

Here's Your Chance!

BUY McINTOSH NOW

OUTPUT TRANSFORMERS MAKE TRANSISTOR AMPLIFIERS COOL, SAFE AND RELIABLE

By Sidney A. Corderman
Vice-President, Research and Development

What Ever Happened to 4-ohm Outputs?

If you've been reading amplifier spec sheets lately you may have noticed that an important operating specification has almost vanished from the scene. Time was when any amplifier worth its salt carried a power rating for 4-ohm loads, 8-ohm loads and 16-ohm loads. Some even had power ratings at 25 volt and 70 volt line output terminals for use with complex multi-speaker hook-ups. In the days before transistorized equipment, an amplifier designer pretty much had to use an output transformer of one sort or another to match the high impedance of output tube circuits to the lower impedances of loudspeaker loads. As long as a transformer had to be used, it was easy enough to wind the secondary with enough taps to match any desired load impedance and transfer maximum power from the output circuits to the speaker load.

What About Transistor Amplifiers

In the 1960's, most audio amplifier manufacturers welcomed the power output transistor as the solution to their problems. After a few faltering starts with unreliable germanium transistors, silicon devices became the standard power device used in high powered audio amplifiers.

Since power output transistors can operate directly into a low load impedance, circuits could be designed to match 8-ohm loads (or thereabouts) without the need for a matching transformer. In fact, most output transformerless (OTL) amplifiers can deliver full rated output to 8-ohm loads all day long without exceeding thermal dissipation limits. The trouble is, we don't listen to 8-ohm loads - - - we listen to loudspeakers, and loudspeakers come in a variety of impedances - - - all the way from under 4-ohms to 16-ohms. Even speakers nominally rated at 8-ohms vary con-

Continued on Page 6

AND FORGET REPAIR COSTS FOR 5 YEARS

TRADE UP NOW!

You cannot spend a dime on repairs for the next FIVE YEARS if you buy a McIntosh before May 31, 1976.

A McIntosh Service Contract means no repair costs for 5 full years. Buy your McIntosh before May 31, 1976 and you'll get complete protection. McIntosh protects you against any costs for labor and for parts. That's complete protection! No other manufacturer offers such protection for your investment.

5 YEARS OF PROTECTION

You get protection regardless of where you live. Should you move your protection follows you . . . anywhere in the U.S.A. or Canada. The 5 Year Service Contract is good at every McIntosh Service Station . . . ANYWHERE!

To further emphasize, McIntosh offers you the assurance of 5 full years of NO repair costs if you buy before May 31, 1976. Is it any wonder that McIntosh has the highest value in the industry?

*MONEY BACK GUARANTEE

Only McIntosh gives you a money back guarantee of performance. *Your McIntosh instrument must be capable of meeting its published performance limits or you get your money back. No other manufacturer offers you this money back guarantee of performance.

Your listening pleasure is assured. Of all the good amplifiers available today, only McIntosh guarantees performance. All McIntosh instruments must be capable of meeting their advertised performance limits or YOUR MONEY BACK! No other manufacturer shows such concern for the performance of your investment. McIntosh guarantees the performance to be as advertised. This assures you will get what was promised.

Here are some of the reasons why McIntosh can make this outstanding offer - - -

Ever since 1949, McIntosh Research and Development has followed a program of testing of component parts in various accelerated life test atmospheres, heat humidity, etc. Only when these components show their capability for long life performance are they specified in a McIntosh instrument. This assures that you get long, trouble-free instrument life with maximum pleasure and satisfaction.

Every McIntosh employee receives a long period of training so as to meet McIntosh requirements. Then all of their work is inspected and tested over and over. Every instrument must meet rigid requirements before it can be put in a shipping container. This assures you that the unit you buy is as near perfect as man can make.

ACT NOW!

This offer expires May 31, 1976. It covers the purchase of all new McIntosh models ML 1C, ML 2C, ML 2M, ML 4C, ML 10C, MQ 101, MQ 102, C 26, C 28, SCR 2, MPI 4, MR 74, MR 77, MR 78, MX 113, MA 6100, MC 50, MC 250, MC 2100, MC 2105, MC 2205, MC 2300, MC 2505 and the McIntosh Audio MAC 1900. This offer is limited to new equipment sold in the United States and Canada only. It excludes used equipment.

the New MC 2205

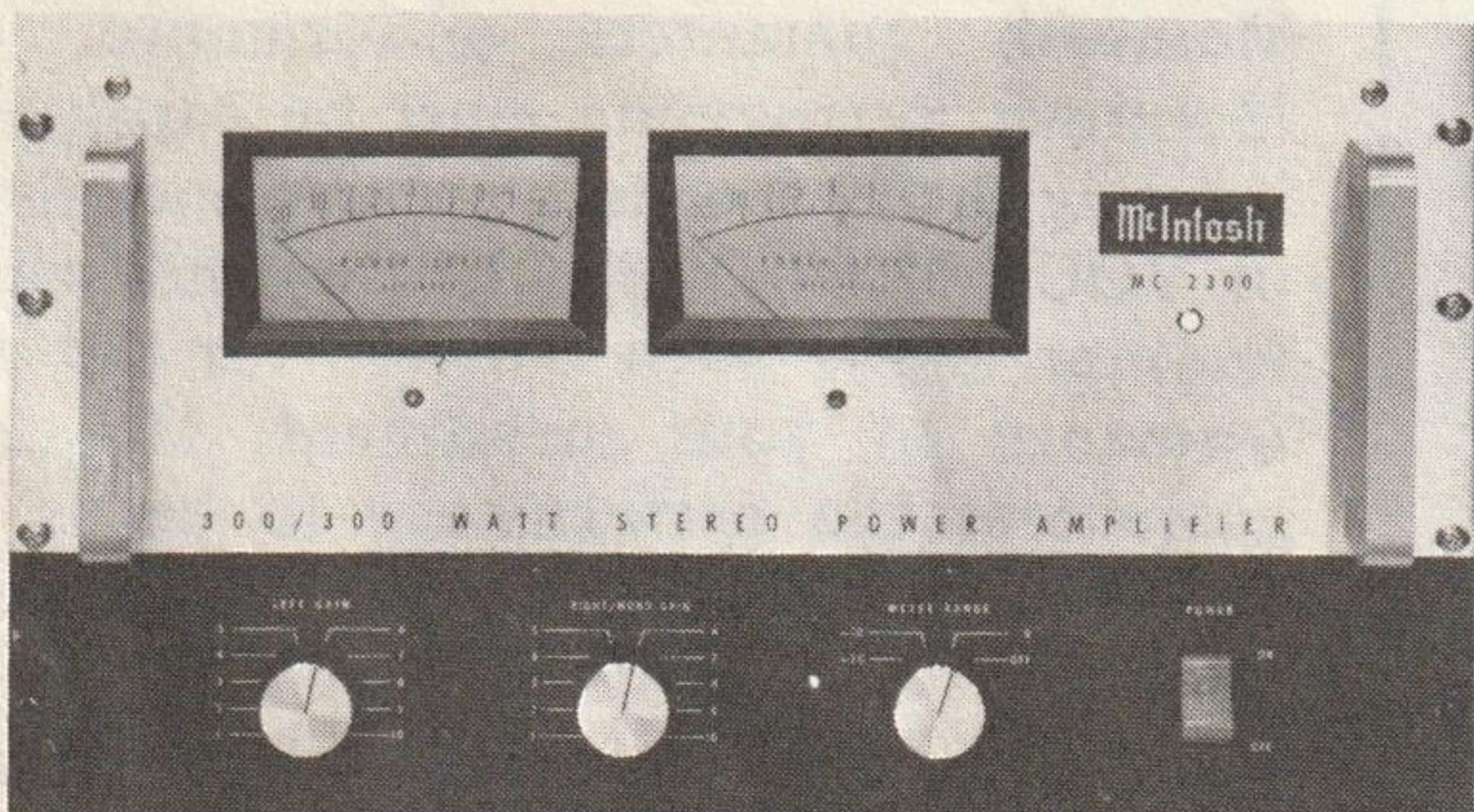


AN EXCITING PERFORMANCE BREAKTHROUGH IN BIPOLAR EPITAXIAL TECHNOLOGY

It is impossible to overload (cause clipping) the NEW MC 2205. POWER GUARD protects your listening pleasure. The MC 2205 has a built in "waveform comparator." The waveform comparator electrically compares the amplifier's output waveform with the input waveform. Should the waveform differences reach 0.5%, the red LIMIT indicator on the front panel is turned on. If the differences increase to 1% the POWER GUARD circuit is activated. POWER GUARD provides an unusual margin of safety for loudspeakers by the prevention of amplifier clipping yet permits the amplifier to deliver designed maximum power.

This is only one of the technological improvements in the outstanding MC 2205. Our store has full information and the complete Owner's Manual waiting for you to examine. With the MC 2205 you must hear it to believe it.

