Vol. 10 FEBRUARY, 1945 No. 2

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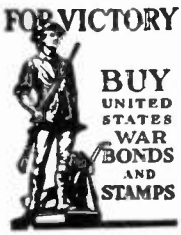

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HUNDREDS of Dubilier mica and paper capacitors made over a decade ago and more, are still giving efficient and reliable service in radio and electronic equipment. These capacitors are as good today as the day they were made. We are collecting case histories of such units.

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These advertisements are listed FREE of charge to C-D readers so if there is anything you would like to buy or sell, if you wish to obtain a position or if you have a position to offer to C-D readers, just send in your ad.

These columns are open only to those who have a legitimate, WANTED, SELL or SWAP proposition to offer. The Cornell-Dubilier Electric Corp. reserves the right to edit advertisements submitted, and to refuse to run any which may be considered unsuitable. We shall endeavor to restrict the ads to legitimate offers but cannot assume any responsibility for the transaction involved.

Please limit your ad to a maximum of 40 words, including name and address. Advertisements will be run as promptly as space limitations permit.

SWAP OR SELL—400 v. 250 mil. P.T., 250 mil. swinging choke, 12" speakers P.M. and 5000 ohm fields, parabolic baffles, 6v. genemotors. Want freq. mod. test oscillator, 50 and 200 microamp. meters, television receiver, 5" cathode ray tube. Henry's Radio, 410 Thames St., Newport, R. I.

FOR SALE—Supreme mode. 555 deluxe diagnoscope (3" scope and all wave signal generator combined). Generator needs slight repair. Cost $180. take $100 f.o.b. Stockton. Radio Bill, 316 E. Clay St., Stockton, Calif.

WANTED—Pocket multimeter, 2 or 3" oscilloscope, capacity resister bridge, vacuum tube voltmeter, communication receiver, service oscillator, prefer Precision. Trade scarce equipment for same. Bob Eubank, 1227 Windsor Ave., Richmond 22, Va.

WANTED—For cash or trade Model B2C condenser tester or model 2C made by Solar. Also output transformer of 4, 8, 15 and 500 ohms to plates of 6L6s in pushpull, and handle 25 or 30 watts of audio. Have large spkrs., line trans. cable and cash, radios and powerpacks. John Arnold, P.O. Box 84, Bluffs, Ill.

TRADE—Abbott MRT-3 2½ meter transceiver completely mobile with Mallory VP-552 vibropack for communications receiver or sell for $55. Want FM television receiver, Sentinel camera. Radio $15 or trade for signal gen. Karl H. Stello, 925 Monroe St. N.E., Washington 17, D. C.

WANTED FOR CASH—Portable recorder and play back 2 speed motor, must be in excellent condition. Apollo, 101 W. 37th St., New York 18, N. Y.

FOR SALE — One 12 watt amplifier, two speakers, all in three piece carrying case with crystal mike and stand, made by Webster. One 20 w. RCA amplifier, brand new. Giant Racon 6v units, trumpets. One genemotor type E2. National Sound Equipment Co., 625 Main St., Worcester 8, Mass.

WANTED—Any one of following output transformers: UTC LS-55, CHT 15S90, K-407, K-408. State condition and price. C. L. Goebel, 221 W. 233 St., Bronx 63, New York.

WANTED—Silver Marshall 716 tuner with 683 amplifier and speaker. Have meters, radio parts, some tubes and two small radios to sell or trade. Walt's Radio Sales and Service, 1801 Illinois Ave., Lansing 6, Mich.

WANTED—Tubes 1.4 v., 12, 35 and 50v. State price and quantity. Pfc. E. J. Malinowski, 36357988, A.A.F., O.R.D., Greensboro, N. C.

FOR SALE—Two JFM-90 G. E. F.M. radios. Brand new, never been used, 2 limiters, each set $55.00. These are 9 tube FM sets without audio. E. L. Cox, 2035 Academy St., Winston-Salem, N. C.

WANTED—Radio tubes and radio receiving sets, also small public address system. Will pay cash. H. G. Radcliffe, 1013 High St., Petersburg, Va.

WANTED—Radio tube tester, must be able to test all tubes to date, and be in A-1 condition. New or used. All letters answered. Joseph A. Wozniak, 1336—5th Ave., Pittsburgh 19, Pa.

WANTED—Power pack for 4 tube 1½ v. portable to supply 1.5 v. at 200 m.a. and 90 v. at 13 m.a. from 110 v.a.c. line. G.T.C. Porta-power Model U equivalent. S. Manville, 189 E. 18th St., Brooklyn New York.

WANTED—Vols 9 to 13 Rider's Manuals, tube tester, a.c. operated oscillator and late model tubes. Must be in perfect condition. Also Graflex camera. State lowest cash price or will trade small metal lathe, like new. V. D. Telschow, 205 South W. 1st St., Red Oak, Iowa.

WANTED—100 small output transformers, pentode to voice coil, all must be same. 100 octal sockets, 200 ½ watt resistors 50 M ohms. New or used. V. R. Parker, 104th A.A.C.S. Sqdn., Bradley Field, Conn.

WANTED—FM tuner or set of FM antennae, RF, oscillator, IF, discriminator, coils with var. cond. Also a recorder unit, with or without playback or record changer. Irwin Olin 429 Fairmount Ave., Jersey City, N. J.

FOR SALE—Service equipment and stock. Supreme signal generator, Triplett tube checker set analyzer, VOM meters, about 300 tubes, 9 radio sets, 10 or 12 for parts salvage, resistors, condensers, transformers, other repair parts. Truck load for $600. Marken's Electric Service, Church Point, La.

WANTED—One Hallicrafter (S-20 or larger) communications receiver, urgently needed. Paul B. Kuzmak, 67 Buckland Road, Wethersfield 9, Conn.

WANTED—Counter model tube tester, also signal generator, VOM analyzer, any model in good shape. Give full price and condition. Clarence W. Hull, Mineral Springs, Pa.

