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EXECUTIVE
MODEL 750
OPERATION
MANUAL

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SECTION I

GENERAL

The INTERNATIONAL EXECUTIVE, Model 750 is the latest of the Executive series designed for remote control operation. This Citizens Band unit combines a sensitive and selective dual conversion receiver with a highly stable and efficient crystal controlled transmitter. The transmit and receive frequency selector circuits are housed in the RMO unit.

A frequency synthesizer is provided in the RMO unit for the selection of any one of the 23 citizen band channels. A squelch circuit is built-in to provide receiver quieting during periods when no signal is being received. The crystals supplied have a frequency tolerance of .005% when used in the EXECUTIVE.

The illuminated 12 position CHANNEL selector dial allows the operator to instantly select the desired channel in two ranges. With the HI-LO switch in the LO position channels 1 thru 12 are selected by the CHANNEL selector dial and when placed in the HI position channels 13 thru 23 are selected by the CHANNEL selector dial.

The EXECUTIVE has been designed with flexibility of installation in mind. It may be used in a car, boat, plane or other mobile and portable applications, wherever there is 6 or 12 VDC available. It may be used with a base loaded whip antenna, regular whip, ground plane, beam and other types of antennas. The Model 750 may also be operated from a 115 VAC source. This new Executive Model has been designed primarily for installation in vehicles where space limits the mounting of other models. The RMO console requires limited space and can be mounted in even the smallest of automobiles.

Though the unit is very versatile, it is not to be expected that either receiving or transmitting results will be the same in every installation. As in all radio communications and particularly in VHF applications, the type of antenna, its location above ground, the noise present in the area and other factors are bound to affect the results obtained.

SPECIFICATIONS

Receiver:	
Tuning Range	Crystal Controlled-Any Channel, 1 through 23.
Sensitivity	Usable to .5 microvolts
Selectivity	15 db down at 10 kc 60 db down at 30 kc
Image Rejection	Better than 50 db down
Audio Output	2.5 watts into 4-6 ohms
Speaker Impedance	4-6 ohms
Squelch Range	.5 to 20,000 microvolts. On-off differential is approximately 1 microvolt, at 5 microvolt input
Noise Limiter	Automatic, series-gate
Transmitter:	
Tuning Range	Crystal controlled any channel, 1 through 23.
Frequency Stability	±.005% @ 0° to 125° F, when used with INTERNATIONAL high stability crystals
RF Power Input	5 watts maximum (FCC rules)
Modulation	Capability-100%
Power Consumption:	
Transmitting	65 watts (approximate)
Receiving	60 watts (approximate)
Weight	12 pounds (approximate)
Microphone	High impedance, ceramic or dynamic type with (push-to-talk switch)

RMO CONTROLS

ON-OFF SWITCH

The on-off switch on the VOLUME control operates in the same manner as the original. This control completes or breaks the primary 110 VAC or 6 or 12 VDC circuit to the power supply and is fused in the RMO Unit.

VOLUME

Although the function of this control is the same, the circuit differs from that of the original. With the unit turned on and the RMO control half open the volume control on the Executive is set for normal listening level then the RMO control is used in the normal manner.

SQUELCH

The RMO Squelch Control is used to eliminate background noise when no signal is being received. Upon initial warmup, turn this control fully counter-clockwise until a click is heard. The switch in the squelch control is OFF in this position. To operate, turn squelch control on and fully clockwise. Then slowly turn the control counter-clockwise until the background noise just disappears. Leave the control set at this point. Do not turn the control too far counter-clockwise as this will reduce the receiver performance and weak signals will not be heard.

CHANNEL SELECTOR

The RMO contains an illuminated 12 position channel selector. When used in conjunction with the HI-LO switch this control switches transmit and receive crystals simultaneously to any one of the 23 citizen band channels. CAUTION: With the HI-LO switch in the HI position DO NOT operate the transceiver with the CHANNEL selector dial on the blank button between channels 22 and 23.

