SUPPLEMENT

In many cases brief summaries or comments are given, particularly with the later references.

This Supplement completely supersedes the smaller Supplements included in earlier impressions.

CHAPTER 1

INTRODUCTION TO THE RADIO VALVE

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CHAPTER 2

VALVE CHARACTERISTICS

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(E) Iron-cored inductors

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CHAPTER 7

NEGATIVE FEEDBACK

SECTION 7 : OVERLOADING OF FEEDBACK AMPLIFIERS ON TRANSIENTS

Negative-feedback amplifiers often distort a signal, such as a pulse, which changes rapidly with time, although the amplitude of the signal is less than that required to overload the amplifier when the rate of change of the signal is small. This is because the feedback voltage changes more slowly than the input voltage, with the result that the voltage applied to the grid of one of the valves becomes large enough to drive it into grid current or beyond cut-off.

The case of a cathode follower with a capacitive load has been covered in Sect. 2(i)(Y) page 327.

The design of single-stage, two- and three-stage resistance-coupled amplifiers is covered in Ref. J3, with curves, of which the following is a summary. In single stage amplifiers the magnitude of signal required to overload the valve decreases as the rise-time of the signal is reduced. In two-stage amplifiers, the voltage applied to the first valve increases as the rise-time of the signal is reduced, but only if the gain of the amplifier is very small is it possible for the first valve to be overloaded by a signal which does not also overload the second valve. The second valve is, therefore, normally the first to overload. If the time-constant of the first stage is sufficiently large compared with that of the second stage, the input signal required to overload the second valve does not decrease as the rise-time of the signal is reduced. In three-stage amplifiers, the voltage applied to the third stage is never greater for a quick change than for a slow change. Therefore, if the first two stages are designed not to overload, the signal required to overload the amplifier is as large when it changes quickly as when it changes slowly.

See also Ref. J10.

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CHAPTER 10

CALCULATION OF INDUCTANCE

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CHAPTER 11

DESIGN OF RADIO FREQUENCY INDUCTORS

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CHAPTER 12

AUDIO FREQUENCY VOLTAGE AMPLIFIERS

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A19. Ayres, W. R. " R-C coupled amplifier charts " Audio Eng. 37.10 (Oct. 1953) 12. Comments on published charts (R.C.A.) and operating conditions of R.C. amplifiers.

A20. Stockman, H. (letter) " Degenerative pentode equivalent circuit " Proc. I.R.E. 41.6 (June 1953) 801. Derives useful formulae.

A21. Goodfriend, L. S. See Ref. B14.

A22. Pullen, K. A. " Conductance curves speed triode r-c amplifier design " Tele-Tech 12.5 (May 1953) 80.

(B) Resistance-capacitance-coupled pentodes

B13. Haycock, J. G. " Pentode gain stabilizing circuit " Elect. 26.11 (Nov. 1953) 200. Stabilizes gain by using voltage-sensitive resistor in low potential section of screen voltage divider of r.c. pentode.

B14. Goodfriend, L. S. " Bypass and decoupling circuits in audio design " Jour. A.E.S. 1.1 (Jan. 1953) 111. Mathematical treatment of partially bypassed cathode and screen resistors, giving gain and phase angle. Also triodes with decoupling network.

B15. Pullen, K. A. " Conductance curves speed r-c amplifier design " Tele-Tech 12.7 (July 1953) 44.

(C) Phase inverters

C28. Bourget, L. R. " Phase splitter " U.S. Patent No. 2,618,711. Described by R. H. Dorf " Audio Patents " Audio Eng. 37.3 (March 1953) 4. Claims perfect balance 20 to 150,000 c/s.

C29. Wen Yuan Pan, " Phase inverter with reduced hum " U.S. Patent No. 2,626,321 (R.C.A.). Described by R. H. Dorf, Audio Eng. 37.6 (June 1953) 4, with circuit diagram. Uses no additional components.

C30. Varkonyi, G. " Cross-coupled inverter " Audio 38.5 (May 1954) 8. Comparison between cross-coupled and split-load—former is deficient at high frequencies and when directly coupled to driver tubes and negative feedback is used, serious trouble is experienced with biasing of drivers, also dynamic balance upset. Split-load type is excellent at high frequencies but gives less low frequency stability. See also letter J. Marshall Audio 38.6 (June 1954) 14.

C31. Boegli, C. P. " Simplified cross-coupled amplifier " Radio and TV News 51.5 (May 1954) 62. Eliminates input tubes of original circuit with some increase in distortion.

(D) Direct-coupled amplifiers

D42. McDonald, D. " Constant current d-c amplifier " Elect. 25.7 (July 1952) 130.

(F) Pulse amplifiers and transients

F2. Boegli, C. P. " Transient and frequency response in audio equipment " Audio Eng. 38.1 (Feb. 1954) 19. Mathematical analysis of the uptake characteristic when unit step input signal is applied to amplifier or pickup.

(H) General

H1. Sodaro, J. F. " The pass band of a transformer-coupled amplifier " Audio Eng. 37.6 (June 1953) 24. Also gives abac for 1 and 3 db attenuation frequencies of a transformer.

H2. Villchur, E. M. " Handbook of sound reproduction—Chapter 13, Voltage amplifiers and phase splitters " Audio Eng. 37.10 (Oct. 1953) 42.

H3. Crowhurst, N. H. (booklet) " Amplifiers " (Norman Price, London, 1951).

CHAPTER 13

AUDIO FREQUENCY POWER AMPLIFIERS

ADDITIONAL REFERENCES

H1. Peterson, A. P. G. " A new push-pull amplifier circuit " G.R. Exp. 26.5 (Oct. 1951) 1. See also Refs. E32, H2, H29, H45.

H2. " Single-ended push-pull amplifier " W.W. 58.5 (May 1952) 203. See also Refs. E32, H1, H29, H45.

H3. Brociner, V., and G. Shirley " The OTL (output-transformer-less) amplifier " Audio Eng. 36.6 (June 1952) 21. Correspondence W. H. and J. R. Coulter ; L. Bourget, 36.9 (Sept. 1952) 10, 14. See also Refs. H36, H43, H45.

H4. Moir, J. " Review of British amplifiers " FM-TV 11.10 (Oct. 1951) 30.

H5. Hafler, D., and H. I. Keroes " Ultra-linear operation of the Williamson amplifier " Audio Eng. 36.6 (June 1952) 26. See also Refs. H6, H11.

H6. Williamson, D. T. N., and P. J. Walker " Amplifiers and superlatives—an examination of American claims for improving linearity and efficiency " W.W. 58.9 (Sept. 1952) 357. See also Ref. H5.

H7. Sarser, D., and M. C. Sprinkle " Musician's amplifier " Audio Eng. 33.11 (Nov. 1949) 11.

H8. Sarser, D., and M. C. Sprinkle " Musician's amplifier senior " Audio Eng. 35.1 (Jan. 1951) 13.

H9. Sarser, D., and M. C. Sprinkle " The Maestro—a POWER amplifier " Audio Eng. 36.11 (Nov. 1952) 19. Gives output 80 watts at 2% intermodulation.

H10. Beaumont, J. H. " Williamson type amplifier using 6A5's " Audio Eng. 34.10 (Oct. 1950) 24.

