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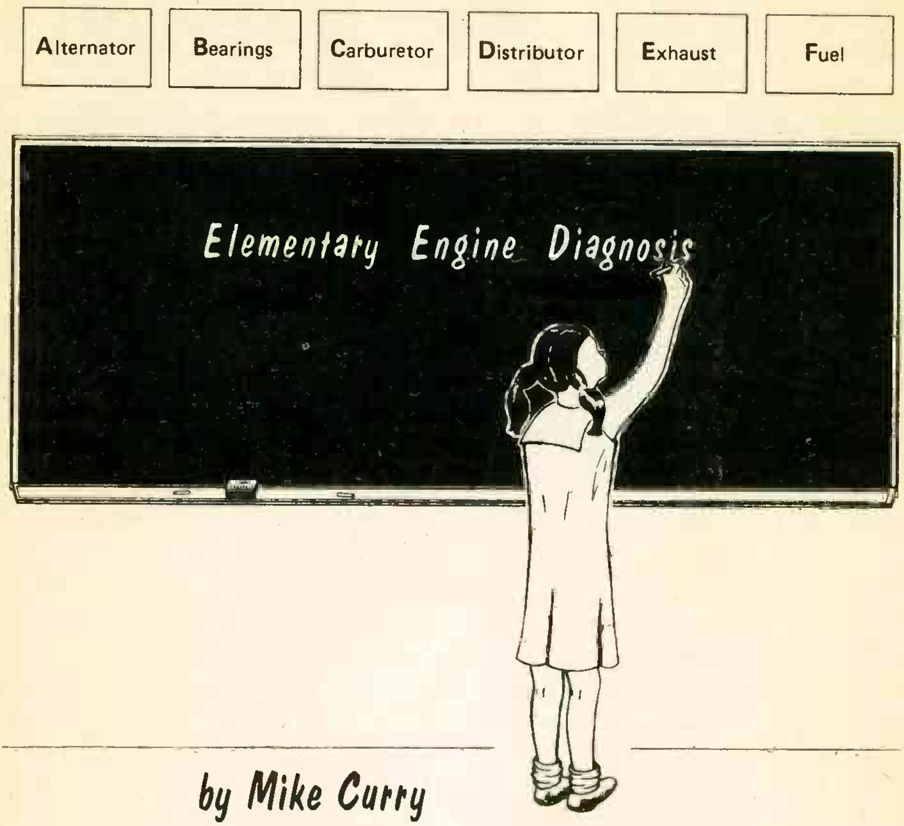


by Mike Curry

At NRI, we receive many letters from automotive students, asking for suggestions on the repair of their vehicles. In the large majority of cases, the person writing does not know what is wrong with the car. Consequently, most of our replies deal with the procedures to follow when attempting to determine the reasons for a loss of power, hard starting, engine miss, and all the other symptoms of engine problems. Most students already know, either from study or practical experience, how to perform a particular test with a particular piece of test equipment. However, if you are going to isolate the direct cause of the malfunction, it is important that you follow an orderly procedure when narrowing down the possibilities. Therefore, this is the question I will address: When your engine won't work right, how do you diagnose the problem with a minimum of equipment?

MAINTENANCE

Ninety percent of all engine problems are brought about by poor maintenance. A quick inspection of the engine compartment should be your first maintenance job. Spot check for oil leaks, coolant leaks, corrosion, loose bolts and belts, and so on.

The most immediately noticeable lack-of-maintenance item is the tuneup. Loss of power, hesitation, occasional engine miss – all are things familiar to most of us. A poor state of tune is harmful to an engine. The spark intensity diminishes, resulting in less complete combustion of fuel in the combustion chamber. This leads to an accumulation of carbon and sludge in the cylinder head and on the spark plugs. The engine has to work harder to overcome the effects of the power loss. Residue begins to accumulate in the crankcase oil. Changing the crankcase oil is the single most important requirement for engine longevity. This point cannot be overstressed. Dirty engine oil is the greatest enemy of reliable, long-term, trouble-free driving. Dirty oil will ruin the bearings, plug the valve lifters, and score the cylinders.

If you have one of the newer cars equipped with electronic ignition, the intervals between tuneups is longer. A few years ago, the 6000 miles between tuneups was also a signal for an oil change. Depending on the engine, this could be the second oil change for the time period. Today, however, it seems that many people are forgetting about the crankcase oil, possibly because of the extended service interval for the ignition. Another point to consider is the proliferation of self-service gas stations. This means fewer checks of the crankcase oil level.

Another factor in engine maintenance involves checking the cooling system. Fortunately, this is an easy task to attend to. Also, those of us who live in areas with cold winters must see to it that the coolant is capable of protecting the engine, or else we couldn't go anywhere during the cold months. But keep an eye on that temperature gauge – if it tends to creep up a little toward the high side, the time has come to flush and refill the cooling system. I have noticed many "Flush & Fill" kits on store shelves. Using one of these kits is a 20-minute job that is well worth the effort.

THE PROBLEM – WHAT IS IT?

Before beginning a repair, it is good practice to *define* the symptoms. Try to have a clearcut perception of what you are attempting to correct. As the driver of the car, you are in the best position to judge the vehicle's performance. Any sudden, noticeable change in the sound and feel of the engine is a sure indication of a problem that must be corrected.

The most common engine problem is the "miss." This was recently described to me as "the engine goes pow-pow-papow." This is as good a description as any, I guess. When an engine misses, one of the cylinders is not firing. This can be due to a number of factors: an ignition problem, a compression problem, improper fuel delivery, and so on. The cylinder that is not firing acts as a sudden additional load. There is a noticeable bump, because the engine block is momentarily out of balance due to the nonfiring cylinder.

Another common malfunction is "engine lopes." This is characterized by a speeding up and slowing down of the engine. It can be extreme – the motor will run up to a peak, and then subside. This usually indicates an intake manifold leak, although bad intake valves can lead to the same symptoms. A faulty carburetor is also frequently to blame.

Engine "shake" is usually caused by bad valves, although the carburetor, as well as the ignition, can contribute to the problem. The engine will quiver like a frightened puppy. There are times when improperly adjusted ignition timing will cause this problem.

Engine "ping" sounds like popcorn popping under the hood. Ping is also known as "spark knock," "detonation," and "pre-ignition." Today, it is most commonly caused by using low-octane fuel. However, advanced timing and carbon deposits can also produce the characteristic noise. Engine ping should be controlled, because it can be very harmful to the block and cylinder head. It can knock holes in the pistons.

Other common problems include overheating, loss of power, hard starting, dieseling, and, of course, mechanical noises. With the exception of mechanical noises, all of these problems can usually be corrected after evaluating the results of standard checks with the basic diagnostic test instruments. Mechanical noises frequently involve worn-out parts, which can mean major disassembly. Some noises, such as valve train tap, can be cleared up by adjusting the clearances.

IMMEDIATE CORRECTIVE ACTION

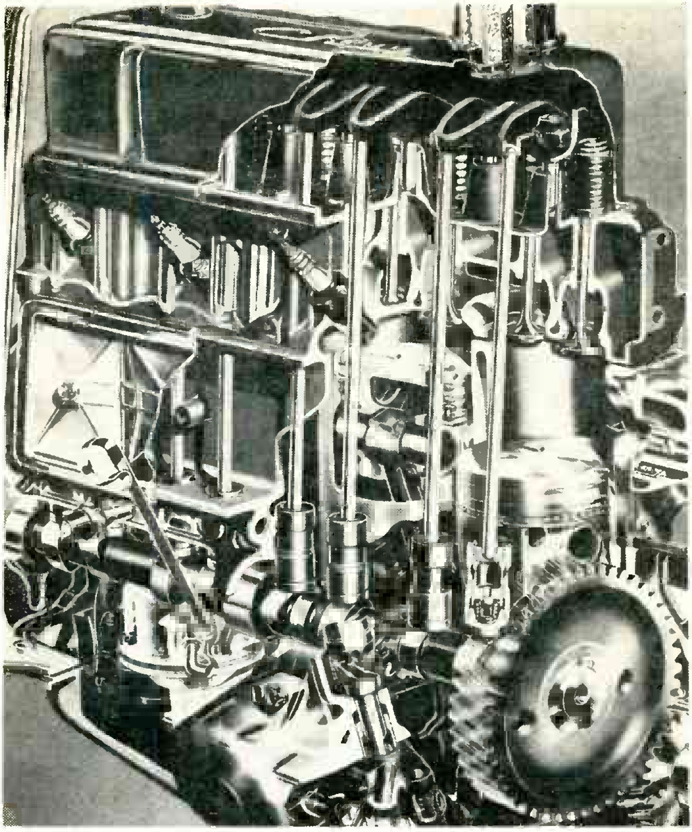
If there is no major problem with the engine, there is a possibility that you can correct the malfunction after visual inspection. There is not that much involved. Simply look for obvious problems. Spark plug wires *do* come loose. Other electrical connections also fail. *Look* for the obvious. Has a wire come off a spark plug? Is the voltage regulator plugged into the alternator? Has a vacuum line come off? Is anything visibly loose? Check the alternator, power steering, and air-conditioner V-belts. Take a good look at all the accessible electrical connections. Shake them, twist them – anything loose should be tightened down. Anything that should be making contact, but is not, should be suspected.

A problem may arise here: How do you know when something should be connected, but is not? Well, look for *clean* surfaces. A plug that has been inserted into a jack, but has fallen out, will be very clean. It will shine and fit very easily into the jack for which it was designed. Usually, it doesn't hurt to make a brief test. You will know by the behavior of the engine whether a "try-out" is the correct connection. If nothing is obviously wrong, then you must proceed to a rundown of the problem, step-by-step.

THE BASICS

The basic principles behind the operation of an internal combustion engine are simple and easy to understand. Within the engine block, a number of hollow cylinders have been bored, and within each cylinder is a piston. The pistons are attached to connecting rods, which are bolted to the crankshaft. As the pistons move up and down within the cylinders, the crankcase is turned and rotary motion is applied to the flywheel, from which power is taken to turn the driveshaft and wheels. At the top of each cylinder bank is the cylinder head, which contains the valves. The valves open and close by means of a mechanical arrangement of pushrods, lifters, and rocker arms. As the valves operate, they allow fuel and air to be drawn into the cylinder on intake, and burned gases to be pushed out during the exhaust stroke. Figure 1 shows the valve arrangement in a four-cylinder engine.

A working engine has four basic functions: fuel intake, compression, ignition (power), and exhaust. These four conditions give the automotive engine the familiar "four-stroke" designation. *Whenever an engine is not working properly, something has happened to prevent one of those four functions.* Therefore, the plan-of-attack is to determine which one (or more) of the four



Courtesy General Motors Corp.

FIGURE 1. VALVE ARRANGEMENT IN A FOUR-CYLINDER ENGINE.

basics is not occurring, and proceed from there to the mechanical or electrical failure that is directly responsible.

A few diagnostic instruments are necessary. These include a vacuum gauge, a compression gauge, a combination dwell and tachometer, a volt-ohmmeter, a timing light, and feeler gauges. In addition, an assortment of hand tools, such as wrenches, screwdrivers, and so on, are needed for the partial disassembly that is inevitable. A crescent wrench and a pocket knife won't get you very far. On the other hand, unless you intend to make a living as a mechanic, there is no need to make a large investment in expensive equipment.

TROUBLESHOOTING PROCEDURE

Let's take our six basic instruments and examine a well-running engine, bearing in mind that we are checking out the four-stroke requirements.

On the intake stroke, fuel delivery occurs. The quickest means of verifying the presence of gasoline at the carburetor is to remove the air horn and look inside the carburetor. When the throttle linkage is operated, either by hand or by pressing on the accelerator pedal, a thin jet of gasoline should spray into the carburetor throat from the accelerator pump nozzle. This tells you two things: There is gasoline in the carburetor float bowl, and the accelerator pump is working. This does not necessarily mean that the carburetor itself is working perfectly, for the main jets are a separate fuel system, and idle is yet another. However, it's a good spot check. If the spray of fuel does not occur, or if it is just a dribble, you would have to disconnect the fuel line at the carburetor.

Before performing this test, make certain that the ignition system is disabled, because a spark could cause a serious fire. The simplest way to avoid ignition sparks is to open the lead from the distributor to the coil by disconnecting it from the coil negative terminal. Also, try to avoid splashing fuel onto the hot engine block and exhaust manifold.

Secure a container of about a pint capacity, and operate the starter, catching the gasoline as it comes out of the line. This should produce approximately a pint of fuel in 30 seconds. To avoid wear and tear on the starter, figure about five ounces in 10 seconds. No fuel, or less fuel, means either a blockage in the line (usually a plugged in-line fuel filter) or a defective fuel pump.

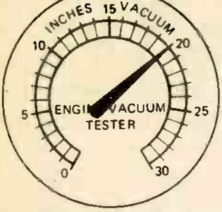
Since this is a well-running engine, let's take a look at the intake manifold vacuum. The intake manifold is directly beneath the carburetor, from where it distributes the fuel/air mixture to the cylinders. Vacuum in the manifold is generated by the downward movement of the pistons during the intake stroke. At this time, the intake valve is open and outside air is rushing down through the carburetor, pulling fuel with it. At idle, the throttle valve is almost completely closed, which prevents the pressure in the manifold from "catching up" with atmospheric pressure. Consequently, there should be about 18 inches of vacuum in the intake manifold, as measured with a vacuum gauge.

A vacuum gauge can be connected to any convenient point. On cars with automatic transmissions, it is usually easiest to disconnect the line going to the transmission vacuum modulator valve, and insert the gauge in its place. Otherwise, one of the vacuum taps for auxiliary systems, such as emission controls, can be employed.