HI-LO SWITCH

This control located to the right of the Channel Selector dial selects the transceiver operating frequency range. With the switch in the LO position channels 1 through 12 are selected by the CHANNEL selector. When placed in the HI position channels 13 through 23 are selected by the CHANNEL selector dial. Pilot lamps are automatically switched to illuminate the proper channel indicating button.

CAUTION: With the switch in the HI position DO NOT operate the transceiver with the CHANNEL selector dial set on the blank button between channels 22 and 23. This will result in operation on an unauthorized frequency.

MICROPHONE (Recepticle)

The RMO Microphone connector requires a four-prong lock-on plug which is furnished with the unit as part of the microphone. High impedance crystal or ceramic and dynamic microphones may be used with this transceiver.

INDICATOR LAMPS

RECEIVE INDICATOR

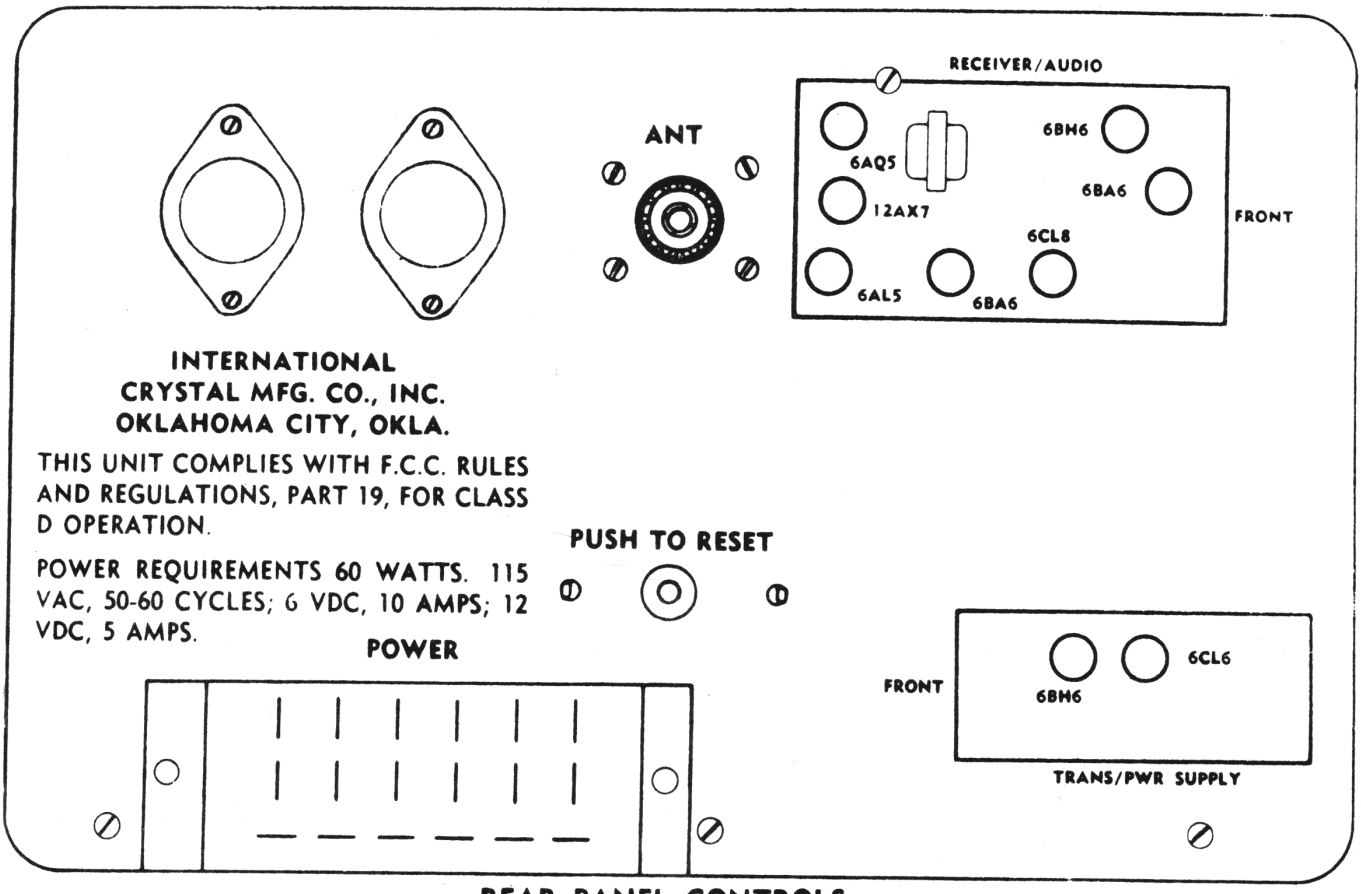
This indicator identified by the letter "R", functions as an on-off (plate voltage) indicator for the receiver section of the transceiver. When the transceiver is operating in Receive position the lamp will glow steadily and go out when the transceiver is placed in the Transmit position.