SALE OR TRADE—New Brush RC 20 crystal recording head and needle. Make offer. Trade for record changer. J. O. Kobzina, 705 Corwin Ave., Hamilton, O.

WANTED—Several small ac-dc receivers. They must be intact but not necessarily in working order. State model, make, etc. in first letter. Write O'Brien's Radio, 164 W. 2nd St., Fulton, N. Y.

WANTED—Hickok model 188X signal generator and Hickok model RFO-5 oscillograph or Supreme 561 oscillator and a Supreme 560 Vedolyzer. State price and condition. R. H. Willard, 7 Johnson Ave., Winthrop 52, Mass.

WANTED—Cameras, camera equipment, small radios, record players, also odd clocks, as China, cuckoo, metal, miniature, and other types. Will pay cash, or trade for other radio items. Gerald Samkofsky, 527 Bedford Ave., Brooklyn, N. Y.

WANTED—Rider's Manuals, vols. 8 to 13 inclusive. Lt. David Salzman, c/o Union Radio Television Lab., 2 Chester Court, Brooklyn 25, N. Y.

WANTED—BKV S1DJ 120 v. tube ballast for Philco model No. 39-18. Will pay list price. Charles Royer, 391 Liberty St., Allentown, Pa.

WANTED—Late models of the following: radio analyzer, frequency modulator AF-RF-IF oscillators, oscillographs, tube checkers, oscilloscope. In first class condition. L. J. Monahan, B.R.R. Bldg., Speigner, Ala.

FOR SALE—Solar CC, condenser tester in excellent condition. Ted Hamilton, What Cheer, Iowa.

WANTED—Voltohmeter in good condition. Have hand phones, never used, also tools. R. Welker, 219—48th St., Union City, N. J.

FOR SALE—Jannette rotary converter, 115 volts dc to 110 v. ac, .3 kw output. Good condition. Suitable for radio operation, price $15.00. George Cowperthwait, Ballston Spa., N. Y.

FOR SALE — QST magazine, from March 1941 to January 1944, 26 mags. in all, plus ARRL handbook, and Nilson and Hornung Radio Operating, questions and answers, plus few others. All for $8.00. John Kozma, 3104 Wilkinson Ave., New York 61, N. Y.

FOR TRADE—Hot water heater for rear seat of car with all fittings, hose. Small steel tool box with lift out tray. Vol. Everybody's Radio Manual, vol. Air Craft Sheet Metal Manual. C. W. Hull, Mineral Springs, Pa.

FOR SALE—Three tube public address system, complete with mike, and speaker, contains 6W6, 5Y3 and 6J7. For particulars write Reed B. Gillette, RFD No. 1, Sharon, Conn.

FOR SALE—Radio tubes, instruments, and supplies, including 12SQ7, 12SK7, 50L6, 0Z4, 6SA7, 6SK7, etc. All at OPA ceiling price. Only 1 to 8 of each kind. Send stamp for list. John J. Trowbridge, 7936 Parnell St., Chicago 20, Ill.

WANTED—Two small copper oxide rectifiers for meter operation. Oscar's Radio Service, Merrill, Iowa.

(Continued on page 13)

USING TUBE CHARACTERISTICS*

HOW STATIC AND DYNAMIC CURVES SHOW TUBE OPERATION IN AMPLIFIER CIRCUITS

The static characteristic curves of a tube as given in tube data books refer only to the electrical behavior of the tube itself and the effect of fixed voltages, without reference to any impedances which may be associated with that tube as loads. The varied range of loads that can be applied to tubes makes it necessary to combine their characteristics with the static tube characteristics to be able to predict the results.

For example, in Fig. 1 is shown the plate characteristics of a 6J5 triode connected to the simple circuit also in Fig. 1, which is a common type of voltage amplifier circuit.

The presence of any impedance in the plate circuit of a vacuum tube will cause the instantaneous plate voltage, e_b, of the tube to vary in some manner determined by the grid voltage, e_c, and the type of load impedance. The combination of the load impedance and the static characteristic of the tube produced the so-called dynamic characteristic. By dynamic is meant the behavior of the entire circuit when an AC grid signal is present.

For a simple resistance load of 50,000 ohms as shown in Fig. 1, for every milliampere increase in plate current, the plate voltage will decrease 50 volts. With a higher load resistance the plate voltage would decrease a greater amount per milliampere increase in plate current.

Many characteristics of performance can be predicted graphically from the static characteristics of an amplifier tube in combination with a load line. A load line is drawn on the static characteristic curves to represent the variation of plate current and voltage for the particular type of load being used. The straight line drawn from 400 volts on the voltage axis to 8 milliamperes on the current axis on Fig. 1 is called the load line. It is characteristic of all load lines for resistance loads. The resistance represented by this line may be an actual resistor as in Fig. 1, or it may be the reflected load on the secondary of a transformer connected in the plate circuit of a tube, similar to Fig. 5. Loads which are inductive or capacitive produce load lines which are ellipses and are more difficult to deal with.

Load Line

The construction of a load line on the static plate characteristic permits the calculation of: (1) the useful

