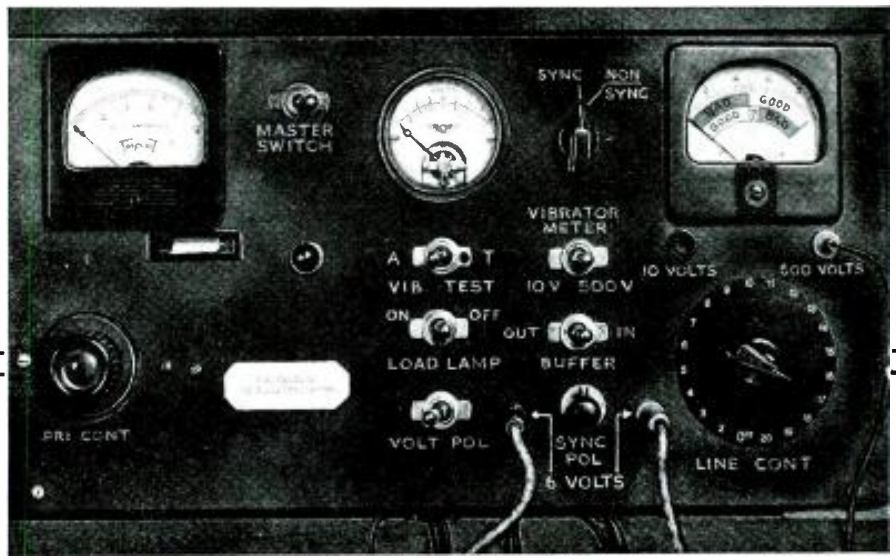
Carvalyzer Services Auto Radios



The front panel of the Carvalyzer. The A-eliminator inside the cabinet supplies the power.

Making complete, accurate, and speedy checks on 6-volt receivers requires a versatile combination instrument

By S. H. COVINGTON, JR.

DESIGNED especially for servicing automobile radios and testing vibrators, the Carvalyzer also furnishes A- and B-voltages for servicing many types of battery and three-way radios, particularly those with series filament strings. It supplies 6 volts for auto radios and indicates the current drawn by the entire set or by the vibrator alone. The name Carvalyzer, suggestive of the unit's functions, was coined from "Combined A-Eliminator with Radio and Vibrator Analyzer." Fig. 1 is the circuit.

The first step is to own or get a good husky 6-volt A-eliminator. (One can be constructed from the directions given in the article "A-Battery Eliminator" in the April, 1949, issue of RADIO-ELECTRONICS.) This unit is built around a type 60 ATR eliminator. Other units can be used by following the general outlines of this article.

If you have the type 60 ATR unit or one of similar construction, it may be mounted as follows. Stand the unit on end so the 6-volt terminals are on your right. Discard the bottom cover. Place a 19-inch metal or Masonite panel over the eliminator so that approximately 1 inch of panel extends on the left side. Cut a slot in the panel directly in front of the fuse clip. This will permit the fuse to be withdrawn when a 2-inch loop of tape is passed around it and allowed to project through the slot (see front-view photo). The fuse clip may be replaced by a fuse extractor post on the panel. Remove the pilot lamp and line switch, and mount them on the panel. Mount a 0-10 or 0-15 d.c. ammeter and primary tap switch on the panel where they will be inside the eliminator case. The panel is fastened to the case with screws or strips of angle iron at the top and bottom.

The PRI CONTROL is a nonshorting switch connected so that turning it to the right increases the voltage at the 6-volt terminals of the eliminator. This switch does not have sufficient control over the output voltage; therefore, a heavy-duty rheostat, marked LINE CONTROL, is inserted in series with the a.c. line. This is a 200-ohm unit with a rating of 200 watts or more. Such units being bulky and expensive, we made one by connecting carbon bars across the contacts of a rotary switch. These carbon bars have various resistances varying from approximately 1.4 to 39 ohms. A general automotive electrician (not a dealer) will probably give you some of these carbon resistors from discarded relays. They have holes in the ends, making it easy to bolt them together. A soldering lug over each bolt connects these points to the switch contacts. The resistors are connected in a square helix as shown in the rear-view photograph. The homemade rheostat is connected in series with one side of the a.c. line so that maximum resistance is in the circuit when the switch is turned counterclockwise as far as it will go.