TRANSMIT INDICATOR

This indicator identified by the letter "T", functions as an on-off (plate voltage) indicator for the transmitter section of the transceiver. When the transceiver is operating in Transmit position the lamp will glow steadily and go out when the microphone button is released and the transceiver returns to receive position.

FUSE

A 15 ampere fuse is installed in the fuse holder and may be changed or replaced, if necessary, by unscrewing the red insert in the center of the holder. If the transceiver is to be operated on 12 volts dc the fuse should be replaced with one having a rating of 7.5 amperes.



REAR PANEL CONTROLS

ANT (Antenna Receptacle)

This receptacle is used to connect the transceiver line to the transmit-receive relay, TR-1. The receptacle is a standard low-loss, VHF type designed for 50-75 ohm coaxial cable.

PUSH TO RESET

This is a thermal cut-out. It protects the unit when it is being operated on 115 volts ac. If overload causes it to cut out, it can be reset by pressing in on the plunger and holding it in for about two seconds.

POWER

An 18-contact plug is used as a power connector. This allows various input voltages to be used without requiring changes within the unit. All necessary connection changes are made on the external plug. Five different cord assemblies are used; 115VAC, 6VDC negative ground, 6VDC positive ground, 12VDC negative ground, and 12VDC positive ground.

LOCAL-REMOTE SWITCH

The LOCAL-REMOTE switch is located on the terminal bracket inside the transceiver unit. This switch is placed in the REMOTE position when shipped from the factory. This control allows the operator to switch the transmitter on for final tune up from the trunk compartment. After tune up this control must be returned to the REMOTE position.

SECTION II

RECEIVER CIRCUIT DESCRIPTION

The receiver section of this transceiver is a double conversion unit employing the superheterodyne principle of frequency conversion. The first converter is composed of three basic sections; an rf amplifier, mixer, and oscillator which is crystal controlled. The crystal controlled oscillator is housed in the RMO console.

A received signal from the antenna is coupled to the control grid of the rf amplifier through a double tuned circuit consisting of coils L1 and L2, their respective shunting capacitors, and coupling capacitors C3. This double tuned circuit aids greatly in the elimination of unwanted signals outside the passband to which it has been tuned. The gain of the rf amplifier is controlled automatically by the receiver's AVC system coupled to the control grid of V1 through a 1 megohm resistor.

After reaching the control grid of V1 (6BA6) the signal is amplified and coupled to the control grid of the mixer, V2. Here the signal is heterodyned with a signal in the 17 mc region coupled through the cable from the crystal controlled oscillator in the RMO unit. A difference frequency signal of 10,000kc or 10150kc is selected by coil L6 in the plate circuit of the mixer, V2 and coupled to the grid of the second mixer in the IF strip. The first IF signal frequency is dependent upon the position of the HI-LO switch in the RMO. In the LO position channels 1 through 12 are received and the resulting IF frequency is 10000kc. In the HI position channels 13 through 23 are received and the resulting IF frequency is 10150kc.