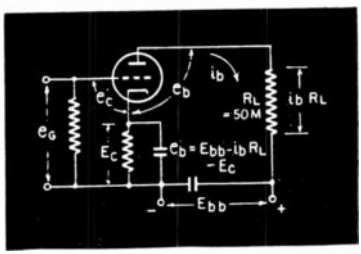
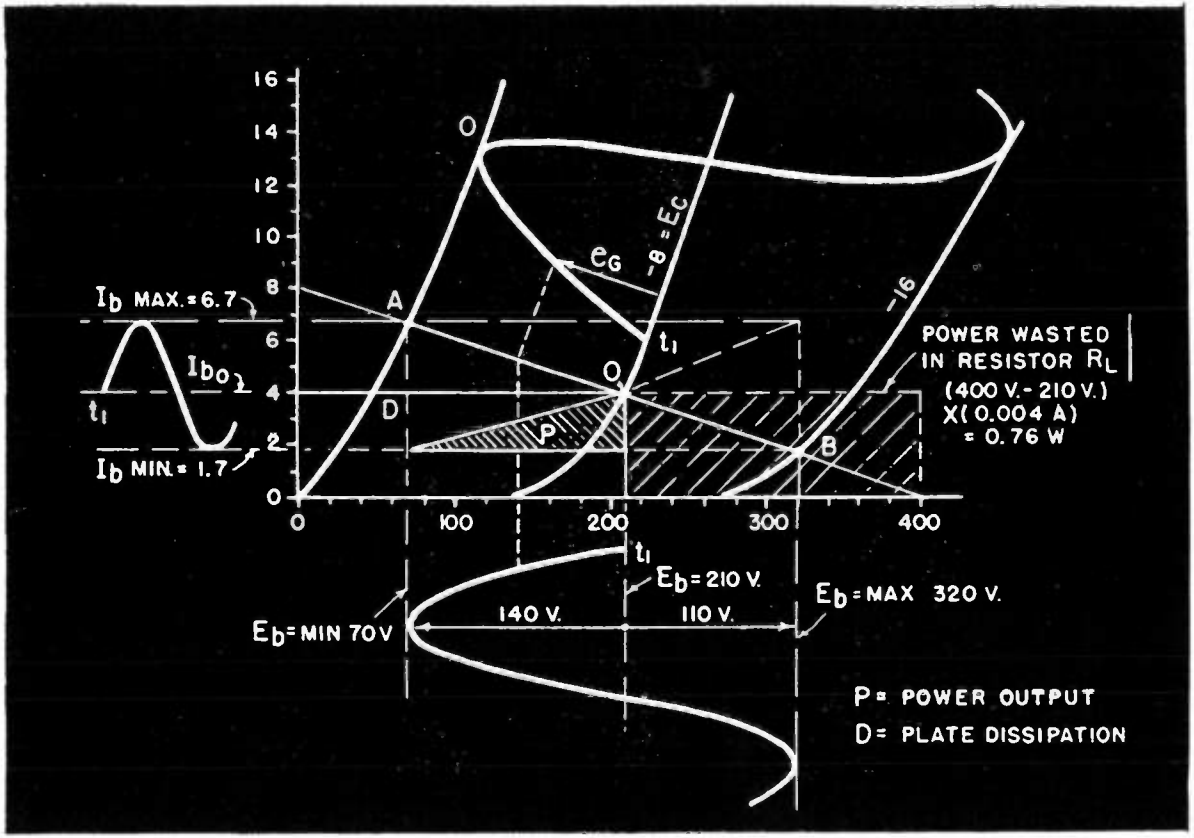


Fig. 1—Current, voltage and power relations for triode amplifier in circuit above. Area P represents useful output. (See diagram next page.)

signal voltage across the load resistor R_L; (2) the gain of the circuit; (3) the distortion; (4) the power

* *Courtesy of Radio & Television Retailing.*



output. A number of other factors may also be easily determined and they will become obvious as the method of constructing a load line is explained.

To construct a load line for a given resistance load when the supply voltage E_{bb} is given, proceed as follows: (1) divide E_{bb} by the value of the load resistance R_L, which will give a current value I_b'; (2) draw a line on the static curves between I_b' and E_{bb}. This is the load line for the given conditions. The intersection of the load line with the static curve representing the grid bias to be used, is called the operating point as O in Fig. 1.

Effect of Signal

If an AC signal voltage is applied to the grid circuit of the tube, the plate current will vary along the load line as constructed, between the limits set by the magnitude of the grid voltage, e_c. For example, in Fig. 1 a grid bias of —8 volts is used giving an average plate current of 4 ma. (the average plate current is found by drawing a line horizontally from the operating point to the i_b axis). The average plate voltage, E_b, is 120 volts (this is found by drawing a line from the operating point perpendicular to the plate voltage axis). If an AC signal with a peak value of 8 volts is applied to the circuit of Fig. 1 the grid will reach an instantaneous voltage of zero once each cycle and —16 volts once each cycle with the axis of operation being —8, which is the DC grid bias.

It will be seen that at the instant the grid is at zero volts the plate current will be 6.7 ma. and the plate voltage will be 70 volts. This is point A in Fig. 1. When the grid reaches an instantaneous value of —16 volts, the plate current will be 1.7 ma. and the plate voltage will be 320 volts. This is point B on the graph. From these figures it will be seen that the plate voltage of the tube varies from 320 at one instant to 70 volts a half-cycle later, giving a total variation of 250 volts. This is the peak-to-peak voltage available across the tube, and as far as the signal is concerned, also across R_L. This is the useful signal voltage available to operate the following tube or circuit. It is seen that for a peak-to-peak grid signal voltage of 16 volts, the tube produced 250 volts peak-to-peak in the plate circuit. This is a gain of 15.8 to 1. The amplification factor of this 6J5 tube is 20. Smaller values of grid signal voltage would naturally produce smaller plate voltage variations. The entire operation of the tube takes place along the load line under the direction of the grid signal voltage. When the grid signal voltage is zero, the tube plate current and voltage are those at its operating point. The plate current also varies from a maximum of 6.7 ma. to a minimum of 1.7 ma., or a peak-to-peak value of 5 ma.

The useful signal power delivered can also be found from the load line and static curves of any tube, by using the method shown in Fig. 1. The useful power output for a resistance load is the peak alternating plate current x the peak alternating plate voltage ÷ 2. From Fig. 1 the power output becomes,

$$P \text{ (watts)} = \frac{(E_{b\,max} - E_{b\,min})\ (I_{b\,max} - I_{b\,min})}{8}$$

The plate current values must be in amperes.

Referring to Fig. 1, it will be noticed that the power output of the tube can be represented by the area of the shaded triangle which is 1/8 of the total block area shown in dashed lines. The power input to any tube is E_b x I_{bo} and this is shown in Fig. 1 as a large rectangular area. The efficiency of the tube circuit is the ratio of the power output to the power input and is also the ratio of the two areas.