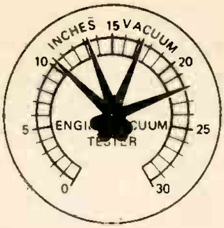
The vacuum gauge reading is an indication of how efficiently the fuel is being used. Vacuum readings can indicate faulty valves, retarded ignition timing, and several other possible problem areas. Refer to the vacuum gauge chart in Fig.2.

The next stage of engine operation is compression. The intake valve has closed, the exhaust valve is still closed, and the piston is moving upward in the cylinder. In theory, the entire combustion chamber is sealed, and pressure within the cylinder will rise to a point determined by the compression ratio. To test the compression pressure, a compression gauge must be threaded into the spark plug hole, or simply held in place by force. The engine is then cranked by the starter motor, and a reading is taken from the gauge. It is easier on the starter if you remove all the spark plugs first, and then check each cylinder.

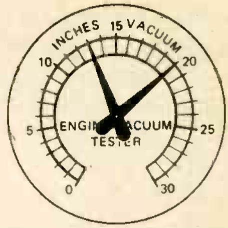
A compression test is an important factor in determining whether you have a major or a minor problem. If the compression is good in all cylinders, you are justified in heaving a large sigh of relief. If compression is low, then you must perform the "teaspoonful-of-oil" test. To do this, you spoon or squirt about an ounce of oil into the cylinder. This oil flows down around the edge of the piston and into the piston rings,



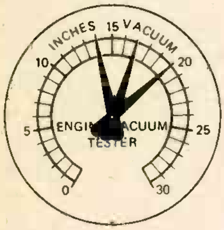
A normal engine will show a gauge reading of 18-22" Hg, with the needle remaining quite steady.



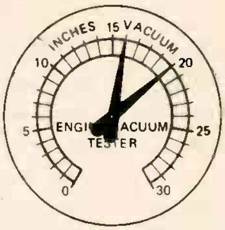
Weak valve springs will cause wide fluctuations of the needle.



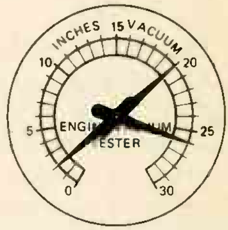
A burned valve will cause the needle to drop sharply each time the valve tries to close.



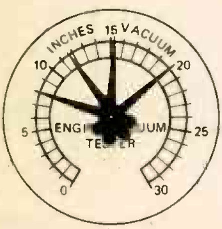
Worn valve guides admit air, which upsets carburetion. The needle will fluctuate slowly.



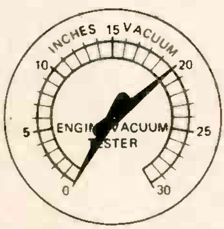
A sticky valve will cause the needle to drop sharply each time the valve tries to close, but not as much as the burned valve.



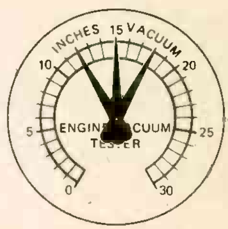
Piston ring defects can be determined by a low reading on the gauge when the throttle is closed rapidly after speeding up the engine.



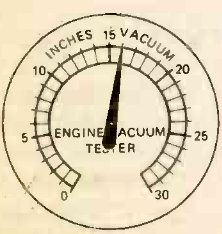
A blown cylinder head gasket will cause sharp drops of the needle.



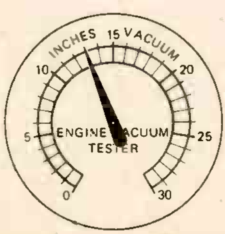
A restricted exhaust will cause a momentary stop to the return of the needle when the throttle is closed quickly.



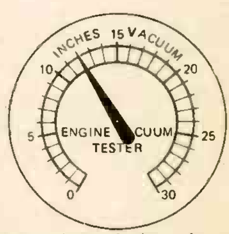
A rich air-fuel mixture on idle will cause the needle to drift back and forth.



Late ignition timing is evidenced by a low but steady reading.



An intake manifold gasket air leak will lower the reading from 3" to 9" Hg.



Late valve timing is evidenced by a low, steady reading, but lower than late ignition timing.

FIGURE 2. TYPICAL VACUUM GAUGE READINGS.

temporarily sealing the rings. With oil in the cylinder, run another compression test. If the compression rises close to the correct level, then the piston rings are bad. If the compression stays about the same, then the valves or valve seats are bad. If the compression is low in two adjacent cylinders, chances are high that the head gasket is blown between the two cylinders. A condition of higher compression than specifications usually means heavy carbon deposits. Any one of these situations is highly undesirable, because it indicates the need for major disassembly. Compression specifications can be found in a specifications chart, such as the Dodge 225 chart shown in Table I.

Now we come to the third phase of operation – ignition. Many books have been written about the ignition system alone, so I do not intend to go into much detail here. As the piston approaches the top of the compression stroke, a spark is generated at the spark plug, and the compressed fuel/air mixture ignites. This leads to a very rapid increase in pressure within the cylinder, and the piston is driven back down with tremendous force. This is where power is generated, and it is probably the most crucial point in engine operation. The idea is very simple; all that is necessary is that a spark occur in the correct cylinder at the correct time.

The ignition system is composed of the distributor, the coil, and the primary and secondary wiring. These are the visible components. Within the distributor are the ignition breaker points and condenser. Cars equipped with electronic ignition will also have the electronic module.

The fastest check of the ignition system is a spark check. Pull off one of the spark cables, and slip the rubber protective boot back until the metal clip is exposed. Holding the cable by the insulation, place the end of the wire approximately 1/8 inch from the engine block. When the engine is cranked with the starter, you should see a bright blue-white spark jump the gap between the cable end and the engine block. As long as the spark is present, it is an indication that the ignition system is functioning. It may not be properly adjusted, but that is what the test equipment is for.

A dwell-tachometer is connected by attaching the leads between ground and the positive side of the distributor. The black (ground) lead can be attached to any convenient point on the engine block, the chassis, or even the negative terminal of the battery. The red (positive) lead goes to the output from the distributor, or the negative side of the coil. On HEI distributors, the "TACH" terminal should be used.

The tachometer function of the meter gives a direct reading of the engine rpm. This reading is important because it is critical that the spark occur at a specific time, at a specified rpm, for calibration purposes. Also, the tachometer is needed to detect small changes in engine speed while adjustments are being made to the carburetor and other areas.

A dwell meter measures the amount of time, in degrees, that the ignition breaker points are closed. Because it is not significant, this reading can be dispensed with in an electronic ignition; the electronic module takes care of the dwell. However, for breaker-point ignitions, it is essential that the dwell be within specifications. The amount of dwell is determined by the breaker-point gap, which is traditionally set with a feeler gauge. As the distributor rotates, small cams on the distributor shaft open and close the points. During the time that the points are closed, current will flow through the points and the primary of the ignition coil. Thus, it is essential that the points be properly

TABLE I

SPECIFICATIONS

SIX-CYLINDER ENGINES

DODGE 225

Type	In-Line OHV
Number of Cylinders	6
Bore	3.40"
Stroke – 225 Cubic Inch	4.125"
Piston Displacement	225 cu. in.
Compression Ratio	8.4 to 1
Minimum Compression Pressure with Engine Warm, Spark Plugs Removed, Wide-Open Throttle	100 psi
Maximum Varation Between Cylinders	25 psi
Firing Order	1-5-3-6-2-4
Basic Timing	Refer to emission control information label on vehicle
CRANKSHAFT	Fully Counter-Balanced
Bearings	Steel-Backed Aluminum with Cast Crank
Main Bearing Journal Diameter	2.7495" to 2.7505"
Connecting Rod Journal Diameter	2.1865" to 2.1875"
Maximum Out-of-Round Permissible	0.001"
Number Main Bearings	4
Clearance Desired	0.0005" to 0.002"
Maximum Clearance Allowance Before Reconditioning	0.0025"
End Play	0.002" to 0.009"
Thrust Taken by	No. 3 Main Bearing
Finish at Rear Seal Surface	Diagonal Knurling
Interchangeability of Bearings	Upper Nos. 2, 4 Lower Nos. 1, 2, 4
MAIN BEARINGS (service)	
All available in Standard and the following Undersizes	0.001", 0.002", 0.003", 0.010", 0.012"
CONNECTING RODS AND BEARINGS	
Type	Drop Forged "I" Beam
Length (Center to Center)	6.697" to 6.701"
Weight (Less Bearing Shells)	26.8 oz
Bearings	Tin Aluminum
Diameter and Width	Dia. 2.1879" Width Cast Crank. 0.715"
Clearance Desired	0.0005" to 0.0025"
Maximum Allowable Before Reconditioning	0.0025"
Side Clearance	0.006" to 0.025"
Bearings for Service	Standard 0.001", 0.002" 0.003", 0.010", 0.012" Undersize
Piston Pin Bore Diameter	0.8995" to 0.9000"

gapped because they control coil current, which in turn controls the generation of the ignition spark.

In checking the dwell, there is an easy rule-of-thumb to use. If the dwell is too low, you must *reduce* the point gap. If the dwell is too high, you must *increase* the point gap. Of course, anytime that you have doubts about the points, it is best to take a few moments to clean them and align the contact surfaces. Some people use fine sandpaper for cleaning, but it is advisable to use a point file because sandpaper leaves a residue.

If a problem is present in the ignition circuits, it is best to use a volt-ohmmeter for checking continuity and resistance. The "volts" section of the meter is used to verify the presence or absence of voltage at any desired point in the circuit. The voltmeter is used with the ignition turned on. The ohms section can be used to trace circuit continuity. The ohmmeter is always used with the ignition turned off. Any breaks, short circuits, or high resistances will show up on the ohmmeter.

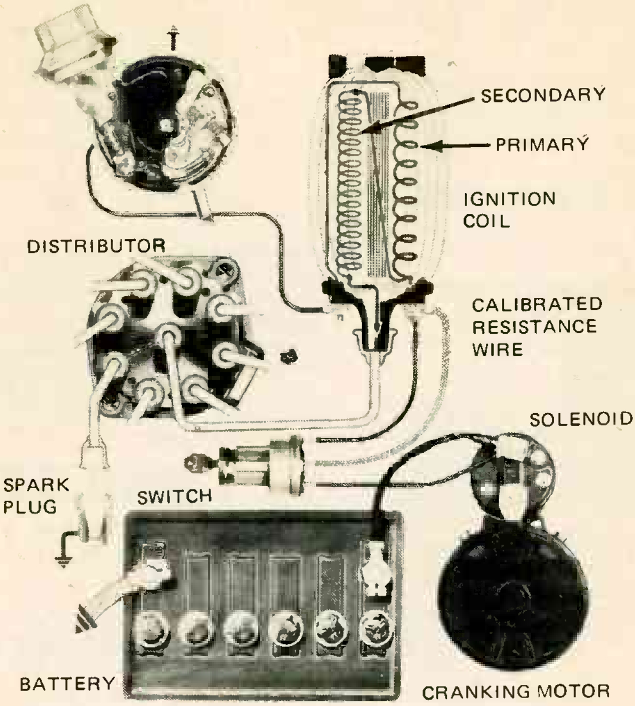
The distributor breaker points are a type of switch. There should be no resistance through the points. Connect the voltmeter to the ignition coil primary windings, on the negative side. If you trace the wiring carefully, you will find that this is electrically the same point as the positive side of the breaker points, for there is only a wire between the two connections. Turn on the ignition, but don't start the engine.

When the breaker points are open, there should be a voltage reading of 12 volts with the above hookup. With the breaker points closed, the voltage should be zero. If the voltage is not 12 volts with the points open, then there is a short circuit between ground and the positive side of the points, usually caused by a bad condenser or careless wiring. Wires within the distributor should not be touching the metal part of the distributor. On the other hand, if there is not a reading of zero volts when the points are closed, then there is a bad connection, resistive points, corroded wire, or a broken wire. The engine might be able to operate in this condition, but it will not be at its best. An effort must be made to clear away any uncalled-for resistance in the wiring.

The only wiring left in the primary ignition circuit will be the coil itself, the ballast resistor, and the ignition switch. These parts are all in series, as shown in Fig.3, so the failure of any single component will disable the rest. Continuity through the coil can be checked with an ohmmeter, as can the continuity of the intervening wiring.

The last ignition relationship is the timing, for which you need a timing light. Retarded timing will cause engine overheating and a loss of power. Advanced timing can lead to pinging, which can produce damage to the pistons and cylinder head. An important factor in setting the timing is to make certain that the engine is timed at the correct rpm. This does *not* mean that you set the rpm, adjust the timing, and then you're done. Rather, you must go back and make sure about the rpm. Every time that the timing is changed, there will be some effect on the engine speed. Timing rpm is specified in order to avoid the possibility that the distributor centrifugal advance weights might be activated. The vacuum advance line should be disconnected and plugged at the carburetor, but you should avoid engagement of the centrifugal weights by keeping the rpm down.

The only major area remaining is the exhaust. Fortunately, exhaust problems are usually visible, or they show up in the vacuum tests. The major problem here is burned exhaust valves, and the vacuum gauge will show this clearly. Otherwise, poor acceleration and power



Courtesy General Motors Corp.

FIGURE 3. TYPICAL IGNITION SYSTEM CONSISTING OF A BATTERY, IGNITION SWITCH, IGNITION COIL, DISTRIBUTOR, SPARK PLUGS, AND WIRING.

is the sign of blocked exhaust. Also, damage to the exhaust line is almost always visible. There are exceptions – catalytic converters can become clogged, as can mufflers. However, most exhaust problems can at least be heard, if not seen. Exhaust manifold leaks can produce an intermittent miss, because of uneven cylinder scavenging. Depending upon the severity of the leak, the noise of an exhaust manifold leak can vary. It can be a high-pitched snapping noise, almost like a valve tapping, but as the leak gets larger the tone gets lower.