The second section of the receiver consists of a mixer and crystal controlled oscillator, intermediate frequency amplifier, second detector and noise limiter, and a special squelch circuit.

The 1st IF signal received at the grid of the second mixer, V3A, is heterodyned with a 10455kc or 10605kc signal from the crystal controlled oscillator, V3B. The difference frequency of 455kc is selected in the plate, circuit of V3A and transformer coupled to the control grid of the intermediate frequency amplifier, V4. The gain of this amplifier is also automatically controlled by the AVC system connected to the grid of V4 through the secondary of transformer T1 and a 220 K ohm resistor.

The signal is further amplified in V4 and coupled from the plate through transformer, T2 to the plate of the detector, V5A, where the audio component is detected. V5A is also used to produce the AVC voltage. The detected signal is coupled to V5B which acts as a series-type noise limiter removing noise pulses which may ride through on the signal. The squelch circuit consisting of a neon lamp, NE-1, silicon diode, CR-4 and associated components is connected so that the audio section of the receiver is cut off and background noise eliminated when no signal is being received. The cut-off level may be varied by use of the squelch control.

The third section of the receiver is a conventional audio amplifier consisting of a twin triode audio voltage amplifier, 12AX7 (V6A-V6B) follwed by a 6AQ5 (V7) tetrode power amplifier. When the transceiver is in RECEIVE position only one-half of the 12AX7 is used. The second triode section V6B receives the audio signal from the center tap of the volume control. The audio signal is amplified in V6B whose output is RC coupled to the control grid of the power amplifier, V7. The audio signal is further amplified in V7. The plate of V7 is connected to transformer, T-3, which performs a dual function. In RECEIVE position this transformer acts as a normal output transformer with its secondary connected to the speaker. In TRANSMIT position, its function is that of a modulation transformer.

TRANSMITTER CIRCUIT DESCRIPTION

The transmitter is a multi-stage unit consisting of a crystal controlled frequency synthesizer signal generator located in the RMO console, a buffer amplifier and neutralized tetrode final amplifier.

The frequency synthesizer has 12 channel crystals in the 17 MC range which are selected by the CHANNEL selector switch and two heterodyning crystals in the 10 MC range selected by the HI-LO switch. With the HI-LO switch in the LO position a 10 MC crystal is placed in the grid circuit of the triode section (V12A) of V12. This signal is cathode coupled to the pentode section (V12B) of V12. A 16.965 MC to 17.105 MC(channels 1 thru 12) signal is coupled from the plate of V11 to the control grid of the pentode section of V12. The resulting sum frequencies of 26.965 MC to 27.105 MC (channels 1 thru 12) are selected in the plate circuit of V12B by L26.

The same procedure is followed for channels 13 through 23 except the HI-LO switch is placed in the HI position and a 10.150 MC crystal is switched into the grid circuit of V12A. This signal is heterdyned as before with the 16.965 MC to 17.105 MC signals from V11 and the resulting sum frequencies of 27.115 MC to 27.255 MC (channels 13 through 23) are selected in the plate circuit of V12B by L26. The output of V12B is inductively coupled through the cable to the grid coil L14 of buffer amplifier V9. Buffer amplifier V9 is also inductively coupled to the grid coil of final amplifier V10. The plate circuit of V10 is a shunt-fed pi matching network. Neutralization is accomplished by capacitor C83, and link coil L20 coupled to the cold end of Coil L19.

POWER SUPPLY CIRCUIT DESCRIPTION

A three-way supply is used in this transceiver. It operates as a conventional, full-wave rectifier circuit on all voltage inputs followed by a capacitor input RC filter network. On 6 or 12 volt battery operation, a transistor oscillator circuit is used to provide the necessary AC voltage for the primary circuit of the power transformer.