H11. Hafler, D., and H. I. Keroes " An ultra-linear amplifier " Audio Eng. 35.11 (Nov. 1951) 15. See also Ref. H5.

H12. Kiebert, M. V. " The Williamson type amplifier brought up to date " Audio Eng. 36.8 (Aug. 1952) 18.

H13. Miller, E. J. " A stable, high quality, power amplifier " Electronic Eng. 24.294 (Aug. 1952) 366.

H14. Werner, C. L., and H. Berlin " New medium-cost amplifier of unusual performance " Audio Eng. 36.11 (Nov. 1952) 30.

H15. Williamson, D. T. N. " High quality amplifier modifications " W.W. 58.5 (May 1952) 173.

H16. " Leak Point One Amplifiers " booklet by H. J. Leak and Co. Ltd., Brunel Road, Westway Factory Estate, London, W.3.

H17. Pullen, K. A. " Using conductance curves in electronic circuit design " Proc. National Electronics Conference Vol. 6 (1950) 112. See also Chapter 2 Refs. B14, B22, B32.

H18. Good, E. F. " RC or direct-coupled power stage " W.E. 30.3 (March 1953) 54. Gives conditions for maximum efficiency for ideal triode with parallel feedback.

H19. Bender, W. G. " A power tube figure of merit " Audio Eng. 37.3 (March 1953) 21. Letters A. J. L. Prasil 37.5 (May 1953) 10, G. B. Houck and W. G. Bender 37.6 (June 1953) 10.

H20. Postal, J. " Simplified push-pull theory—a graphical, non-mathematical explanation," Audio Eng. (1) 37.5 (May 1953) 19 ; (2) 37.6 (June 1953).

H21. Bogen, L. H., and A. M. Zuckerman " Loudness contour selector in new amplifier " Audio Eng. 37.5 (May 1953) 31. David Bogen DB20 amplifier, distortion 0.3% total harmonic at 20 watts, 0.25% at 15 watts, 0.2% at 10 watts 1000 c/s. Combined plate and cathode loading. Loudness contour-selection 5 positions. See also Ref. H25.

H22. Werner, C. L., and H. Berlin " Everyman's amplifier—new low cost ten watt unit described as the Ford of the Hi-Fi industry " Audio Eng. 37.10 (Oct. 1953) 40. Distortion 0.25% up to 9 watts output, 1% at 10 watts.

H23. White, S. " The White Powtron Amplifier " Audio Eng. 37.11 (Nov. 1953) 32. Uses ultra-linear amplifiers, with 2 channels, 20 watts main amplifier, 10 watts treble amplifier, with frequency dividing network prior to both amplifiers. No distortion figures quoted. Employs mainly negative voltage feedback, but also small degree of negative current feedback ; this is claimed to eliminate " power distortion " caused by variation in loudspeaker impedance. See comment Chapter 12 Ref. C30.

H24. Langford-Smith, F. " Limiting Class A operation—a useful device for good quality push-pull power amplifiers " Radiotronics 18.10 (Oct. 1953) 177.

H25. Frieborn, J. K. " High quality circuits " Radio Electronics 24.9 (Sept. 1953) 33. Includes Brociner UL-1 (ultra-linear), Bell 2200 (combined plate and cathode loaded), Bogen DB 20 (combined plate and cathode loaded—see also Ref. H21—with distortion curves) and Stromberg-Carlson AR-425 (pentodes with overall feedback—with distortion curves).

H26. Hust, L. B. " Extended Class A amplifier " Radio and TV News 50.3 (Sept. 1953) 40. Two triodes and two pentodes in push-pull parallel, output 50W. See R.D.H. p. 587 and Refs. E31, E13.

H27. Marshall, J. " Junior Golden-Ear amplifier " Radio Electronics 24.11 (Nov. 1953) 55. Modified ultra-linear with push-pull 6V6. See also Ref. H33.

H28. Crowhurst, N. H. (booklet) " Amplifiers " (Norman Price, London, 1951).

H29. Yeh, Chai " Analysis of a single-ended push-pull audio amplifier " Trans. I.R.E.—PGA. AU-12. (March-April 1953) 9. Theoretical analysis and experimental results. See also Refs. E32, H1, H2.

H30. Onder, K. " A new transformerless amplifier circuit " Jour. A.E.S. 1.4 (Oct. 1953) 282.

H31. Corderman, S. A., and F. H. McIntosh " A new 30-watt power amplifier " Jour. A.E.S. 1.4 (Oct. 1953) 292. A Class AB1 McIntosh amplifier. See also Ref. E28.

H32. Pomper, V. H., " The Scott 99A Amplifier " Radio and TV News 51.2 (Feb. 1954) 66. 10 watts output, distortion 0.8%, hum 80 db below full output, pre-amplifier on same chassis. See also Ref. H38.

H33. Marshall, J. " The new Golden-Ear amplifier " Audio Eng. 38.1 (Jan. 1954) 17 ; pre-amplifier and tone control 38.2 (Feb. 1954) 22. Power output 20 watts ; distortion not stated. See also Ref. H27. See comment Chap. 12 Ref. C30.

H34. Macpherson, C. H. " A medium-power tetrode amplifier with stabilized screen supply " Audio Eng. 38.2 (Feb. 1954) 30. Complete with pre-amplifier and tone control on single chassis. Output stage 6V6-GT. Intermodulation distortion less than 0.5% up to 8 watts, 1.2% at 10 watts.

H35. Sterling, H. T., and A. Sobel " Constant current operation of power amplifiers " Jour. A.E.S. 1.1 (Jan. 1953) 16. Also Elect. 26.3 (March 1953) 122. Uses push-pull parallel 5881's in " ultra-linear " Class A2 with high load resistance (12,000 ohms P-P) to give an approach towards constant current operation. Each cathode with its own resistor and bypass ; matching of valves and subsequent adjustments not required. Driver stage P-P 12B4's as triode cathode followers, directly coupled.

H36. Onder, K. " Audio amplifier matches voice-coil impedance " Elect. 27.2 (Feb. 1954) 176. Balanced transformerless amplifiers ; outputs 8 and 18 watts. See also Ref. H3.

H37. Roddam, T. " Grounded-grid A.F. amplifier " W.W. 60.5 (May 1954) 214. Increased power output, using positive feedback and negative overall feedback.

H38. " Tested in the Home : Scott 99-A Amplifier " High Fidelity 4 : 2 (April 1954) 81. Output tubes balanced automatically. See also Ref. H32.

H39. Langford-Smith, F. " Triodes versus pentodes in high-fidelity output stages " Radiotronics 19.7 (July 1954) 73.

H40. " Equipment report—QUAD II " Audio 38.5 (May 1954) 28.

H41. Bereskin, A. B. " A high efficiency-high quality audio frequency power amplifier " Trans. I.R.E. PGA. AU-2.2 (March/April 1954) 49. Push-pull 807's in Class B1 with 24 db feedback from tertiary, output 50W for 0.7% distortion at 400 c/s. Direct coupling to output stage. Does not require matched valves. Permits different plate and screen voltages. Uses special bi-filar output transformers.

H42. Hafler, D. " Ultra-linear operation of 6V6 tubes " Radio and TV News 51.6 (June 1954) 43.