IT SOUNDS BETTER WITH



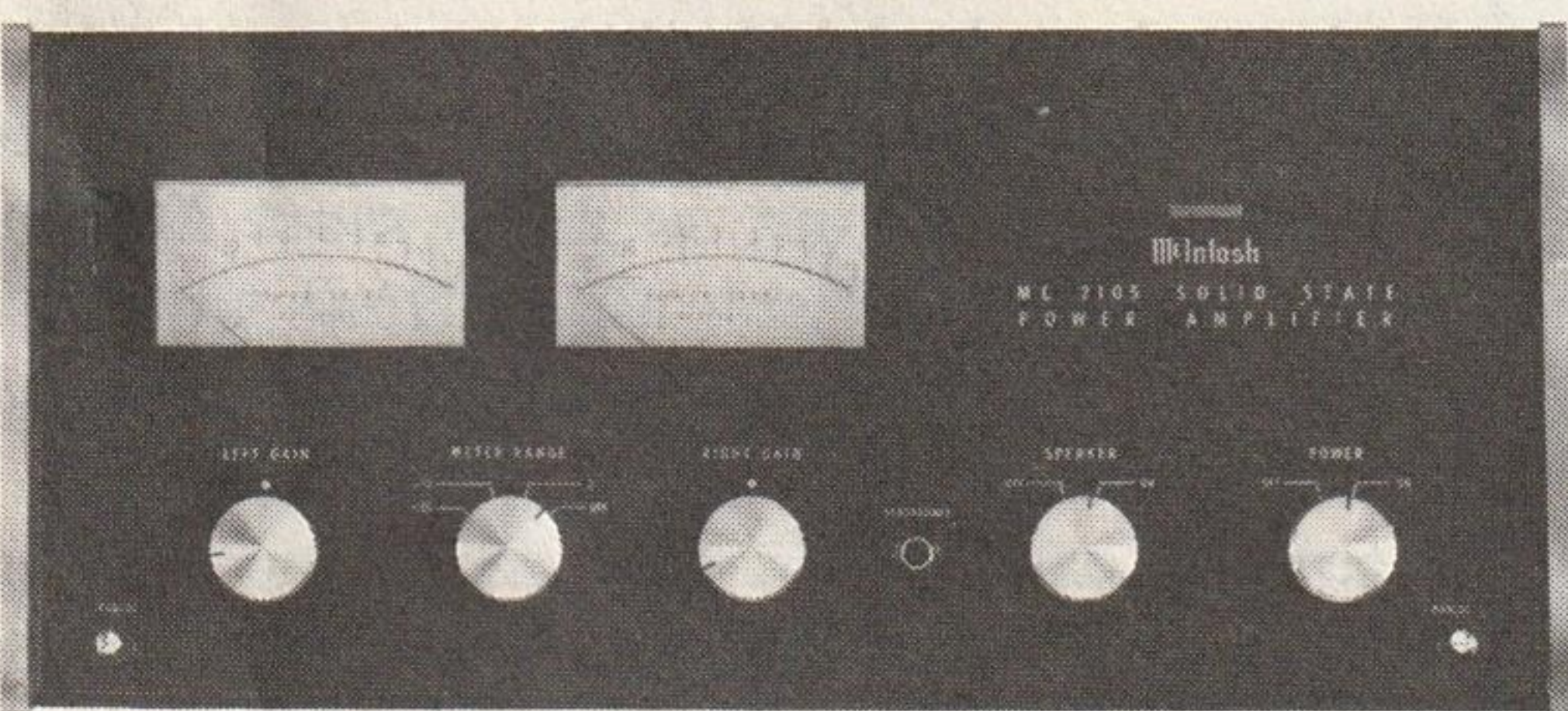
MC 2300

STEREO:

300 watts per channel, minimum, RMS into 0.5, 1, 2, 4, 8, or 16 ohms, 20 to 20 kHz, with less than 0.25% total harmonic distortion

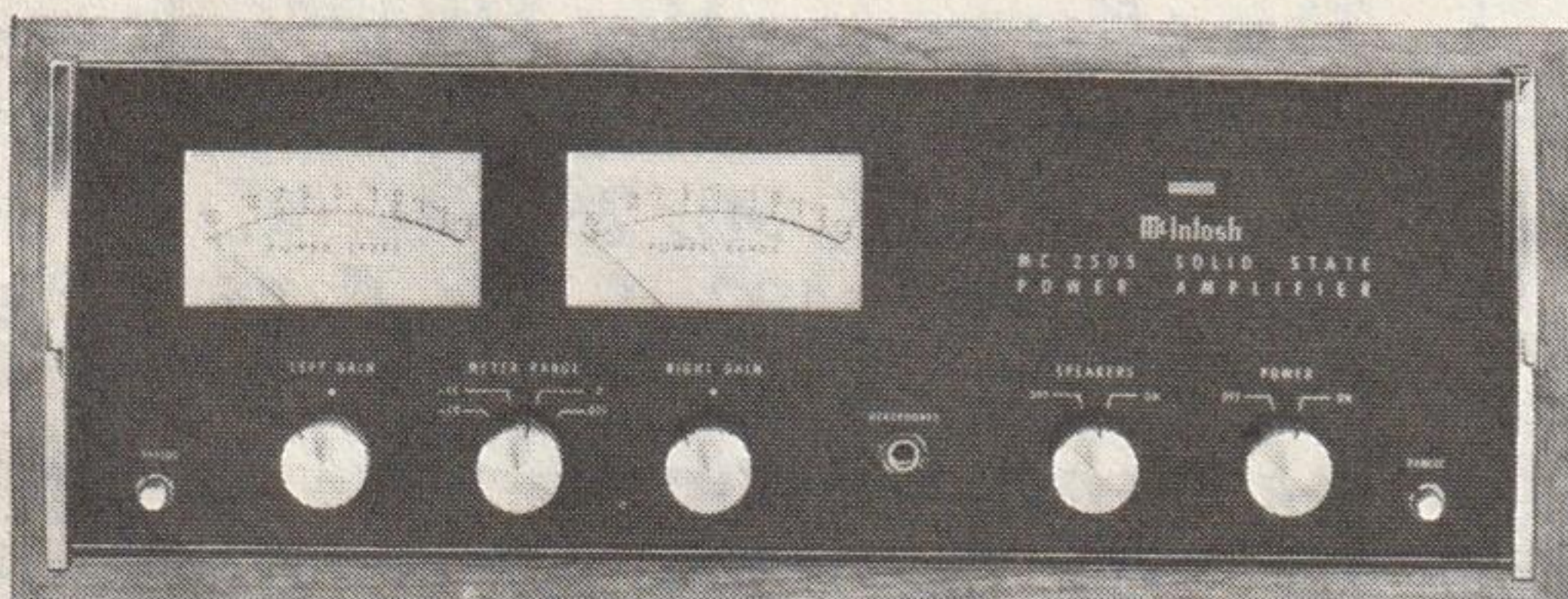
MONO:

600 watts, minimum, RMS into 0.25, 0.5, 1, 2, 4 or 8 ohms, 20 to 20 kHz, with less than 0.25% total harmonic distortion



MC 2105

105 watts per channel, minimum, RMS, into 4, 8 or 16 ohms, 20 to 20 kHz, with less than 0.25% total harmonic distortion



MC 2505

50 watts per channel, minimum, RMS into 4, 8, or 16 ohms, 20 to 20 kHz, with less than 0.25% total harmonic distortion

McIntosh amplifiers have been the "LABORATORY STANDARD" in vacuum tube electronics for 20 years. McIntosh audio scientists have generated solid state innovations that have continued the McIntosh reputation for "LABORATORY STANDARD." New levels of performance, even greater reliability, and highest quality have created levels of cleanness and beauty in music that until now have been clouded by lower performance standards.

McIntosh amplifiers are completely stable when connected to any loudspeaker system or even to any reactive loads. Each has special circuits to prevent damage by short circuit or open circuit of the output loads, or by any amount of output impedance mismatch. Thermal cutouts are mounted on the output transistor heat sinks to provide protection in the event of inadequate ventilation.

You will hear all there is to hear with a clarity and naturalness never before achieved. And this performance is guaranteed! Only McIntosh gives you a money back guarantee on performance. Every McIntosh instrument must be capable of meeting its advertised performance limits or you get a refund of your purchase price. McIntosh promises performance. We either meet our promise or you get your money back.

And best of all — you are protected for FIVE FULL YEARS from any service cost. With the purchase of a McIntosh you are offered a FREE FIVE YEAR SERVICE CONTRACT. You can't pay us for the repair of a McIntosh for the first five years you own it!



