GAS Vol. 1 No. 3

THE GREAT AMERICAN SOUND CO. INC.
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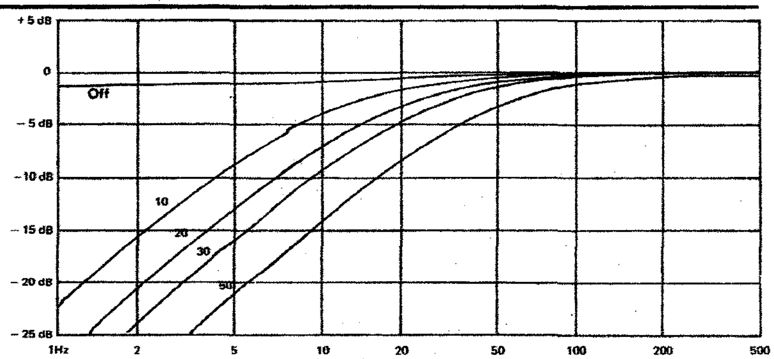
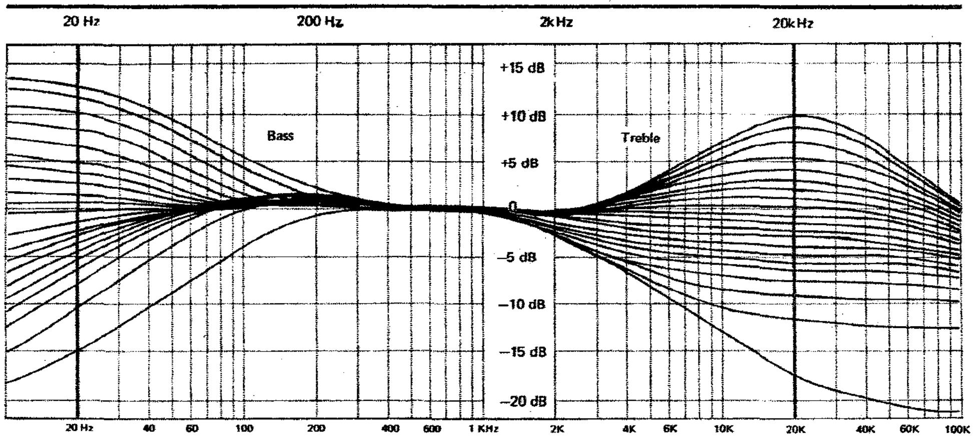
# GAS-THAEDRA

## Compare these THAEDRA specs




THAEDRA LOW-FILTER CHARACTERISTICS




THAEDRA SERVO-LOOP TONE CONTROL CHARACTERISTICS

<u>HEAD AMP (Moving-Coil Phono):</u>

Gain — 69 dB to tape output
90 dB to main output
Noise — 75 Nano Volts - 20 Hz to 20 KHz referred to input
32 Nano Volts - 400 Hz to 20 KHz
Distortion — Less than .01% at 2 Volts R.M.S. output at tape output at any freq. 20 Hz to 20 KHz
RIAA — ±0.5 dB 20 Hz - 20 KHz

<u>MAGNETIC PHONO:</u>

Gain — 42 dB to tape output
63 dB to main output
Noise — 500 Nano Volts - 20 Hz to 20 KHz referred to input
Distortion — Less than .01% at 2 Volts R.M.S. output at tape output at any freq. 20 Hz to 20 KHz

<u>HIGH LEVEL:</u>

Gain — 21 dB to main output
Noise — 6μV - 20 Hz to 20 KHz referred to input
Distortion (Tone controls flat) less than .01% at 2 Volts R.M.S. output at any freq. 20 Hz to 20 KHz into 600 Ohms
Freq. Response — D.C. to 100 KHz ±1 dB (Tone controls flat)

Maximum input before clipping:
Heat Amp: 3.5 mV at 1 KHz
Phono: 100 mV at 1 KHz
High Level: 1 Volt R.M.S. level, full

Maximum output before clipping - all outputs:
10 Volts R.M.S. minimum

# ꟷAEDRA
# ·IRCUITRY IS AHEAD
# )F ITS TIME

k in 1964, when the first transistor ɔ was introduced, it was heralded as wn of a new age. Unfortunately in the ;ince, a new sonic age did not arrive — ıow. The vacuum tube is still with us extent that our most worthy competi- ı tube-oriented company.

ally and proudly, after years of :h, THE GREAT AMERICAN SOUND \C. introduces THAEDRA, the first tate preamp that surpasses the sonic es of tubes by an order of magnitude. thermore, THAEDRA is the first environmental-proof preamp. G.A.S. so aware that the serious audiophile is ;ted in the basic features which are ary for good sound reproduction and interested in the gimmicks and those uently-used facilities that are found ny of today's touted preamps.

**ıVING COIL CARTRIDGES.**

our search for improved sonic repro- ın, we are generally limited by the luction capabilities of the transducers as phono cartridges and loud-speakers). ı last few years, considerable improve- have been made in these areas so corresponding improvements are re- l in the matching electronics. Today, ıoving-coil cartridge is king. Unfor- ıly, the moving-coil cartridge has a very ıutput level which requires either a p transformer or a "pre-preamp" to e the needed gain. Many assume that ansformer is a necessary evil with its limitations. Recently, a few "pre- ps" have been manufactured which ate the need for the transformer and sociated difficulties. These electronic also suffered problems such as noise, tion, and sometimes less-than-accept- ıerformance. Both of these approaches rely on the phono section of the ıing preamp adding extra links to the

which is also producing 3rd-harmonic distortion, then there will be some resultant 9th-harmonic distortion produced. If another stage were then added, some 27th-harmonic products would result, etc., etc.) No other preamp in existence can claim this important feature. To achieve this feature, a totally-new circuit concept was incorporated known as the Servo-loop. THAEDRA is the world's first Servo-loop preamplifier.

