sergeant-at-Arms.

Members of the finance committee will include John Nagy and Leo Blevins. A new research committee was formed to research and present information on new developments in the field of electronics. Ed Quinn and John Nagy will serve on this committee.

All those elected will be installed and assume their duties in September. There are no meetings during July and August.

### GOOD ATTENDANCE AT FLINT/ SAGINAW VALLEY CHAPTER

At the May 11 meeting, Dale Keys brought in two General Electric color television sets for experimental service work. After the experiments, Fred Malik, Jerry Lev, Dale Keys, Chester Mazur, and Jack Heilborn disassembled the sets. They used the cabinets for phonograph records and salvaged some of the spare parts.

The Chapter is opening up a new sales and service outlet for CB radios and security systems. This will be at the branch office at G5513 S. Saginaw, next door to the Chapter headquarters. The call letters for the CB station are KDS6511.

At the June 8 meeting, the Chapter took two television sets and made one good set from the parts.

At the June 22 meeting, Jerry Lev brought in a black-and-white television set with no high voltage. After making a few checks, he found that the yoke was shorted. However, when a substitute yoke was used, the set played but it also had a vertical problem. After a few more checks, he found that the retrace condenser was bad. When it was replaced, the vertical was okay.

Andy Jobbagy worked on a Montgomery Ward color set which had a high-voltage arc. After the focus voltage module was replaced, the set performed perfectly.



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