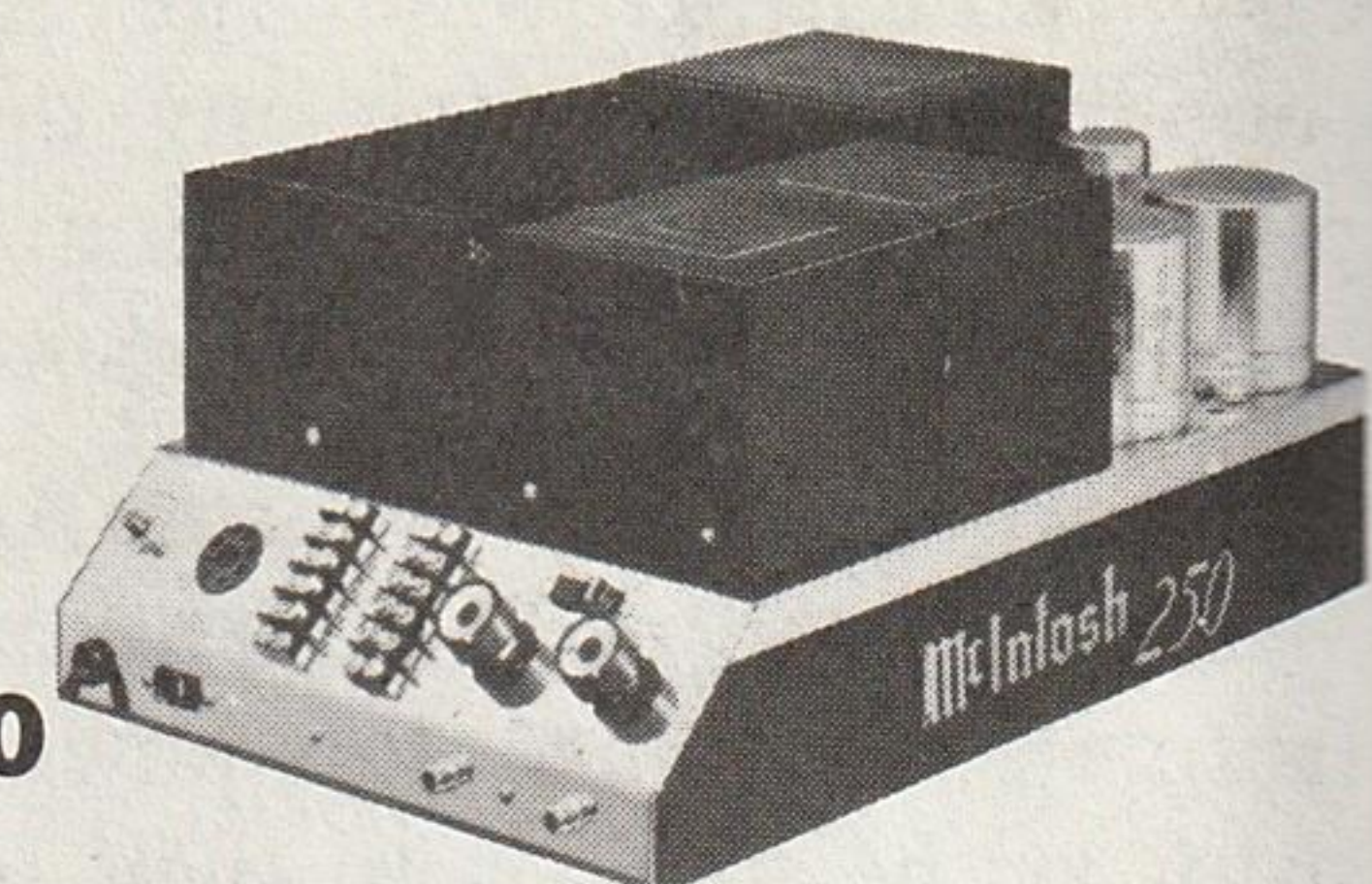
MC 2100

STEREO:

105 watts per channel, minimum, RMS into 4, 8, or 16 ohms, 20 to 20 kHz, with less than 0.25% total harmonic distortion

MONO:

210 watts, minimum, RMS into 2, 4, or 8 ohms, 20 to 20 kHz, with less than 0.25% total harmonic distortion



MC 250

STEREO:

50 watts per channel, minimum, RMS into 4, 8, or 16 ohms, 20 to 20 kHz, with less than 0.25% total harmonic distortion

MONO:

100 watts, minimum, RMS into 2, 4, or 8 ohms, 20 to 20 kHz, with less than 0.25% total harmonic distortion



MC 50

MONO:

50 watts, minimum, RMS into 4, 8, or 16 ohms, 20 to 20 kHz, with less than 0.25% total harmonic distortion

C 28

AN EXTREMELY QUIET
PREAMPLIFIER WITH
FLEXIBILITY, EASE OF USE,
AND MOST OF ALL,
OUTSTANDING PERFORMANCE



The C 28 is a preamplifier that makes you the master of your stereo system. Here are some of the ways that your enjoyment will increase: Use 3 tape machines — 2 with their own electronics and 1 tape playback deck with complete easy front panel switching; Individual Channel Tone Control Switches — complete, repeatable flexibility; Main Remote Loudspeaker Switching — turn the main speakers on or off without affecting the remote speakers and vice versa (operates with accessory relay); New Low Noise Phono Input — listen to your records with a new quietness; Individual Channel Output Level Controls — match levels from different phono cartridges without degrading signal to noise ratio; Built-in Headphone Amplifier — listen to your favorite music - - - privately; Individual Channel Output Level Controls — perfect balance from your stereo always, and more.

A McINTOSH

C 26 STEREO PREAMPLIFIER



Performance is important to your listening expectations. Low distortion is a requirement for high performance in a preamplifier. A typical wave form analysis of the C 26 at 2.5 volts output is a 99.95% perfect reproduction of the input wave, 20 Hz through 20,000 Hz! Your C 26 must be capable of meeting its advertised performance limits or your purchase price will be refunded. McIntosh promises performance and delivers performance.

MX 113 STEREO - TUNER - PREAMPLIFIER



The MX 113 accommodates all regular inputs of AM-FM/FM stereos, phonos, tape, auxiliary, and allows the selection of the right power amplifier needed for your system. It is the most advanced, with switchable selectivity, and has performance beyond others available today.

MA 6100

THE MA 6100 DELIVERS McINTOSH
QUALITY, PERFORMANCE AND
VALUE IN A "ONE UNIT" STEREO
PREAMPLIFIER AND POWER AMPLIFIER.



The preamplifier is an outstanding example of what the electronic designers have done to provide for highest quality with great flexibility in a space limited housing. It has unusually low noise and low distortion. The high gain will produce maximum results even from the lowest output phono cartridges.

You have more real power and more protection. The power transistors are mounted on oversized black anodized heat sinks to assure that under normal operation the transistors will operate at low temperature. The power transistors used in the output circuits are selected for their high power dissipation capability, wide frequency response and large "safe operating area."

The reserve power and complete protection of the output circuit allows safe operation with your choice of speakers - - - dynamic or electrostatic!

TRADE UP NOW!

You cannot spend a dime on repairs for the next FIVE YEARS if you buy a McIntosh before May 31, 1976.

5 YEARS OF PROTECTION

The Special Five Year Service Contract is good at any authorized McIntosh service station. You get protection regardless of where you live. Should you move your protection follows you . . . anywhere in the U.S.A. or Canada.

*MONEY BACK GUARANTEE

Only McIntosh gives you a money back guarantee of performance. *Your McIntosh instrument must be capable of meeting its published performance limits or you get your money back. No other manufacturer offers you this money back guarantee of performance.

ACT NOW!

This offer expires May 31, 1976. It covers the purchase of all new McIntosh models ML 1C, ML 2C, ML 2M, ML 4C, ML 10C, MQ 101, MQ 102, C 26, C 28, SCR 2, MPI 4, MR 74, MR 77, MR 78, MX 113, MA 6100, MC 50, MC 250, MC 2100, MC 2105, MC 2205, MC 2300, MC 2505 and the McIntosh Audio MAC 1900. This offer is limited to new equipment sold in the United States and Canada only. It excludes used equipment.

The SOUND of REALITY

A McIntosh Loudspeaker is a promise of a new psycho-acoustic experience - - - the experience of reality in your listening room - - - the experience of listening to an almost perfect sound image. From many man years of research, McIntosh promises you nearly perfect sound images will occur in your listening room - - - whatever the room is like! A McIntosh Environmental Equalizer and McIntosh Loudspeakers promise you the flexibility to properly match McIntosh loudspeakers to *your* room. For the first time, loudspeakers and electronics have been designed *together* to give you near perfection in reproduction in your listening room. To say it differently - - - if the actual live or real sound would please you in your listening room, then the McIntosh loudspeaker in your listening room will equally please you.



ML 10C

- 1 - 8-3/8" (21.27 cm) Radiator
- 10" (25.4 cm) Loudspeaker
- 1 - 1-1/2" (3.81 cm) Dome Radiator
- 1 - Coaxial Super Radiator