These have been the basic areas of engine problems, and how to approach them. In later articles, I will look at specific problems in greater detail.

ABOUT THE AUTHOR

For over a year, Mike Curry has been the Senior Small-Engine Instructor for NRI. However, as a certified mechanic, he feels equally at home with automobile engines. Because of recent staff changes, Mike will be undertaking additional consultation duties in the automotive area.

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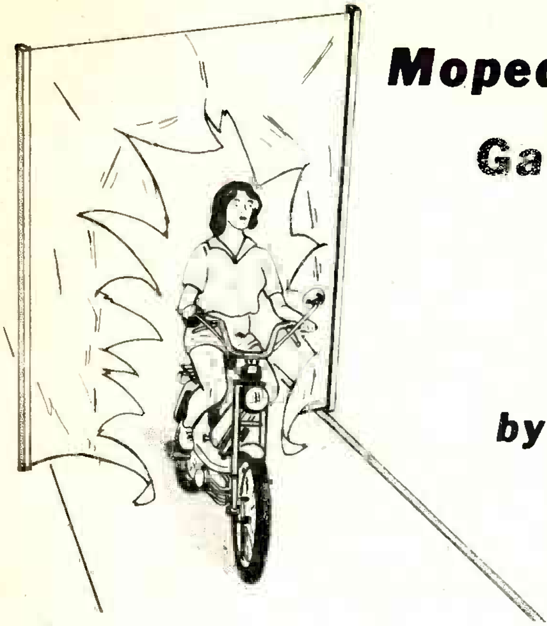

Mopeds: The Little Gas Savers

by Elspeth Root

Are mopeds here to stay, or will they disappear when the gasoline shortage eases? I left the NRI headquarters building the other day thinking about this question. As I crossed the street, I dodged a moped carrying a young man with a tennis racquet. Three other mopeds passed me before I had walked to the end of the block. At the end of the block, I noticed a new store just opening up in an expensive office building. It had a showroom packed with shiny new Vespas.

That short trip is not a very complete sample, and mopeds were only a small part of the total traffic count. But I'm convinced that mopeds are here to stay.

A whole new group has discovered that it's a lot more fun to travel on two wheels rather than four. Many of them may graduate up to small motorcycles and then perhaps to larger ones. But I think a lot of them will be content with the speed limitations of the moped, along with its light weight, convenience, gas economy, and freedom from restrictive regulations. Add low cost and easy maintenance to that list, and you can see that a moped has a lot of advantages going for it.

In recent years, mopeds of many different makes have hit the American market. Most of them are dependable machines. They have already been proven by many years of use in the European or Asiatic markets. There isn't as much variation between these makes as you might expect. In this country, mopeds are designed to conform to federal and state laws. These low-power, low-speed machines are exempt from many of the safety requirements set up for motorcycles.

WHAT'S A MOPED?

A moped is a cross between a small motorcyle and a heavy bicycle. To run it by pedal power is possible – but not easy. A moped has a small motor, but it obviously doesn't need the same safety equipment required for the heavier and speedier motorcycles. In 1974, the National Highway Traffic Safety Administration decided that a moped was neither a bicycle nor a motorcycle and established a separate category for it. Each of the states then got into the act, and passed specific regulations concerning mopeds. The restrictions vary somewhat from state to state, and a moped sold in a particular state will have a motor at, or slightly below, the maximum size and a gear ratio that will maintain the maximum allowable speed with that motor.

The result of these regulations is a little machine that usually looks like the one pictured in Fig.1. It features a small engine – under two horsepower in this country. Most have only one speed, although some have two. Shifting is automatic. A typical moped has a centrifugal clutch and a magneto ignition system like the one in your lawnmower. All controls are operated by cables from levers on the handlebars.

A moped is not a high-speed machine. The 1 hp mopeds are capable of only about 18 to 20 miles per hour. A 1-1/2 hp moped has a maximum speed of about 25 miles per hour and a 2 hp machine will have about 30 miles per hour as its top speed. These speeds, of course, are quite dependent on road conditions and the load you are putting on the moped.

There are many types of mopeds. Some have the engine mounted over the front wheel, with power applied to the front wheel through a friction drive. Some are electrically driven and depend

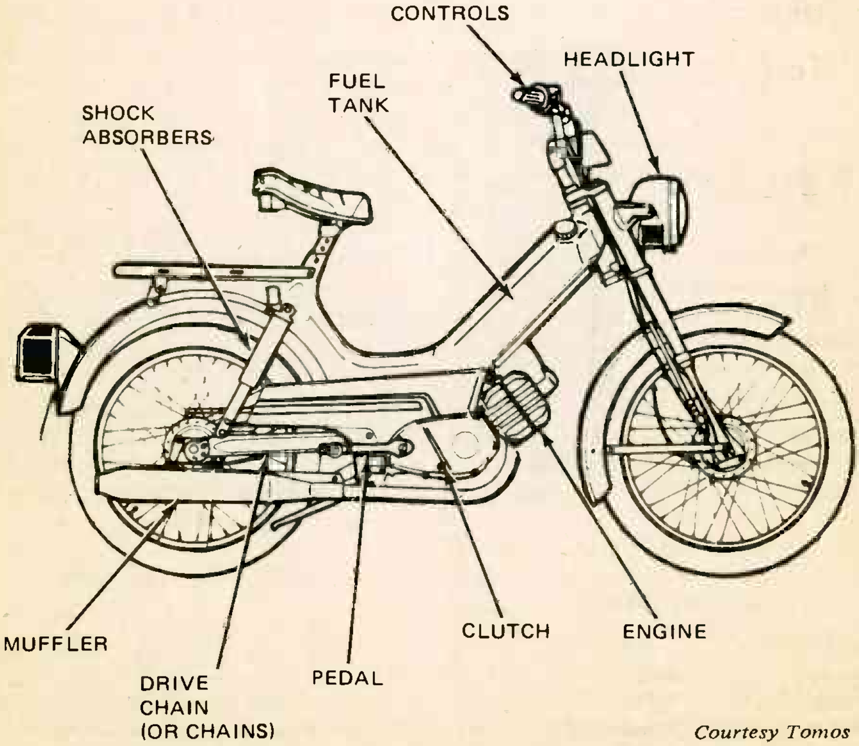

FIGURE 1. OVERALL APPEARANCE OF A TYPICAL MOPED.

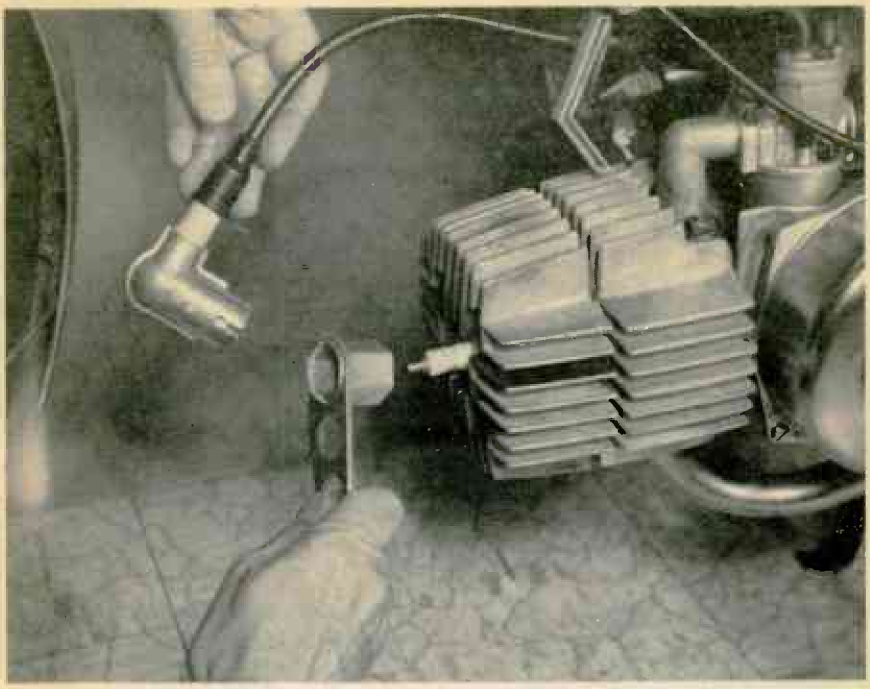

FIGURE 2. USING A MULTI-PURPOSE WRENCH FOR MAINTENANCE.

on a rechargeable battery pack. There are tricycle mopeds, mopeds with side-cars, and mopeds styled to look like little motorcycles. There is at least one with a liquid-cooled engine and one folding model.

Whatever the type, it is easy to keep a moped in top operating condition. You will find that many maintenance steps can be performed by the owner. Mopeds are usually provided with a set of hand tools. Some part of the multi-purpose wrench should fit any nut or bolt on the machine, as shown in Fig.2. Brake linings can be checked through inspection holes in the wheel hubs. Brake cables and other control cables can be tightened by turning adjustment nuts. Lubrication of the moped, including chain lubrication, should be part of a regular service schedule. The owner should check tightness of bolts and operation of controls regularly. More complicated repairs can be performed with the help of a service manual, or by a qualified small-engine technician.

CONSTRUCTION OF MOPEDS

The quality of the ride given by these little gas savers varies. Some have a "no-frills" pressed steel frame. They give a ride comparable to a heavy, balloon-tired bicycle. On anything other than a very smooth, paved city street, this kind of model will give you a lot of that old feel-of-the-road. This kind of frame is sturdy, inexpensive, and relatively light.

Dual hydraulic shocks mounted on swing arms at the rear and a spring-loaded telescoping front fork make for a much softer ride. Combine these with a reasonably soft saddle and you will have a ride comparable to a full-sized motorcycle. When choosing a moped, look for a seat adjustable for both height and angle, as well as adjustable handlebars.

MOPED ENGINES

Typical mopeds have single-cylinder, two-cycle engines as shown in Fig.3. Almost all states limit the moped to an engine with 50 cc displacement, although some allow engines with 60 cc displacement. Some states limit mopeds to 1 horsepower or under, while many allow 2 hp mopeds. Some states have special inducements for the lowest powered mopeds. For example, a moped of 1 horsepower or under may not even need to be licensed, while one a bit larger may need licensing. Most manufacturers make mopeds with engines ranging between 1 and 2 horsepower. This is large enough to reach the speed limit in most communities.

Like all other two-cycle engines, the moped engine is fed gasoline mixed with oil. The only lubrication between the moving parts in the cylinder is provided

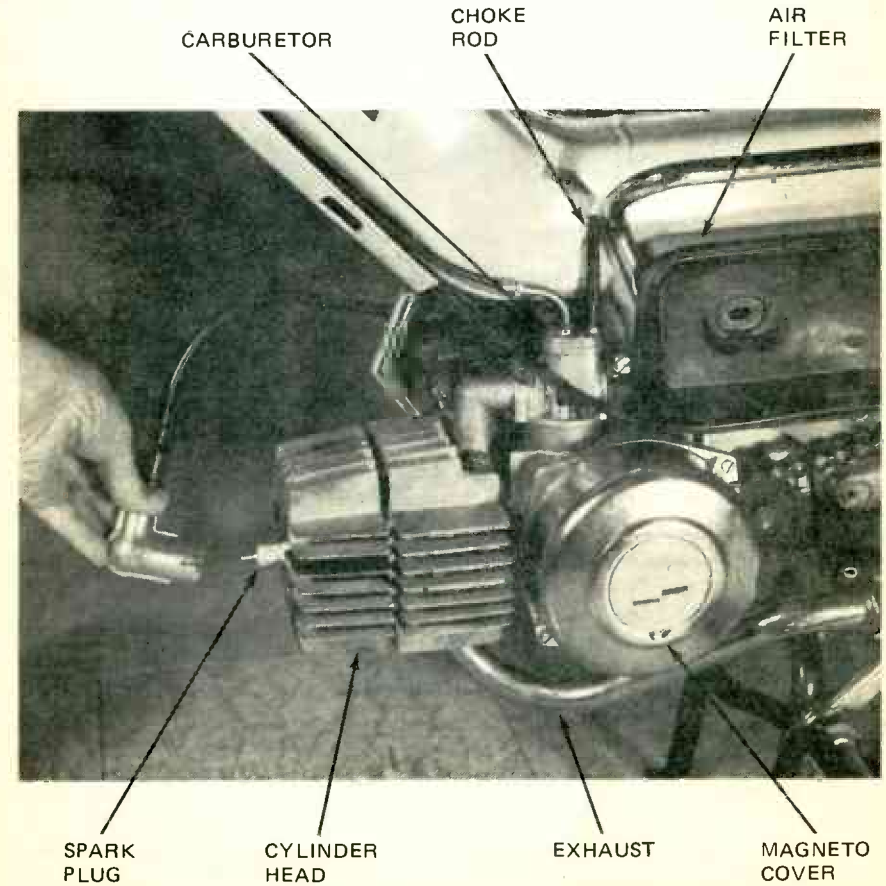

FIGURE 3. VIEW OF THE MOPED ENGINE AND CARBURETOR.

by this oil. It is therefore critical to keep a little gasoline flowing into the cylinder, even when the machine is coasting downhill.

A two-cycle engine has no valves to require service. The engine is air-cooled so no external cooling system is needed. The engine has one spark plug of a size that is now quite readily available. In all two-cycle engines, soot builds up on the piston heads and at the head of the cylinder, including depositis on the spark plug itself. The carbon deposits should be cleaned out periodically.