To avoid cascading many stages of gain to obtain the required sensitivity for moving coil cartridges, a concept was needed to achieve this in one stage of gain (gain block). Even though the required gain (closed loop) is 70 dB (at 1 KHz), this is further increased because of the requirements to provide RIAA equalization. Therefore, the total gain required is 90 dB at 20 Hz. This is an extensive amount of closed loop gain. Under normal conditions, this much gain would be virtually impossible to control. To accomplish these objectives, THAEDRA uses a Servo-controlled, D.C.-coupled head amp. Except for the phono input coupling capacitors, THAEDRA is 100% D.C. coupled (the only preamp with this claim).

Unfortunately, all D.C.-coupled amplifiers suffer a problem known as D.C.-drift. In addition, along with this drift, low-frequency modulation noise can occur. Until now, the only way to eliminate drift was to use capacitor coupling or extensive amounts of negative feedback. THAEDRA uses neither of these methods.

The servo-loop is rather unique in that it comprises two amplifiers in one. The first is the primary audio amplifier which is for the audio signals, and the second is the servo amplifier which is used only for D.C. control. (Both the primary amp and the servo amp are D.C. coupled.) A simplified circuit is shown below.

tors the output D.C. level continuously, there are absolutely no low-frequency modulation effects even when driving large high-frequency signals through the preamp. If the servo head amp is driven to full clipping (overload) at 20 KHz, it will produce less than ±5 mV of D.C. offset at the output. No other phono circuit can achieve this claim.

Other important features of the servo Head amp are: its very low noise (less than 70 nanovolts wide-band, referred to the input), an input impedance of 600 ohms to match today's moving-coil cartridges, and maximum output at clipping (into 600 ohms at tape output) which exceeds 10 Volts R.M.S. (This is equivalent to an overload point of 3 mV at the input providing 54 dB of headroom above standard operating level [standard operating level is −10 to −20 dB below 0 VU) before overload. This would correspond to an output level to the average power amplifier that would drive it [if it could] to 10,000 Watts for a 200-Watt per channel amplifier having a sensitivity of 1.5 Volts.)

The distortion components of the servo head amp are not discernible (below .001%) at rated output level of 2 Volts R.M.S. at the tape output. Even at 10 Volts R.M.S., the distortion components are less than .03%.

**PLUG-IN MAGNETIC PHONO AMP.**

In addition to the servo-head amp, THAEDRA also contains a separate phono circuit for conventional magnetic cartridges. The output capabilities, distortion and overload cleanliness are identical to those for the head amp. The noise level is 500 nano Volts referred to the input (wideband with no filter). Even though we conservatively rate the input overload point at 100 mV at 1 KHz, it must be pointed out that with the largest modulation index that can be put in a record groove of 40 cm., and with the highest output cartridge available, the largest signal that can occur is approximately 80 mV. Therefore 100 mV of overload capabilty represents an adequate safety margin.

One of the most useful features of THAEDRA is its ability to perform an "A-B" listening test of moving-coil cartridges. No other preamp offers this versatility. This test can be accomplished by removing the magnetic phono circuit card and inserting a second servo headamp card (available at extra cost——consult your dealer)

Furthermore, it was decided that the tone controls be accurate and resetable thus eliminating any need for a tone cancel switch as the flat settings would be truly flat.

The type of tone control action in THAEDRA is rather unique. The turnover frequencies were moved further out from the customary midrange frequencies in order to eliminate their effect on the critical midrange frequency band. These turnover points are 160 Hz for the bass, and 4 KHz for the treble. Furthermore, on each side of the flat setting, there are 10 positions of boost and cut which results in greater resolution in setability. As can be seen by the tone frequency curves, the treble control provides a perfect Gaussian band–pass frequency filter when boosted. This aids in eliminating high-frequency noise and distortion as well as R.F. interference, while still providing augmentation of treble audio frequencies.

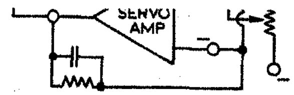
Another useful feature, not previously available, is THAEDRA's unique 5-position low-frequency Bessel-response filter. This filter is available on all inputs. Therefore, although THAEDRA is fully D.C. coupled for the absolute-purist audiophile, those users having less-than-optimum turntables and arms have the added flexibility of an adjustable subsonic filter.

The volume and tone controls in THAEDRA are totally sealed to provide environmental-proof components. They are manufactured by depositing a metal-glaze resistance element on a glass substrate using thick-film processing. The resulting reliability, repeatability, and freedom from noise is well worth the additional cost involved.

Another feature of the Servo tone amplifier is its output capability. THAEDRA's main outputs are capable of driving 100 AMPZILLAS in parallel while meeting all specs, and therefore we rate our specs while driving a 600 Ohm load. The main outputs are in fact able to deliver more than 1 Watt into an 8 Ohm load and will drive a pair of KOSS PRO-4 AA headphones into overload. This capability is achieved because the line amplifiers are running pure class A (8 Watts dissipation at idle).

