IMPROVED KEYING FOR THE DX-100

The original keying circuit of the DX-100 involved simultaneous keying of the VFO and buffer stages in the cathode circuit. The two remaining stages were biased to cutoff and remained idle until excited by the buffer. This method of keying is simple, fool-proof, and allows break-in operation. However as the VFO is started and stopped very suddenly there is a tendency toward chirps or frequency shift, particularly on the higher frequencies. Also, there may be key clicks as there is no provision for wave shaping.

The sudden starting of an oscillator produces a sharp wave front with a possibility of over-shoot and the following stages running class C further sharpen the wave front. This transient response results in harmonics which splatter over adjacent frequencies causing key clicks. See Figure 1.

From the above discussion you will see that there are two problems which must be solved before good keying is possible. One is to eliminate the chirp caused by a small, but instantaneous frequency shift of the VFO when power is applied suddenly. Two is to eliminate the extremely sharp wave front which produces harmonics causing clicks

Figure 1

A good solution to the chirp problem is to allow the VFO to run continuously and key a following stage. This might preclude the possibility of operating break-in on one's own frequency; however, the VFO in the DX-100 is well shielded in it's own case and again shielded by the transmitter cabinet. Tests performed with a good receiver using coax antenna feed gave a reading of only S1 for the VFO signal. This would readily allow break-in on any frequency.

Figure 2

The solution to the click problem is to round off the corners of the transmitted wave and thus prevent the higher order harmonics. See Figure 2. This may be done by using a keying system that allows the introduction of a time constant in the circuit. The time constant slows the starting and stopping time and eliminates the sharp wave front and over-shoot.

Grid block keying is one method in which it is quite simple to introduce a time constant. In grid block keying a relatively high negative potential is applied to the grid of the keyed stage, cutting off the tube's conduction. When the key is depressed this negative voltage is shunted to ground and the tube allowed to operate.

OPERATION

In the following modification the key lead is removed from the phone-CW switch and connected to a separate tie point. Then pin 9 of the phone-CW switch is tied to pin 7. This results in the plate switch turning on the VFO and buffer stages whenever the high voltage is on, in the CW as well as the Phone position. However, the buffer stage is rendered inoperative by a negative bias and only the VFO operates.

As it would not be practical to tune up the low power stages with high voltage on the final, a push-button switch is installed which duplicates the effect of both the plate switch and the key without applying high voltage.

Approximately -60 volts is obtained from the bias supply and passed through two 27 K and one 100 KΩ resistors to the grid of the 12BY7 buffer cutting the tube off. See Figure 3. When the key is depressed the point between the two 27 K resistors is grounded. The first 27 KΩ resistor isolates the bias supply so that it is not shorted, the second 27 K resistor in conjunction

with the .15 μfd capacitor provides the time constant for the "make" side of the wave. The .15 μfd capacitor has to discharge through the 27 K resistor to ground by way of the key contacts. Thus, the negative voltage on the grid of the 12BY7 does not instantaneously fall to zero and a slope is introduced on the wave front. With the key down, the 12BY7 is self-biased through the 27 K and 100 K resistors. When the key is released the .15 μfd capacitor has to charge through both 27 K resistors, and the tube grid voltage rises at a relatively slow rate to cut off. This produces a slope on the "break" and again eliminates the click.

INSTALLATION

The installation is extremely simple with the possible exception of boring the hole for the push-button switch. Using Figure 4, lay out the hole on the panel, then mark the spot with a center punch. Drill the hole first with a small drill to insure accuracy; it would be well to hold a plate or block behind the panel to protect the filter capacitors. Now drill the hole with progressively larger drills and if necessary use a reamer until a 3/8" hole is obtained.

Wire the push-button switch in the following manner before it is mounted: With a blade-type push-button switch such as the Switchcraft (1004), connect the two moving blades together and (green) connect a wire approximately 7 inches long to this point. This wire should carry some means of identification such as a different color from others used. Connect two wires about the same length to the two stationary contacts of the switch. These wires need not be distinguished from each other. Mount the push-button switch on the panel and feed the three wires through the chassis hole between the filter capacitors. See Figure 5 for the following wiring. The identified wire is connected to terminal 1 of the key jack (ground); the other two wires are connected as shown.