H43. Gilbert, F. H. " The Stephens OTL amplifiers " Radio and TV News 49.3 (March 1953) 45. No output transformer, triode output, distortion 0.1% at 18 watts. See also Ref. H3.

H44. Marshall, J. " The importance of balance in push-pull amplifiers " Radio Electronics 24.7 (July 1953) 28.

H45. Dickie, D. P., and A. Macovski " A transformer-less 25-watt amplifier for conventional loudspeakers " Audio 38.6 (June 1954) 22. Output 20 W into 16 ohms with 0.4% harmonic distortion. Three type 6080 valves with 6 triode units in parallel. See also Refs. H1, H3.

CHAPTER 14

FIDELITY AND DISTORTION

ADDITIONAL REFERENCES

(A) Distortion and fidelity—general

A56. Schjelderup, J. R. " A proposed solution to the loudness control problem " Audio Eng. 36.9 (Sept. 1952) 34.

A57. Robbins, J. G. " The acoustic significance of the amplitude and phase of harmonics present in a source of sound in a room " J. Acous. Soc. Am. 24.4 (July 1952) 380.

A58. DeLange, O. E. " Distortion measurement " U.S. Patent No. 2,618,686 (see R. H. Dorf, Audio Patents, Audio Eng. 37.3 (March 1953) 2. Visual method employing outphasing principle.

A59. Lampard, D. G. " Harmonic and intermodulation distortion in ' power law ' devices " Proc. I.E.E. 100.5 Part IV (Oct. 1953) 3. The calculation of the amplitudes of harmonic and intermodulation components produced when two sinusoidal voltages are applied to a device whose transfer characteristic is a simple power law—e.g. in variable density sound-on-film and use of diodes in a.g.c. circuits.

A60. Aerovox, " Phase shift distortion test " reprinted Radio and Hobbies, Australia, 15.11 (Feb. 1954) 37. Combines output with input, phase reversed 180 degrees, to show distortion on CRO.

A61. Tyler, V. J. " Simple distortion meter " W.W. 59.9 (Sept. 1953) 431. Uses filter-amplifier to remove fundamental frequency (letter) G. H. Askew and R. Malchell, W.W. 59.12 (Dec. 1953) 582.

A62. Wigan, E. R. " Diagnosis of distortion—The Difference Diagram and its interpretation " W.W. 59.6 (June 1953) 261.

A63. Peterson, A. G. " The measurement of non-linear distortion " Presented at the I.R.E. Convention, March 1949. Technical Publication B-3, General Radio Company, Cambridge, Mass. Compares various methods of measurement.

A64. Pressey, D. C. " Measuring non-linearity " W.W. 60.2 (Feb. 1954) 60. The fundamental is subtracted by frequency-insensitive element, using adding amplifier with one valve, and test signals need not be pure sine wave. Corrections 60.3 (Mar. 1954) 128.

A65. " High fidelity—what is it ? Some suggestions for a high-fidelity yardstick " Jour. A.E.S. 2.1 (Jan. 1954) 56.

A66. Bloch, A. " Measurement of non-linear distortion " Jour. A.E.S. 1.1 (Jan. 1953) 62. The harmonic, heterodyne (CCIF) and intermodulation methods of measurement are examined from a mathematical standpoint.

A67. Maxwell, D. E. " Comparative study of methods for measuring non-linear distortion in broadcasting audio facilities " Jour. A.E.S. 1.1 (Jan. 1953) 68. Compares harmonic, I.M. and C.C.I.F. methods for essentially pure quadratic and cubic distortion, with frequency response uniform ; limited to 8,000 c/s ; and increasing at low and high frequencies.

A68. Lampard, D. G. " Harmonic and intermodulation distortion in ' Power law ' devices ". I.E.E. Monograph, Dec. 1952. Digest Proc. I.E.E. 100. Part III 64 (March 1953) 111. Mathematical treatment deriving both intermodulation and harmonic distortion in terms of the index.

A69. I.R.E. Standards on Circuits : Definitions of Terms in the field of Linear Varying Parameter and Non-Linear Circuits 1953. Proc. I.R.E. 42.3 (March 1954) 554.

A70. Dadson, R. S. " The normal threshold of hearing and other aspects of standardisation in audiometry " Acustica 4.1 (1954) 151. NPL determination of normal threshold of hearing. Results differ significantly from those of Sivian and White and given by Fletcher (Ref. A3).

A71. Jones, E. M. " How much distortion can you hear ? " Trans. I.R.E. PGA. AU-2.2 (March/April 1954) 42. 35% detected an increase of distortion from 0.3% to 0.9% at 1000 c/s and an increase from 0.8% to 1.7% at 100 c/s ; 28% detected an increase in I.M. distortion from 1.5% to 3.7% on tape ; 21% detected 1.3% I.M. distortion on a live performance.

(B) Intermodulation distortion

B23. Berth-Jones, E. W. " Intermodulation distortion—its significance and measurement " Jour. Brit. I.R.E. 13.1 (Jan. 1953) 57.

B24. Scott, H. H. " Intermodulation measurements " Jour. A.E.S. 1.1 (Jan. 1953) 56. Describes the two main types of intermodulation measurements—modulation meters and beat tone measurements, with comments. Good bibliography.

(D) Limited range, speech and noise

D20. Conference on speech analysis, Acoustical Society of America, J. Acous. Soc. Am. 24.6 (Nov. 1952) 581-642 (10 papers).

D21. Hirsh, I. J., and W. D. Bowman " Masking of speech by bands of noise " J. Acous. Soc. Am. 25.6 (Nov. 1953) 1175.

CHAPTER 15

TONE COMPENSATION AND TONE CONTROL

Additional Tone Control Circuit

(see page 669)