**OTHER THAEDRA FEATURES:** Four regulated supplies from two independent

Tone Amp. This two-amp system reduces harmonic-distortion multiplication. (Harmonic distortion multiplication occurs when stages of gain are cascaded. For example if one stage, which is producing 3rd-harmonic distortion, is cascaded to another stage,

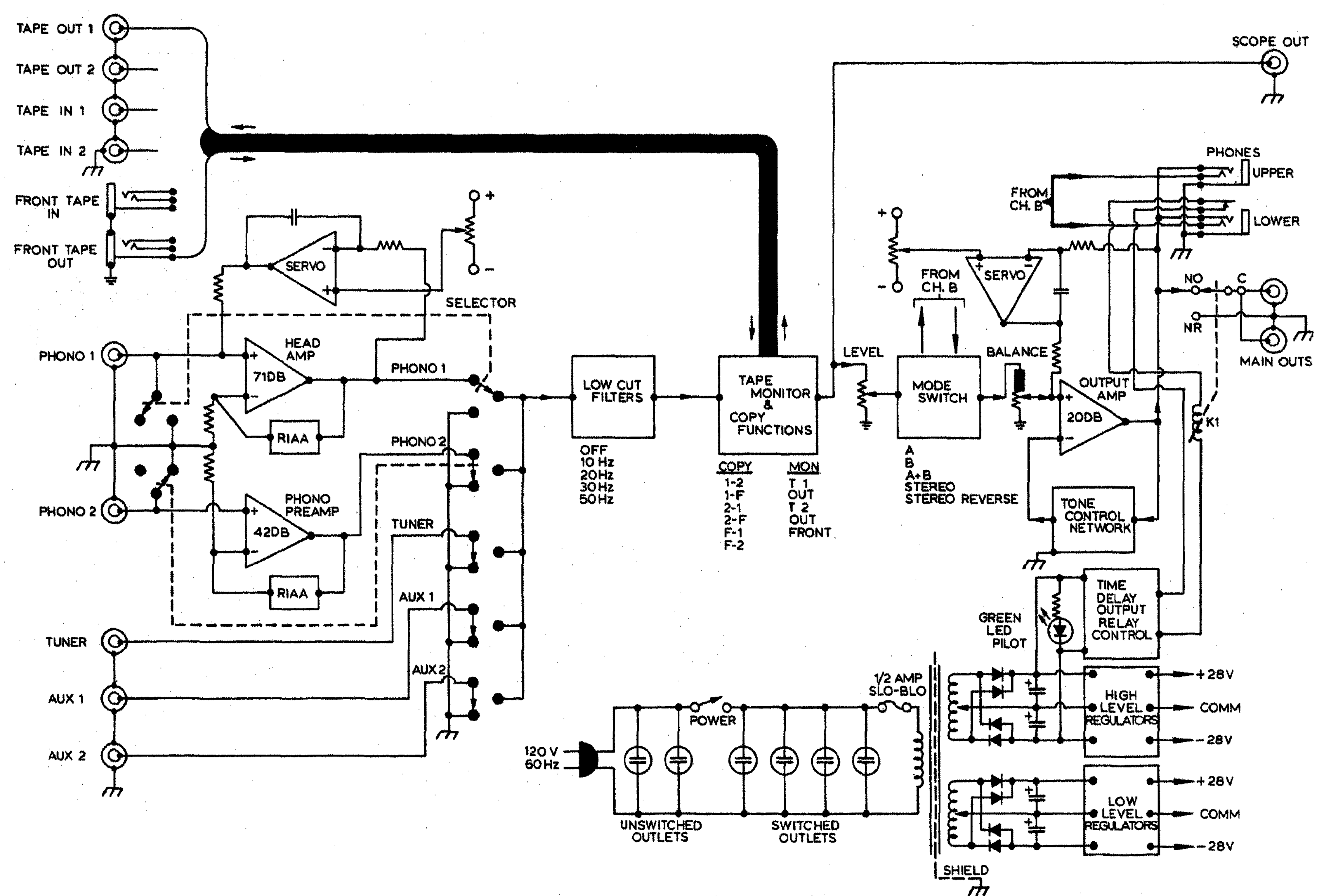


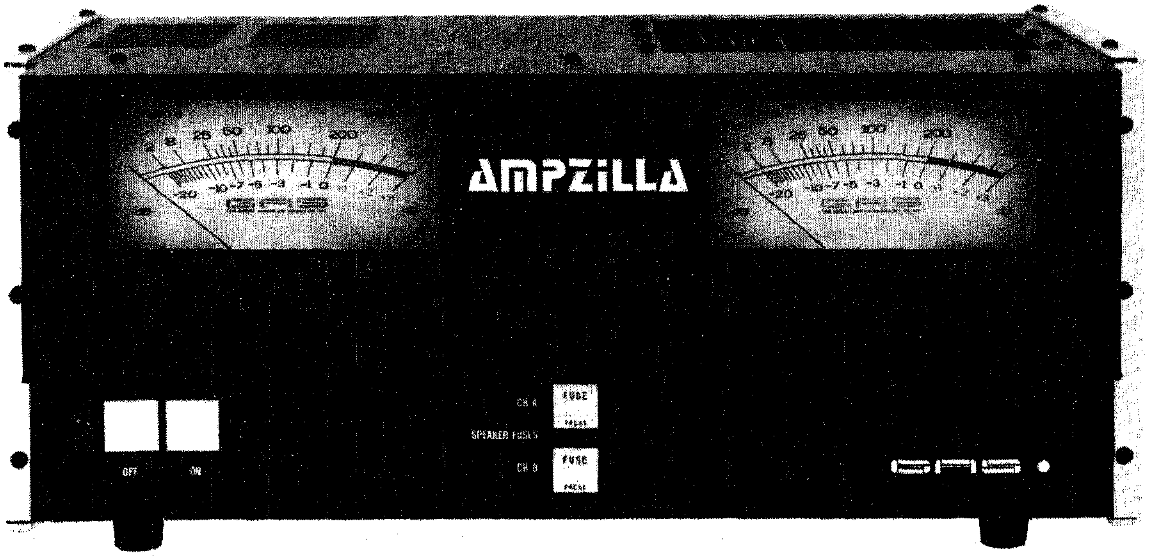

The servo amp completely eliminates D.C. drift. Also, since the servo amp moni-

the usual coloration that has always plagued preamps that have them. G.A.S. Co. engineers also felt it mandatory that all high-level gain and tone controls be incorporated within one circuit gain block to absolutely minimize coloration due to cascading stages.