Mount a one-lug terminal strip near the key jack using the corner screw holding the filter capacitor. Mount a three-lug terminal strip behind the 12BY7 stage using the screw which holds the octagonal loading capacitor.

The key jack line choke is removed from terminal 9 of the phone-CW switch and connected to the one-lug terminal strip. Terminal 9 is then connected to terminal 7 with a jumper. The 100 KΩ resistor from pin 2 of the 12BY7 oscillator socket to ground is removed. The rest of the wiring is easily accomplished by following Figure 5.

ADJUSTMENT

After the modification has been completed, turn on the transmitter and readjust the clamp circuit. With plate power applied to the final and no excitation (VFO-xtal switch in an unused xtal position), set the clamp (screw driver adjustment) until the final plate current just returns to zero. Do not pass this setting.

Turn off the high voltage, set switch for VFO operation and while holding the push-button switch tune VFO and buffer for desired operating frequency. Now release push-button, turn on HV and tune final and loading for normal operation.

The push-button switch is used for frequency spotting or tune-up and the final tuned as before.

This modification is strictly optional on the part of the builder. It will work equally well for crystal or VFO operation and produces a far superior signal on both.

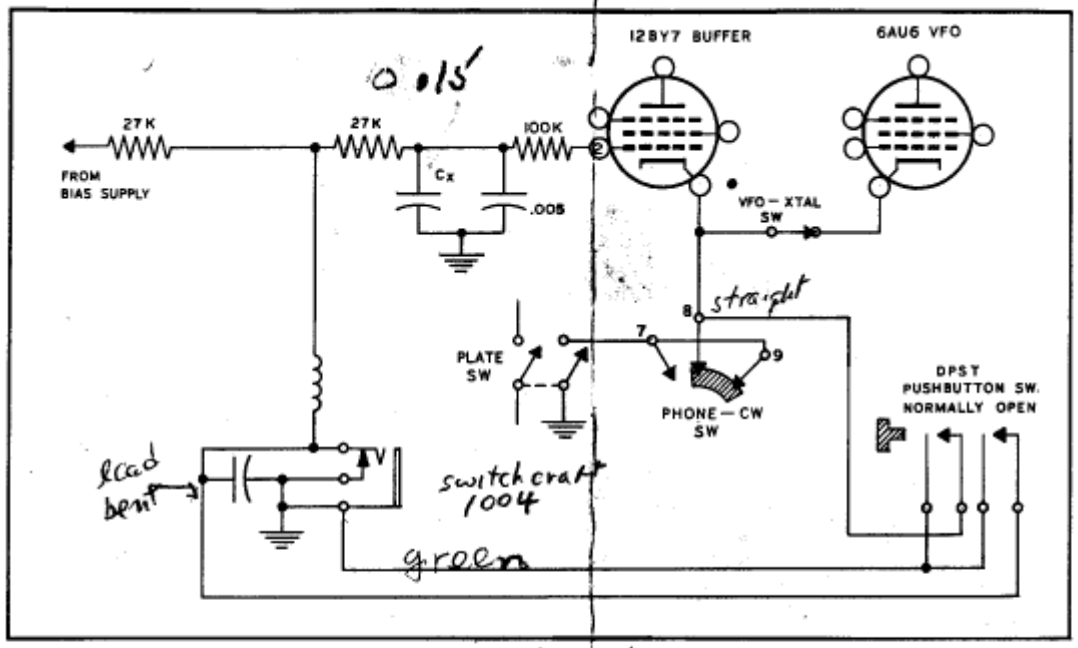
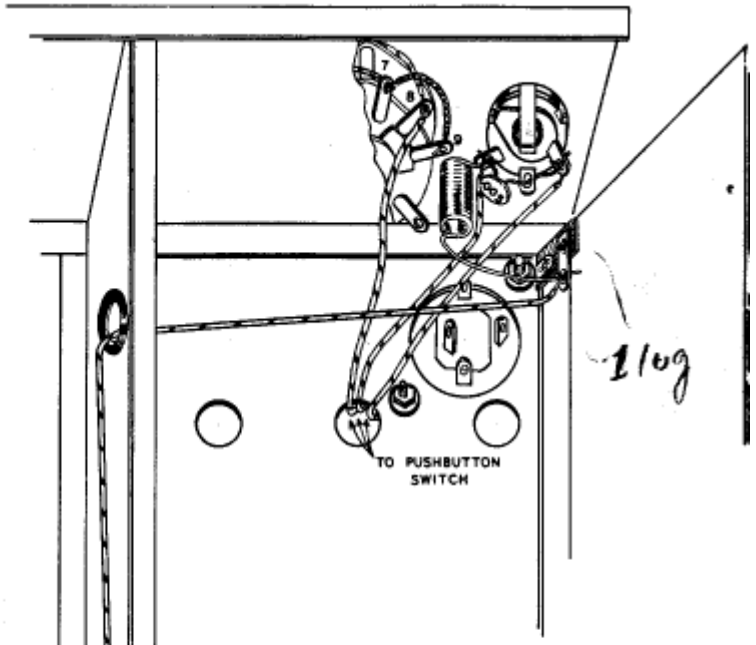