The transceiver is supplied with a DC power cord kit. The unit may be operated either from 6 volt positive ground, 6 volt negative ground, 12 volt positive ground, or 12 volt negative ground by use of the proper power cord connections. The power supply is equipped with a thermal circuit breaker for protection on AC operation. For protection on 12 volt DC operation a 7.5 ampere fuse is used with the transceiver. Protection on 6 volt DC operation is provided by a 15 ampere fuse which is supplied with the unit. When 12 volt DC operation is desired the 7.5 ampere fuse must be substituted for the 15 ampere fuse.

TRANSMIT-RECEIVE RELAY CIRCUIT DESCRIPTION

By including a transmit-receive relay (TR-1) in this transceiver, the many advantages of "Push-to-talk" operation and maximum transfer of energy to and from the antenna are afforded the operator at no extra cost. The circuit consists of a half-wave rectifier which receives its AC voltage from a 12 volt secondary winding on the power transformer. The rectifier is followed by an RC filter network whose output is connected in series with one end of the relay coil. The other end of the relay coil is connected through the microphone socket to the microphone switch button. This completes the 12 volt DC relay circuit to ground and the relay performs the following switching functions:

RECEIVE- In this position the relay is not energized and the antenna is connected to the receiver input, B+ voltages are furnished to the receiver section and one side of the speaker is grounded.

TRANSMIT- The relay is energized and the antenna is switched to the transmitter output circuit, B+ voltages are furnished to the screen and plate circuits of V6A, V9, V11, V12 and final amplifier V10. The speaker voice coil is removed from ground.

ANTENNAE AND THEIR SELECTION

The most common antennae for citizen use are the Ground Plane and Coaxial for base use and the Vertical Whip for mobile use. The Yagi multi-element beam antenna can be used to great advantage where point-to-point communication is required rather than non-directional coverage from the base station. Any antenna with a directional gain will effectively increase the radiated power of the transmitter as well as the received signal applied to the receiver.

It is best to purchase a good commercially built antenna rather than attempt to construct your own. Good commercial antennae have low SWR (standing wave ratio) which is a merit of the radiation efficiency. With home constructed antennae it is sometimes difficult to effect a good match between the antenna and the transmitter causing considerable power to be lost in the system. An antenna should have an SWR of no more than 2:1.

Some power will be lost in the transmission line and therefore long runs should use the larger RG-8U cable. This cable has a lower loss per foot than the smaller RG-58/U. Both types have a characteristic impedance of 53 ohms. Loss per 100 feet at 27 megacycles is 1 db for RG-8/U and 2 db for RG-58/U. For short runs the RG-58/U cable is more easily handled.

Most of the antennae are available in two grades. The lower priced standard grade will not be as mechanically strong as the commercial grade. Electrically both grades are usually about equal. Where ice loads, wind, and salt air are a factor it will be cheaper in the long run to purchase the better antenna.

For extremely short range communication (less than a mile) the base loaded case whip antenna works very well. With two units using case whips, the signals will become quite weak after a block or two and poor squelch operation will be encountered. The outside antenna is by far the best choice and should be mounted as high as practical and still be within F.C.C. regulations. [Paragraph 19.25(c)]. In brief, the F.C.C. limits antenna height to no more than 20 feet above an existing structure or not to extend above the top of the radiating element on an existing tower. Remember the Yagi type antenna is usually mounted in a horizontal position. This type antenna must be used with another antenna mounted in the same plane. If the Yagi is to be used to communicate with mobile units using a whip antenna, the Yagi should be mounted in a vertical plane. A little thought in antenna installation will greatly improve your coverage.

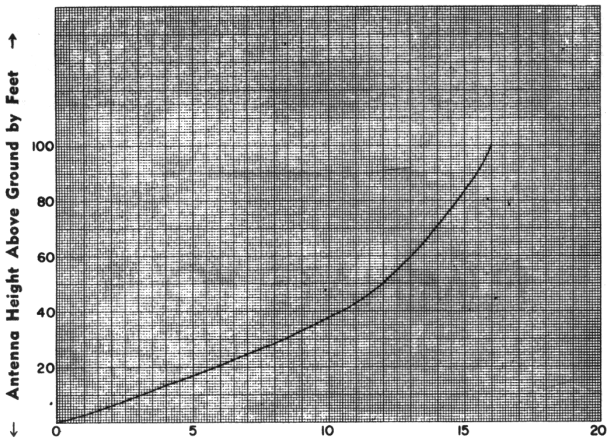
DISTANCE vs ANTENNA

The direct coverage you are able to obtain using Citizen Equipment in the 27 megacycle band will depend a great deal upon the antenna. We shall speak of direct coverage rather than skywave coverage wherein you may communicate 500 to 2000 miles at various times.