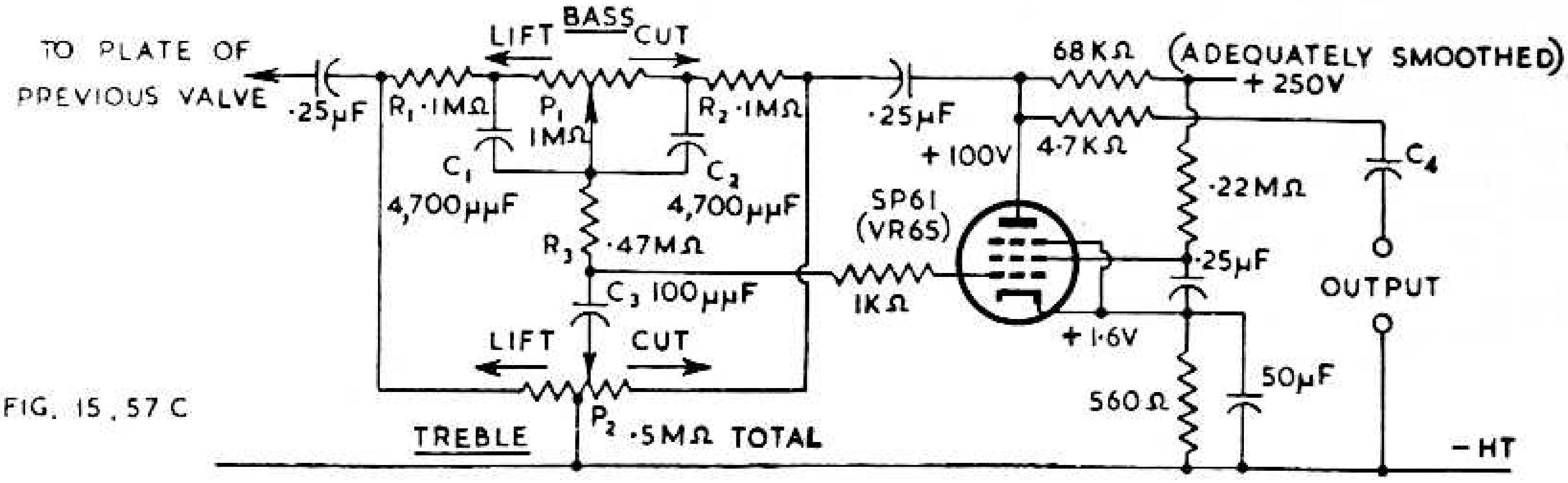

FIG. 15.57 C

Fig. 15.57C. *Tone control circuit. Tolerances R_1, R_2, C_1, C_2, R_3, C_3 ± 5%. P_1 and P_2 are linear potentiometers, P_2 having a fixed tapping at 50% rotation. The source impedance should not be more than 10,000 ohms. C_4 should normally be 0.05μF if following stage has 0.25 MΩ grid leak (Ref. 91). Type 6AU6 could be used as substitute for the type shown, with suitable values of cathode and screen resistors, to give an output of about 2 V r.m.s.*

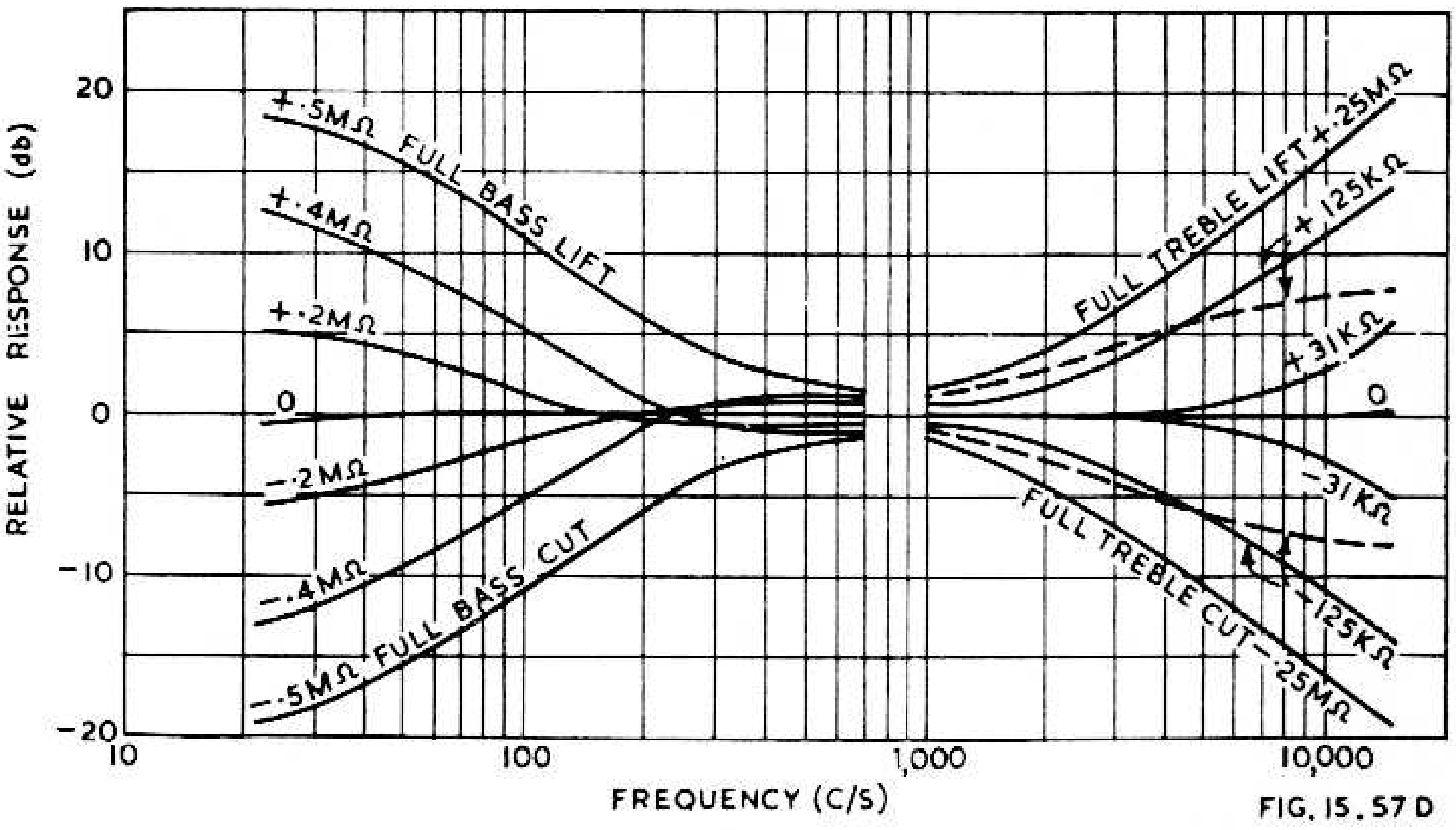

FIG. 15.57 D

Fig. 15.57D. *Measured frequency response curves of circuit of Fig.* 15.57C. *Labels on curves are resistance values between potentiometer slider amd centre of element. Dotted curves are with P_2 centre-tap disconnected from earth and with one* 0.33 *MΩ resistor connected from each end of P_2 to earth (Ref.* 91).

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91. Baxandall, P. J. " Negative feedback tone control—independent variation of bass and treble without switches " W.W. 58.10 (Oct. 1952) 402. Correction 58.11 (Nov. 1952) 444.
92. Douglas, G. A. " Simplified equalizer design—charts and tables to reduce complication and construction hints to ease building " Audio Eng. 36.12 (Dec. 1952) 18.
93. " The ' Vari-Slope ' Pre-amplifier " H. J. Leak and Co. Ltd., Brunel Road, Westway Factory Estate, Acton, London, W.3. Uses modified twin-T resistor-capacitor networks in negative feedback loops to give continuously-variable slope of attenuation characteristic (from 5 db to 50 db over the octave immediately following the cut-off frequency), and choice of two cut-off frequencies. See also Ref. 99.
94. Villard, O. G., and D. K. Weaver " The Selectoject " Q.S.T. (Nov. 1949) 11 ; A. Q. Morton " Oscillator/filter unit " W.W. 59.3 (March 1953) 129.
95. Villchur E. M. " The selection of tone control parameters " Audio Eng. 37.3 (March 1953) 22