For Class A conditions as shown in Fig. 1 (where I_{bo} does not change

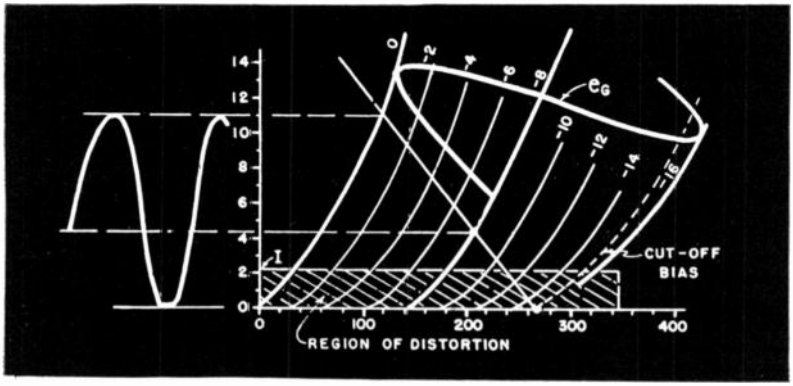


Fig. 2—Distorted output caused by incorrect load line value.

with the variations in grid signal voltage), it is seen that the power input to the tube is always a constant value, regardless of whether power output is obtained. This means that the useful power output of a tube operated Class A is power that is saved from that which would otherwise be wasted in heating the plate of the tube.

The plate of a Class A tube actually runs cooler when it is delivering large amounts of output power (within its rating) since this power will go back into heating the plate whenever the grid driving voltage is absent. It can also be seen from Fig. 1 that the maximum power output of a Class A tube will occur when the shaded triangle has its maximum size, which is ½ of the tube input or a 50 per cent efficiency. This cannot be achieved in actual practice since it would require that the instantaneous plate voltage reach zero and the instantaneous plate current reach a maximum value.

When it is necessary to select the best value of load resistance for an unusual condition of operation proceed as follows: When the operating point O is given and the peak grid voltage is known, draw several lines through O (the line which crosses the characteristic grid voltage lines at right angles is usually best) and select the line which gives the least distortion. The least distortion is obtained when the $I_{b\,max}$ is as many milliamperes above I_{bo} as $I_{b\,min}$ is below. The effect of an incorrect value of load resistance is shown in Fig. 2.

To avoid distortion in a Class A amplifier, care should be taken in selecting the value of load resistance and the operating point so when the grid is at its most negative voltage, the instantaneous plate current is not in the "region of high distortion" which is shown as the shaded area of Fig. 2. The curvature of the characteristic lines is too great in this region and distortion will result for plate current values in this territory.

The same principles of constructing load lines for the triode series of tubes apply to pentodes and tetrodes. The plate characteristics of pentodes and tetrodes show that greater distortion will result by the use of these tubes. As an example, reference to the plate characteristic of the 6L6 beam power tube (which is similar to most pentodes), shows that the distance between the grid voltage lines changes from a fairly large value between the $E_c = 0$ and $E_c = -5$ to

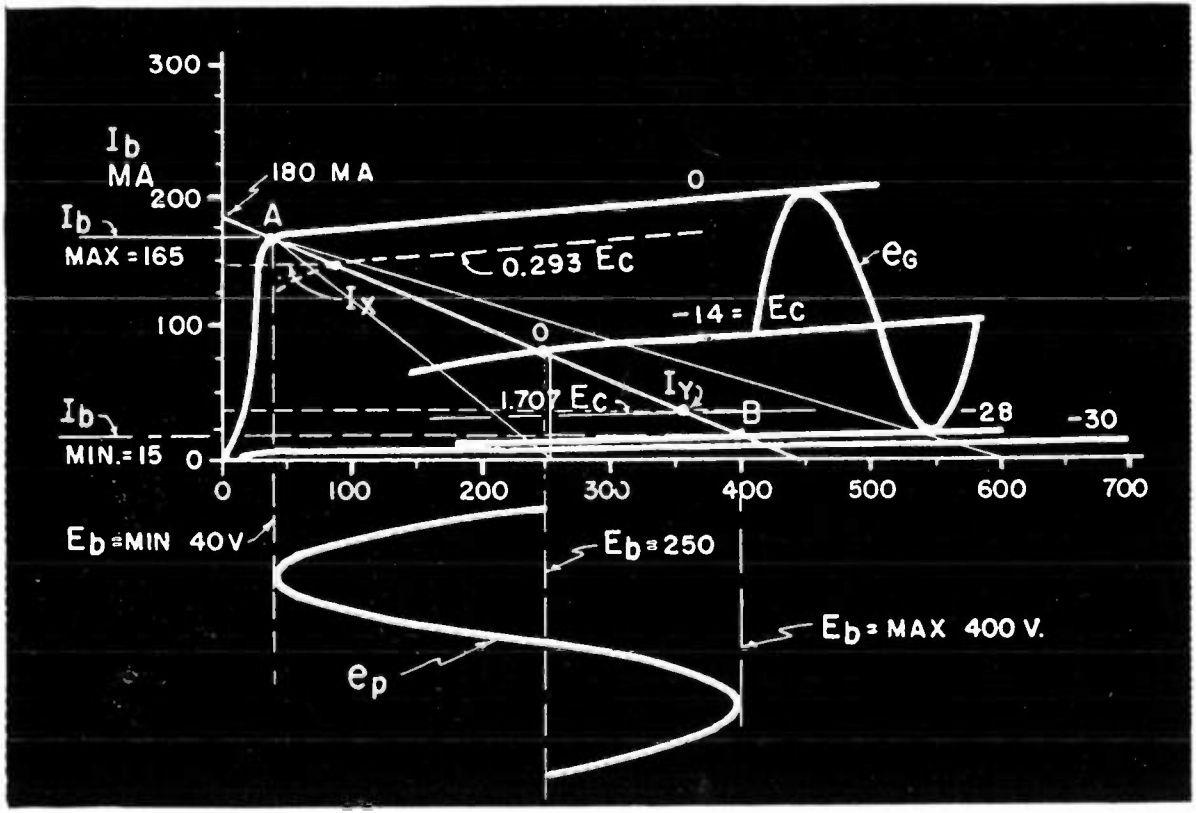


Fig. 3—Load line construction method for pentode amplifier. AOB is correct load for particular tube. I_x and I_y are used for distortion calculations.

a small value between $E_c = -25$ and $E_c = -30$. This gradual crowding of the family of curves at the higher grid bias values is typical of pentodes and tetrodes. It means that a 5 volt change in grid voltage will produce a smaller current change at the higher bias voltages than at the lower bias voltages. This characteristic must be kept in mind when constructing a load line for minimum distortion.