and the power transformer an nickel-plated steel chassis. Fully environmental proof selector, m and tape switches. Capability to m copy with 3 tape machines. Two l power switch capability.

FIG. 1. THAEDRA BLOCK DIAGRAM (CHANNEL A ONLY.)






## VER OUTPUT

| | |
|---|---|
| OHMS | Minimum 200 watts per channel, both channels driven, 20 Hz to 20 KHz |
| OHMS | Minimum 125 watts per channel, both channels driven, 20 Hz to 20 KHz |

## TAL HARMONIC DISTORTION & I.M. DISTORTION

& 16 OHMS Less than .05% at any frequency or combination of frequencies, and at any power level to clipping.

**IT SENSITIVITY**
1.6 Volts R.M.S. for 200 Watts into 8 Ohms.

**IT IMPEDANCE**
7.5 K Ohms

**SSOVER NOTCH – NON EXISTENT**

**QUENCY RESPONSE (Power Bandwidth)** at rated power or any level less than rated power.
& 16 OHMS Better than ±0.1 dB, 20 Hz to 20 KHz
Better than ±1 dB, 1 Hz to 100 KHz

**: TIME AT 8 OHMS**
Better than 2$\mu$seconds. AT FULL POWER AT 20 KHz.
Slew rate equal to 40 Volts per $\mu$ second.

**Y CYCLE** Low-noise integral fan provides continuous operation at ambient temperatures up to 125°F.

**BILITY**
100% stable into any load angle 0° to 90°, capacitive or inductive, regardless of waveshape - sine, square, triangular. No oscillations or modulation noise.

**RLOAD PROTECTION**
Transistorized dynamic short-circuit protection. Thermal breaker also protects against overheating.

**SE** Better than 100 dB below full power (unweighted, wide band). 112 dB below full power (wide band with R.F. filter).

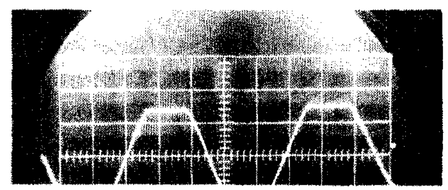
:: 17½" (W) x 7" (H) x 9" (D).

**PING WEIGHT:**


The Ampzilla All-Complementary circuit is truly push-pull from input to output. It utilizes full complementary dual-differential inputs, full complementary driver transistors, and full complementary series-connected output transistors. Since most amplifiers employ only a single differential input circuit and a single driver transistor, they are essentially single-ended designs. Virtually all power amplifiers can accurately reproduce sine waves fed into their inputs. However, it is not necessarily true that all amplifiers will accurately reproduce music and voice signals which are generally asymmetrical and thus rarely have positive and negative peaks that are equal in amplitude. A solution to amplifying these asymmetrical music and voice signals accurately is to use separate amplifiers for the positive and the negative half cycles. If the amplifiers are identical, it is then possible to obtain a virtually "perfect" symmetrical amplifier. Due to its unique symmetrical complementary mirror-image design, Ampzilla is an almost perfect symmetrical amplifier.

The positive and negative half-cycle amplifiers in Ampzilla also share a common feedback loop, an advantage for any source that must drive the amplifier.

Ampzilla also employs a unique integrated-circuit biasing system that contains five operational amplifiers. The op amps in this IC track the quiescent output current in such a way as to continuously maintain minimum cross-over notch as well as to make thermal runaway impossible.



# you hear ZILLA

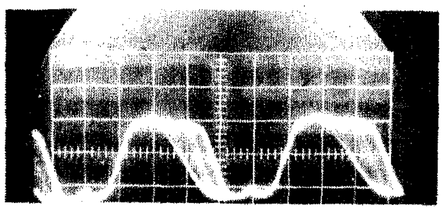
ıge of Ampzilla operates partially in a ile the driver and slave output stages are for the full cycle. Only the driven output erated class B. However, these transistors rom positive to negative. Rather, they rough the class-A region at the zero- 'his eliminates the crossover notch cus- ı most other power amplifiers.

ıtary differential input pairs are supplied ating regulator circuit which provides a ıates any possibility of sound thumps at ff.

ges of the amplifier are full-complemen- ·ated, employing epitaxial-base power eature high-frequency response five-fold nal output transistors.

ısformer has a special bilfilar winding of ıer with a square cross section. The bifilar ue locates the center tap exactly to loops thus minimizing any evidence of n.

capacitors have unusually high capacity $\mu$F so that only the minimum amount of ıe used to optimize the stability factor no loss of power output at 20Hz. Other ıve been included which provide stable vhen driving electrostatic speakers which a 20 $\mu$F load.