96. Mountjoy, G., and C. R. Shafer " Tone control circuits " U.S. Patent 2,626,991 (Stromberg-Carlson) described by R. H. Dorf, Audio Patents, Audio Eng. 37.6 (June 1953) 4. Two circuits shown, with curves, each providing bass boosting, one with potentiometer control.
97. Barber, B. T. " Flexible tone control " Audio Eng. 37.9 (Sept. 1953) 29. Americanized form of Baxandall circuit, Ref. 91.
98. Villchur, E. M. " Handbook of sound reproduction—Chapter 14. Tone control and equalization " Audio Eng. 37.11 (Nov. 1953) 25.
99. Crowhurst, N. H. " British audio circuits " Radio Electronics 24.11 (Nov. 1953) 74. Telrad, Leak " Vari-slope " and QUAD tone control circuits.
100. Dundovic, J. F. " A three-channel tone-control amplifier " Audio Eng. 37.4 (April 1953) 28. Provides bass and treble boosting of varying slope and fixed hinge-point. Correction (new diagram) 37.12 (Dec. 1953) 20.
101. Sisson, E. D. " Resistance-capacitance networks in amplifier design " Jour. A.E.S. 1.1 (Jan. 1953) 116. RC networks reduced to 2 basic types, and attenuation and phase angle characteristics given.
102. Blies, F. R. " Attentuation equalizers " Jour. A.E.S. 1.1 (Jan. 1953) 125. Comprehensive treatment of equalizers to correct overall gain-frequency characteristic with 11 charts.
103. John, R. S. " Dynamic loudness control " Radio and TV News, R.E.E. Supplement 49.5 (May 1953) 10. General principles and circuit giving frequency compensation varying with instantaneous level.
104. O'Leary, M. G. " Loudness control : the good and bad features of some popular types " Radio Electronics 24.8 (Aug. 1953) 48.

CHAPTER 16

VOLUME EXPANSION, COMPRESSION AND LIMITING

ADDITIONAL REFERENCES

88. Pope, G. J. " Design for a constant volume amplifier " Electronic Eng. 24.296 (Oct. 1952) 464. Letters B. D. Corbett and G. J. Pope, 24.298 (Dec. 1952) 580.
89. Roberts, D. E. Volume compressor, U.S. Patent, 2,596,510. See R. H. Dorf " Audio patents" Audio Eng. 36.12 (Dec. 1952) 2.
90. Scott, R. F. " Volume expanders and compressors " Radio Electronics 24.3 (March 1953) 41.
91. Culicetto, P. J. " Volume expander and compressor " U.S. Patent 2,615,999. Described by R. H. Dorf Audio Eng. 35.5 (May 1953) 2. Second harmonic 0.35%, third harmonic 0.15% with 17 db expansion ; or output level ± 3 db for 22 db input level changes. Tubes 2 6 SNT-GT, 1-6J5, 1-6H6.
92. Schouten, G. H. " A.G.C. by means of miniature NTC resistors with heating element " Philips Tec. Com. 7 (1953) 9. Reprinted from Electronic Application Bulletin 12.2 (Feb. 1951) 33. May be applied to public address a.v.c.
93. Roberts, F. W., and R. C. Curtis " Audio automatic volume control systems " Jour. A.E.S. 1.4 (Oct. 1953) 310. Useful summary of limiting, compression and public address a.v.c. devices.
94. Nigro, J., and J. B. Minter " Concert-hall realism through the use of dynamic level control " Jour. A.E.S. 1.1 (Jan. 1953) 160. Uses 6SK7 with cathode bias, screen varying from -2 to $+5$ volts, and suppressor from 50 to 150 volts for dynamic control, and frequency response is a function of the output level.

CHAPTER 17

REPRODUCTION FROM RECORDS

DISCS AND STYLI (Continued from page 709)

(D) R.C.A. 45 r.p.m. Extended Play (EP) records

These records have a maximum playing time of 7.9 minutes and the following characteristics :

Grooves per inch, normal max.	300
Peak recording velocity	14 cm/sec.
Diameter innermost music groove	4¼ in. min.
Groove width	2.5 to 3.0 mils
Minimum permissible groove width	2.2 mils

The lead-out groove is reduced in length due to the smaller ending diameters. All other factors (except intermodulation distortion and groove velocity) as shown on pages 708 and 709. For shorter selections (3 to 4 minutes or so) the number of grooves per inch is selected to bring the last music groove to 4.875 inches, and the lead-out groove is as described on pages 708 and 709. For longer selections the number of grooves per inch is gradually increased and minimum recording diameter decreased simultaneously to the limiting values stated above.

SECTION 5 (i) Standard Playback Curve

(Continued from pages 731-732)

The original AES Standard Playback Curve (Fig. 17.15A) has now been revised, and the new curve (Fig. 17.15D Curve B) has been adopted by the RIAA, AES, NARTB (transcriptions) and leading American phonograph manufacturers. The original curve is also shown as Curve A in Fig. 17.15D to enable a direct comparison to be made.

This curve may be duplicated on a flat amplifier by the RC network of Fig. 17.15E following a triode, or that of Fig. 17.15F following a pentode.

The history and details of the new curve are given by Moyer (Ref. 346).