Additional components

A 115-cycle vibrator transformer must be used in this unit, since most vibrators work at that frequency. If a 115-cycle vibrator is tested on a 180-cycle transformer, it will pass too much current and its contacts will be damaged.

The transformer, hash chokes, 0.5-μf capacitors, and the filter choke may be salvaged from an old automobile radio. The vibrator replacement guide will tell you whether the set selected has a 115-cycle transformer.

There are three meters. M1, a 0-10 or 0-15 d.c. ammeter, reads current drawn from the eliminator. M2 is a 0-8, or preferably a 0-10, d.c. voltmeter that indicates the d.c. output of the eliminator. M3 is a 0-1 d.c. milliameter that is converted to a 10- or 500-volt meter by throwing the METER switch.

Two GOOD-BAD scales are drawn on the face of meter M3. The upper scale checks vibrators by measuring the output voltage. The BAD area goes from 0

to 0.47, and the GOOD area covers the rest of the scale. Convert the meter reading to volts by multiplying by 500. The lower scale indicates the starting voltage of the vibrator. A good vibrator will begin to vibrate at as low as 4.7 volts, and a perfect one with no film on its contacts will start at 4 volts. The area between 0 and 0.4 (4 volts) is marked GOOD, the area between 0.4 and 5.6 is marked "?", and the balance of the scale is BAD.

The VIBRATOR switch, a four-circuit, double-throw unit, switches the transformer secondary to the rectifier plates for nonsynchronous vibrators, or to the secondary contacts of a synchronous vibrator.

The SYNC POL switch is a d.p.d.t. leaf type used to reverse the polarity of the secondary winding when testing synchronous vibrators. This switch must withstand several hundred volts; therefore, the usual radio toggle switch cannot be used.

The 50,000-ohm wirewound potentiometer, switch S1, the B-voltage jacks, the push-button switch, and J5 were added after the original Carvalyzer was completed and do not appear in the photographs. The 50,000-ohm control has a s.p.d.t. switch S2 ganged to it and connected so that A- and B-minus are tied together when the control is all the way over in a counterclockwise direction. Advancing the control connects the resistance of the control across the B-supply and isolates the A- and B-supplies. This prevents shunting the bias supply in some sets. A jumper can be run between the vibrator test clip R and the B-minus terminal if the A- and B-supplies must be connected together. The B-supply having very little filtering, faulty filters in a set will show up in the form of hum.

A 32-candle-power lamp loads the 6-volt supply and prevents the voltage from rising when there is no external load.

Leads marked R, A, P1, P2, S1, and S2 are brought out and terminated with insulated alligator clips with the end teeth filed down to fit the pins of the vibrator under test. A small round file will remove the teeth nicely. Mark the leads clearly to avoid mistakes when connecting them to vibrators. Typical vibrator connections are shown in Fig. 2.

J1, J2, and J5 are standard pin jacks, and J3 and J4 are heavy-duty banana jacks. Leads for J3 and J4 are heavy wires, one of which is terminated with a heavy battery clip and the other with a fuse holder of the type most commonly used on auto radios. A pair of smaller leads is made to fit into J3 and J4. These leads terminate in alligator clips filed to fit the A-battery prongs of most battery radios. A similar pair of leads is made with suitable clips for the B-voltage jacks.