FUEL SYSTEM AND CARBURETOR

The fuel for a moped is leaded gasoline mixed with two-cycle oil. Mixing is usually done in a can, but some mopeds now have an oil injection system. This amounts to an oil reservoir with a manual plunger for injecting the right amount of oil.

Air is admitted to the carburetor through an open mesh filter. Maintenance of the air filter includes shaking or washing out the dirt, and lightly oiling the outer surface to improve pickup of very fine particles of dirt. It doesn't take much to plug the tiny passages in the carburetor. If you are riding your moped in dusty areas, be particularly careful of air-filter maintenance.

There is also a tiny filter in the fuel line. It should be inspected and cleaned occasionally. You can prevent trouble by using a strainer while filling the tank.

The moped carburetor is a relatively simple one. This is fortunate, for you will probably find you have to clean it out once or twice, If the moped has been allowed to stand unused for a while with gasoline in the tank, the tiny passages in the fuel valve and carburetor are likely to be plugged with gum. If this happens, there just isn't any way of getting the moped back on the road that is as good as taking the carburetor apart and cleaning it thoroughly. If dust particles have bypassed the air filter, the same job is probably called for. A service manual for your specific moped will thoroughly explain maintenance jobs like this one.

EXHAUST SYSTEM

The exhaust system is another source of occasional problems in the moped. The exhaust gases are normally somewhat acid, which is hard on the muffler. Some mopeds try to get away from this problem by using corrosion-proof materials. Others count on eventual replacement of the exhaust system. Don't try to operate the moped without its muffler connected. Not only is this illegal, but the motor generally operates better with the properly designed exhaust pipes.

Since the engine should be decarbonized about every 2000 miles, this is a good time to clean out the exhaust pipes. The muffler has to be removed anyway in order to get to the exhaust port. Again, your owner's manual will explain how to clean the exhaust system.

IGNITION SYSTEM

The one spark plug of a moped is fired by a magneto instead of a battery. For those who are not familiar with small engines, a magneto is a small generator that can be operated manually. A magneto coil placed in the field of a moving permanent magnet generates sufficient electricity to fire the spark and to power the lights and horn. The magneto contains a pair of

FIGURE 4. APPROPRIATE SAFETY EQUIPMENT SHOULD BE WORN.

breaker points or an electronic breaker circuit similar to the breakerless ignition systems in automobiles. We can expect that the electronic ignitions will take over in the next few years. Until this time, the timing and gap of the breaker points can be checked much as you would check them in an automobile. A line scribed on the magneto flywheel should line up with a mark on the crankcase at the moment the breaker points begin to open. In some mopeds, the points can be observed without pulling the magneto cover off its shaft. This is a definite help in maintenance. You will probably want to have a service manual for the moped before making this adjustment.

The lights and horn of mopeds are inferior to motorcycle systems because the magneto simply cannot supply sufficient power to meet motorcycle standards. This is not too much of a problem because of the low speed of mopeds. A compressed-air horn can be mounted on the handlebars as an accessory, if the weak horn worries you. A safety helmet, like the one shown in Fig.4, is a good idea, too.

As noted earlier, all two-cycle engines tend to produce soot and carbon deposits, which may bridge the spark plug electrodes. The spark plug should be removed and inspected at least once every 1000 miles of use. Cleaning and regapping can keep the spark plug in service.

CLUTCH AND TRANSMISSION

Almost all mopeds have centrifugal clutches. Two-speed machines have an additional secondary clutch for automatic shifting. Most manufacturers employ a wet clutch system, with the clutch and gears immersed in transmission fluid or ordinary engine oil. The level of oil in the gear box should be checked regularly, and the oil should be replaced about every 1500 miles. Instructions in your owner's manual on changing "engine oil" refer to this use of oil. The two-cycle engine does not have a lubricating system apart from the oil mixed with the gasoline.

CHOOSING A MOPED

A moped is a very personal machine, and you will have to think about the way you plan to use it before you decide which one is for you. Cost will be an important consideration, of course, while you are comparing simple machines with machines that have more comfort and accessories.

The quality of the ride as described above is important, especially if you plan to make long trips. But a lightweight, easily lifted machine may suit your situation better.

Within the legal limits that hold in your state, horsepower will be an important criterion in the choice. A heavy person or a person who plans to carry fairly heavy loads may want to have more than the basic 1 hp engine. A larger engine certainly causes less irritation for drivers behind you on streets with fairly high speed limits. For maximum gas mileage, though, pick the smaller engine.

In a very hilly area, I would be inclined to pick a two-speed model in spite of the additional complexity and cost. Two-speed machines have two centrifugal clutches. However, they are normally trouble-free and they certainly aid hill-climbing. For comparison, a 1 hp, one-speed Puch claims ability to climb a 9% grade, while a 2 hp, two-speed Tomos claims that it can manage a 20% grade. Especially if the moped is to be heavily loaded, the two-speed machine would be a great convenience if your streets are like roller coasters.

For me, the reputation of the moped for dependability and the availability of service by a truly competent small-engine technician may be the most important factors in choosing a specific moped. Look for an adequate owner's manual, too. Last but not least, a shop run by an NRI graduate is a good place to start a search for exactly the right moped.

If you are interested in small engines you might find the expanding field of moped repair a rewarding hobby or business.

ABOUT THE AUTHOR

Elspeth Root is a technical writer and development engineer who specializes in electromechanical systems. She helped to prepare the new NRI Appliance Repair Course, and developed the Action Locator for the NRI course in Small-Engine Repair. A long-time moped owner, Elspeth finds that she doesn't enjoy her moped as frequently as she'd like, since everyone else in the family wants to ride, too.

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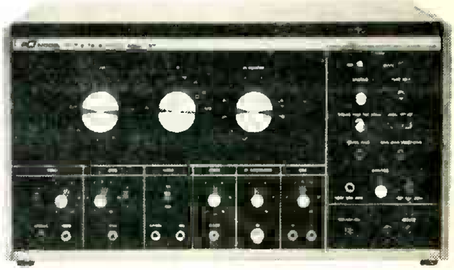

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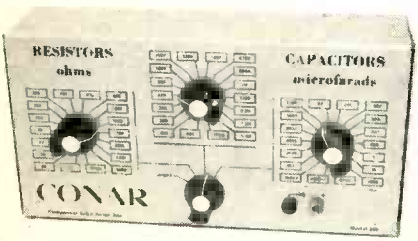

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CB SERVICING NOTEBOOK

NAME *Harold Kinley*

DATE *September 1979*

SUBJECT *Case Histories*

CB radio servicing is never dull! I get several sets to repair every day, and although there are similarities in the actual defects, each case has its own peculiarities. Many times I fix a defect only to uncover other problems that had been masked by the major defect. This can get quite costly!

PACE CB166

The customer said that someone had given him this radio, so he wanted me to check it out to see if it would work properly. The microphone was missing and the radio was wet and muddy. In addition, the squelch control shaft was bent. It appeared that the radio had been dropped face down into the mud!

I set the unit up on my workbench and hooked up a microphone to the set. With the set on channel 15, I fed a signal into the transceiver to check the receiver operation. With the signal generator set to the 1 μV level, there was no sound from the speaker and no indication on the "S" meter. I kept cranking up the output from my signal generator until I finally heard the modulated signal coming through the set. The generator output was now at 300 μV. The receiver's sensitivity was quite poor, to say the least!

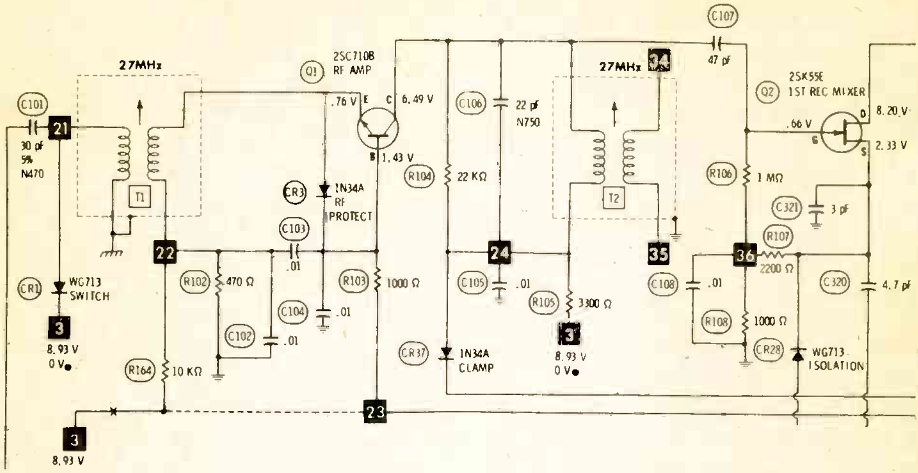
So much for the receiver. Next, I turned my attention to the transmitter. Upon keying the microphone, I found that the transmitter had no measurable power output. This was beginning to look like an expensive repair job!

I removed the cover from the set and decided to start troubleshooting the transmitter first. My first thought was to use my rf probe to check the rf level at various points in the transmitter. I planned to check first at the driver transistor. When I had located this transistor I noticed that a choke coil next to it was literally burned up! This coil is in the collector circuit of the driver transistor. I removed the coil (in pieces) and had to construct one to work in its place. I had some small gauge wire (enameled) on hand from a junked transformer, so I carefully wound about 25 turns around a cotton swab. I really wasn't sure just how this would work, but I would soon find out!

I installed the coil in the set, but before applying power I figured I had better try to find out what had caused the first coil to burn up or the same thing might happen again. A high percentage of choke failures like this are caused by the failure of the transistor with which the choke is associated. In this case the choke was connected to the driver transistor, so I removed it from the circuit and checked it on my transistor tester. There was an emitter-base short as well as a collector-base short. I replaced the transistor with a 2SC1760 that I had on hand. I then applied power and keyed the transmitter to check the results. The transmitter was putting out 5 watts now. Since this is over the 4 watt limit, I retuned the final stage for around 3.6 watts. I adjusted the set to 3.6 watts instead of the maximum 4 watts because the output leveling across the band was nearly equal at the level of 3.6 watts.

This took care of the transmitter, so I turned my attention back to the receiver. With a very strong modulated signal fed into the receiver input (300 μV), there was only a faint sound from the speaker and only a slight "S" meter indication. From past experience I knew that more often than not this symptom is caused by trouble in the rf amplifier stage.

Figure 1 shows the rf amplifier of this transceiver. Transistor Q1 is connected as a common-base amplifier. The base is placed at rf ground by capacitor C104, a 0.01 μF capacitor. The input is applied to the emitter and the output is taken from the collector across the primary of transformer T2. You will notice that the secondary of T2 is not connected. There is a good reason for not using the secondary of transformer T2 to feed the following mixer stage: The following mixer stage uses an FET transistor. As you may know, an FET



Courtesy Howard W. Sams

FIGURE 1. RF AMPLIFIER OF PACE CB166.

transistor has a high input impedance. So the low impedance secondary of T2 can't be used to feed the high impedance input of Q2. This brings up another point. Transistor Q1 is connected as a common-base amplifier in order to give a high output impedance at the collector. Of the three basic transistor configurations (common-emitter, common-base, and common-collector), the common-base amplifier has the highest output impedance.

Anyway, I suspected Q1 of being the troublemaker. With a very high signal level fed to the receiver input, I used my signal tracer to check the amplifier. First I touched the probe of the tracer to the emitter of Q1, then to the collector of Q1. There wasn't much difference in the signal level at the two points. Apparently Q1 wasn't amplifying.

I thought the transistor was probably defective, so I made some voltage measurements on the transistor. All the voltages were just about right; there were no significant deviations from the voltages shown on the schematic. I then removed the transistor to test it on my transistor checker. It checked good. Before reinstalling the transistor I decided to check diode CR3 (the rf protect diode). I removed the diode from the circuit, and the checker revealed that the diode was borderline (too much leakage). Leaving the diode out temporarily, I reinstalled the transistor in the circuit and reapplied power to see if the receiver would work. The receiver was working fine now, so I figured the diode was the problem.

To double-check, I temporarily connected the diode back into the circuit, expecting it to kill the receiver. To my surprise, the receiver still worked with the diode connected! What caused the receiver to start working? All I had done was to remove Q1 and CR3 and reinstall them in the circuit. I have run across cases in which heating the leads of a transistor would "cure" a defective transistor, usually for only a short period of time. Also, the type of transistor tester I use is the simple curve-tracer type. The tracer applies an ac voltage through the transistor junction being tested. On one alternation of the ac voltage the junction conducts, while on the other alternation the junction does not conduct (if the junction is good). What happens is this: On one ac alternation the horizontal sweep input to the scope is killed, while on the other alternation the sweep is present. At times I have noticed that the ac voltage applied to a semiconductor junction will seemingly cure certain types of defects. Apparently in this case either the diode or the transistor was "cured" by heat either from the soldering iron or from the voltage applied through the transistor tester.

On general principles I decided to replace both the diode and the transistor. After installing the new transistor and diode, I proceeded to run a complete performance check on the radio. Having satisfied myself that all was well, I installed the cover on the set and wrote out the ticket.