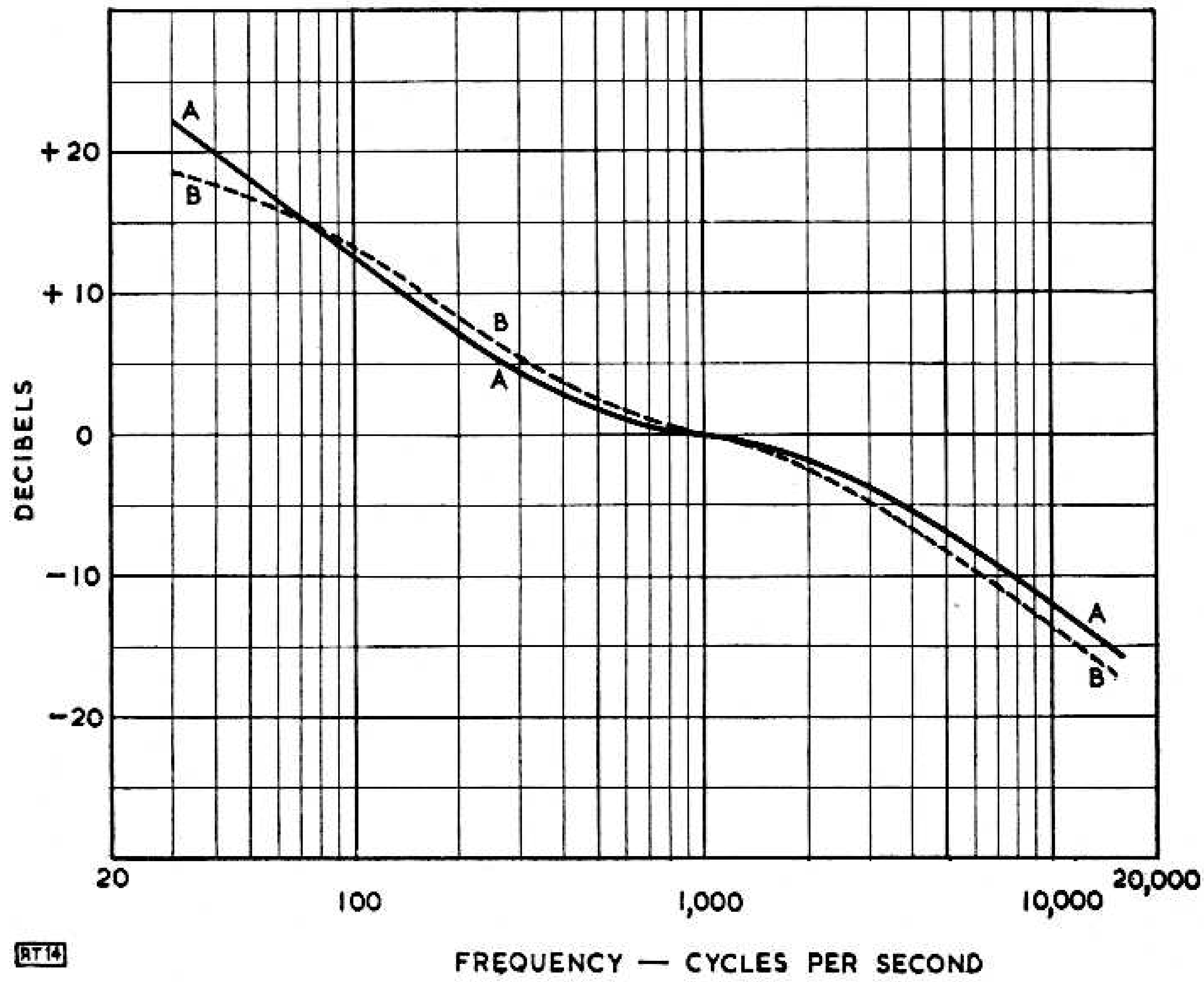
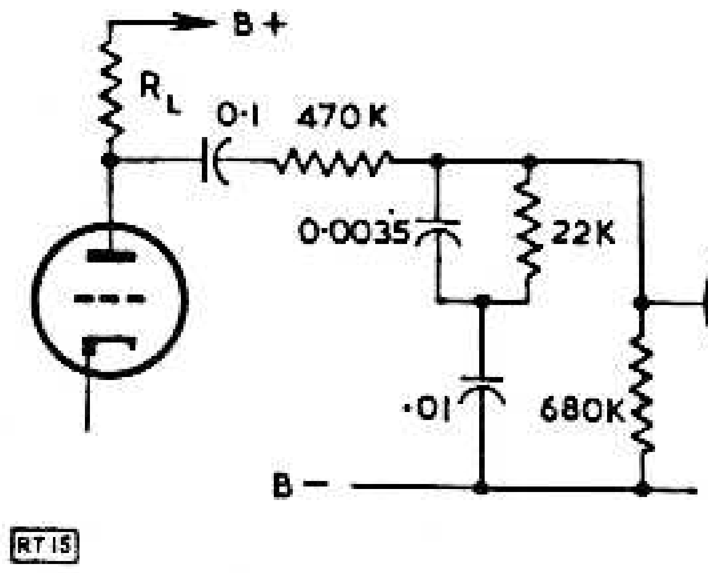


Fig. 17.15D. (*A*) *Old AES Standard Playback Curve* ; (*B*) *New RIAA—AES—NARTB—RCA New Orthophonic Standard Playback Curve* (*RT*14).



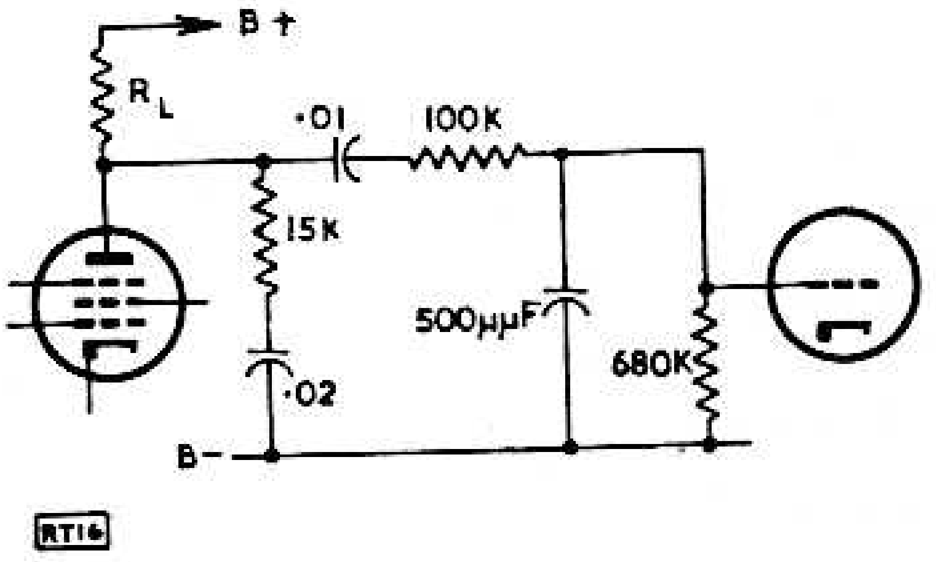


Fig. 17.15E. *Equalizing circuit following a triode* (*RT*15).
Fig. 17.15F. *Equalizing circuit following a pentode* (*RT*16).

ADDITIONAL STANDARD FREQUENCY TEST RECORDS

(Continued from pages 753-757)

LXT 2695 Decca Microgroove Frequency Test Record

This record has been cut at 33-1/3 r.p.m. with the groove width, at the top, of 0.0037 of an inch (0.95mm) with an included angle of 90° + or − 1° and a radius at the bottom of the groove of less than 0.0003. The recording is from outside to inside in bands of constant frequency and in the following order :—

15 Kc/s (+ 12.5 db) ; 14 Kc/s (+ 13.1 db) ; 13 Kc/s (+ 12.9 db) ; 12 Kc/s (+ 12.0 db) ; 11 Kc/s (+ 11.5 db) ; 10 Kc/s (+ 10.5 db) ; 9 Kc/s (+ 10.1 db) ; 8 Kc/s (+ 9.2 db) ; 7 Kc/s (+ 8.5 db) ; 6 Kc/s (+ 7.3 db) ; 5 Kc/s (+ 5.9 db) ; 4 Kc/s (+ 4.6 db) ; 3 Kc/s (+ 3.6 db) ; 2 Kc/s (+ 1.9 db) ; 1 Kc/s (0 db) ; 500 c/s (− 2.3 db) ; 250 c/s (− 6.6 db) ; 125 c/s (− 9.0 db) ; 60 c/s (− 11.7 db) ; 40 c/s (− 13.9 db).

The recorded velocity at 1,000 cps is 1.2 cm per sec. r.m.s. These levels are accurate to within + or − 0.5 db.

This record should be played with a pickup using a point radius of 0.001 of an inch and with a vertical force of not greater than 10 grams.

ADDITIONAL REFERENCES : REPRODUCTION FROM RECORDS

318. Godfrey, J. W. and S. W. Amos (book) " Sound Recording and Reproduction " (B.B.C.) Iliffe and Sons Ltd., London, 1952.
319. Williamson, D. T. N. " High quality amplifier modifications " W.W. 58.5 (May 1952) 173.
320. " What is a recording characteristic " W.W. 58.5 (May 1952) 178.
321. Kelly, S. " Further notes on thorn needles " W.W. 58.6 (June 1952) 243.
322. Rabinow, J., and E. Codier " Phonograph needle drag distortion " J. Acous. Soc. Am. 24.2 (March 1952) 216.
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See also Chapter 18 Refs. A43, A44, B16, B17, B18, B41, B43, B48, B52, B53, B54, B55, B56, B57, B58, B60, B61.