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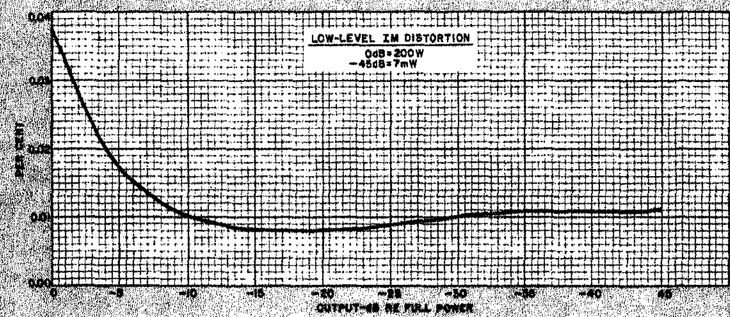
Popular Electronics

## Hirsch-Houck Labs Tests Ampzilla

Ampzilla is aptly named. Its 45-pound (20.5-kg) weight and more than 400 watts of output power place it solidly in the audio "monster" amplifier class. The heavy-duty, three-conductor power cord emphasizes the fact that this brute is definitely not to be plugged into an ordinary switched outlet on a preamplifier.



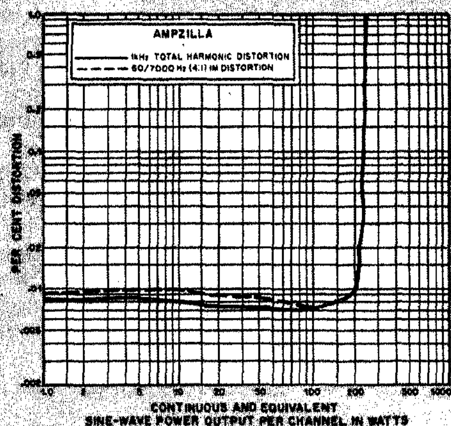

*Low-Level IM distortion is exceptionally small, indicating there is no crossover notch.*

**Laboratory Measurements.** With both channels driven simultaneously at 1000 Hz into 8-ohm loads, the output waveform clipped at 225 watts/channel. Into 4-ohm loads, the maximum power was 350 watts/channel, while into 16-ohm loads it was 132 watts/channel.

Using 8-ohm loads, the 1000-Hz THD was less than 0.01 percent for all power outputs up to 200 watts/channel. It rose to 0.03 percent at 220 watts/channel just before clipping occurred. The IM distortion followed a similar pattern, measuring just less than 0.01 percent up to 200 watts/channel and reaching 0.43 percent at 220 watts/channel. The low-level IM distortion was exceptionally low, indicating a complete lack of crossover "notch" distortion. It measured about 0.01 percent from 7 milliwatts to 25 watts output, with a smooth rise to 0.037 percent at the rated 200-watt output.

We drove the amplifier at frequencies from 20 Hz to 20,000 Hz to 200, 100, and 20 watts/channel output into 8-ohm loads. The harmonic distortion measured between 0.003 percent and 0.01 percent at all power levels for frequencies higher than 200 Hz. It rose slightly at the lower frequencies to a maximum of 0.05 percent at 20 Hz (at the 200-watts/channel level).

The gain of the amplifier is fixed. An




*Curves of distortion vs power output show under 0.01% THD to 200 watts output.*

10 watts (96 dB below rated power). As would be expected from a top-quality amplifier, the frequency response of Ampzilla was flat over the entire audio range and well beyond. Our measurements revealed a variation of less than ±0.1 dB from 5 Hz to 40,000 Hz. The response was down 1 dB at 200,000 Hz and 3 dB at 330,000 Hz. The square-wave rise time was 1.3 µs.

erally cool to the touch even after extended full-power operation. (The middle-speed cooling fan was incorporated in the test unit.) In fact, at the conclusion of our tests, which frequently overheat amplifiers and trip their thermal protective devices, the heat sinks on Ampzilla were still cool to the touch. The only signs of heat were in the vicinity of our test load resistors.

All in all, we cannot imagine a less

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Audio

September 1975

# Equipment Profiles

## G.A.S. Ampzilla Basic Power Amplifier

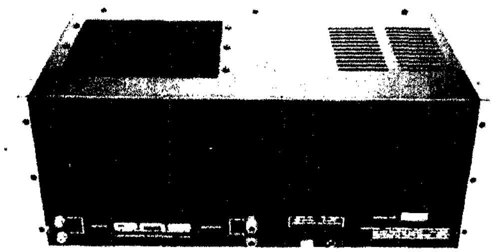

**Fig. 1**—Rear view of G.A.S. Ampzilla.

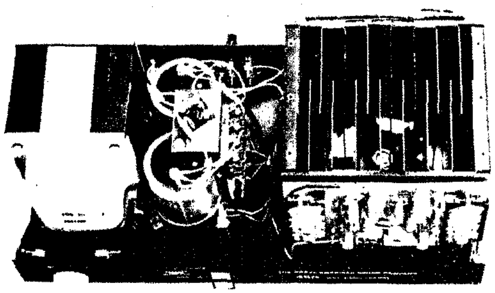

**Fig. 2**—Internal view.

Ampzilla is the first product of a new audio company—The Great American Sound Co. It is different and unusual in appearance and quite attractive after one gets used to it. It is available as a kit or factory wired; the unit reviewed was factory wired.

Refer to Figs. 1 and 2. The package is rugged, solid, and relatively simple. A U-shaped bottom piece serves to mount the power transformer, two filter capacitors, cooling fan, heat sink chimney assembly, and some of the normal front and back panel components. The chimney has the two power-amp circuit boards mounted on opposite sides, with four output transistors at the bottom on each side below the circuit boards. The fan is powered from the main secondary winding of the power transformer. Operating at a low-medium speed, it is reasonably quiet, as fan-cooled amps go.