The F.C.C. has intended the Citizen use to be for short range communication and all installations should be calculated on this basis. The following charts consider a base station antenna mounted on a mast with the calculated range to a mobile unit using a standard 108" whip. Remember that the antenna may be mounted on an existing structure or mast [reference F.C.C. 19.24(c)].

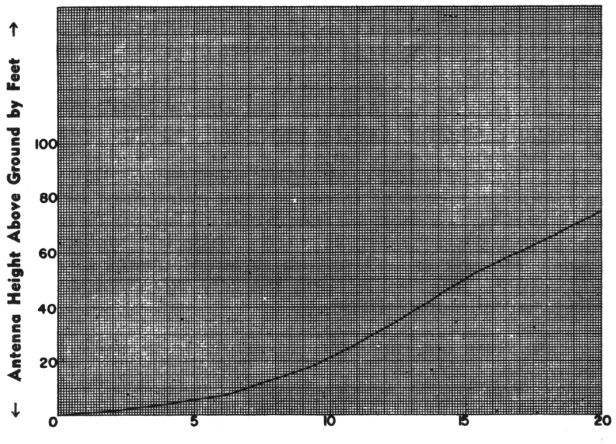
Ground Plane or Coax Antenna For 2 Microvolts at Receiver

Chart #1



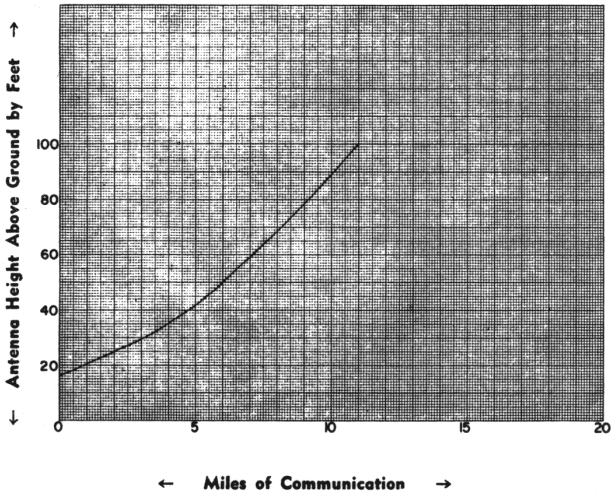
Yagi Antenna Mounted Vertical For 2 Microvolts at Receiver

Chart #2



Ground Plane or Coax Antenna For 15 Microvolts at Receiver

Chart #3



Note how the distance increases with increase height of the antenna for a given installation as in Chart 1. If a direction antenna is used as in Chart 2 you can see how the distance is further increased, however, this reduces the area covered since the Yagi Antenna is quite directional.

Charts 1 and 2 are based on a 2 microvolt signal at the receiver. This signal will not be sufficient for many city areas where high levels of noise exist. Chart 3 considers the coverage for 15 microvolts at the receiver and is more practical for general city use.

When the Citizen frequencies are open to skywave transmission, signals from distant stations will be strong enough to over power weak direct signals. When one is considering communication he should understand that for 100% contact he should base the calculations on 15 microvolts or more.

In mobile communication dead spots will be found at various points as well as locations giving excellent signals. These points should be noted and contacts made from the best possible locations. Vehicle noise and electrical interference will greatly reduce your communicating distance.