FIG. 3



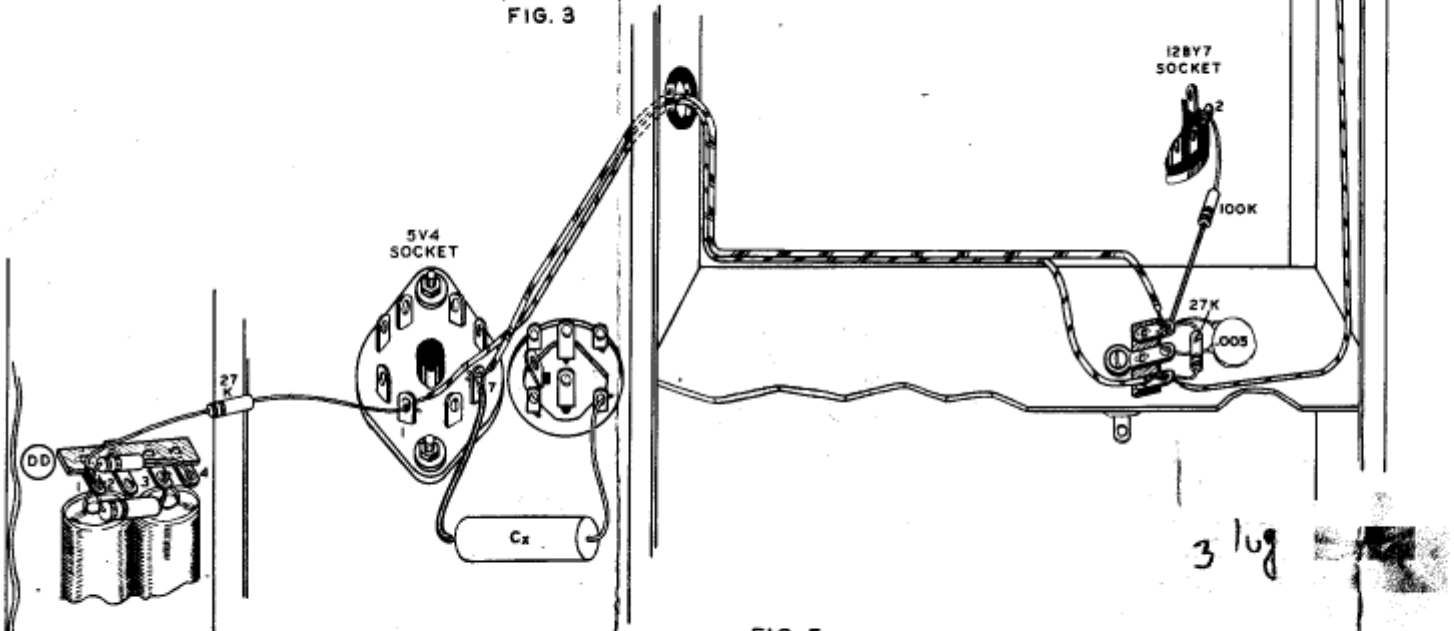


FIG. 5

1 ea switchcraft 1004
2 ea 27K resistors
1 ea 100K "
1 ea .005
1 ea 0.15
1 ea 1 lug strip
1 ea 3 lug strip