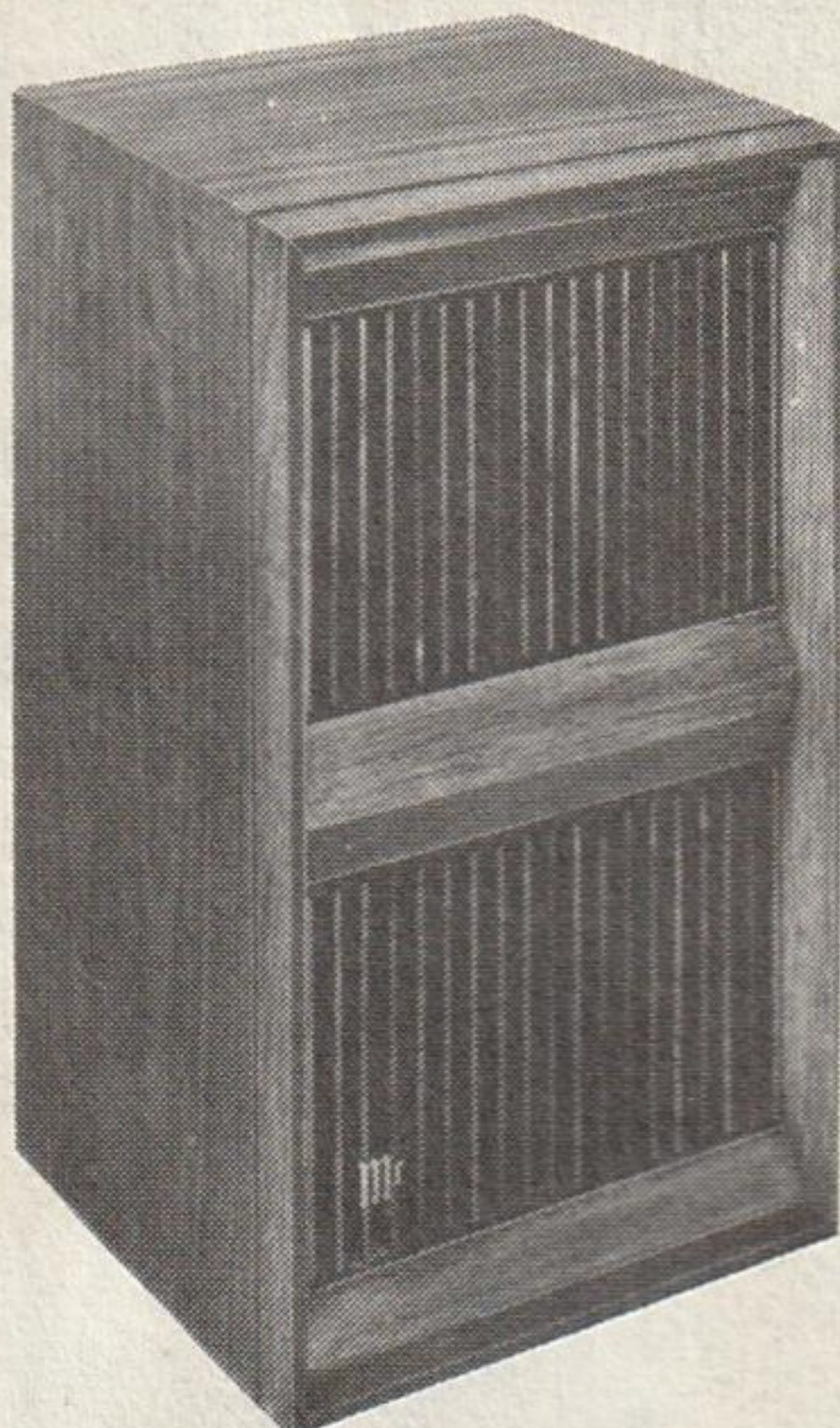
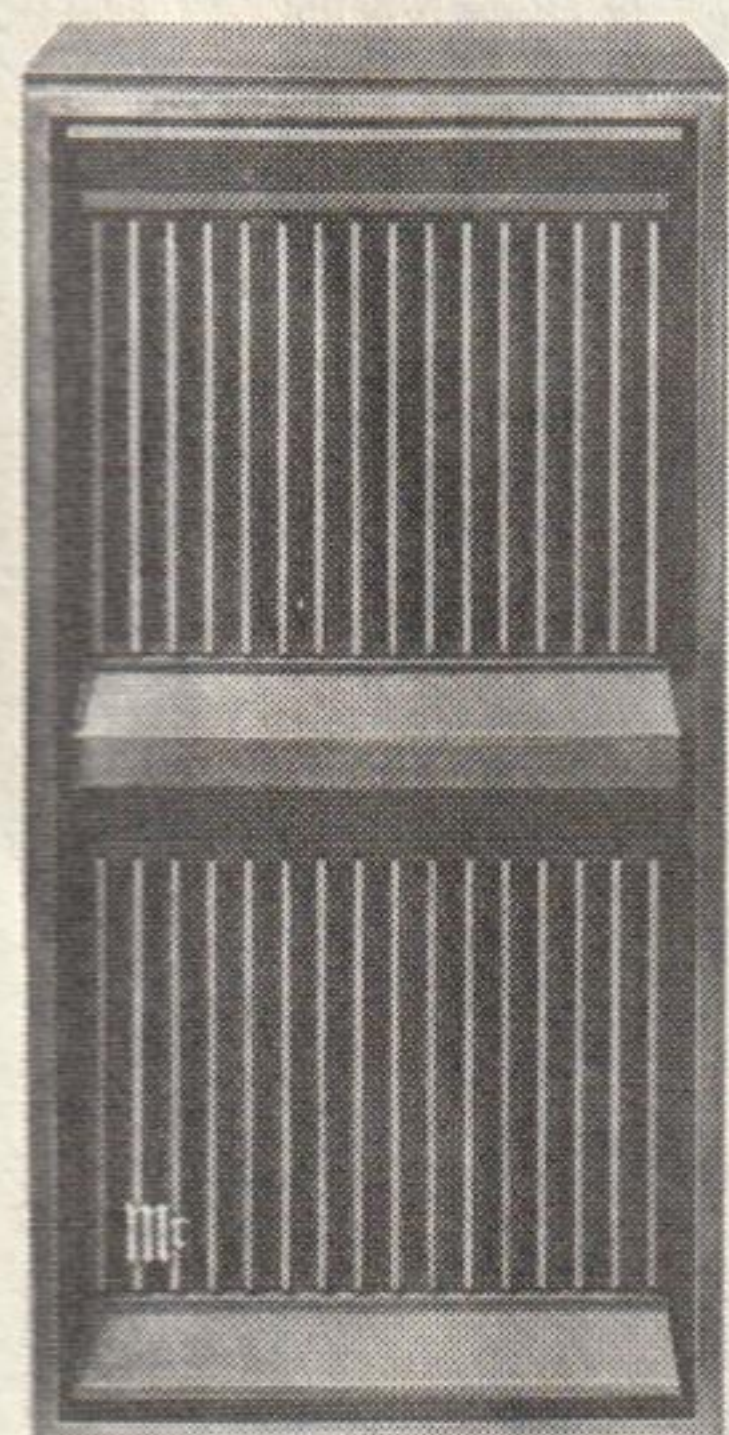
ML 1C

- 1 - 10" (25.4 cm) Radiator
- 12" (30.48 cm) Loudspeaker
- 1 - 5" (12.7 cm) Radiator
- 8" (20.32 cm) Loudspeaker
- 1 - 1-1/2" (3.81 cm) Dome Radiator
- 1 - Coaxial Super Radiator

ML 4C

- 4 - 10" (25.4 cm) Radiator
- 12" (30.48 cm) Loudspeakers
- 1 - 5" (12.7 cm) Radiator - 8" (20.32 cm) Loudspeaker
- 4 - 1-1/2" (3.81 cm) Dome Radiators
- 2 - Coaxial Super Radiators

Cabinets are particleboard construction using genuine walnut veneers. Front panel has a matching walnut finish on selected hardwood solids. Decorative grilles have a simulated walnut finish on the front surface of polystyrene moldings.



In McIntosh loudspeakers, the characteristics of the speaker enclosure (cabinet) and of the loudspeaker have been combined to produce near perfect transient response. The design for excellent transient response must compromise the system's low frequency response. The most effective way of restoring flat, low frequency response is the use of an electrically equalized speaker input signal. McIntosh Environmental Equalizers do that job.

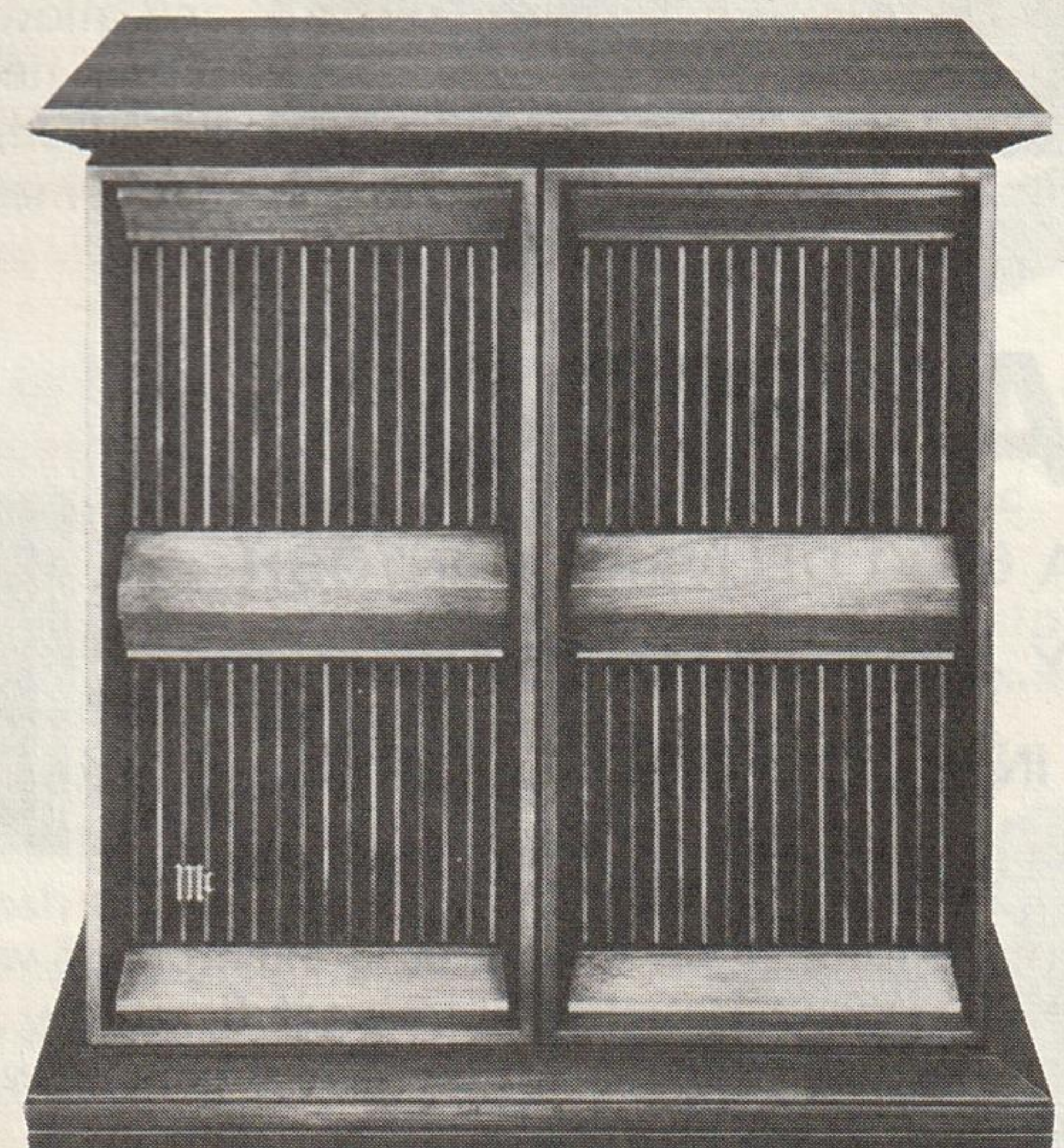
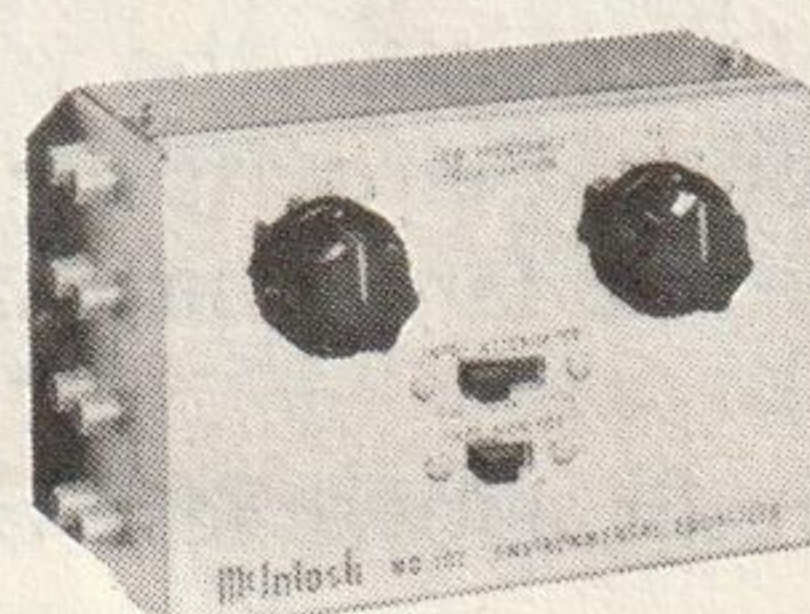
MQ 101

The MQ 101 McIntosh Environmental Equalizer is a three-band equalizer divided into low frequencies, mid-frequencies and high-frequencies.