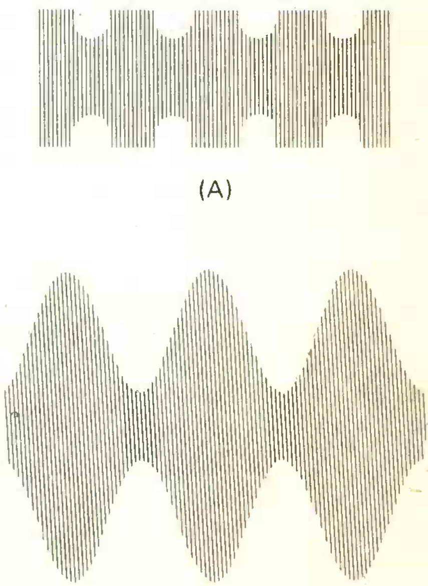
ALAN K350B

The owner of this set left it with my wife without giving many details about the complaint. I hooked the set up on the workbench to run a performance check. When I keyed the microphone the power meter indicated 4 watts. I then whistled into the microphone to check the modulation. The modulation pattern looked absolutely terrible! See Fig.2(A).

I checked the Sams index but could find no listing for any Alan radios at all. I then looked long and hard through my Sams manuals to try and find a set like the Alan, but came up with nothing. Working without any service information isn't my favorite pastime, but I decided to have a go at it anyway.

I had already checked the modulation and found it to be almost nonexistent, so I decided to check the audio output power on my B & K 1040 CB Servicemaster. I did this by feeding a strong modulated signal into the receiver input and feeding the receiver audio output from the external speaker jack to the B & K "receiver audio" terminals.

By the way, if you don't have an audio power meter you can make a simple one for CB use. Paralleling four 33 ohm, 2 watt carbon resistors gives an 8 ohm load rated at 8 watts. By measuring the audio voltage across the load, you can calculate the audio power from the formula $P = E^2/R$. At 1/2 watt audio the voltage will be 2 volts



(A)

(B)

FIGURE 2. MODULATION PATTERN AT (A) WAS BEFORE REPAIR. PATTERN AT (B) WAS AFTER REPAIR.

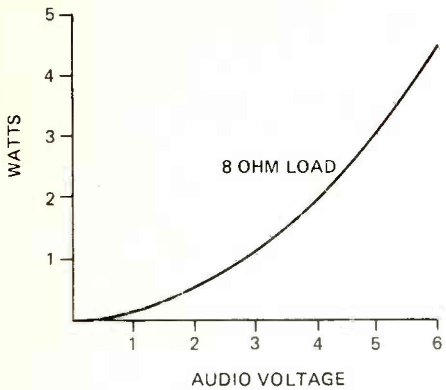


FIGURE 3. AUDIO VOLTAGE VS AUDIO POWER FOR AN 8 OHM LOAD.

across 8 ohms. Using the formula we can see that $P = 2^2/8 = 4/8 = 0.5$ watt. To simplify matters, you could make up a graph of voltage versus power like the one in Fig.3.

Anyway, getting back to the business at hand, the audio power meter showed that the unit was only capable of approximately 0.1 watt at full volume. I checked both audio output transistors and found one of them to be defective. This was a 2SC1096 type of transistor. I had some of these in stock, as this is a very popular type of output transistor.

Both audio output transistors were mounted on a heat sink. I had to unsolder both of the transistors from the circuit board in order to remove the heat sink with the transistors attached. I couldn't get my screwdriver on the screw that holds the transistor to the heat sink without removing the heat sink first. I installed a new 2SC1096 on the heat sink in place of the bad one and then reinstalled the heat sink in the radio. After carefully soldering the transistor leads back to the proper points on the circuit board, I rechecked the modulation and audio power. The modulation looked as bad as before!

Next, I took a close look at the audio output/modulation transformer. It showed signs of having been very hot at one time. I removed the transformer from the radio to make some resistance checks on the various windings. The transformer had a center-tapped primary and two separate secondaries. The ohmmeter showed that the two secondaries had a dc resistance of around 1/2 ohm. This was normal. Resistance checks on the primary showed that from the center tap to one side of the winding there was a resistance of approximately 1 ohm. From the center tap to the other side of the winding the resistance was only 0.1 ohm.

This was a good indication that the transformer was indeed defective (probably shorted turns). I didn't have an exact replacement for this transformer, but I found one in a junked set that I thought might work. I measured the resistance of the windings on the transformer from the junked set. The primary resistance was 1 ohm from the center tap to either side, and both secondaries were around 1/2 ohm! The junked set from which I removed the transformer also used 2SC1096 transistors in the output, so the transformer should match up very well with the Alan radio.

After installing the transformer in the Alan set I rechecked the modulation. This time the modulation pattern was excellent. See Fig.2(B). The audio power meter now showed the set to be capable of 5 watts audio output. This would be a little over 6 volts of audio ac across the 8 ohm load. A distortion check showed about 6% distortion at 3 watts, very acceptable. This completed the repairs. The total cost of the job came to $21.95, including the used transformer.

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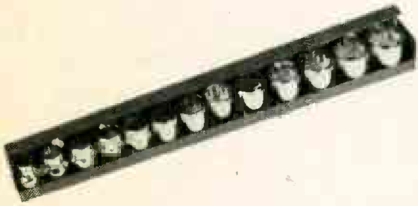

A complete metric 3/8" drive socket set. This quality set is drop forged, chrome plated, and has a handy metal tray to keep the set together. All metric sizes from 7mm through 19mm.

Metric Ratchet Socket Set

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Stock No. TO272

This 3/8" drive combination ratchet socket set has a 200mm ratchet handle, a 75mm extension, and a spark plug socket. Contains 6 pt. sockets (9mm, 10mm, 11mm, and 12mm) and 12 pt. sockets (14mm, 17mm, and 19mm). This set is triple chrome plated, drop forged, and rustproof.

MECHANICS TAKE NOTE!

All General Motors "X-body" cars are metric, and by 1982, all other body types made by GM will be metric, too. Check your tool boxes and be prepared!

Honors Program Awards

In the tradition of NRI's pursuit of excellence in training, the following graduates who earned NRI diplomas in May and June also earned unusual recognition under the NRI Honors Program. On the basis of their grades, these graduates distinguished themselves by earning the right to honors listed below, in addition to their regular NRI diploma. This distinction is made part of their permanent NRI record.

WITH HIGHEST HONORS

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John Agius, Toronto ON CANADA
John W. Barnes, Jr., Crane IN
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Robert Chandler, Columbus OH
Walter Ralph Conner, Richmond VA
Florence V. Corbin, McVeytown PA
Ronald Clarence Cornett, Hampton NE
Robert Eugene Craig, Cherokee IA
Michael Richard Davis, Tucson AZ
James F. Edgerton, Houston TX
Jack Fortner, Carson City NV
Daniel Joseph Fouch, Traverse City MI
Basil John Gilger, Charleston NC
Ronald D. Henderson, Fort Lauderdale FL
Ellis Acey Hines, Norfolk VA
James F. Houlette, San Diego CA
Dexter C. Hutchins, Bethesda MD
Henry M. Kendall, Westland MI
William E. Larrison, Heath OH
Charles W. Lasley, Richmond VA
Frank T. Lazarchick, San Diego CA
Jerry L. Lohr, Navarre OH
Orville C. Long, Sprague WA
Ronald P. Maslana, Westchester IL
Myron L. Metcalf, Winlock WA
Dennis Wayne Miller, Taneytown MD
Harry J. Palen, Jr., Forestport NY
E.G. Patterson, Schefferville PQ CANADA
Jess L. Walker, Jr. Valdosta GA
Frederick R. Wunder, Oak Park IL
Millard Zimmerman, McBride BC CANADA

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Richard Allen Abbott, Coolville OH
Harlow G. Ackerman, Port Hueneme CA
Delbert Henry Amala, Aloha OR
Alfred Lee Anderson, Putnam Valley NY
Wallace Ray Anderson, Tavernier FL
Rick J. Aymong, APO New York
Robert D. Baldwin, Wheatland MO
Michael E. Banko, FPO Seattle
William Donald Barcelo, New Orleans LA
Dwayne Martin Barcus, Little Rock AFB AR
Hal S. Barrett, Decatur GA
Peter J. Bartolo, Wareham MA
James L. Beauchamp, FPO New York
Michael A. Beaudoin, Seneca SC
Jerry Fred Bellamy, Bloomfield IN
Harvey W. Berning, Cleves OH
Omar E. Bibbs, Kingston NY
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Richard H. Blomquist, Pasadena MD
John C. Bockman, Milford IA
Richard J. Boudreaux, Franklin LA
James D. Brewster, Irondale MO
Stephen R. Briggs, Falls Church VA
John Robert Brogan, Boise ID
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Joseph A. Bush, Miller Place NY
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Joseph Paul Carpenter, Polkton NC
Bryan Ward Chambers, St Ann Jamaica
Robert Keith Chambers, Charlotte NC
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George L. Childers, Louisville KY
Buck Childress, Lapine OR
Charles A. Chrysler, Hollywood FL
Elmer H. Church, Brownville NY
James H. Clark, Henryville PQ CANADA
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Paul Diaz, APO New York
James S. Dixon, Kirby TX
Leonard H. Doke, Tucson AZ
Joseph Doskis, Brooklyn NY
Lawrence W. Duff, Jr., Memphis TN
Donald W. Duncan, Idaho Falls ID
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Peter L. Eherman, Santa Cruz CA
John A. Ellis, Jr., Hudson MA
Glen A. Erickson, Perry OH
Bruce Farquhar, St. Johnsville NY
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Paul Ronnie Fesmire, Lexington TN
Ernest Victor Filewood, Salem OR
James Melvin Fizer, Thayer IA
James Larry Flowers, Mary Ester FL
Kevin Michael Gade, Edwards AFB CA
Baldemar Garza, Corpus Christi TX
Robert Gershwin Glass, FPO San Francisco
Samuel L. Goldberg, Baltimore MD
Robert N. Griffith, Tampa FL
Roger Lee Gugel, Santee CA
Jesse C. Gunn, Mortons Gap KY
Fritz Gusmer, Clover SC
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George W. Hall, Carol City FL
Wayne Edward Hall, St. Joseph MO
Larry D. Hamm, Sumter SC
Ben Lee Harned, FPO New York
John T. Harrington, Lewiston NC
Lawrence R. Harris, Wolf Point MT
Donald C. Harrison, K. I. Sawyer AFB MI
Edward V. Heinssen, Jr., Lake Grove NY
Mark A. Hetzel, Westover AFB MA
William H. Hicklin III, Orangeburg SC
Chester Charles Hill, Shepherdstown WV
Raymond A. Hiller, Jr., Mattituck NY
Martin Hofmarks, Surrey BC CANADA
Ronald Hoggard, APO New York
Michael George Jenkins, Blue Springs MO
C.T. Jewell, Coronado CA
Walter L. Jewell, Corry PA
Jack Eugene Jones, Woodbridge VA
Glen Rhea Joyner, Kingsport TN
Adolphus C. Justice, Richmond CA
Daniel E. Kaufman, West Salem OH
Charles Edward Ketner, Sault St Marie MI
Wayne E. King, Tinker AFB OK
Brian C. Kissling, West Yarmouth MA
Miroslav F. Kolousek, Winnipeg MB CANADA
Robert W. Kreger, Wycoff NJ
Edward Kwitkowski, Chicago IL
James W. Land, Delbarton WV
William Morton Lanham, Charleston WV
Ralph Leatherman, Perleasie PA
M. C. Leh, Chico CA
Lyndon E. Lewis, Niagara Falls ON CANADA
Thomas Ford Lewis, Pascagoula MS
David F. Lihou, Juneau AK
Clarence Max Lindeman, Clinton OH
Robert L. Little, Sulphur LA
Mike K. Liu, Park Ridge NJ
William E. Lohman, Great Falls MT
Thomas Leon Lupinek, Clinton CT
William H. MacDougall, Bradford MA
Marvin Francis Mancl, Wisconsin Rapids WI
James Lee Mason, Princeton IN
Gregory Neel Matlock, Hamilton Field CA
Wayne G. Mayo, Powderly TX
Lois Jane McClure, Chambersburg PA

George S. McGeorge, Ft. Huachuca AZ
William H. McGraw, Blackstone VA
Robert W. McKay, Abbotsford BC
Randy Robert McMahan, Grabill IN
Judes A. Meadows, Princewick WV
Marthe B. Menegus, Old Bridge NJ
Ralph E. Mills, Cowgill MO
Herbert Mitschan, Petaluma CA
Shaheed Mohammed, St Croix VI
John J. Monsanty, Warren OH
James Edward Morin, Grand Rapids MI
Bonnie Ray Muhasky, Wichita KS
Robert Arnold Nelson, Dallas TX
Roy D. Neufeld, Larslan MT
Barry R. Nicholson, Stafford VA
Ralph W. Nolte, Ozark MO
Wayne R. Nord, Shallotte NC
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Vincent D. Palermo, Running Springs CA
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Gary Wayne Parsons, Marbury MD
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Darryl Andre Tanner, Miami FL
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David Gene Thomas, Marion SD
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Juan R. Tirado, San Antonio TX
Gerald Francis Tobias, Hastings MN
Lee M. Tong, Fresno CA
Albert Silvio Torizzo, Torrington CT
Angel M. Torres, Mayaguez PR
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Kenneth Harold Way, Detroit Lakes MN
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Boyd Whalen, Schefferville PQ CANADA
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Dennis Lee Williams, Troy MI
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Coley Wilson, Houston TX
Ronald L. Wilson, Independence MO
Wendy Wirth, Watkins Glen NY
James Lynn Wood, Valparaiso FL
Graham Alfred Wooten, Hadlock WA
Kenneth W. Worthey, Mundelein IL
Thomas J. Wylupek, Maple Shade NJ
Robert A. Yaw, Wilsalt MT
Herman L. York, Ashdown AR