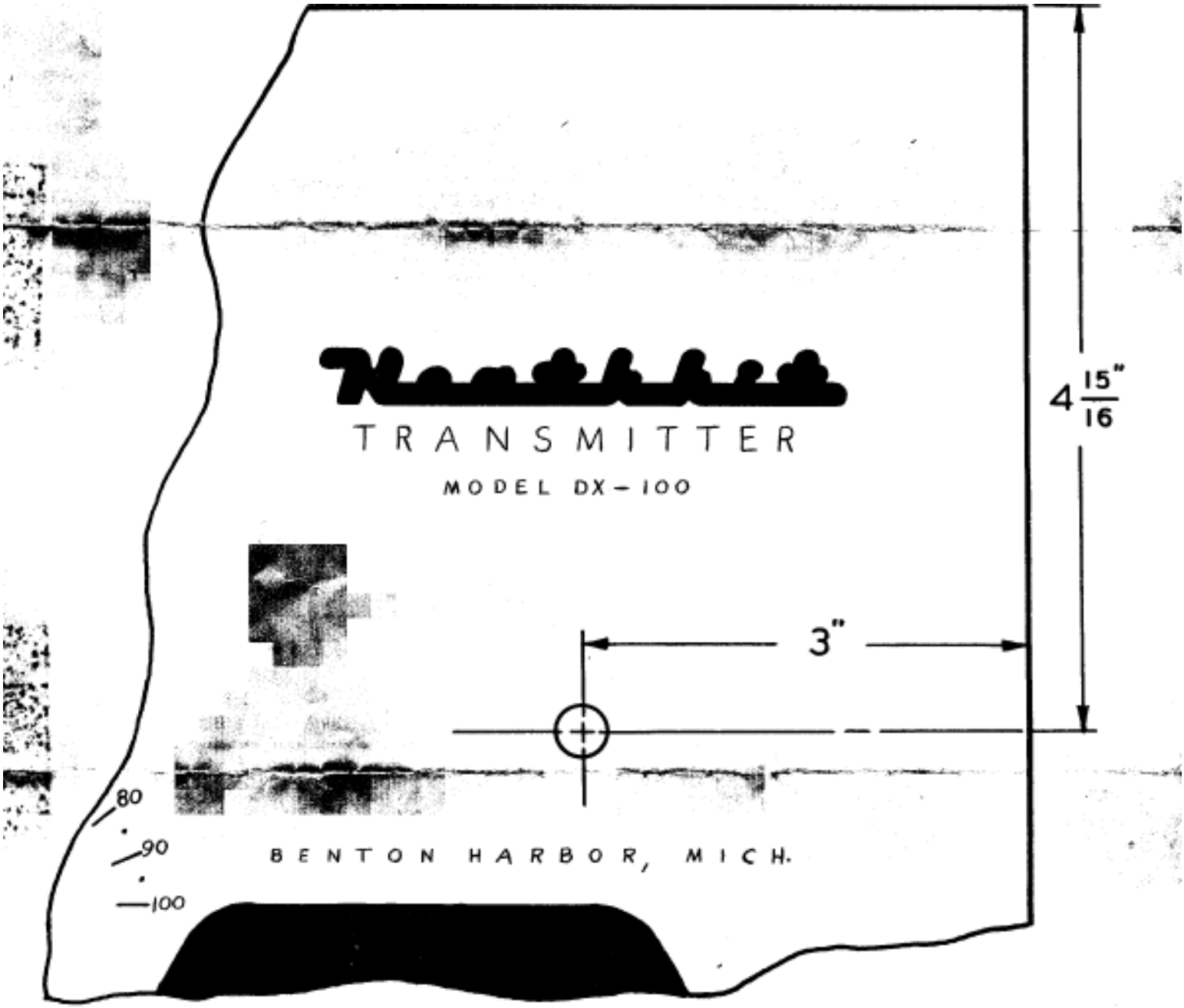

TRANSMITTER
MODEL DX – 100
3"
4 15/16"
80
90
100
BENTON HARBOR, MICH.

FIG. 4