MQ 102

The McIntosh MQ 102 is a single band equalizer that compensates below 150 Hz.



ML 2C

- 2 - 10" (25.4 cm) Radiator - 12" (30.48 cm) Loudspeakers
- 1 - 5" (12.7 cm) Radiator - 8" (20.32 cm) Loudspeaker
- 2 - 1-1/2" (3.81 cm) Dome Radiators
- 1 - Coaxial Super Radiator

THOROUGH, UNINHIBITED RESEARCH HAS DEVELOPED THE NEW TECHNOLOGY NECESSARY FOR A TRULY LOW DISTORTION FM TUNER

MR 78

Ever since the beginning of FM, research engineers have realized that constant delay IF filters (equivalent to linear-phase) were necessary for low distortion reception. Crude approximations to constant delay filters have always been used in FM tuners—with disappointing results. The filters used in today's tuners can have delay errors up to 100%!

The IF filter in the MR 78 has a delay error of less than 1% from antenna input to discriminator output! In its useful bandpass, it is a true mathematical approximation to linear-phase—the world's most selective, linear-phase, minimum-phase shift filter.

Distortion of the bridge detector is pretty close to the theoretical zero. In addition to its lack of distortion, the bridge detector also exhibits capture ratio close to 0 dB.

Tuned circuits are not used in the MR 78 detector. They are quite difficult to manufacture and align accurately, and ordinary tuned-circuit discriminators go out of adjustment.

The MR 78 has excellent selectivity. The bandwidth (210 kHz wide at 60 dB down) permits tuning stations that are impossible on ordinary tuners. Even though the MR 78 has the narrowest IF bandwidth ever used in a stereo tuner, (it is the correct width to let just one FM station through) the great number of stations crowding the FM band requires a tuner with variable selectivity. The three positions of variable selectivity allow stereo reception even under severe receiving conditions.



COMPARE THE PERFORMANCE OF THE MR 77 WITH ORDINARY FM TUNERS.....

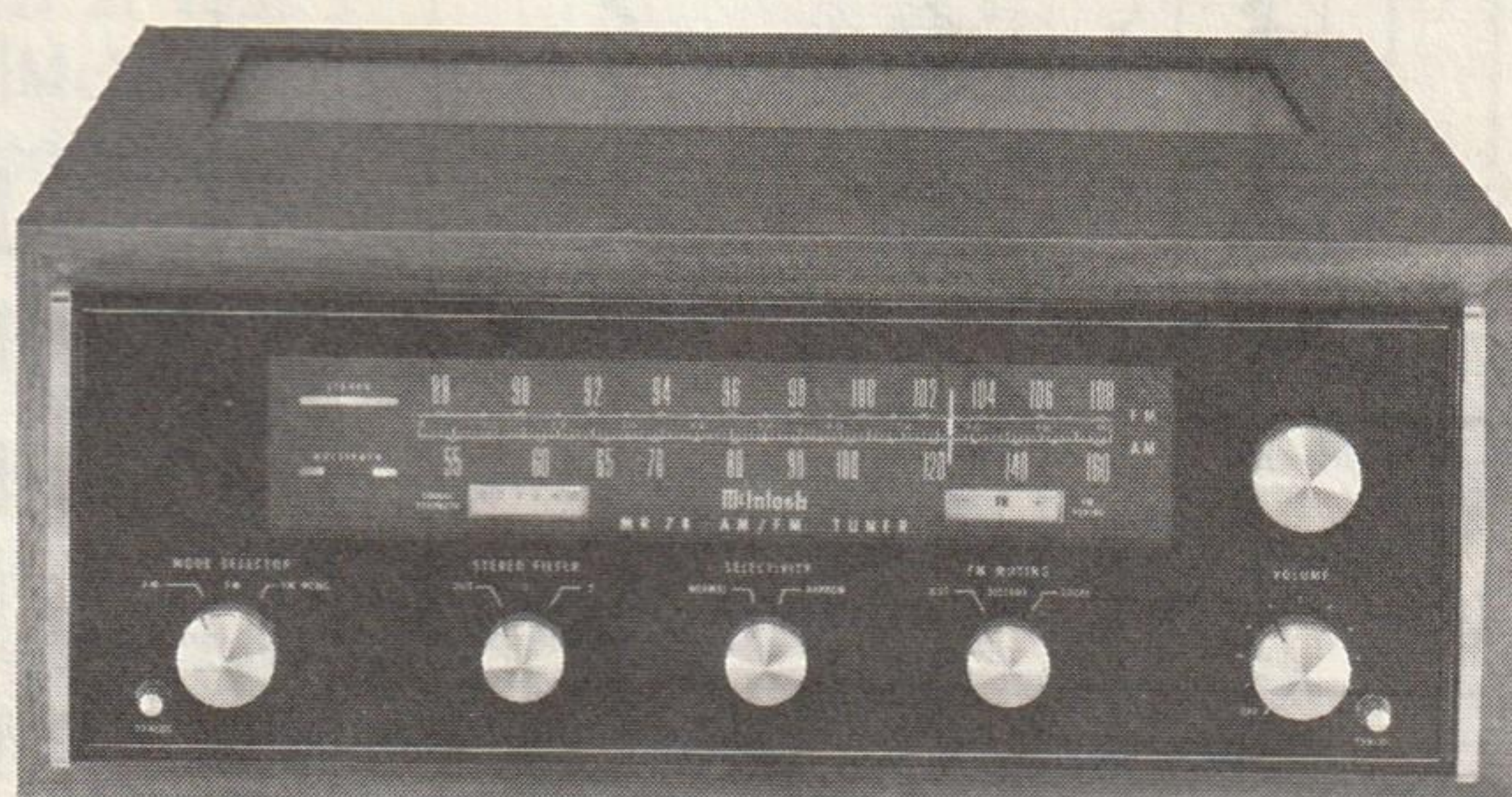


MR 77

SIGNAL TO NOISE RATIO—75 dB below 100% modulation; **HARMONIC DISTORTION**—Will not exceed 0.2% mono or stereo at 100% modulation, 20 Hz to 15,000 Hz; **INTERMODULATION DISTORTION**—Will not exceed 0.2% mono or stereo for any combination of frequencies from 20 Hz to 15,000 Hz with peak modulation equal to 100% or less, 0.1% typical; **CAPTURE RATIO**—0.25 dB detector only; 2.5 dB complete tuner at 100% modulation; **SELECTIVITY**—Adjacent channel: 6 dB; Alternate Channel: 50 dB.

MR 74

The McIntosh MR 74 AM-FM Stereo Tuner is a superb instrument. It incorporates a unique front end IF filter mixer and provides for two positions of selectivity. The AM portion represents the most advanced techniques that bring about a desirable rediscovery of AM.



TRADE UP NOW!

You cannot spend a dime on repairs for the next FIVE YEARS if you buy a McIntosh before May 31, 1976.

5 YEARS OF PROTECTION

The Special Five Year Service Contract is good at any authorized McIntosh service station. You get protection regardless of where you live. Should you move your protection follows you... anywhere in the U.S.A or Canada.