WITH HONORS

Nedford Thomas Ager, Guthrie OK
Andres A. Aguilar, Los Angeles CA
Michael D. Allen, Ft Wainwright AK
Elba R. Anderson, Lewiston ID
John R. Armstrong, Park City IL
Scott A. Arsenault, Methuen MA
Ferdinal Urick Austin, Fort Davis CZ
Edward A. Ayers, Webster NY
Peter R. Baca, Canfield OH
Dan Allen Bachedler, Molalla OR
David Wayne Bailey, Griffiss AFB NY
Dean Allen Baker, Roanoke VA
Warren A. Baker, Cape May Court House NJ
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A. Lewis Barnett, Birmingham AL
Danny Lloyd Barnett, Franklin OH
Melvin H. Batts, Newark NJ
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Arlington M. Beal II, Littleton CO
Lee R. Belle, Branson MO
Charles M. Bender, FPO New York
Sam Wayne Bennett, Kansas City MO
Thaddeus Binkowski, Ottawa ON CANADA
William E. Bishop, Gilmanton NH
John R. Blake, Thompson CT
Danny L. Bockelmann, Ogallala NE
Steve Boor, Shelby OH
Frank Lee Bragg, Jane Lew WV
Robert H. Bragg, Windsor NF CANADA
Martin J. Bree, Medford NJ
Virgil Eugene Brock, Holiday FL
Zeffie Ray Brogan, Logan WV
John Paul Brown, Dickson TN
Kevin P. Buck, Purchase NY
Ronald Rojas Bueno, Rutherford NJ
Kenneth R. Buser, Hinckley OH
John Douglas Butler, Pittsburgh PA
Michael A. Cabin, Highland NY
Gerald K. Campbell, Flint MI
Edwin J. Carroll, Jr., Marbelmount WA
Alfonse Edward Cauchon, Gary IN
Oliver Howard Cessna, Greensboro FL
Robert Chapman, Seymour-Johnson AFB NC
Dr. Hoyt A. Childs, Jr., Fairhope AL
Larry J. Christensen, Marlette MI
Charles E. Clark, Pensacola FL
Rocky L. Clark, Castle AFB CA
Peter James Clifton, Nellis AFB NV
Roy Thomas Collier, Memphis TN
Matthew Connarton, Exeter NH
John J. Conte, Holiday FL
Charles M. Craddock, Wilmington NC
Benjamin M. Crane, Harrisville NY
Craig A. Crichton, The Dalles OR
Leatrice N. Crowl, Sitka AK
Daniel J. Curran, Pomeroy WA
Robert Allison Curry, Moncton NB CANADA
Robin A. Curtis, Canadaigua NY
Elias Alcantara Dacon, Alameda CA
Kenneth F. Dalnes, Bellwood IL
Walter Lee Darling, Springville NY
Allen W. Davis, Alexandria VA
Herrold T. Dearman, Denver CO
Richard A. DeHaas, Lock Haven PA
Thomas E. Dekalb, Whitehall NY
William Eugene Deyo, Bayville NJ
Harold T. Doersam, FPO New York
William E. Dougherty, Montgomery PA
Calvin Jay Douglas, Murfreesboro TN
Gerald C. Dovich, Lincoln NE
Ned E. Downer, Atchison KS
Earl Lewis Downs, Kathleen GA
Dale Arvin Draper, Slaton TX
Avel H. Dulatas, Don Mills ON CANADA
James Allan Dunn, APO New York
M. William R. Dye, Lakeland FL
Donald Lee Ebersole, Elizabethtown PA
Marciel Presto Ecado, Norfolk VA
Frank Edison, Tohatchi NM
Danny D. Ellenberger, Maiden Rock WI
Robert Elbert Endicott, Plainfield IN
James Lewis Erbes, San Jose CA
James Thomas Eroh, Hazelton PA
John Peter Faust, St. Cloud MN
Donald Norman Feavel, Milton WI
Charles Feeder, Kingman AZ
Harry E. Fields, Las Vegas NV
Merlin V. Fitzgerald, Toledo OH
Gary R. Flatt, Tucson AZ
Phillip L. Fleming, Millboro VA
Gerald Joseph Foster, Blackwood NJ
Walter G. Frame, Jr., Lancaster CA
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Robert F. Funk, Alexandria VA
Kenneth Ray Galbraith, Georgetown OH
Thomas J. Gambaccini, Derby CT
Donald R. Ganshaw, Statesboro GA
Anthony Gentile, Erie PA
Douglas W. Germanine, Flint MI
George M. Gerulaitis, Hartford CT
Mark Edwards Gibson, Tomah WI
William F. Gillism II, Powell TN
Norman Gene Gobble, Abingdon VA
Manuel Frank Gomez, Orange CA
Marshall R. Graham, Poway CA
Jose Santana Grant, Jamaica NY
Jerel Walter Gregory, Hancock MD
John C. Griffith, York ME
Charles Henry Groves, Barnesville OH
Robert William Hackett, Chicago IL
George C. Haddock, Martin GA
Harry T. Hall, Belleville IL
Edward T. Halverson, Des Moines IA
Lawrence Lee Hamilton, St. Joseph MI
Lynn B. Harris, Jr., Topping VA
Ernest R. Hartsell, Concord NC
Duane M. Haugen, San Jose CA
William L. Haynes, Tyndall AFB FL
Bertram Kirby Hawkes, Guilford CT
David I Heisey, Washington Boro PA
Billy Jack Helms, Dierks AR
Thalon Preston Hobbs, Pensacola FL
John L. Hodges, Columbus GA
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Charles Bert Hulse, Tacoma WA
Joseph J. Ihle, FPO New York
Harold J. Iuzzolino, Albuquerque NM
Nicholas P. Jackman, Jr., Governors Island NY
Daniel Jackson, Clarksburg WV
Brent Jacobsen, Gales Ferry CT
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Tim Joseph Jandreski, Port Austin MI
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Ronald L. Kurpuis, East Wenatchee WA
James L. Kusisto, Jr., Catskill NY
Dennis Lachance, Chicoutimi PQ CANADA
Henry Pierre Landry, Pierre Part LA

Samuel A. Lansberry, APO New York
Charles W. Lauer, Northwood OH
Darrel John Lease, Grand Island NE
Franklin D. Lemasters, Alexandria VA
Edwin Patrick Leonard, Louisa VA
Harry Lewis, Jamaica NY
Rodney K. Lewis, North Edward CA
Richard Gene Loeffert, Newfane NY
Robert S. Logan, Albuquerque NM
Herman R. Long, Wichita Falls TX
Lionso J. Luis, Victoria TX
Daniel Magalnick, Danvers MA
Joe B. Mallory, Jr., Salt Lake City UT
Ronald J. Mann, Goldsboro NC
Floyd Maples, Jr., Killeen TX
Charles L. Marble, Munising MI
Jerry W. Martin, Omaha NE
Carl D. Mattern, East Liverpool OH
Terry W. McAvoy, Erie PA
Donald Wade McClure, Pickens WV
Robert L. McDonald, Kansas City MO
William E. McGowan, Jr., East Hartford CT
Gordon McClure, Winnipeg MB CANADA
Scott D. McMahon, Bella Vista CA
Theodore W. McNamer, Coyle OK
Leslie J. McNutt, Divide CO
Paul Joseph McVean, North Olmsted OH
Antonio Gomez Mendez, Manitowoc WI
Lidalynn A. Mesna, Minnetonka MN
C. Clive Metcalf, Monticello NY
Stuart Jay Meyerson, Flushing NY
Robert A. Mikkelson, San Antonio TX
Terry Owen Miller, Gaspe PQ CANADA
William R. Miller, Turbotville PA
Arthur Reese Milligan, Hurlock MD
Darrell S. Mills, New Orleans LA
Ralph F. Montanus, Virginia Beach VA
Gary Morrison, Colborne ON CANADA
Brian Wesley Mosley, Grand Forks AFS ND
John P. Moure, LaPlata MD
John Maurice Mullins, Tucson AZ
Danny E. Murphy, Calera AL
Steven W. Myers, Mena AR
Michael William Nagy, Fairfax VA
Andrew Dennis Naum, Rockland ME
Reginald I. Nelson, Colorado Springs CO
David J. Nevitt, Columbia SC
Thomas K. Nielsen, Apple Valley CA
Kenneth K. Oakley, Mentor OH
David A. Osgood, Durand IL
Andre G. Pare, South Portland ME
Lyle W. Parker, Parnell MO
Raymond Lee Parker, Marion IN
Kenneth Averell Parr, Gary IN
Erwin J. Paschoal, Honolulu HI
Victor John Petras, Peru AFB IN
James F. Petrey, Ashland KY
Donald Roy Pidgeon, Massena NY
Mark P. Pope, Piscataway NJ
Arthur Harold Poppe, Monroe CT
Robert Alton Ports, Punta Gorda FL
Bernard Posey, LaPlata MD
Bruce Prindle, Hamilton NY
Kenneth Dale Proffit, Omaha NE
Raymond J. Pluto, Alexandria VA
William C. Rabenold, Jr., Northampton PA
Glendel E. Ramage, Earlington KY
Dale Emery Ransford, Aurora CO
Clarence M. Redding, Willoughby OH
Herbert L. Reinkens, Dayton OH
Rolane Renfrow, Broadlands, IL
William C. Rexroat, Atlanta IL
Brian Michael Rickard, Verona Beach NY
Kenneth P. Riebel, Mahtomedi MN
Paul E. Ritz, Canton OH
John Curtis Roberts, Philadelphia PA
Dennis Robertson, Fayette AL
Daniel S. Robey, Shickshinny PA
Kenneth R. Rogers, Green Bay WI
Robert G. Romppel, Wenatchee WA
Paul Rose, Detroit MI
Blaine R. Rourke, Windsor NS CANADA
Chester Lewis Roush, Smithsburg MD
Elvin Duane Russell, Sierra Vista AZ
Laurence W. Salter, Fulton IL
John B. Schenk, Ontario NY
Robert H. Schmidt, Willard UT
David L. Schmitt, Ft. Eustis VA
Douglas C. Schober, Sr., LaCrosse WI
James C. Schreiber, McGuire AFB NJ
Ronald Mathew Schuller, Sheffield OH
John T. Scobee, APO New York
William W. Sexton, APO New York
Michael D. Siegert, Cleves OH
Thomas G. Sigler, Wilmington DE
John W. Simon, Welsh LA
Bernard John Shimko, Marietta PA
Paul E. Skinner, McGuire AFB NJ
Bruce H. Silker, St. Petersburgh FL
John F. Slottke, Milwaukee WI
George Forrest Smith, Waynetown IN
Irven Albert Smith, Oakland IL
Lloyd D. Smith, Vidor TX
William Calvin Sneed, Lima OH
Edward N. Snelling, Sr., Canterbury CT
William C. Speaker, Mountainhome PA
Dixie R. Strader, Buckhannon WV
Ralph Edward Studer, Orrville OH
Henry J. Sulley, Rock Tavern NY
Darrell Lee Summers, Norton VA
John Steven Sutch, Ferndale MD
Alfred P. Sutlick, Jr., San Diego CA
Eugene Andrew Szymanik, Philadelphia PA
Orlin Dee Taylor, LaPuente CA
Roger Clifford Titus, Warsaw OH
V. Treat, Houston TX
Charles Edward Travis, Union City TN
Jose Luis G. Trevino, Garza Garcia NL Mexico
David J. Troupe, APO New York
Flore Tucci, Sante Fe Spring CA
James Erwin Tuthill, Port St Lucie FL
Jeffrey Kenneth Turner, Piney Point MD
Robert L. Vanisenberg, Virginia Beach VA
Stelios Vassiliades, Kapsalos-Limassol Cyprus
Robert W. Vaughn, Jr., Gulfport MS
Rolla L. Wallace, Ravenswood WV
Wilton L. Wallace, Salem OR
Shafter Weaver, Healdton OK
Rod Weeb, Norwood ON CANADA
Norbert E. Weiler, Brookeland TX
Philip Trout Wene, Jr., Flemington NJ
Willie West, Cincinnati OH
Edward Jeffrey Weter, Xenia OH
Gerald D. Whealton, Norfolk VA
James S. Wheeler, Macungie PA
James Edward Wilde, Portsmouth NH
Keith R. Williams, Macon GA
John W. Wolkowicz, Westfield MA
Ngew T. Wong, Brooklyn NY
Charles V. Wood, Chicago IL
Melvin Walter Young, Plano IL
Donald D. Zeller, Denver CO
Gerold Raymond Ziska, Atkinson NE

NRI Notes —

A new microprocessor control system, manufactured by Honeywell, will be used by at least six different heat-pump manufacturers on their 1980 models. The system has microcomputer, memory, logic, and communications ability, with emphasis on reliability.

Latest Census Bureau figures show that the number of air-conditioning systems in the U.S. has doubled in the past seven years. Over 22% of all homes now have central air conditioning, and 30% of all homes are cooled (at least in part) by window units. Also, approximately 1.3% of all homes are heated by heat pumps.

Indoor air pollution may be more hazardous than outdoor pollution, because the average person spends more time indoors than out. Always check filters when making a service call.

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REVOLUTIONARY NEW PC BOARD HOLDER

~~$12.50~~

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Just clamp the 3rd Hand to your bench or table and insert any size circuit board. Then, position the components and flip the circuit board to the flat position for soldering and clipping. The 3rd Hand is a real helper and it keeps your bench top clear for working.

All-Purpose Alignment Tool Kit

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Now 12 of the most popular TV alignment tools all in one attractive, durable plastic case. Roll-up case, stores easily in service kit.