CHAPTER 18

MICROPHONES, PRE-AMPLIFIERS, ATTENUATORS AND MIXERS

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See also complete list of References to Pre-amplifiers at end of Chapter 17 References.

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CHAPTER 19

UNITS FOR THE MEASUREMENT OF GAIN AND NOISE

(iii) Loudness Units (Continued from page 827)

The **sone** is commonly used as an alternative to the loudness unit, 1 sone being equal to 1000 loudness units. The solid curve in Fig. 19.9 is the A.S.A. Standard, as in Fig. 19.8. The broken curve is the relationship between subjective loudness and loudness level in phons as determined by Garner (Ref. 46) and is scaled in lambda (λ) units to distinguish it from the present standard system. The difference between the two curves is very great.

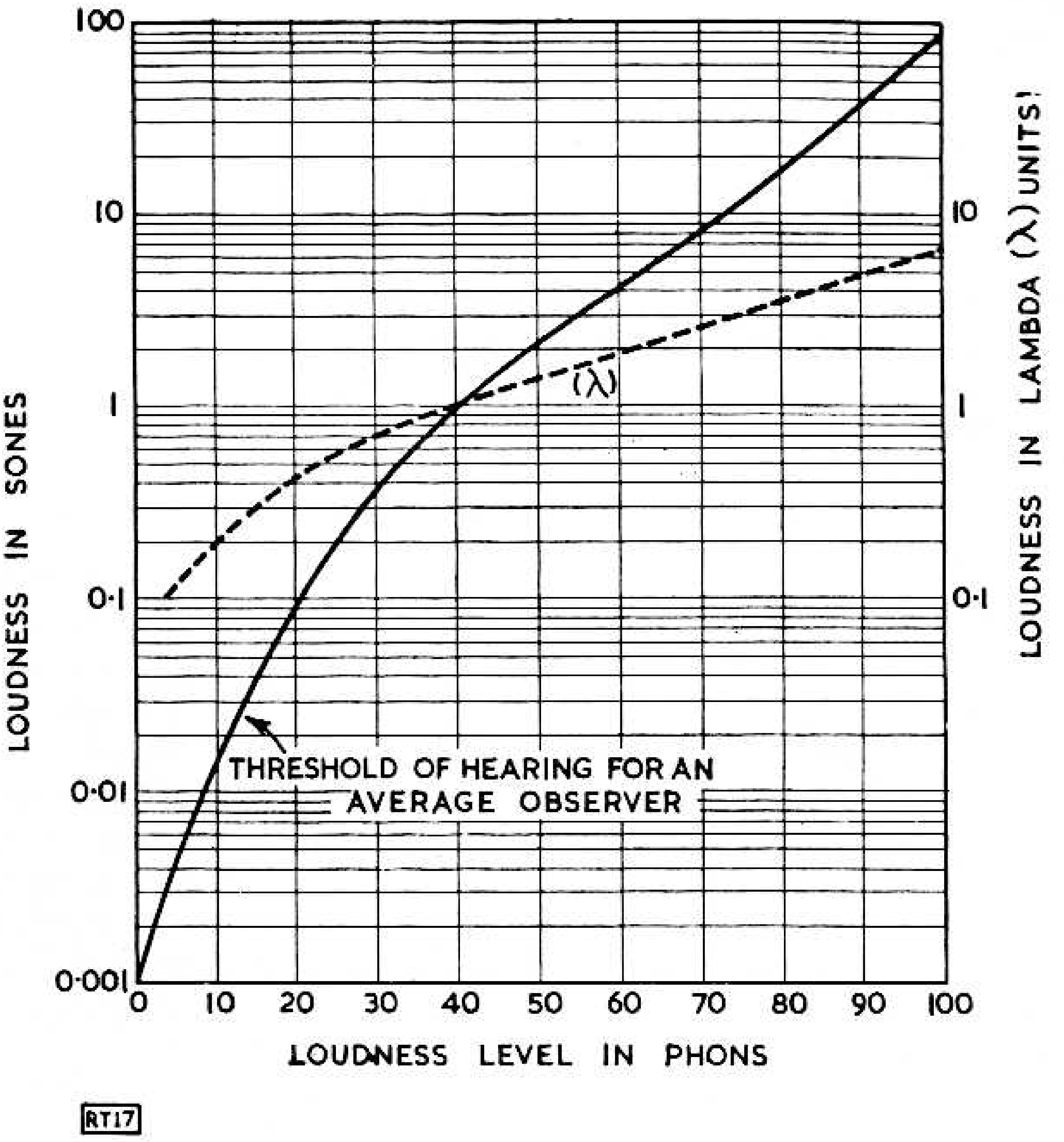

Fig. 19.9. *Relationship between loudness in sones (solid curve) or in lambda units (broken curve) and loudness level in phons (RT*17).

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CHAPTER 20

LOUDSPEAKERS

SECTION 3 : BAFFLES AND ENCLOSURES

(Continued from page 850)

(C) Special types of vented baffle loudspeakers

(1) The Baruch and Lang loudspeaker

The Baruch and Lang loudspeaker employs four 5 inch loudspeakers in an enclosure with a volume of only half a cubic foot and is claimed to radiate 0.1 acoustic watt at 3% distortion, with an input of 2 watts and an efficiency about 5%. The response is claimed to be flat ± 3 db from 40 to 12,000 c/s, and the high frequency angular dispersion is 75°. It is a modified acoustical phase inverter (vented baffle) with an array of small holes on one side to provide the requisite port area—15 holes each 15/32 inch diameter spaced 2¼ inches apart. There is an internal baffle with 21 holes spaced 2 inches apart. These holes provide acoustical resistance to damp down the system resonance to the most desirable degree. In addition, it is claimed that, because the holes are distributed over a large area, the radiation impedance of the array is equivalent to that of a 21 inch cone.

The speakers employed are standard low-cost replacement units, modified to meet the requirements of the system. The optimum dimensions of cabinet and holes, as well as the configuration of holes and the speaker array, are determined by the characteristics of the particular speakers used.

This is a most interesting high-fidelity loudspeaker and enclosure which has been designed to bring the cost within reach of those with limited means—a commercial model is now selling in U.S.A. for less than 20 dollars.

Refs. 202, 311, 316.

(2) **Additional Notes on the R-J loudspeaker** (from page 850)

When one speaker is intended to handle a wide frequency range, the central portion of the cone must not be obstructed by the frontal board ; an oval or lemon-shaped opening may be used. The loudspeaker is mounted on a " speaker board " which is mounted a short distance behind the frontal board. By decreasing the spacing between these two boards, it is possible to lower the Q of the system. Usually apertures are provided between the speaker board and the frontal board on two sides only, the remaining two sides being blocked up. These two apertures should feed in where the frontal board projects furthest over the cone, thus giving maximum front loading on the cone. One effect is to reduce the resonance of the system considerably below the speaker resonant frequency. When properly designed and adjusted, the system is well damped and remarkably free from frequency doubling, even below the system resonance.

Refs. 189, 190, 219, 234, 246, 247.