*MONEY BACK GUARANTEE

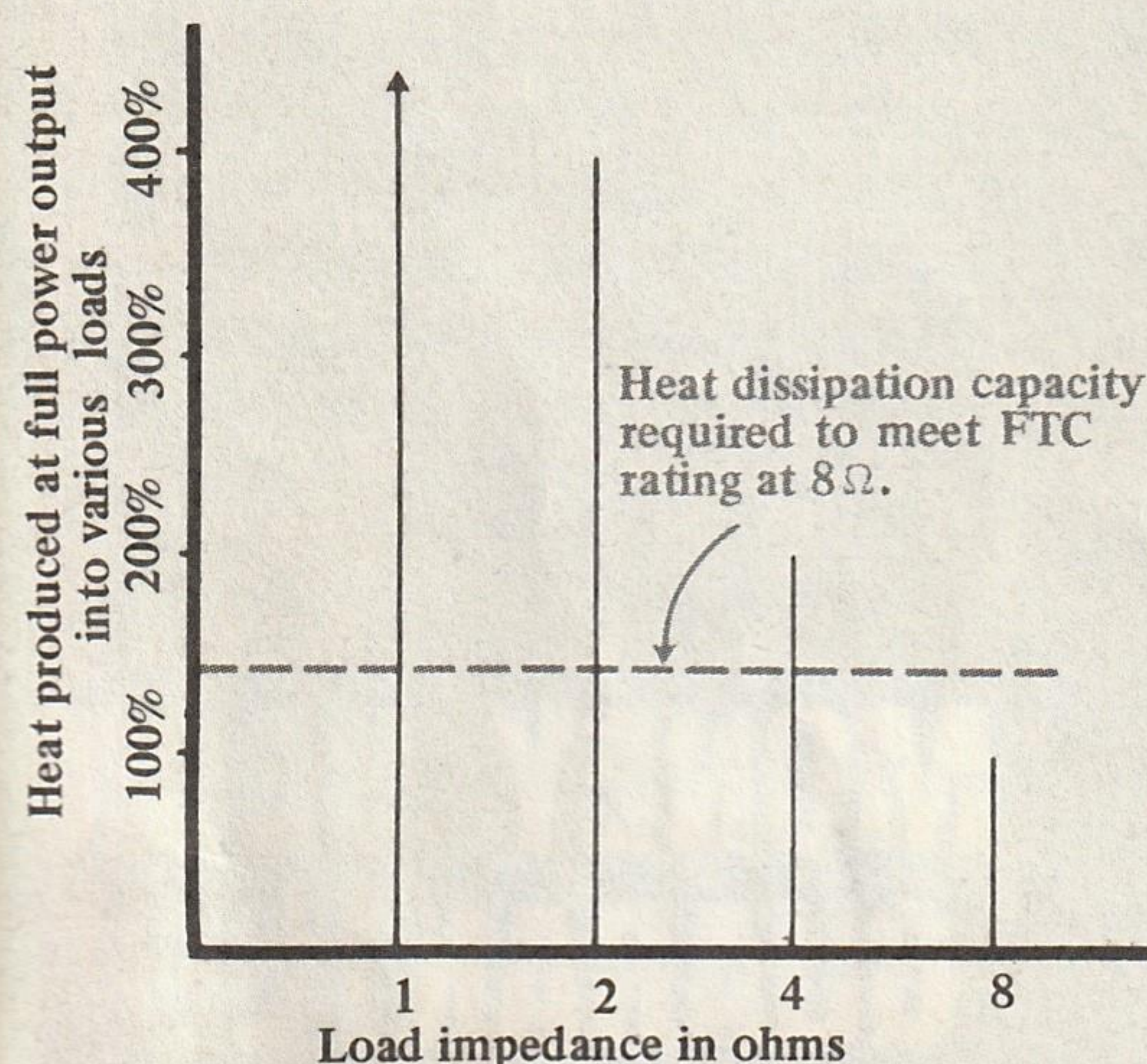
Only McIntosh gives you a money back guarantee of performance. *Your McIntosh instrument must be capable of meeting its published performance limits or you get your money back. No other manufacturer offers you this money back guarantee of performance.

ACT NOW!

This offer expires May 31, 1976. It covers the purchase of all new McIntosh models ML 1C, ML 2C, ML 2M, ML 4C, ML 10C, MQ 101, MQ 102, C 26, C 28, SCR 2, MPI 4, MR 74, MR 77, MR 78, MX 113, MA 6100, MC 50, MC 250, MC 2100, MC 2105, MC 2205, MC 2300, MC 2505 and the McIntosh Audio MAC 1900. This offer is limited to new equipment sold in the United States and Canada only. It excludes used equipment.

OUTPUT TRANSFORMERS MAKE TRANSISTOR AMPLIFIERS COOL, SAFE AND RELIABLE

siderably in impedance, dipping below that value at certain frequencies and rising above it at others. Then, too, a good many popular speakers are nominally rated at 4-ohm impedance. What happens to an OTL amplifier when such low impedance loads are connected to it? In theory, if the output stage is designed to match an 8-ohm load, its power output capability should double when the load is divided in half. But as this mis-match occurs, thermal dissipation increases rapidly. In fact, dissipation doubles. (Fig. 1)



(100%=Heat produced at rated output into 8 ohms.)
Fig. 1 - Heat Produced by Transformerless Amplifier at Various Load Impedance

If the amplifier was designed for 8-ohm use, it was probably designed to withstand the new Federal Trade Commission preconditioning requirements at that impedance and at that impedance only. The safety margin is not nearly enough to permit operation at 4-ohms - - - or 2-ohms - - - or 1-ohm. That explains why so many manufacturers have quietly dropped any mention of 4-ohm power ratings. But that doesn't prevent a user from hooking up 4-ohm speakers to the product, or dual pairs of 8-ohm speakers which adds up to the same thing - - - and often results in thermal cutout, blown fuses - - - or worst of all, destruction of the power output transistors.

Unless manufacturers are willing to use disproportionately massive heat sinks, cooling fans, or combinations of both (some have, and passed on the added cost to the consumer), designing output-transformerless amplifiers that can deliver their maximum powers at both 4 and 8-ohms becomes physically impractical.

The Answer - - - Output Auto-transformers!

If a transistorized amplifier were equipped with an output transformer which had taps for different impedances, its output stages could always work into an ideal load at which maximum power can be transferred and dissipation would not change or be exceeded.

While it is true that tube-designed amplifiers had inherent limitations insofar as their compatibility with transformers was concerned, that is not the case when low impedance transistorized output stages are considered. For example, it is no longer necessary to "step-down" by factors of several hundred to one in impedance. The extremely good balance required in tube push-pull circuits (to avoid notch distortion) is a thing of the past, now that transformers can be driven "single-ended", now that dual polarity (plus and minus) power supplies are used in complementary output stages. Since there is no DC flowing in the transformer coil, the entire winding can be returned to ground, and a simple auto-transformer (single winding) can be used.

McIntosh, long ago, developed transformers which overcame many of the problems inherent in tube output stage designs. And we've done even better, given the parameters of output transistor stages. Figure 2 shows a typical arrangement used in our new MC 2205 amplifier. The output stages are designed to work optimally into a load impedance of 2.1 ohms and it becomes a simple matter to "tap in" to the auto-transformer for that precise impedance match. Output taps, for 1-ohm, 2-ohm, 4-ohm and 8-ohm operation are brought out so that the output circuits continue to work into optimum load impedance. The result: full rated power output of any of these impedances, with no possibility of thermal over-dissipation.

Mac's popular MC 2300 amplifier also uses an autoformer and Fig. 3 shows how that amplifier is able to deliver its full rated power (300 watts continuous, per channel) into any impedance from 0.5-ohms to 16-ohms, as well as to 25-volt and 70-volt multi-speaker system taps on the transformer. Compare these results with those obtained from a similarly rated OTL amplifier as in Fig. 4, and you'll see that at all but 8 and 16-ohms, continuous operation at theoretical maximum power is all but impossible because of overheating and protection circuit limiting. Operation at 16-ohms, while possible, is limited to a maxi-