Pentode Operation

As an example, consider the problem of constructing a load line for minimum distortion on the 6L6 plate characteristic of Fig. 3. The tube is to be operated Class A which means, of course, that the grid is never to be driven positive by the signal voltage. A point is selected on the $E_c = 0$ curve near the "knee" as point A in Fig. 3. The peak grid signal voltage must be determined or known and the value of negative grid bias selected so that the grid will never become positive. The grid bias is usually selected as ½ of the last useful negative bias curve shown in the characteristics. In the case of the 6L6 of Fig. 3, this is in the neighborhood of —14 volts.

The object now is to draw load lines from point A so that equal distances are intercepted on the load line between points A and the point of intersection with the operating bias line and between the latter point and the point where the load line intersects a bias line of twice the value of the grid bias. As shown in Fig. 3, for minimum distortion the distance between A and the operating point O, must be the same as between point O and point B. This load line is most easily established by using a marked scale with a center O, positioned on the plate characteristics until the lengths of the load line on either side of the operating bias line are equal.

After the correct line for minimum distortion has been drawn on the characteristic curves, its corresponding value of resistance may be determined by getting the slope of the line which will be the conductance. As in Fig. 3, the load line has been extended until it meets the plate current and plate voltage axes at 450 volts and at 180 ma. $\frac{450}{180 \times 10^{-3}} =$ 2500 ohms which is the correct value of load resistance to use with this tube under the given conditions. The operating bias in this case is —14 volts, the average plate current is 70 ma. and the average plate voltage is 250 volts. These values are all determined at the operating point O.

Because of the greater distortion in pentodes, the average plate current I_{bo} is not a fixed value over the range from no signal to full signal voltage. The distortion causes the plate current wave shape to differ from a pure sine wave and this causes a small rectification of the signal which will make I_b increase slightly from its no signal value. This increase in average plate current caused by rectification makes the load line shift slightly to the right as shown in Fig. 3, where the line AOB is the operating position and the dotted line is the position the load line occupies with no signal.

The power output from the tube in Fig. 3 can be calculated by the use of the above formula. In this case $I_{b\,max} = 165$ ma., $I_{b\,min} =$ to 15 ma. and $E_{b\,max}$ is 400 and $E_{b\,min}$ is 40 volts which gives a power of 6.7 watts. The rated power output for this tube as a Class A amplifier as given by manufacturers' data is 6.5 watts.

Because of the relatively large harmonic output of pentodes it is customary to include the power in the harmonics as part of the output. The power output taking into account the harmonics can be calculated from the following formula:

$$P \text{ (watts)} = I_{b\,max} - I_{b\,min} + 1.41\,(I_x - I_y)^2 R_P$$

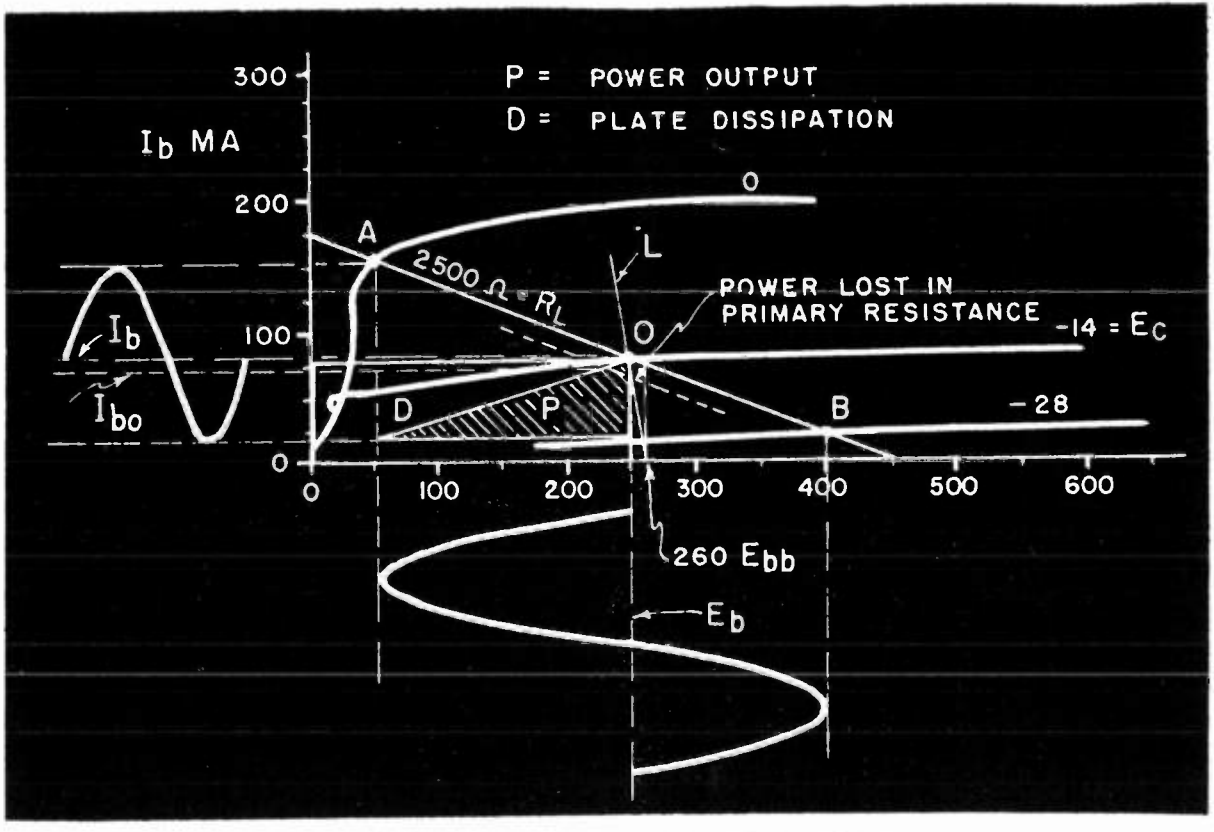


Fig. 4—Power diagram for pentode (6L6) showing load line.