The rectifier bridge and four supply fuses are mounted on a bracket that connects the ground sides of each filter capacitor to the chassis ground.

On the front part of the bottom chassis piece is a three-position phase-reversing power switch (*Off/On/Off*), two speaker-line fuses, and a green LED *Power On* indicator. On the back part of the main chassis are the line cord, line fuse, two sets of binding posts for the outputs, and a pair of phono jacks for the signal inputs.

Ampzilla has a front protrusion housing the meters and meter switch. In both cases, white end caps, contrasting with the black anodized chassis pieces, fit over the ends of the U sections and are solidly screwed to them to hold the whole unit together. Pemm nuts and machine screws are used throughout Ampzilla, with no self-tapping screws used anywhere.

The meters are calibrated in rms watts into eight ohms with a sine wave and relative dB, with 0 dB equal to 200 watts. The meters are average-responding and appear to have somewhat faster ballistics than a standard VU meter. As this reviewer has mentioned before, decade range switching is very desirable for easy reading of power on the lower ranges, and a 200-milliwatt full scale is a very handy reminder of the fact that a lot of listening on efficient speakers takes place down in the 1-100 mW region.

**Table I**—Output noise

| Bandwidth, Hz | Left, μV | Right, μV |
|---|---|---|
| 20 to 20K | 325 | 217 |
| 400 to 20K | 60 | 36 |

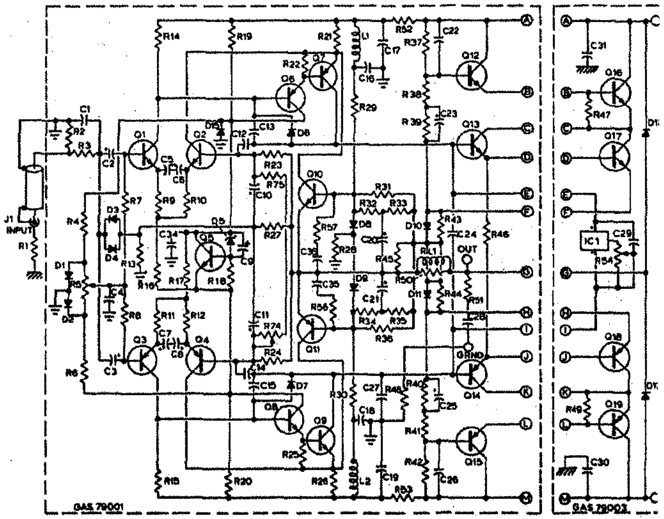

**Fig. 3**—Circuit schematic.

### Circuit Description

As can be seen in Fig. 3, the circuit of Ampzilla is full-complementary from input to output. The input stage consists of a dual-complementary differential amplifier, Q1-4. The output of Q1 drives Q6, a PNP emitter follower. Q6 drives Q7 which is a PNP inverting gain stage and is the plus predriver. In a similar manner, Q3 drives Q8 and Q9 with Q9 being the negative predriver. Q7 and Q9 operate Class A, with a quiescent current of about 25 mA. The signal currents at the collectors of Q7 and Q9 are in-phase but even harmonics are out of phase and will tend to cancel out. These collectors are tied together through the bias regulator. The predrive signal is thus relatively free of even harmonics and can drive the output stage equally hard in both directions. The bias regulator is a special integrated circuit designed to accurately control the idling current of the output stage as a function of temperature. The IC is mounted with its top surface in good thermally greased contact with the bottom of the heat sink where the output devices are.

The output stage is effectively a complementary follower with emitter-follower drivers. Each driver and output composite device is made up of two transistors in series to increase the safe area of the output stage. The inner drivers and outputs (Q13, 14, 17, 18) are driven from the predrive signal, while the outer devices (Q12, 15, 16, 19) are driven as slaves via voltage dividers from the amplifier-output signal. These signal dividers cause the voltage across the series-connected transistors to remain equal over the entire signal cycle.

The emitters of Q17 and Q18 are connected to the output buss through relatively large (0.39 ohm) emitter degeneration resistors that are paralleled by Shottky rectifiers. This assures good thermal stability of the output transistors with minimum drop at high current due to the low foward drop of the paralleling rectifiers. Turn-on thumps are eliminated in this design by causing the emitter currents, and hence the subsequent stage currents, of the input pairs to be zero at turn-on and then to slowly come up to the operating value. This is accomplished by the action of the voltage

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### Listenin

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VOLTAGES:

COLLECTOR Q17 — +37 V
—"— Q18 −37 V
—"— Q6 +23.5 V
—"— Q8 −23.5 V

ACROSS R43 .04 V
—"— R21 MIN 1.2 V MAX 1.8 V
—"— R26 MIN 1.2 V MAX 1.8 V

NOTE:

R75, R74 MAY OR MAY NOT BE SUPPLIED WITH THE UNIT. IF R75, R74 ARE SUPPLIED R23, R24 BECOME 270K.