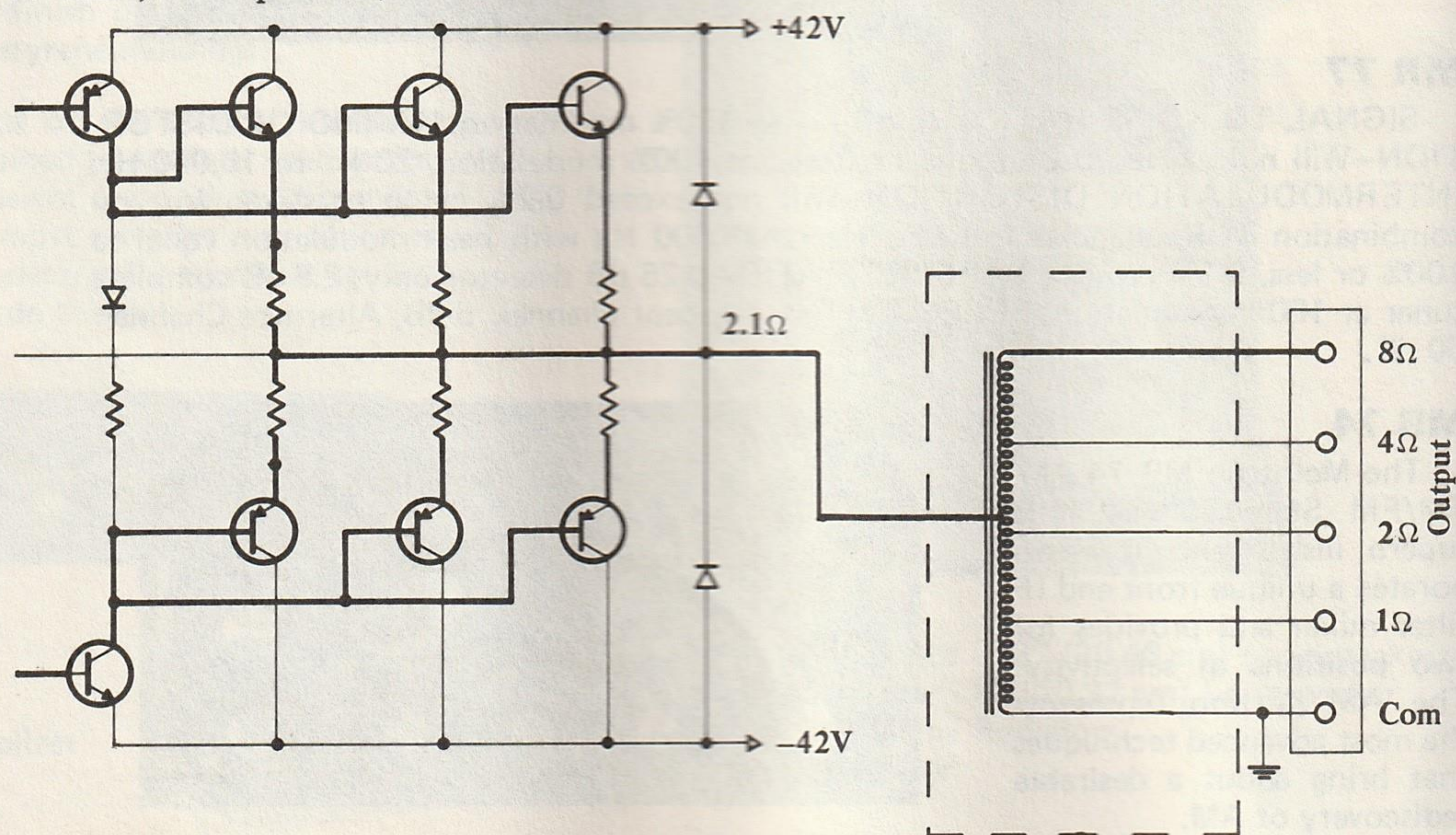


Fig. 2 MC 2205 output stage and transformer

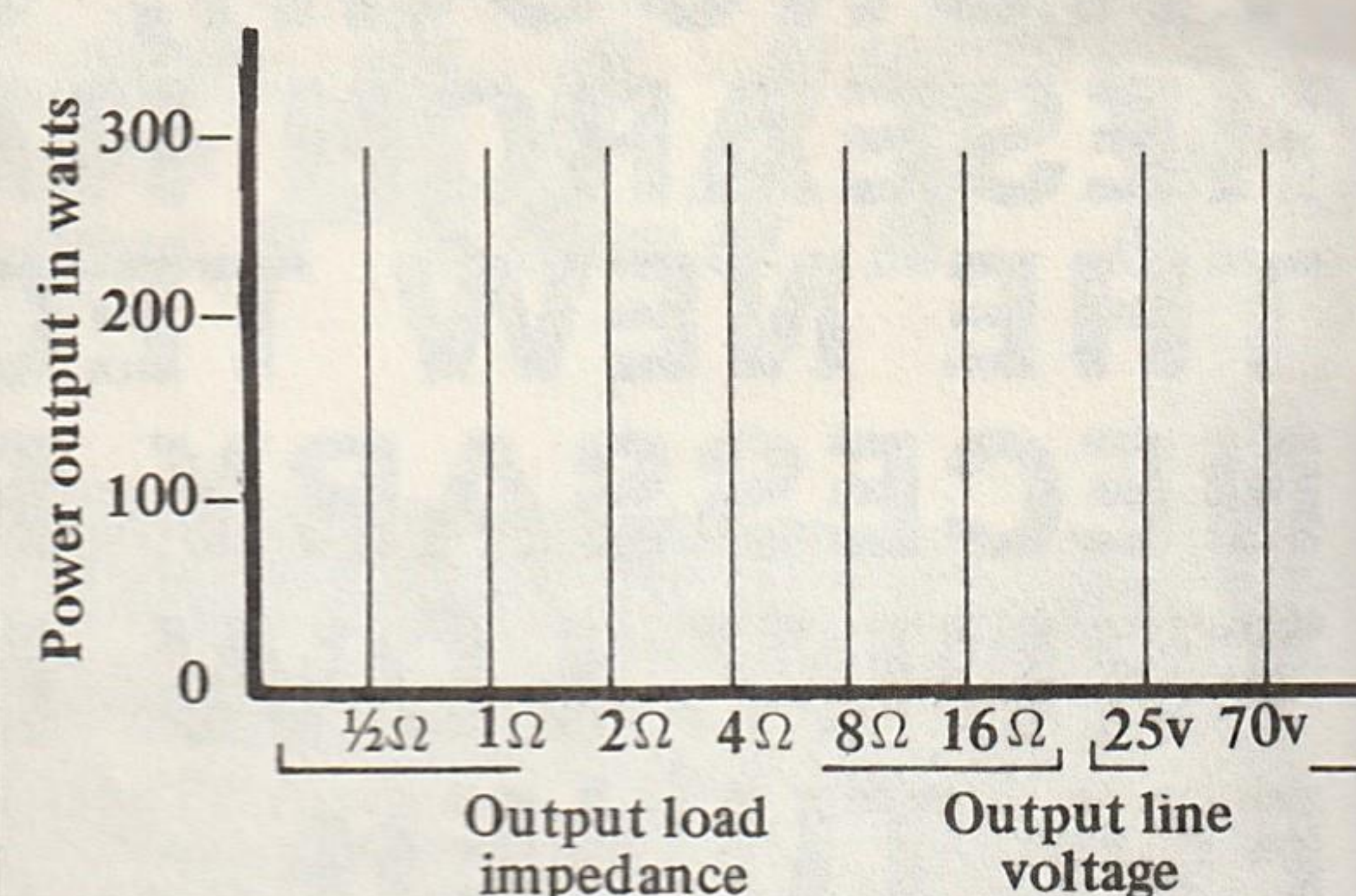


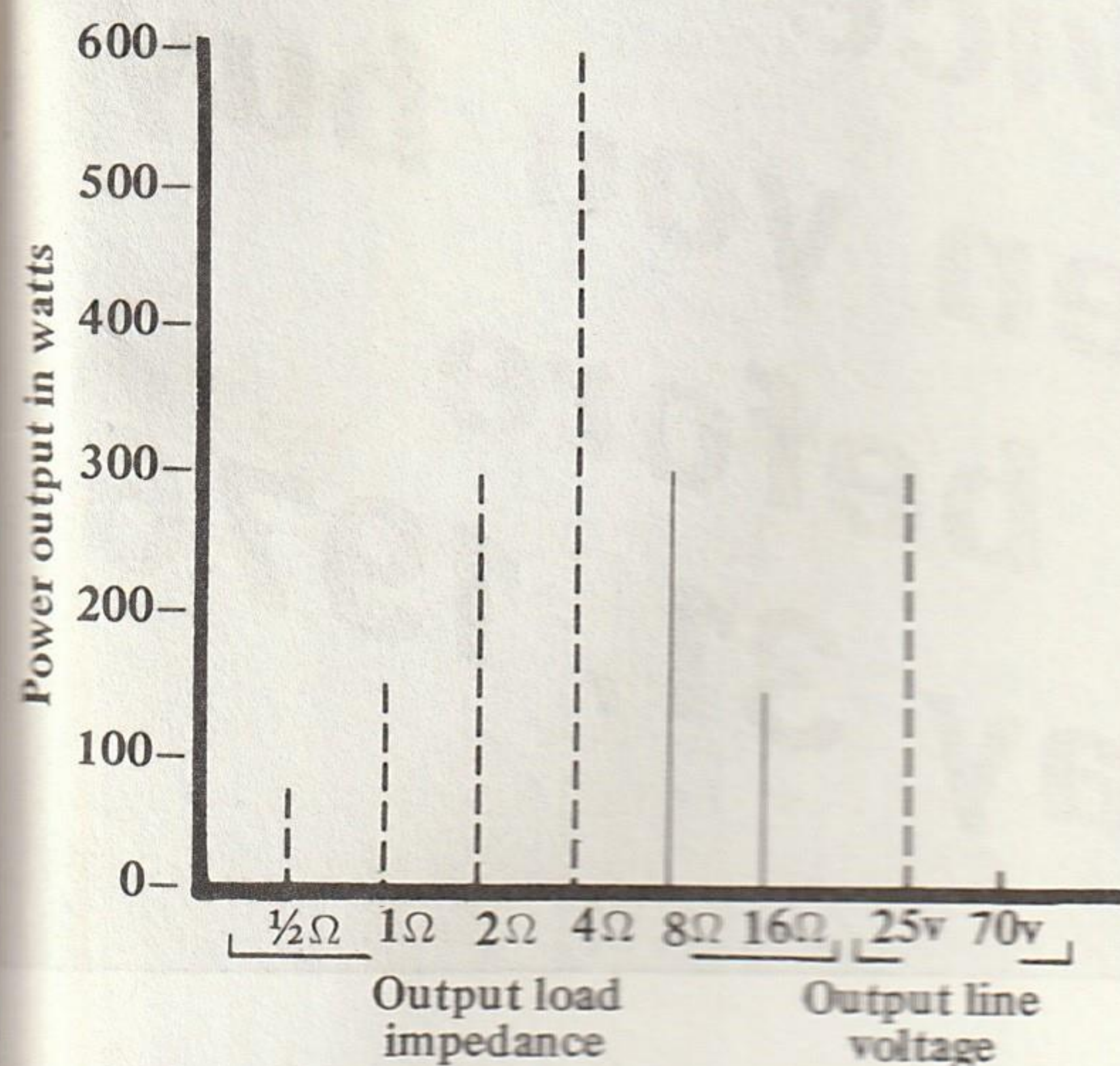
Fig. 3 Performance of MC 2300

mum power output of 150 watts, while operation into a 70-volt line is impossible because of limitations in power supply voltage.

Not All Output Transformers Can Solve The Problem

If popping an auto-transformer onto the end of an amplifier were all it took to deliver full power at all desired impedances, with full power bandwidth, negligible phase shift and minimal loss within the transformer itself, no doubt more manufacturers would choose this design approach. So why haven't more manufacturers used output transformers on solid state amplifiers? Simply because they are not aware of the technology or, if they are, they don't want to spend the extra cost. A good transformer is an expensive component. Here, at McIntosh, we design and build our own. A great deal of experimentation is required before a newly designed transformer can be mated to a specific amplifier circuit. In the case of our new MC 2205 amplifier, we went through dozens of designs until we came up with one that would work perfectly for this model. The transformer is tri-filar wound to provide tighter coupling between sections. It has five different winding sections, all of which are tied together in parallel. Figure 5 shows this winding arrangement. We use grain oriented silicon steel core laminations which means tighter coupling, and less winding resistance for a given wire size. The grain oriented silicon steel core has a higher magnetic saturation

tion point - - - about 17 kilogauss versus the 12 to 13 kilogauss obtainable from the non-oriented variety. All of our transformers are potted with material which has especially high thermal conductivity. Besides helping to keep operating temperatures down, this compound reduces lamination buzz to inaudible levels. We figure you'd rather listen to your speakers than to our transformers!



(---Continuous operation not possible due to overheating. Protection circuit is assumed to current limit when load falls below 4Ω, in actuality the output into 4Ω and lower impedances will fall below the values shown.)