Testing vibrators

Determine the make and type number of the vibrator you wish to test and look up its characteristics and base connections in a vibrator manual. Set up the Carvalyzer as follows:

1. MASTER switch OFF.
2. VIB TEST on T.
3. METER switch on 10 VOLTS.
4. VIBRATOR switch on SYNC or NON-SYNC for synchronous or nonsynchronous vibrators, respectively.
5. BUFFER switch IN.
6. LOAD LAMP switch ON.
7. Set LINE CONTROL for highest resistance.
8. B-VOLTAGE CONTROL counterclockwise until S2 is OFF.
9. PRI CONTROL at lowest-voltage setting.
10. Close S1.
11. Connect VIBRATOR TEST LEADS to vibrator letting unused clips hang clear.
12. MASTER switch ON.

M3 should indicate about 1½ volts.

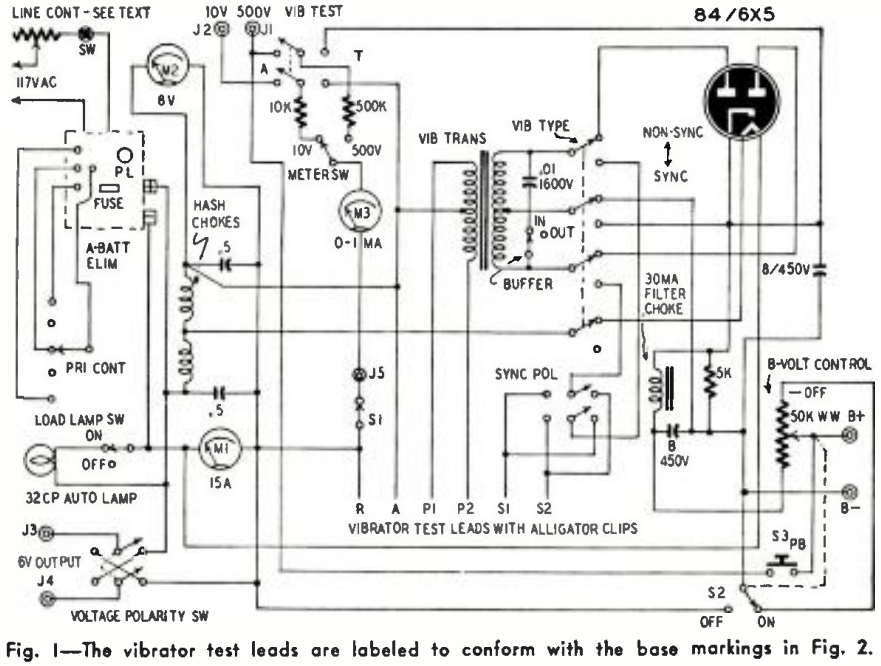


Fig. 1—The vibrator test leads are labeled to conform with the base markings in Fig. 2.

Hold the vibrator in your left hand and advance the LINE CONTROL until the vibrator starts to vibrate. Note the indication on the lower GOOD-?-BAD scale of M3. If the meter reads BAD or "?", or M1 reads more than 2.4 amperes, reject the vibrator. This test tells the condition of the reed, driving coil, and starting contacts.

If the vibrator is good, test it for

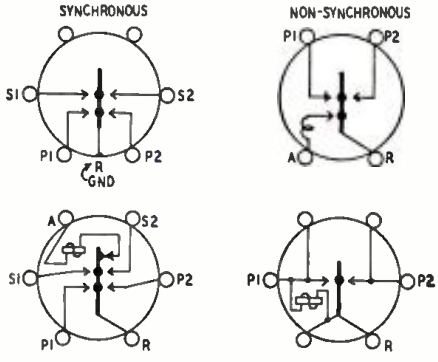


Fig. 2—Typical vibrators, with pin markings.

output. Set the METER switch to 500 volts. If there is no indication when testing synchronous vibrators, throw the SYNC POL switch to the opposite position. M3 should read up-scale. Check the SYNC POL switch as soon as possible because, when it is incorrectly set, a negative voltage is applied to the positive side of the filter capacitors in the Carvalyzer.