KIT INCLUDES

- Long Reach
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WELLER PROFESSIONAL PRODUCTS

- 25 watt soldering iron with 750 degree tip temperature
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TOP QUALITY XCELITE PRODUCTS

- 4" longnose pliers
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All with polycushion grips

- Slotted screwdriver
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- Convenient storage tray

Sale Ends November 15, 1979

Ham News

Ted Beach K4MKX

Well, our judges had a real tough time picking a winner from among the many entires in our QSL card mini-contest, but at long last they have made their decision. The winning design (printed elsewhere in black and white) was based on the card submitted by William Chapman, WA6FIQ. Bill will get the first 100 cards when we start to print them. Congratulations, Bill.

Of the many entires received, we had to eliminate about sixty because they did not conform to the rules outlined at the start of the contest. Most of these did not provide for entering pertinent QSO information on the "design" side of the card as specified.

Of the twenty or so cards submitted that conformed to the specifications, our judges selected nine as "finalists" in the contest. These nine finalists are listed in this column also. Our thanks go to all of you who took the time and put forth the effort to submit entries. Perhaps we'll have another minicontest some time in the future.

During the time we were conducting the contest, I received several letters from people wanting to order QSL cards from NRI. Well, perhaps sometime down the road we will be able to do this. I certainly hope so. In the meantime, the QSL cards will be used only as originally indicated in this column: as a reward to *graduates* of NRI's amateur licences courses. One hundred QSL cards will be sent to every graduate of the three courses starting right now. Unfortunately, we cannot make this retroactive for previous graduates, so please don't write asking for QSL cards.

Because of the individualized nature of the cards, we will be printing them in "lots" rather than on demand. What this means is that we may have to wait until we have fifteen graduates before we will make a printing run. Graduates will receive a card to fill out with the information to go on the QSL card. We

Here, at last, is the winning QSL card. To get the full effect of this beauty, you must imagine the background in gold. The call, county, name/address, and chart are all in black. NRI, the border, and the globe are in red for a final touch. Congratulations again to winner William Chapman.

will keep these cards on file so you can re-order cards later, if you want. Hopefully (if we have lots of graduates) you should get your QSL cards shortly after you receive your diploma from NRI.

As mentioned earlier, if we have enough requests, we might be able later on to let *all* NRI students and graduates order the NRI QSL cards. We'll keep you posted in this column as to when, if, and how much these would cost. For the Amateur course graduates, the first 100 cards are free!

As this column is being written (late July), there has not been an opportunity to see if the new Get Together schedule is working, but I feel quite certain that the way we have it set up this time will make it much easier to work with than last time. Unfortunately, my rig is still "down," but I do hope to get on the air for the August Get Togethers if at all possible (using a borrowed rig, if necessary). Check the dates over and check in on some of the Tuesdays. As we get reports on the progress of the Get Togethers, we'll print recaps here in this column.

Last time I mentioned that I had just gotten a copy of the New ARRL Radio Amateur's License Manual, and would give a review of it here this time. First of all, if you *don't* have a copy of this manual ($4.00 from ARRL, Newington, CT 06111), I would strongly urge that you order one. It is a really good reference for all amateurs, both licensed and unlicensed, and contains much more information than previous editions.

It is a 168-page paperback manual (8-1/2 X 11) divided into 10 chapters. The first two chapters discuss amateur licensing and include a good explanation of the complex Station License structure currently being used. The next three chapters are about examination procedures in general and the Novice and Technician exams in particular.

Chapters 6, 7, and 8 contain 110 pages devoted to the General, Advanced, and Extra class licenses. These

QSL CARD MINICONTEST FINALISTS	
Rick Mills	WA1WPR
Randall Kelly	N3AJV
William Chapman	WA6FIQ (winner)
John Noonan	WA6SWL
Richard Volbrecht	KA7CFM
Mike Barton	WD8BKE
Lloyd Dolby	WBØQPI
David Williams	KH6JST
John McKeown	No Call

NRI "GET TOGETHER" SCHEDULE FOR 1979

	75/80	15	40	75/80	15	40
SEPTEMBER			4	11	18	25
OCTOBER	2	9	16	23	30	
NOVEMBER			6	13	20	27
DECEMBER	4	11	18			

TIMES:

CW	8:30 - 9:00 PM EST
SSB	9:00 - 9:30 PM EST

* +5 kHz in case of QRM or QRN

FREQUENCIES:	CW*	SSB*
15 Meters	21.150	21.400
40 Meters	7.130	7.280
75/80 Meters	3.730	3.980

three chapters contain a wealth of tutorial material arranged in an easy-to-read format. Each major section is followed by typical FCC-type multiple choice test questions, the answers to which are contained in a special section at the end of the book. The information contained in these three chapters alone is worth the price of the manual. Any amateur will find these to be excellent reference chapters on all aspects of radio communications.

Chapters 9 and 10 cover International Regulations and FCC Regulations respectively. In addition, there is an "Update" page in the front of the manual that contains any changes to the FCC Regulations that might have been made just prior to the particular press run of the manual. The last seven pages of the book are devoted to answers to the multiple choice questions and to a comprehensive index to subjects in the book.

All in all, I would say the new ARRL Radio Amateur's License Manual would be a good investment for anyone interested in amateur radio. I intend to have a current edition somewhere nearby at all times!

Now, let's see who we've heard from since last time. The first 13 people mentioned in the list are students and graduates of the NRI Amateur programs. Notice that we've got nine upgrades this time. In addition, most of the Novices are brand new. Our congratulations to all of you!

K2PVB writes that he is a new student and is wondering about the NRI QSL cards he read about in the last *Journal*. Well, Joe, keep studying and when you get your diploma, 100 cards are yours for free!

Joel, KA4HHD, had quite a few problems when he first tried to get his rig going, to use with his new Novice ticket. He couldn't get the transmitter to load at first and discovered a broken wire in an rf choke. With that problem fixed, Joel was still getting very poor reports, even from local hams. He took the rig to a friend's house and worked several stations, getting excellent reports. "Aha," said Joel. "Antenna problems!" Some new coax for his vertical cured his problems, and now he's doing fine from the home QTH.

KA4ILP got his Novice ticket in May and has had lots of fun using his Drake TR3 on 10, 15, and 40. Mike uses a multi-band inverted vee antenna on these bands. His only complaint with the TR3 is that it doesn't have a built-in sidetone oscillator, so he can hear what he's sending. Not to be foiled, Mike built a separate sidetone oscillator keyed by the TR3. Unfortunately, the oscillator does not have adjustable pitch or level, but I'm sure you can find a

Charles	WD2AGC	N	Perth NY
Joseph	K2PVB	–	Medford NY
Frank	WD4BYN	A*	Spartanburg SC
Joel	KA4HHD	N	Decatur GA
Robert	KA4IFU	N	Brandenburg KY
David	KA4IJL	N	Conyers GA
Mike	KA4ILP	N	Anniston AL
Margaret	KA4JOQ	N	Camden SC
Harold	KA5DVF	T*	Columbus MS
Mike	KA6FLD	T*	Durham CA
Woodrow	N7ATV	G	Big Piney WY
Ralph	W7SK	E	Reno NV
Herman	WDØFUJ	N	Independence MO
Fran	KA2FOR	N	Utica NY
Bill	WA2NYR	E*	APO NY
Richard	KA3DAN	–	Three Springs PA
Bud	KA4HIF	G*	Jacksonville FL
Gary	WD4RJD	A*	Ashland KY
W. E.	N5BIA	T	Houston TX
Manfred	KA5EPU	N	Spring TX
Ted	KA5EUG	T*	Lake Jackson TX
Mike	N7ACD	T	Mountain Home ID
Dave	KA7DKS	N	Waco TX
Dick	KB8IJ	A*	Pontiac MI
Carlos	WD9DSS	G	APO NY
Cliff	WDØFIR	G	Eilson AFB AK
James	WBØTIM	G	Kansas City MO
Yasuo	KH6JQT	A*	Honolulu HI

*Just upgraded — Congratulations!

cure for that, Mike. You might try a pair of stereo headphones so you can hear the sidetone in one channel and the TR3 receiver in the other. That might solve the hearing problem.

N7ATV got his license in June and is very happy. Later this year, Woodrow is planning to go to Salt Lake City to sit for the Advanced exam. Best of luck to you, and be sure to let us know when you get the new ticket.

Like so many of us, Herman, WDØFUJ, got his brand new license and then just *had* to get on the air and use it. Unfortunately this meant a halt to studying, but now Herman's over the initial interest and says he is back into the swing of studying regularly. Good work, Herman. Let us know when You've taken the next step.

KA2FOR says that after 47 years he has finally realized his ambitions and has a brand new Amateur license. Congratulations, Fran, and we're sure you can convince your wife to join you in the amateur ranks when she sees how much fun it is.

In addition to getting an Extra call as a graduation present, WA2NYR also got his First Radiotelephone license. Very nice going, Bill. Now when you return from Germany, you'll be more than prepared for that job in the FM station.

KA3DAN is another one whose studies suffered when he got his new Amateur license. Richard says that he is back on track again, and that the NRI training made the "tricky" FCC examination fairly easy to pass. He is also looking forward to building and using the Model 452 transceiver that is part of the Communications course. I think you'll like it, Richard. It's a pretty good rig.

KA4HIF did not take long to get this General ticket. Bud got his Novice call in March of this year and one month later passed the General test. He is waiting for a new call sign (group C) so we'll probably not recognize his call next time we hear from him. Bud built a Heath HW101 transceiver and added a Heath keyer for cw work. For antennas, he has a Hustler 4BTV vertical and an 80 meter dipole. When he got his new General ticket, Bud realized he didn't even have a microphone to use with the HW101. He scrounged up an old public address system microphone that had the right impedance, and was in business. The only problem is the silly slide switch (slide-to-talk?). Oh, well. Bud plans to try for his First Phone *and* Advanced tickets in October, and we all wish him the best of luck. Let us know how things turn out, Bud.

N5BIA writes that he got his Technician ticket recently, thanks mainly to the NRI lessons and the incentive of being able to use the Model 452 transceiver. Unfortunately, he had a defective rf amplifier module when he first fired up the rig, but a new module fixed things up fine.

N7ACD says that he has had his Technician license a couple of years and has only recently gotten on the low bands. Mike's shack includes a Heath HW7 transceiver, a Heath DX100 transmitter, and a very "drifty" Super Pro receiver. TVI problems keep the DX100 off the air during "prime time," but otherwise it's in use constantly. Mike says he doesn't have too much time for operating, however. He says his wife and new baby come first and he spends a lot of time building up a business of his own as a sideline to his Air Force duties. In September he will be in England for a three-year tour and fully expects to check in on some of the Get Togethers from across the pond. We'll be looking for you, Mike.

Dick, KB8IJ, is a graduate of two NRI courses, Master Color TV and Complete Communications, both of which he says he thoroughly enjoyed. Dick's shack consists of a Kenwood TS520, a Heath SB200 linear, and a Dentron Super Tuner. He uses this with open wire feeders (my favorite) to a 134 foot fan dipole. This arrangement tunes all bands well enough so that he has 49 states for WAS and needs only Vermont to make it 50. Then he's going to start chasing DX and work on the theory and code for an Extra ticket. Be sure and let us know when you make the grade, Dick.

WD9DSS is another GI stationed in Germany (DA1UZ over there) and is waiting to finish the Model 452 transceiver. Carlos says that it's a ball operating as "DX" from Europe! When he returns to the States he is planning to upgrade to Advanced class and try for the Commercial license as well. Then it's off to college for some more education and a *good* job. Real fine, Carlos. We wish you the best in all your endeavors.

WDØFIR reports a couple of errors on my part. Cliff is stationed in Alaska and says that in the Winter edition of the *Journal* I reported that Jose, WL7ADM, got his Novice license and was waiting for Santa to bring an antenna so he could get on the air. After one contact as a Novice (with WDØFIR), Jose upgraded, *not* to Technician but to Advanced. Sorry, Joe, and thanks, Cliff, for setting the record straight.

KH6JQT writes that he was planning to make a trip to Japan in July for some "eyeball QSOs" with the JA's he's worked over the years. Since he last wrote, Yasuo says he has 49 states confirmed for WAS but is finding it very difficult to snag Delaware. Maybe someone in Delaware would like to set up a schedule with Yasuo (on 15 meters, his favorite band). Here's his address:

Yasuo Konno – KH6JQT
35 N. Kukui St.
Honolulu HI 96817

In addition, Yasuo says he is still having trouble with rf interference in his keyer and has not found a solution to the problem. The biggest difficulty is that the vertical antenna sits just outside his apartment on a balcony. Unfortunately there is no other location for the antenna. Guess you'll have to use a hand key, Yasuo!

Well, that about wraps it up for this time, gang. We'll be seeing you more often now since the *Journal* is scheduled to start coming out every other month. That means less "lag" between the time I hear from you and the time your names and calls appear here in the Ham News column. Please do continue to write. We always enjoy hearing from you and everyone out there wants to know what you're doing. Until next time, I'll be looking for you on one of the NRI Get Togethers, so listen for me.