9, and R18. Upon turn-on, ɔw from R19 through R18 ing its collector-to-emitter at about ground potential. the time-constant multi- or-to-emitter voltage of Q5 about 52 V when D5 con- d, the collector will be +26 supplying about 3.3 mA to in conduction, the voltage e constant with changes in nitter currents of the input stant. A cute circuit trick! volt-amp (VI) type, sensing e output stage. If voltage excessive, Q10 or Q11 will Q7 or Q9 and hence the cing the current in the pre- , and is in contrast to the ive current from predrivers nto the output buss. ropriately large and beefy egulation. Filter capacitors voltage at idle is about ± 75

time listening to Ampzilla, hs. Speakers have included quist DQ-10s, and Magne- is inescapable. Ampzilla is available bipolar solid-state end is incredibly tight and efined, and the high end is dginess and grit. When lis- good solid-state amplifiers, d isn't as transparent and lentifiably in the reproduc-

## Measurements

Ampzilla was first run for one hour at one third power, or 67 watts per channel, with a continuous 1 kHz test tone. It passed this test easily getting only moderately warm. Voltage gain was measured and found to be 24X or 27.6 dB in both channels. The input voltage for 200 watts into eight ohms is therefore 40/24 or 1.67 V.

Harmonic distortion at 1 kHz and IM distortion as a function of output power are shown in Fig. 4. Total IM distortion and especially the sum of 5th and 7th harmonics are exceptionally low in this unit. There is no measurable crossover type nonlinearity at low levels (power levels from 1-100 mW). Harmonic distortion vs. frequency and power and one-watt frequency response are plotted in Fig. 5. The aberration in THD near 120 Hz is caused by a beat between the signal frequency and 120 Hz power supply ripple. As has been mentioned in previous reviews on the Dyna 400 and SAE III CM, which also exhibit this phenomena, it is doubtful that this effect is audible.

Scope pictures of amplifier response to various test signals and loads are shown in Figs. 6 to 9. Fig. 6 is for a 50-Hz square wave into eight ohms for a low power and for full power. The lack of tilt in these waveforms is exceptional even though the amp is a.c. coupled at the input and feedback bases. However, the time constants are very long, being equivalent to a cutoff frequency in the region of 0.01-0.02 Hz. Fig. 7 is for 10 kHz square waves at low power into eight ohms and 2 µF loads. These responses are typical of most amplifiers that have been reviewed. Fig. 8 illustrates the response with a full-power 20kHz square wave into eight ohms and a 200 VA 20 kHz sine wave into a 1 µF load. (The slight ringing on the +½ cycle is mostly due to a slight aberration on the output of the pulse generator used.) The measured rise time for the square wave is about 3.2 µS and the slew rate is about 20 V/µS. THD for the 200 VA sine wave is about 0.25%.

Fig. 9 shows the response to a 20-kHz 80 V p-p square wave into a 1 µF load and a 20-kHz sine wave into eight ohms with a 2 dB input overdrive where the input is increased 2 dB over the value that just causes the output to begin to clip The large signal square wave indicates the amplifier's ability to deliver in excess of 10 amps into a 1 µF load. This qualifies it as a third amplifier in this reviewer's experience that can deliver such a fast large signal into a capacitive load. The response to the 20-kHz overdrive signal is outstanding. Virtually every other solid-state amplifier "sticks" on high frequency clipping. ["Sticking" is where the squared-off portion, when clipping, lasts longer than it should and then suddenly jumps toward zero vertically or very quickly and then finally gets back into the sine wave slope after recovery from clipping.] It is believed that how a power amp clips at high frequencies has some effect on how the amplifier sounds when not clipping. Amps that clip cleanly and don't stick generally do sound better, all other standard measurements being about the same. Damping factor was measured as a function of frequency and found to be about 160 from 20-300 Hz, decreasing smoothly to about 154 at 1 kHz, and 28 at 20 kHz.

Output noise as a function of measurement band-width with inputs shorted is shown in Table 1 below. The highest noise voltage in the 20 to 20 kHz band is about 102 dB below 200 watts into eight ohms and is composed mainly of lower order line harmonics.

In summary, Ampzilla is unquestionably in the state-of-the-art class and takes its place among a small group of fine amplifiers that really do make reproduced music sound more like live music. *Bascom H. King.*

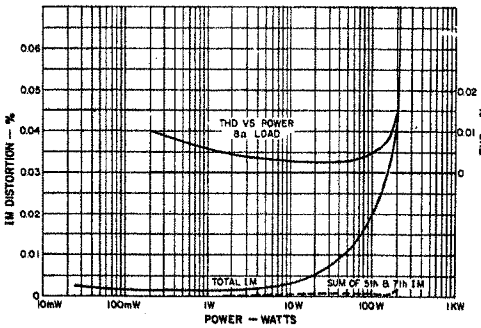



**Fig. 4**—Upper curve, THD versus power into 8-ohm load (use right-hand scale); lower curve, total IM and sum of 5th & 7th versus power into 8-ohm load (use left-hand scale).

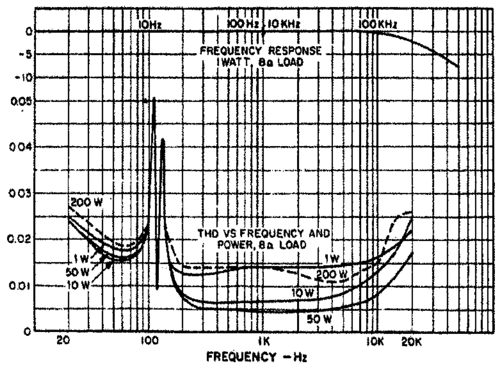



**Fig. 5**—Upper curve, 1-watt frequency response into 8-ohm load, note break in curve at 100 Hz to 10 kHz; lower curves, THD versus frequency at various power levels into 8-ohm load.