Fig. 4 Performance of OTL amplifier rated for 300 watts into 8 ohm load

Are There Any Disadvantages

Critics opposed to the use of output transformers in output circuits of audio amplifiers may tell you that transformers introduce "phase shift" - - - or that their leakage inductance plays havoc with wide-band frequency response in an amplifier. As a matter of fact, a properly designed transformer, such as those we've been talking about, introduces about 4 degrees of phase shift at 20 kHz. The typical input level control used on most power amps (OTL or not) introduces more phase shift than that - - - about 20 degrees. And since an output transformer is driven from an extremely low impedance (in a solid-state amplifier), there is actually more low frequency phase shift caused by the usual input coupling capacitor at these low frequencies than by our carefully designed autoformers.

As for frequency response and bandwidth, at the 8-ohm tap of the MC 2205 response is down 0.3 dB at 50 kHz. With a 4-ohm connection, response is down only 0.2 dB at that same high frequency. That's because McIntosh transformers introduce less leakage inductance than is commonly encountered with OTL amplifiers which usually require a series inductance between the output circuit and the speaker connection point for stability. At the 8-ohm tap of our MC 2205 leakage inductance is a minute 3.5 microhenries. That represents a series impedance of only 2.2-ohms at a frequency of 100 kHz!

To Sum It All Up

The points we've tried to make are relatively few, but they sell the difference between a McIntosh output-autoformer equipped amplifier and every other kind of power amplifier around.

1. A transformer equipped amplifier will deliver full rated power output at any impedance for which a transformer tap is provided.

2. An OTL amplifier designed for 8-ohm operation cannot operate safely (or meet FTC rules) when driving lower impedances (4-ohms, 2-ohms, etc.) unless it is over-designed in terms of 8-ohm operation. Yet, low impedance loads are commonly encountered either because of speaker impedance variations with frequency or because of paralleling of multiple speaker systems across one channel of an amplifier.

3. The new FTC power rule relating to audio amplifiers has forced many manufacturers to omit 4-ohm ratings - - - even though 4-ohm speakers are in common use. McIntosh autoformer equipped amplifiers deliver full power at any impedance for which a tap is provided.

4. Properly designed output transformers impose no limitations on frequency or phase response. The MC 2205 amplifier, using its specially designed output transformer, is accurate to within 9 degrees at the 8-ohm tap at a frequency of 50 kHz and undergoes zero degrees phase shift at 20 Hz. At the 4-ohm tap, phase shift at 50 kHz is only 7.2 degrees.

Next time anyone tries to tell you that an output-transformerless audio amplifier is "better", you might let them read this story.

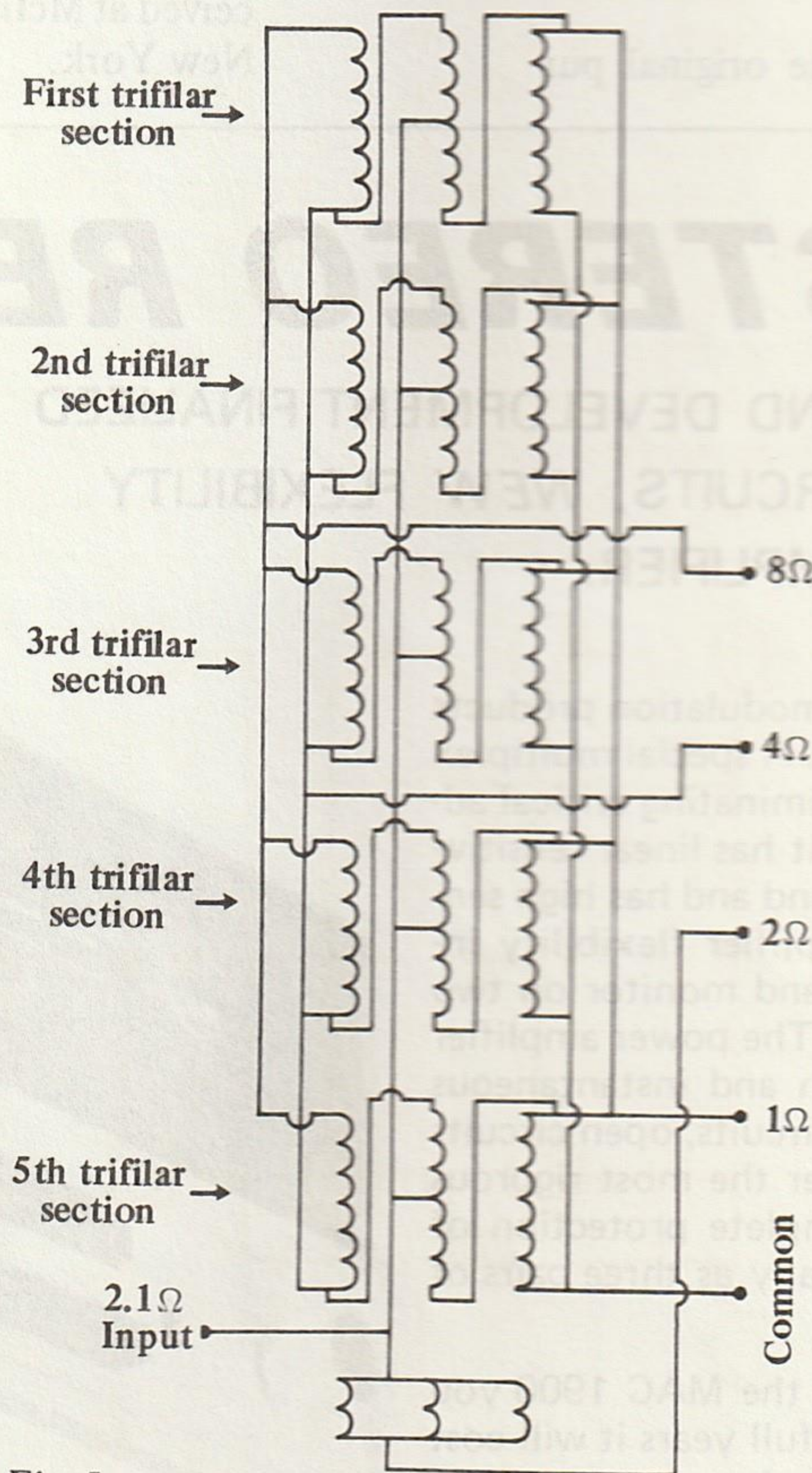


Fig. 5
Mc 2205 output transformer schematic diagram

TRADE UP NOW!

You cannot spend a dime on repairs for the next FIVE YEARS if you buy a McIntosh before May 31, 1976.

5 YEARS OF PROTECTION

The Special Five Year Service Contract is good at any authorized McIntosh service station. You get protection regardless of where you live. Should you move your protection follows you . . . anywhere in the U.S.A or Canada.

*MONEY BACK GUARANTEE

Only McIntosh gives you a money back guarantee of performance. *Your McIntosh instrument must be capable of meeting its published performance limits or you get your money back. No other manufacturer offers you this money back guarantee of performance.

ACT NOW!

This offer expires May 31, 1976. It covers the purchase of all new McIntosh models ML 1C, ML 2C, ML 2M, ML 4C, ML 10C, MQ 101, MQ 102, C 26, C 28, SCR 2, MPI 4, MR 74, MR 77, MR 78, MX 113, MA 6100, MC 50, MC 250, MC 2100, MC 2105, MC 2205, MC 2300, MC 2505 and the McIntosh Audio MAC 1900. This offer is limited to new equipment sold in the United States and Canada only. It excludes used equipment.

**YOU CANNOT SPEND
A DIME ON REPAIRS
IF YOU BUY A
McINTOSH BEFORE
MAY 31, 1976.**



**You get 5 years
FREE of
service costs
when you buy
before
May 31, 1976**

1. McIntosh will provide all parts, materials and labor needed to return the measured performance to the original performance limits free of any charge. The SERVICE CONTRACT does not cover any shipping costs to and from the authorized service agency or the factory.
2. To receive the free service under the terms of the SERVICE CONTRACT, the SERVICE CONTRACT CERTIFICATE must accompany the instrument when taken to the service agency.
3. Damage by improper use or mishandling is not covered by the SERVICE CONTRACT.
4. The SERVICE CONTRACT is issued to the original purchaser.

chaser. To protect from misrepresentation the contract cannot be transferred to a second owner.

5. To receive the SERVICE CONTRACT your purchase must be made from a McIntosh franchised dealer.
6. Your completed application for a SERVICE CONTRACT must be postmarked within 30 days of the date of purchase of the instrument.
7. To receive the SERVICE CONTRACT all information on the application must be completed. The SERVICE CONTRACT will be issued when the completed application is received at McIntosh Laboratory Incorporated in Binghamton, New York.

THE BEST STEREO RECEIVER

YEARS OF McINTOSH RESEARCH AND DEVELOPMENT FINALIZED IN A RECEIVER THAT HAS **NEW FM CIRCUITS, NEW FLEXIBILITY AND AN OUTSTANDING POWER AMPLIFIER.**

MAC 1900

The FM RF amplifier greatly reduces the cross modulation products over a wider dynamic range than ordinary receivers. A special multiplex detecting circuit has the particular advantage of eliminating critical adjustments. The completely NEW, superb AM circuit has linear sensitivity and linear frequency response over the entire band and has high sensitivity and excellent dynamic range. The preamplifier flexibility includes, in addition to FM and AM, play, record, and monitor on two tape recorders, and the use of two record players. The power amplifier output circuit has temperature sensing protection and instantaneous current limiting which protects from output short circuits, open circuits and overloads. You get reliable performance under the most rigorous operating conditions. The reserve power and complete protection of the output circuit allows safe operation with as many as three pairs of speakers, individually or all together.

Then to make the value greater, when you buy the MAC 1900 you get a free 5 YEAR SERVICE CONTRACT! For 5 full years it will cost you absolutely nothing for parts or labor for any repair.



MAC 1900