Very 73–Ted K4MKX

1	Conditional Class License eliminated. Novice power limit upped to 250 W.	June 25, 1976
2	Technicians given Novice privileges.	July 23, 1976
3	No new distinctive Novice call signs, although Novice may sign "/N."	October 1, 1976
4	No requirement to sign "portable" or "mobile" except foreign operators using reciprocal licenses.	November 26, 1976
5	First "comprehensive" CW exam given in Washington, D.C. office. No solid copy for one minute requirement.	January 1, 1977
6	Court case "temporarily" suspends all license fees.	January 1, 1977
7	New interim licenses issued upon upgrade of license class at an FCC office.	March 1, 1977
8	Secondary station license eliminated.	March 3, 1977
9	97.95(a)(2) deleted. No notification of new address required.	March 9, 1977
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).	April 15, 1977
11	Code sending test deleted from Commission-administrated examination.	August 26, 1977
12	97.95(b)(2) rescinded. Maritime Mobil in Region 2 may use all amateur frequencies. In foreign waters, Maritime Mobil may use only frequencies authorized by regional government.	September 12, 1977
13	Call sign restructured, making special calls available to various class license holders.	March 24, 1978
14	Ban on commercial 10-meter linear amplifiers.	April 28, 1978
15	Novice license term extended to five years, renewable. Technicians given full privileges above 50 MHz.	May 15, 1978

ALUMNI ACCOMPLISHMENTS

by Colleen Bohr

Students take NRI courses for a variety of reasons – to get a good job, to improve their present position, to start their own business, or simply to increase their knowledge. Still, whatever their reasons for enrolling with NRI, many graduates find that their training gives them access to opportunities that far exceed their original expectations. To discover what fellow NRI students and graduates have done with their training, let's examine the paths that two alumni have followed.

GERALD TATE: FROM NRI TO CIA

In 1947, after serving with the Navy and completing three years of college at Southern Methodist University, Gerald Tate came across an ad for NRI in an electronics magazine. When Gerry first discovered NRI, TV had not yet arrived in his home town of Waxachie, Texas. Still, Gerry decided to enroll in NRI's Radio/TV Electronics course "out of sheer curiosity about the field." He had compared NRI's program to those of other home-study schools, and decided that NRI could offer him the best training.

Subsequent to his graduation in 1949, Gerry worked for a time for a service station, deciding that he preferred using his mechanical ability to his previous job selling insurance. In 1950, Gerry began working for a construction firm, and he was still employed there when he spotted an intriguing ad in the June/July, 1956 issue of NRI's own *National Radio/TV News* (the predecessor to today's *NRI Journal*). In those days, employers seeking well-trained electronics personnel advertised in the pages of the *NRI News*. The particular ad that caught Gerry's attention is reproduced in Fig.1. As you can see, the wording of the ad is vague – even mysterious. Yet, according to Gerry, "The ad gave me enough information to know that it was a good opportunity." Gerry responded to the ad, knowing only that he was applying for a government job involving travel.

In time, Gerry was interviewed, tested on his knowledge of electronics, and thoroughly screened. This was a long process and it was two years, almost to the day, before Gerry signed a contract with his new employer. Only after he had been hired did Gerry discover exactly *who* his employer was – the Central Intelligence Agency (CIA)!

For 14 years, Gerry was one of the CIA's top technicians, performing audio and radio communications work under the official title of Audio Operations Engineer. His work took him all over the world. In one year, Gerry worked in as many as 26 countries.

According to Gerry, his years with the CIA were fascinating ones. Through his work, he gained access to the private workings of government and played an integral role in the defensive strategy of the United States. However, he says that the travel and the pressure became wearing. Often, Gerry had to step off one plane only to board another for a destination thousands of miles away. Finally, in 1971, Gerry left the CIA for reasons of declining health.

———n r i——— ———n r i———

Unusual Employment Opportunities Requiring Electronics Background

A number of interesting positions are open for mature, well-adjusted people who find working with others challenging and interesting, over and above the technical requirements of electronic work. Applicants should be well grounded in basic electronic theory. Advanced NRI students or graduates would likely have the required background. Some college training, not necessarily in electronics, would be helpful, but is not necessary. Amateur radio experience and practical experience, again, would be helpful, but are not absolutely necessary. Applicants must have a high school education and U. S. Citizenship is required.

These are not routine jobs. The individual will be called upon to improvise and has ample opportunity to use independent initiative in solving problems connected with Radio or Electronic applications. Individuals should be willing to serve overseas at some time in the future and must pass physical examinations. These jobs are unusual in that the man, himself, is just as important as his technical training and background.

Starting salaries range from $4,500 to $5,500 per year. Junior positions also exist with starting salaries from $3,600 to $4,500 per year. Applicants for Junior positions should have high school education, good appearance and personality, and know basic electronic theory. These applicants will undergo on-the-job training on basic electronic repair work. Should be willing to travel overseas at some time. Interested applicants should write a complete letter of application giving name, date of birth, address, telephone number, complete military history, non-military training, employment background, and mentioning amateur or commercial licenses held, if any.

These letters of application will be forwarded by NRI to the prospective employer and will be acknowledged by that organization within a reasonable time.

———n r i——— ———n r i———

FIGURE 1. AD APPEARING IN A 1956 EDITION OF THE *NRI NEWS*.

Still, despite his health problems, Gerry has very positive feelings about the CIA. "I look back on my career with no regrets." In fact, Gerry is in the process of writing a book about his years with the CIA. According to Gerry, although the CIA has been the subject of recent controversy, "I'd like to give the other side of the story – the CIA has been very good to me."

Gerry attributes a large part of his success to his NRI training. "Without NRI, I wouldn't have had the confidence to respond to the ad, nor the ability to pass the CIA's examination. . . . My NRI training was the basis of my whole career." According to Gerry, the CIA itself encourages its employees involved in the electronics field to take NRI courses to expand their knowledge.

Since his original course in Radio/TV Electronics, Gerry has completed NRI's Appliance Servicing course, and is currently taking our course in Microcomputers. For Gerry, NRI courses have proven to be helpful not only in his career, but in his personal life as well. "After I finished the Appliance course, our washing machine broke down. My wife challenged me to fix it. 'Let's see what you've learned,' she said. I fixed it." Gerry says he decided to enroll in the Microcomputer course because "it gives me something to keep my mind digging."

Gerry says he is very grateful for his NRI training, and claims that he learned more through home study than through attending college classes "because I worked harder with my NRI courses." He would like to encourage others to take advantage of the opportunities that home study can provide. "A lot of people are doing jobs they detest because they don't believe they can learn through a correspondence course. I'd like to show them that you *can* learn a great deal through home study."

GERALD TATE

Today, Gerry lives in Springfield, Virginia. Of his five children, two are ministers, and his youngest son is the new quarterback for Pennsylvania State University. Gerry is especially grateful to his wife and family for their patience during the years when his career forced him to be gone for weeks at a time. He is now able to spend more time with his family, and is enjoying his retirement.

It is satisfying to us – and, we hope, encouraging to you – to know that NRI was able to help Gerry achieve such success. Obviously, Gerry could not have accomplished as much without a great deal of hard work and the support of his family. Still, in order to actively pursue his goals, Gerry needed training and, of equal importance, confidence in his own abilities. NRI was able to give him both.

JIM MENENDEZ: CONFIDENCE COUNTS

Jim Menendez is currently a District Supervisor of the Service and Equipment Division for Eastman Kodak Company, supervising service technicians in the Washington, D.C. area. Before 1971, however, Jim had no marketable skills, no definite goals, no direction. Jim shares the credit for his success with NRI: "Although the NRI courses did not do it *for* me . . . I couldn't have done it *without* them."

Jim had heard of NRI before, but it was not until he actually looked through a friend's textbooks that he decided to enroll. Impressed with the material and the way in which it was presented, Jim said he felt that NRI offered him an opportunity to develop his potential. At this point in his life, Jim was looking for something, and he decided that NRI's TV/Radio course was the something he was looking for.

Even before Jim completed the TV/Radio course, he began his own part-time TV repair business. "I had gone from having no skills to being able to market my skills in my own business." As Jim's confidence increased, his goals became higher. Like many NRI students, Jim discovered that the value of his training lay not only in the knowledge that he gained, but also in the incentive and confidence he acquired by mastering a course of study. With skills, confidence, and ambition, Jim was now able to make *choices.*

Soon, Jim's interest shifted to field service, and he decided to take NRI's Electronics Technology course to help him in this new area. Before enrolling in this second course, however, Jim compared NRI's program to those of other home-study schools. Because he had been so successful in the TV/Radio course, Jim decided to continue with NRI.

JIM MENENDEZ

In 1974, Jim was able to qualify as a field service representative for Eastman Kodak Company. According to Jim, "The course in Electronics Technology proved to be invaluable to my career." Within three years, Jim was promoted to District Supervisor, a position that normally demands 10 years of experience. Today, Jim's salary is almost four times as great as when he first joined Eastman Kodak.

Of course, Jim could not have achieved such success without a great deal of hard work. Combining his training with his own ambition and determination, Jim was able to develop his potential and accomplish his goals.

From his own experience, Jim has found that employers regard NRI training at least as highly as college or technical school training. Today, people come to Jim seeking jobs. "I consider NRI graduates to be well-trained, not only through books, but through practical experience." According to Jim, people who are interested in TV or electronics tend to practice in the field on their own, while proper training gives direction to this interest.

Jim's advice to students and alumni seeking positions in technical fields is, "Don't be afraid to start at the bottom. Then it's only a matter of time and hard work before you get ahead." Again, it seems that the important message is to have confidence. If a person knows that he is well-trained and has the potential for growth, he will realize that starting at the bottom is often a necessary step toward attaining higher goals.

Also important to maintaining success and ensuring future growth is the need to keep up with changes in the field. For this reason, Jim is considering taking another NRI course. According to Jim, education is an ongoing process: "Don't stop learning. Education should continue."

The prevailing theme throughout Jim's success story is confidence. In order to begin his career, Jim needed confidence in his own abilities and potential. In order to move up in his career, Jim had to reinforce that confidence. At NRI, we try to build this sort of confidence in all of our students. Our own success lies in accomplishing this goal.

NRI'S CHALLENGE

The NRI student first demonstrates a degree of self-confidence by enrolling with NRI, choosing to make a commitment (and an investment) toward his future. From there, NRI courses are designed to develop this confidence. Through our "expanding core" approach to teaching, a student sees tangible results from the very start of his training, rather than having to complete the course before any visible progress can be discerned. Through a series of small successes, NRI prepares its students to achieve ultimate, long-range success.

Yet even the most confident student wonders about his future as he approaches the completion of his studies. "Should I take more courses? Should I start on my career now? Am I capable and prepared enough to succeed in a competitive world?" These questions must be answered personally, of course, but it is encouraging to see that others have succeeded with the same NRI training. We hope that learning about the achievements of Gerry Tate and Jim Menendez inspires others to attain the same degree of success.

Is the success of Gerry Tate and Jim Menendez unusual, or do other NRI graduates experience equally satisfying rewards for their hard work and training? We hope to find out by looking at other NRI students and graduates in future issues of the *Journal*. If you have an interesting story to tell, or if you know of another successful NRI student or graduate, please drop a line to Managing Editor, *NRI Journal*, McGraw-Hill CEC, 3939 Wisconsin Avenue, Washington, D.C. 20016.

About the Author

Colleen Bohr joined NRI's staff last year as an editorial assistant. A native Chicagoan, Colleen attended Georgetown University in Washington, D.C., and was graduated in 1978 with a B.A. in English. Her interest in the success of NRI students stems from her work with alumni from her alma mater. "The success of a school's alumni has a significant impact on present and future students. Knowing that your school trains its students for success provides confidence and inspiration – two requirements for enthusiastic learning."

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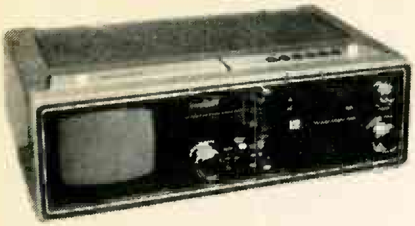

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SPECIFICATIONS

Receiving System: American standard. **Channels:** uhf 14-83, vhf 2-13. **Picture Tube:** 4" picture measured diagonally, 9 sq.in. viewable area. **Antenna:** Telescopic uhf/vhf/FM – monopole, AM radio – built-in. **Speaker:** 3-5/32" round. **Audio Output:** 0.8 W (max.). **Solid-State Components:** 4 integrated circuits, 26 transistors, 40 diodes, 28 LEDs. **Power Consumption:** 12 W at 120 VAC. **Power Requirements:** 120 VAC, 60 Hz. **Dimensions:** 5-7/8" H X 14-31/32" W X 10-5/32" D. **Weight:** 8.2 lbs.

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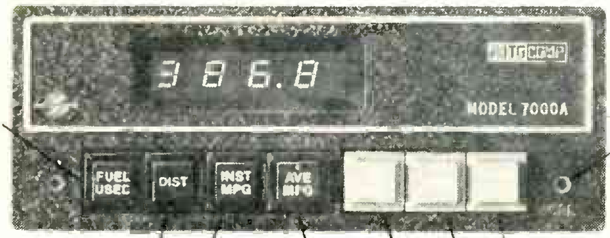

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The Model 231 Signal Tracer

Signal tracing is a method of checking each stage of a receiver or amplifier. This is done by following, or *tracing*, a received or injected signal from input to output until the faulty stage is located. With the Signal Tracer, you can quickly locate a hum, noise, distortion, or a dead stage. The Model 231 will pay for itself again and again. Here is an instrument that will be invaluable to the beginner, and may cut servicing time in half for the experienced technician.

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Specifications

Probe: High input impedance FET connected in a source follower circuit. **Input Modes:** A selectable ceramic filter. Tuned inputs covering the standard broadcast i-f frequencies (262 kHz, 455 kHz, and 10.7 MHz), untuned rf and audio. **Semiconductors:** Three integrated circuits, three transistors, and five diodes. **Controls:** Volume, band switch, coarse attenuator switch, fine attenuator/on/off switch, am/fm switch. **Power Requirements:** 110-120 volts ac, 60 Hz. **Dimensions:** 8-1/2" wide by 6" high by 6-1/2" deep.

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