All current values must be in amperes. Where the current value I_x and I_y are determined as shown in Fig. 3, all current values are in amperes; R_L, the load resistance, is in ohms.

The percentage of distortion may be calculated from the characteristic curves and the load line from the following formulas. For triodes:

$$\% \text{ 2nd Harmonic} = \frac{\frac{I_{b\,max} + I_{b\,min}}{2} - I_{bo}}{I_{b\,max} - I_{b\,min}} \times 100$$

where $I_{b\,max}$ and $I_{b\,min}$ are the values as shown in Fig. 1.

For pentodes the per cent distortion is

$$\% \text{ 2nd Harmonic} = \frac{I_{b\,max} + I_{b\,min} - 2I_{bo}}{I_{b\,max} - I_{b\,min} + 1.41\ (I_x - I_y)} \times 100$$

where the current values are determined as in Fig. 3.

Since practically all power amplifiers use an output transformer to connect the relatively low impedance load to the high plate resistance of the tubes the actual load resistance presented to the tubes is the value reflected into the primary of the output transformer. In Fig. 5 a typical power amplifier stage is shown with an output transformer in the plate circuit connected to the load resistance R_s of 10 ohms. The turn ratio of the transformer is 15:1 step-down. The 10 ohm load on the secondary will present an impedance of $10 \times 15^2 = 2250$ ohms. This reflected resistance is shown in phantom across the primary of the transformer as R_L. Since this load resistance R_L is a reflected value only and does not actually exist as a resistor, there is no direct voltage drop across it due to the average plate current of the tube. The only resistance to DC in the circuit is the resistance of the wire in the primary of the output transformer and this is usually a very few ohms. This primary DC resistance can be plotted from E_{bb} to find the operating point O as in Fig. 4. The line L represents the DC primary resistance.

While this reflected R_L is only present when there is a signal voltage on the grid of the tube, it can be represented by a load line on the plate characteristic in the same manner as previously described.

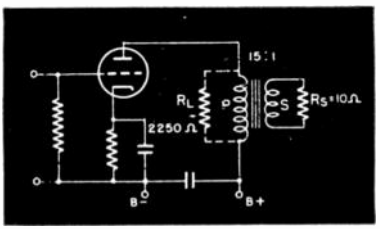


Fig. 5—Triode power amplifier and reflected load R_L.

In all cases, where the load resistance R_L is an actual resistor, the intersection of the load line with the plate voltage axis is the value E_{bb} or the required plate supply voltage. However, if the load resistance R_L is a reflected value as in the case with an output transformer, the intersection of the load line with the plate voltage axis is not necessarily the plate supply voltage, E_{bb}.

In nearly every case the required power supply voltage E_{bb} is only a few volts higher than the average plate voltage, E_b, at the operating point O. The extra few volts required are those lost across the DC resistance of the primary of the transformer. This is shown in Fig. 4. It is possible for the instantaneous plate voltage to rise above the power supply voltage in the transformer coupled amplifier because of the counter-emf across the primary due to the changing plate current. This counter-emf adds to the plate supply

voltage E_{bb} to increase the instantaneous plate voltage e_b above the value E_{bb}. Where a real resistor R_L is used, it is impossible for the instantaneous plate voltage to be higher than E_{bb}.

While every amplifier stage may quite reasonably be called a "driver" for the next stage, in either a radio frequency or an audio frequency amplifier, the term is generally restricted to refer to the stage just ahead of the final power-amplifier stage. Since the output stage may be anything from a single tube in Class A to a push-pull pair of Class B triodes, it follows that the "driver" in its turn may be anything from a small receiving pentode in a Class A circuit to a push-pull pair of heavy duty tubes.

THE RADIO TRADING POST

(Continued from page 4)

FOR SALE—1 Tork time clock, Bosch auto radio 40; Dumore 24 v.d.c. motors $2.75 each, Jefferson Pow-R-Unit, misc. tube list and parts list. Send for two page list. N. K. Stover, 1357 Hill St., York, Pennsylvania.

WANTED—Model 1230 Superior sig. gen., or similar. All vols. Rider's Manuals. Also neon Radio Service sign. Give all details. Cash. Joseph T. Lawman, 2105 Dundalk Ave., Baltimore 22, Md.

WANTED—One or two Jensen type Q8P high freq. speakers (tweeters) as used in JHP-52 CoAxial speakers. State condition and price. G. E. Beggs, Jr., School Lane, Warrington, Pa.

WANTED—Following tubes, new or used. 12SA7, 12SK7, 12SQ7, 12SG7, 1A7, 1N5, 1H5, 3Q5, 35L6, 50L6, 25L6, 35Z4, 35Z5, 25Z6, 25Z5, 6A7, 12A8, 12K7, 12Q7, 117Z6. Price in first letter. All letters answered. O'Brien's Radio, 164 W. 2nd, Fulton, N. Y.

FOR SALE—One Crosley Xervac in new condition. Complete with all accessories. Best offer takes it. French Radio Electric Store, 476 Main St., Stamford, Conn.

FOR SALE—Tubes, new, in sealed cartons at OPA ceiling prices. 4 each of 6V6GT, 6A4, 6A6, 12A5, 1 each of 156G, 1C6, 1A4, 1A6, 1F4. French Radio Electric Store, 476 Main St., Stamford, Conn.