ELIMINATE YOUR MOBILE "NOISE GENERATORS"

Now that low cost TWO-WAY radio communication is available to everyone with the opening of the eleven meter band for Citizen use the number of mobile installations will probably exceed the number of base, or control, stations by a factor of 5 to 1 within the near future. It is estimated there are now over 160,000 citizen band mobile installations and approximately 45,000 base, or control, stations in operation. Proper installation and necessary steps towards the elimination of electrical, and mechanical, interference inherent in all motor vehicles is of prime importance if distances of three miles or more are desired to be covered.

For short range coverage the simple installation of a "radio condenser" on the generator and the "interference suppressor" installed in the top of the distributor, or coil, is usually sufficient noise suppression. But when maximum distances of three or more miles must be covered, great pains must be taken and all known means of noise suppression must be used. Different makes and models of vehicles will require different means of noise suppression. Some models only the very simple, others will need the "all out" method.

As there are numerous "generators" of radio interference in every motor vehicle the elimination of one source may not be noticeable as it's noise level may be below one you have not located so the proper way to approach your "noise" problem is by a systematic process of first suppressing all known offenders, namely the generator, voltage regulator, distributor and spark plugs.

We will explain throughout this article what is considered to be the proper vehicle noise suppression methods. The volume of noise you can, or will, tolerate in your receiver will depend upon the amount of suppression applied. Few installations will require the "all out" method and the user must decide when he is satisfied.

The purpose for eliminating your own "noise generators" is the fact that your receiver's automatic volume control (AVC) will react to these random noise pulses the same as though a strong station was tuned-in and will cut the receiver's sensitivity way down which will eliminate the weak stations you normally wish to copy. There's an old saying "if you can't hear them, you can't work them."

Let's start our "noise elimination" with the generator and voltage regulator. The generator is the item that causes the whine as the speed of the motor is increased. It is very easily detected by speeding up the engine and then cutting the ignition off. The instant the switch is turned off ONLY the generator and voltage regulator can cause the noise as all other "noise generators" are eliminated when the switch is off EXCEPT the generator as it is still in operation and is still trying to charge the battery through the voltage regulator. Even though it will operate only a few seconds after the switch is off this is time enough for you to hear the terrific amount of noise it is generating. As the speed of the engine decreases the whine will decrease in unison.

Practically all vehicle manufacturers cable the two leads from the voltage regulator to the generator in a harness with other wires. It is recommended that both of these wires be run in **separate** tinned copper braid. Just disconnect the present wires from the generator and the other end of them at the voltage regulator's "A" and "F" terminals. They can be cut-off where they enter the harness or just taped down out of the way.

A Sprague 48P18 coaxial capacitor, or a similar .5 mfd coaxial capacitor, should be installed directly ON the generator and the lead from the condenser to the battery armature terminal of the generator must be as short as possible. In fact a length of one inch is sometimes too long. A .001 mfd mica capacitor should now be installed from the same battery terminal to the frame of the generator, here again lead length is extremely important and they should be no longer than one-quarter inch. Be sure to remove paint and grease on the generator where the capacitor is bolted as a "good" ground at this point is necessary.

Dress the cable from the coaxial capacitor on the generator against the body of the car. Use speed clips to keep in place or run through presently installed cable clamps. This cable is usually the longest "noise generator" we must suppress and it is preferred to shield this wire in tinned copper braid. The end of the braid must be soldered directly to the coaxial capacitor's body. Be sure to use size #12 copper stranded wire when making-up this new lead. Connect a new cable to the generators' "F" (field) terminal and run this lead in a tinned copper braid shield and dress it along side the battery lead. This new lead may be of size #16 copper stranded wire.

The voltage regulator is next and the "job" from here on is usually easy compared to the one just completed. Remove the cover from the voltage regulator and clean off any paint that may insulate the cover from the frame. Check the mounting screws and be sure the regulator is being grounded directly to the firewall. If necessary remove and clean away any paint so you may secure a "perfect" ground connection.