When M3 reads up-scale with either type of vibrator, turn the load lamp off and advance the PRI and LINE CONTROL until M2 reads 6 volts. Check M1 to make sure the vibrator is not drawing more than 2.4 amperes. The indication on the upper GOOD-BAD scale of M3 will tell whether the vibrator passes the voltage-output test.

Testing auto radios

Consult the sticker on the chassis or a service manual to determine the drain of the set. Connect the Carvalyzer to the set through the heavy leads from J3 and J4. Set the PRI CONTROL and the LINE CONTROL for the lowest voltage. Close S1.

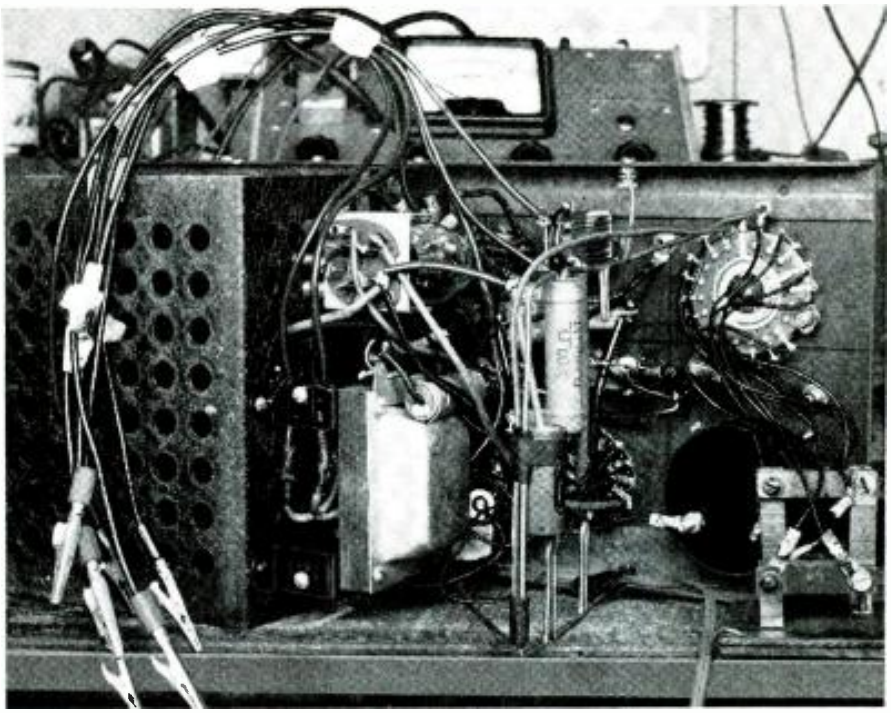
Make sure all tubes and the vibrator are firmly seated in their sockets. Turn on the Carvalyzer and radio while watching M1 to make sure it does not go off-scale. Advance the LINE CONTROL and note the starting voltage on M2. The vibrator should start at about 4 volts. Adjust the voltage polarity for the lower current on M1. This corrects for positive or negative ground on polarized sets.

If the current drain is greater than specified by the manufacturer, test the tubes, pilot lamp, and vibrator; record any defects. Do not replace these components at this time. Turn on the set and Carvalyzer and adjust the input voltage to 6 volts. Note the current drain. It should be zero if the set has a PM speaker, and less than 1½ amperes if the set has a 4-ohm field coil. If it is more than 1½ amperes, disconnect the hot lead from the coil. The current

should drop to zero. If current still flows, look for stuck contacts on the push-button solenoid or clutch circuits, leaky capacitors, defective spark plates, and other defects in the 6-volt circuit.

Clear up any trouble in the 6-volt circuit; then check the B-circuits. Some sources of trouble in the high-voltage circuit have been cleared when the vibrator and tubes were checked. To check the vibrator transformer, install a good vibrator in the set. Open the BUFFER switch and disconnect the field coil. Open the center tap of the secondary if the set has a synchronous vibrator. Current greater than 1 ampere indicates shorted turns in the transformer, which must be replaced.