WANTED—Tripplett modulating monitor, No. 1696A; RME LF 90 inverter, Abbott TR4, Hallicrafters S22R; meters, oscilloscope amplifier, 300 watt multi-match class B, mod. transf. Walter Kryger, 912 W. 151 St., East Chicago, Ind.

WANTED—Late model ac operated sig. gen., also Cornell-Dubilier cap. analyzer model BN, or similar good make. State price. F. L. Campbell, P. O. Box 332, Montezuma, Ind.

FOR SALE—Motor-generator, ac 110v, 60 cycle motor, dual voltage dc generator, 7.5v, 3 amp. and 500v, 75 ma. Good shape $15. Louis M Mendezoff, 5810 Pleasant Valley Rd., Cleveland 9, Ohio.

WANTED—Rider's Manuals, vols. 9 to 13 complete. State price and condition. One vol. or all wanted. Buening Electric, Red Lodge, Montana.

SWAP OR SELL—Three tube home-made regenerative receiver, Amperex 211-c, Various transformers, tubes. Want com. short wave set, with power supply. N. Waldman, 101 Wellington Hill St., Mattapan 26, Mass.

SELL OR TRADE—Two 813s, 6L6GX, one 7G7/1232; Yaxley hamband switch, type 162-C. Above all new. Need enlarger 2¼ x 2¼ with F 4.5 lens, Solar or similar; Kalart master speed flash with or without PWA adapter. C. Rataski, 1343 Edgehill Rd., Darby, Pa.

FOR SALE — Kolster K20 radios for PM spks., Colonial mod. 38, Majestic table model 370, Majestic, Philco, RCA and Brunswick radios. Write for list. Louis A. Goldstone, 1279 Sheridan Ave., Bronx 56, New York

FOR SALE—RCA test oscillator, A-1 cond., complete less battery, type TMV 97B, $12.50. Rider's Manuals, 1 including 7, $48.50, good cond. DeForest radio training course $15. L. N. LaBossiere, Garcau Ave., Ware, Mass.

WANTED—Radio tubes any quantity, must be perfect and boxed, give full particulars. Regal Radio Stores, 171 Washington St., New York City.

FOR SALE—Radio City Products 663 electronic multitester, like new. Best offer. John Anderson, 514 South Park St., Elizabeth, N. J.

WANTED—Rider's Manuals 6 to 13; also radio tubes, send list. Want signal generator, state price. Castle Hill Radio Shop, 2228 Newbold Ave., Bronx 61, New York.

WANTED—1 type 12SA7 tube, Weston or Triplett 0-1 ma; Signal chaser and 4x5 or 5x7 Speed Graphic or B.J. press camera with lens and between lens shutter. Darold McCann, Box 481, Drumright, Okla.

FOR SALE OR TRADE — Dodge rewound generator, 110v. ac, 300 watts $30. Want good signal generator, multi-meter or receiver. Sell AM-FM carrier level meter $10. K. H. Stello, 925 Monroe St. N.E., Washington, D. C.

TUBES FOR SALE—I have a few of the following type tubes, new and in original boxes, at 30% off list: 5Z3, 6A3, 6A4, 6SK7GT, 12SK7GT, 12A, 37, 57. Ralph Hunter, 12 North St., Catskill, N. Y.

WANT—Small VOM such as Triplett 666, Supreme, Precision, etc. In perfect condition. G. Samkofsky, 527 Bedford Ave., Brooklyn, N. Y.

WILL TRADE—Scarce tubes such as 1LA6, 1LN5, 7B7, 12SA7, 50L6, etc., for Thordarson transformers, no. 15S91, 15A74, 15C55 and 14C70. Eugene Kursith, Box 247, St. James, Minn.

FOR SALE OR TRADE — Tubes, instruments, parts, etc. Send stamp for my big list. J. Trowbridge, 7936 Parnell St., Chicago 20, Ill.

FOR SALE—1936-37 Ford auto radio, separate header speaker, good condition, $35. One .25 automatic $25; ¼ hp motor , A-1 condition, $12. Paul Capito, 637 W. 21 St., Erie, Pa.

FOR SALE OR TRADE—Used radio tubes, Jewel 0-200 dc MM, dynamic spkr. for 6F6 tube, 3 power trfs., 300 cal. rifle shells, Taylor compass, Bud code practice osc. with tube. Write needs. O'Brien, 164 W. 2nd, Fulton, N. Y.

FOR SALE — 1941 edition of NRI radio course. 50 lessons. Make offer. Wanted Ac voltmeter 1000 ohms per volt, two ranges, 0-20 and 0-150 volts approx. Denver Radio, 1427 Glenarm Pl., Denver, Colorado.

FOR SALE—Large stock of radio tubes and parts. Write for list. Henshaw Radio Co., 3313 Delavan, Kansas City 2, Kansas.

WANTED—A condenser analyzer, a model CE Exam-eter or Sprague Tel-Omike or Aerovox 95 LC checker. Want Rider's Manuals, 9-12. What have you, price, condition. Clyde W. Wimer, 800 Wampum Ave., Ellwood City, Pa.

WILL TRADE—W. E. 555-W theatre loud speaker unit for 33 1/3 rpm turntable. Have W. E. relays, many types, strips of 10 for standard rack mounting. What do you need? A. H. Dreesen, Mansfield Centre, Conn.

WANTED—Triplett model 1200-C VOM or model 625-T. Must be in new condition. Full particulars. Cecil Fernandez, Box 1453, St. Petersburg 1, Fla.

FOR SALE—Esco No. RSL4, 110v. ac, 3 2 amp. generator. Has slip clutch, self-excited field, filter and control rheostat. Used about 100 hrs., in top shape. Price $80. Used tubes for sale. E. O. Reinhardt, 322 N. Tejon, Colorado Springs, Colo.

FOR SALE — 1,000 6SL7 tubes, new in original carton. Wire or write F. A. B. Distributing Co., 704 Baronne St., New Orleans 13, Louisiana.

WILL SELL—Oscillators, testers, all kinds. transformers. speakers, switches, condensers, 244 tubes, mostly new hard to get. Get list. All or none, price $420.00. W. E. Collins, Church Point, La.