Use two 48P3 of 48P5 Sprague coaxial capacitors or similar .1 to .5 mfd coaxial capacitors and install at the "A" and "B" terminals of the regulator. The capacitors metal body must be grounded directly to the firewall. This can be easily accomplished by using a piece of cadimun plated metal about 4" x 4" bent to a 90° angle. Drill two holes for the capacitors and two holes to pass sheet metal screws to bolt to the firewall. Attach the capacitors to the angle with screws and nuts and **also** solder. Locate the assembly so the lead from each capacitor to the "A" and "B" regulator terminals are extremely short. Be sure to clean the paint from the firewall so the bracket will make a good solid ground connection. Attach the cable from the generator's "F" terminal to the voltage regulator's "F" terminal. Connect a .002 mfd capacitor and a 4 ohm resistor, in series, from this point to ground. Again, lead length is important and the overall length of the capacitor-resistor combination must be as short as possible. Attach the lead from the generator's armature terminal to the coaxial capacitor connected to the voltage regulator's "A" terminal. The shielding braid on these leads must be grounded to the capacitor bracket or to the firewall by soldering or with the use of washers and sheet metal screws. Attach the "B" battery lead to the coaxial capacitor connected to the "B" terminal of the voltage regulator. This is the lead coming through the firewall and usually goes direct to the battery charging indicator on the vehicles dash panel.

The next superb "noise generators" of them all are the spark plugs. But here we have available to us years of research for only a few dollars. Just go to your local auto supply store and purchase a complete set of AUTO-LITE RESISTOR spark plugs that are direct replacements for your particular brand and model of vehicle. CAUTION: We own no stock in Auto-Lite, but please accept no "substitute" as some **resistor** plugs will actually increase your noise problem. Be patient, if your dealer does not stock your size just ask him to get them for you. When installing the new plugs be sure to have the gap properly set.

After **properly** installing the "recommended" suppression to these trouble makers you should be able to drive comfortably and communicate with stations you never heard before with your engine running. However, in most cases this is only the beginning of the job in order for you to say that you have a good mobile installation.

If you have been checking your "noise elimination" progress as you complete each step we know you will be extremely pleased with your work. But from here on each suppression job will not be very noticeable until you hit the one big joker that's causing a lot of trouble. The little "noise generators" will be obscured by this one and wouldn't have showed up until it was eliminated. All-in-all the little ones can really add up and must be taken care of in due time.

Have your distributor checked to see that the capacitor across the breaker points has the proper capacitance and the points are properly set. If the vehicle has been driven 30,000 to 40,000 miles or more it is recommended that the distributor cap and rotor be replaced. This will usually not only reduce the ignition noise, but also improve the overall performance of the engine. At the same time have the timing checked and properly adjusted.

When purchasing your new AUTO-LITE resistor spark plugs also buy enough 4,000 ohm-per-foot ignition cable to make up a new wiring harness from the distributor to the spark plugs. Be sure that the new terminals (ferrules) are installed whereby they make **good** contact with the center conductor of the new cable. It is preferred that the ferrules be soldered rather than crimped on as there is danger of a poor contact causing another "noise genertor" to appear.

Check your ignition wiring by shorting out each plug, in turn, while listening to the receiver. Any reduction in the noise level will usually indicate that the ferrules are not making good contact in the distributor head, or the ferrule and center conductor should be soldered.

Install a 10,000 ohm carbon suppressor in the distributor's center terminal and make up a new lead to run to the coil. Here again be sure the ferrules are soldered and are making a "tight" connection inside the coil and distributor. A new lead is recommended here as any breaks what-so-ever in the ignition system's wiring insulation could be a source of "ignition noise." With very short leads connect a .001 mfd disc ceramic capacitor from the coil's battery terminal to the coil's case.

Bonding braid should now be run from the fire wall, coil, and the distributor to the engine. Use as short a piece of braid as possible in each case. If the ground lead of the battery is attached to the fire wall it should be removed and attached to the starter mounting bolt. The power cable ground lead for your transceiver should also be connected at this same point. Usually the hot and ground leads from the battery go direct to the starter's