(3) **The Karlson Exponential Slot enclosure**

This is totally enclosed except for an exponential form of slot in front. The enclosure is divided into two chambers by a partition on which the loudspeaker is mounted and which includes a port joining the two chambers. The front chamber includes the exponential slot, with the smaller dimension near the top of the cabinet, while the back chamber is enclosed and has some acoustical padding.

Refs. 214, 288 (latter gives dimensions).

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See Chapter 11 References (A).

CHAPTER 27

DETECTION AND AUTOMATIC VOLUME CONTROL

LOW DISTORTION A-M DETECTOR

A low-distortion A-M detector has been developed by W. T. Selsted and B. H. Smith (Fig. 27.56). This consists of a conventional diode rectifier direct-coupled to a cathode follower which is in turn connected to an r-f filter to reduce the carrier signal output. The excellent performance of this circuit is due to two facts :

1. That the load on the diode for normal A-M carrier frequencies is essentially resistive, and the normal effects of excessive shunting capacitance are eliminated.

2. That, since the coupling to the cathode follower is direct, there is no effect of biasing currents which are normally developed in a diode loading circuit using coupling condensers. The distortion for 100% modulation, as shown in Fig. 27.57, is claimed to be 0.3% at a modulating frequency of 420 c/s and 0.8% at 4000 c/s. The carrier input voltage and frequency are not stated.

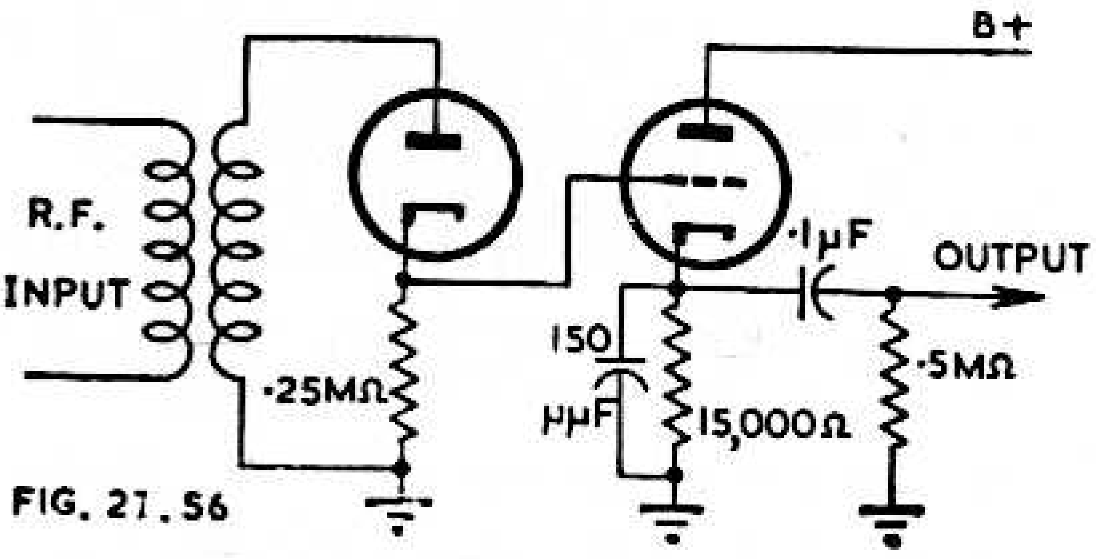

FIG. 27.56

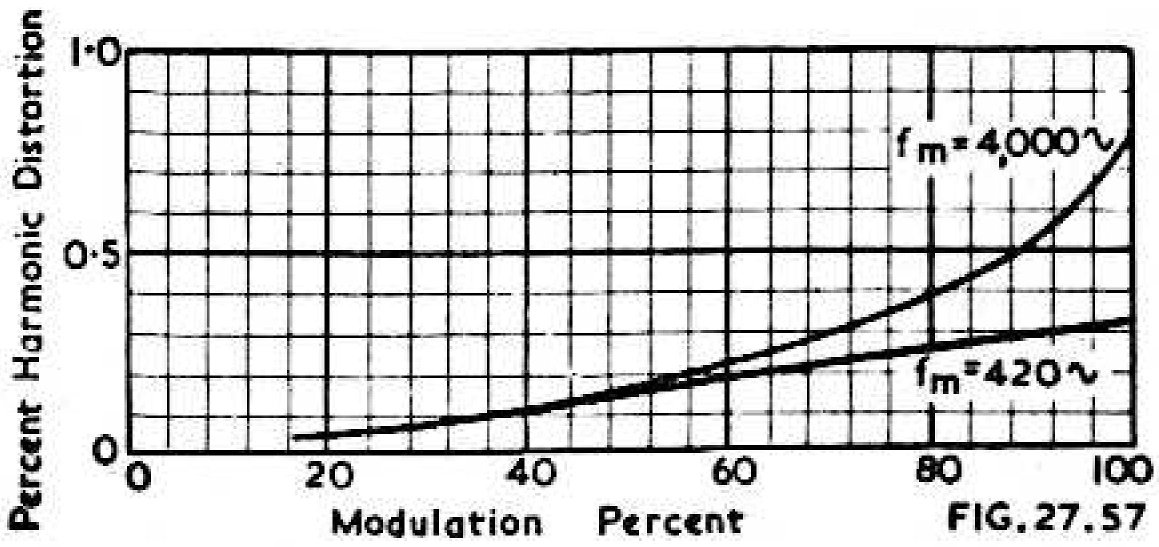

Fig. 27.56. *Circuit of low distortion A-M detector* (*W. T. Selsted and B. H. Smith*).

Fig. 27.57. *Distortion characteristics of low distortion A-M detector* (*W. T. Selsted and B. H. Smith*).

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CHAPTER 38

TABLES, CHARTS AND SUNDRY DATA

Sect. 3 (xi) (F) British Radio Industry Council (page 1360) add after F5 :—
F5a.RIC/131/B. Capacitors, fixed, paper dielectric, foil, in rectangular metal cases.

Additional definition

Maximum output (in receivers). The greatest average output power into the rated load regardless of distortion.

Abbreviations of titles of periodicals, pages 1367-1369, add

Acustica	S. Hirzel Verlag, Zurich.
Comm. Eng.	Communication Engineering, The Publishing House, Great Barrington, Mass. U.S.A. Previously known as FM-TV and FM-TV Radio Communication.
High Fidelity	Audiocom Inc., Great Barrington, Mass. U.S.A.
Jour. A.E.S.	Journal of the Audio Engineering Society, Box 12 Old Chelsea Station, New York 11, N.Y.
Proc. I.E.E.	Proceedings of the Institution of Electrical Engineers (Savoy Place, Victoria Embankment, London, W.C.2, England).
Trans. I.R.E.-PGA	Transactions Institute of Radio Engineers, U.S.A. Professional Group Audio.

Additional references to standard symbols and abbreviations page 1369)

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ADDITIONAL ITEMS

Neutralizing circuits (reference to page 1065)

These circuits in Figs. 26.19 and 26.21 are strictly not neutralizing circuits, but the effect achieved by using C_N is similar to that achieved by true neutralization as it allows the effect of feedback due to grid-to-plate capacitance to be reduced to negligible proportions, although it does not completely eliminate it.