WANTED—Hickok model 530 tube tester, G. E. model SG-2 sig. gen., voltohmyst. Other makes considered. Claude Haston, 2652 Woodbine Ave., Knoxville, Tenn.

FOR SALE—12, 25, 35, 50 v. tubes repaired on your present tube tester. Send 50c for details. Want 1.4 v. tubes, and sound head for 35mm Powers movie projector. L. M. Wycoff, Marmaduke, Ark.

FOR SALE—W. E. hearing aid 38-B audiphone (used), complete with rubber ear piece and case. Suitable for persons with moderate loss in hearing. First $25 check gets it. Have 12A7 tube new, unused. C. R. McLaughlin, 801 Kingston Road, Baltimore 12, Md.

FOR SALE—Auto radio for 1942 Ford or Mercury, original carton, never in car, six tubes, separate speaker, push button and foot control, all accessories. Make offer. Want FM converter or receiver, test equipment, or Rider's Manuals. George Swanson, Box 224, Englewood, N. J.

FOR SALE OR TRADE — Tubes, meters, transformers, chokes, condensers, motors, generators, etc. Complete list for stamped, self-addressed envelope. Leonard Tulauskas, 72 N. Fenton Ave., Indianapolis 1, Ind.

WANTED—15 or 20 watt amplifier, reliable make with two speakers and good crystal mike all angle pickup. State particulars. All letters answered. R. A. Bookman, Casey, Illinois.

WANTED—If you have burnt out or inoperative test equipment, receivers or other electronic equipment to sell, describe. Pace's Radio Service, P. O. Box 611, Vicksburg, Miss.

WANTED—Zenith radio. For use in day room at army camp. Not necessary to be in playing condition. Give price and condition. L. J. Monahan, M. & M. Radio Service, B. R. R. Bldg., Speigner, Alabama.

FOR SALE — Radiotron Designer's Handbooks, $1.10 postpaid. Handbook of receiver design for servicemen and engineers. Description upon request. Engineers' Book Co., Box 575, Alexandria, Virginia.

WANTED—Several 32 v. radios at once. Campbell's Radio Shop, Iowa Falls, Ia.

WANTED—Philco model 42-123 1½ v. battery radio receiver, without battery. Joseph A. Spalla, Plaza, N. Dak.

FOR SALE—Early model GE tube tester in exchange for NRI or Sprayberry Radio Course. Can offer latest AC tubes in addition or cash. State age, condition and price. Albert Spector, 178 Cornell St., Roslindale 31, Mass.

FOR SALE—12 headless boys' figures, each with new shoes and socks. Especially made for infants' wear store (ages 6-8). Best offer takes all. Want C-D B-F 50, Solar BQC, Sprague Tel-Omike capacitor analyzers. Price and condition. Milton Maultasch, 535 Grand St., Brooklyn 11, New York.

FOR SALE OR TRADE—DC generator, 6 or 12 v. to 350 and 750 v.d.c. Just overhauled, new bearings & brushes. Interested in photographic or fishing equipment. Make offer. S. Wiseman, 114 N. Elmwood Ave., Buffalo 1, N. Y.

SALE OR TRADE—Astatic X26 crystal recording head $12; Kwick Feed, No. 2, S. & R. mimeograph; Vensen 20w PM spkr., late model $15. Need analyzer oscillator a.c. or batt., pocket multimeter, 2" oscillograph. Describe. Stamp brings list. Robert Bargdill, Westboro, Ohio.

FOR SALE—Radio tubes, mostly new at OPA list. 12SA7, 12SK7, 12SQ7, 6SK7, 6SQ7, 1A7, 1N5, 27, 6J5. 15 new P.M. spks. COD on 25% deposit. Melvin Okin, Suite 1103, 210 Fifth Ave., New York 10, N. Y.

WANTED FOR CASH—Rider's Manuals 1, 2, 3, 4, 6, 8, 10. Any or all. State price and condition. Radio Service Lab., Box 150, Washington, Iowa.

WANTED — Hickok oscillator, mod. OS12 instruction book. Will pay $2. Pinkney's Radio Service, 9 Duncan St., San Francisco 10, Calif.

SWAP OR SELL—New 25 watt amplifier, custom job, 2 6L6, 1 7F7, 1 7B4, large chassis, for small refrigerator motors, any reasonable offer. Pvt. A. S. Rossberg, 1035 46th St., Brooklyn 19, N. Y.

WANTED—Rider's Manuals, vols. 9-13 inclusive, in new condition. Current net prices paid. Give details. Rackley's Radio & Electric Shop, 213 Hopewell St., Hopewell, Va.

WANTED—Signal generator, Hickok, mod. 188 X, or what have you? State particulars. E. Taffe, Jr., 411—42nd St., Union City, N. J.

WANTED—Late mod. all-wave sig. gen., comb. tube and set tester. Prefer Hickok, Triplett or RCP. Operate on 110-120 v. 50-60 cycle, excellent condition. Give details. Cash. Norm's Radio Service, 1016 E. Palm Ave., Bellflower, Calif.

URGENTLY NEEDED—Rider's Manuals 8 through 13; new, used, or any condition as long as no pages missing, prices must be reasonable. Buford Brown, Box 307, Trion, Ga.

WANTED—One RCA Universal a-c bridge, type TMV-132-A. State condition, price. George E. Beggs, Jr., School Lane, Warrington, Pa.

WANTED — Late N. R. I. radio course. Send information as to year and price. L. T. Hussin, 63 Miriam St., Valley Stream, N. Y.

WANTED—Philco, model 1841 auto radio for 1941 Ford, also FM tuner or parts, and Ford - McCullough Supercharger. Bill Matchett, P.O. Box 1563, Santa Ana, Calif.

FOR SALE—All types of electronic tubes, such as: cathode ray, acorn, transmitter, receiver, etc., supply limited. Send self-addressed stamped envelope together with your order for tubes. New list out late January. V. Kozma, 3104 Wilkinson Ave., New York 61, New York.

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