Replace all defective components. Be sure to put in a new buffer capacitor if the vibrator was bad. Turn on the set, adjust the Carvalyzer to 6 volts, and let the set warm up. Note the current drain. Remove the vibrator, readjust the input to 6 volts, and note the current. The difference in current consumption is the current passed by the vibrator. Most vibrators are rated at a 6-ampere maximum.



Inside the Carvalyzer. The A-eliminator is at left and the line-control resistor at right.

Measuring B-voltages

To measure B-voltages in any set being supplied by the eliminator, set the VIB TEST switch to A, the METER switch to the desired range, and plug the positive test lead into J1 or J2. Voltages are read on M3. With this connection, the filament lead is the reference point. Plug the negative test prod into J5, and open S1 to make measurements from other reference points, as across individual filaments in a series string.

Continuity tests

For low-resistance circuits, set the VIB TEST switch to A, turn the load lamp off, METER switch to 10 VOLTS, VIBRATOR to SYNC, and B-VOLTAGE CONTROL off. Plug one test lead into the 10-volt terminal J2, and clip the other to vibrator test lead A. Turn on the Carvalyzer, and adjust the primary and line controls for full-scale reading on M2. Touch the prods together, and M3 will read full scale. Use the prods for low-resistance tracing.

For high-resistance testing, connect a good synchronous vibrator as you would when running a test and adjust the output to 250 volts (mid-scale) on M3. Open S1, and M3 returns to zero. Plug one test lead into J5 and the other into the B-minus jack. Touching the leads together will bring M3 to mid-scale. Use known resistances to calibrate M3 on the low- and high-resistance ranges.

Operating 3-volt sets

Connect a good nonsynchronous vibrator to the test leads and adjust the output of the eliminator to 3 volts. Slightly less than 90 volts will appear at the B-terminals. For higher B-voltages, use a synchronous vibrator and adjust the Carvalyzer accordingly.

Plug the small test leads into J3 and J4; place the clips over the A-pins on the battery cable of the set. Plug another pair of leads in the B-voltage terminals and connect the clips to the B-voltage pins on the battery cable. Be sure to observe circuit polarity when making these connections. Consult the diagram of the set to see if there is a resistor in the negative lead; if so, make sure that it is good.

Set the Carvalyzer as for starting-voltage tests on the vibrator attached to the test clips. Turn on the unit and adjust it so the voltage on M2 does not exceed the filament voltage for the set. Turn on the set and correct the filament voltage if necessary. Insert test leads in J2 and J5, throw the VIB TEST switch to A, and check the polarity of the voltage on J3 and J4. If the polarity is incorrect, reverse it with the VOLTAGE POLARITY switch. Remove the leads from J2 and J3. Close S1. Set the METER switch on 500 VOLTS and advance the B-VOLTAGE CONTROL just enough to throw S2 ON. Check the filament voltage on M2. Hold the push-button switch S3 closed while adjusting the B-VOLTAGE control until the correct B-voltage is indicated on M3.

INEXPENSIVE RESISTANCE BOX

Here is a cheap and easy way to make up a resistance box which will allow the serviceman or experimenter to choose many values. Four octal tube sockets and 31 resistors are needed. The diagram shows the necessary connections.

Though half-watt resistors would be least expensive in making up the box, using 1- or 2-watt units will allow it to be employed where higher voltages and currents are to be dealt with to any extent.

Any combination of series resistors can be selected by plugging test leads into the proper pin holes. For 33,000 ohms, for instance, use terminals 22 and 13. If the desired value cannot be obtained with a series combination, use resistors in parallel by providing a jumper lead with a single phone tip on one end and a phone tip and tip jack on the other. For quick calculation of parallel resistances, one of the commercial cardboard "slide rules" is extremely helpful.

The schematic will be needed each time you use the resistor box, so preserve it well. Draw it with ink on white cardboard very carefully and shellac it.—*G. P. Brunton*