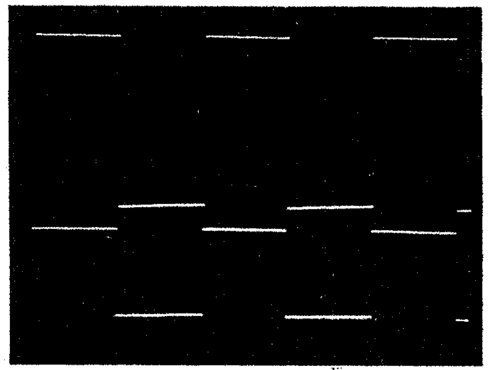


**Fig. 6**—50-Hz square waves; upper trace, 200 watts into 8 ohms (scale 20 V/cm, 5 mS/cm); lower trace, 3.12 watts into 8 ohms (scale 5 V/cm, 5 mS/cm).

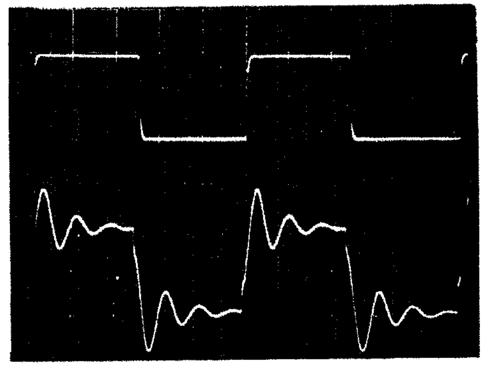


**Fig. 7**—10-kHz square waves; upper trace, low power into ohms (scale 5 V/cm, 20 µS/cm); lower trace, low power int 2 µF (scale 5 V/cm, 20 µS/cm).

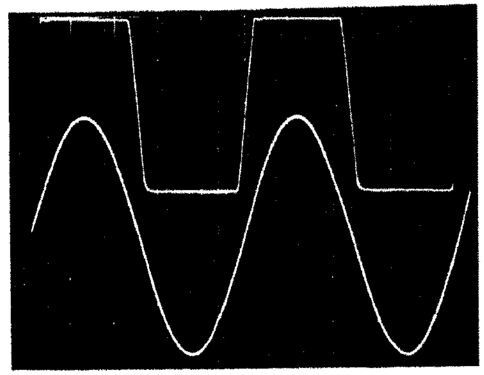


**Fig. 8**—Upper trace, 20-kHz full-power square wave into ohms, 80 V P-P note text (scale 20 V/cm, 10 µS/cm); low trace, 20-kHz sine wave, 200 VA into 1 µF, 40 V rms, TH 0.25% (scale 10 µS/cm).

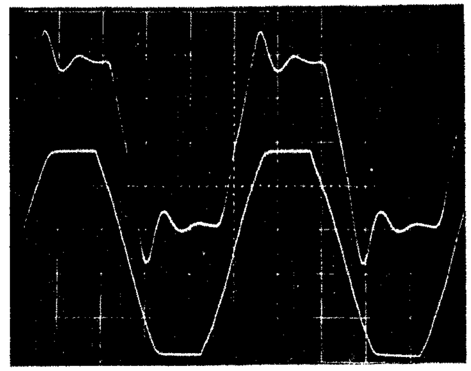
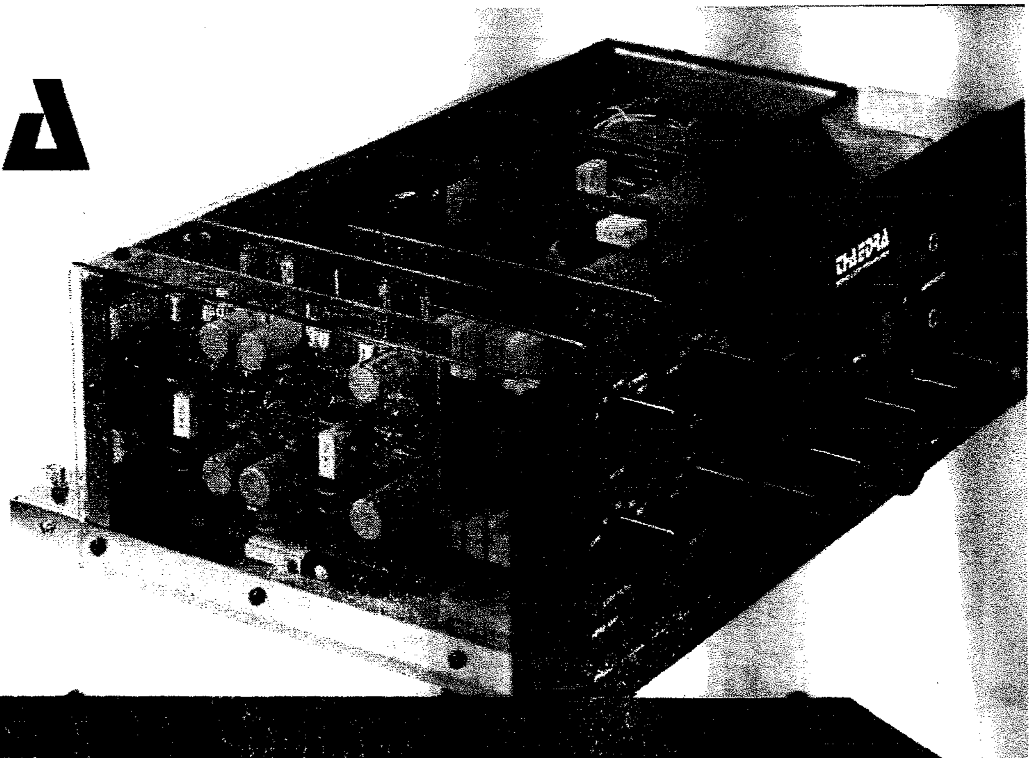
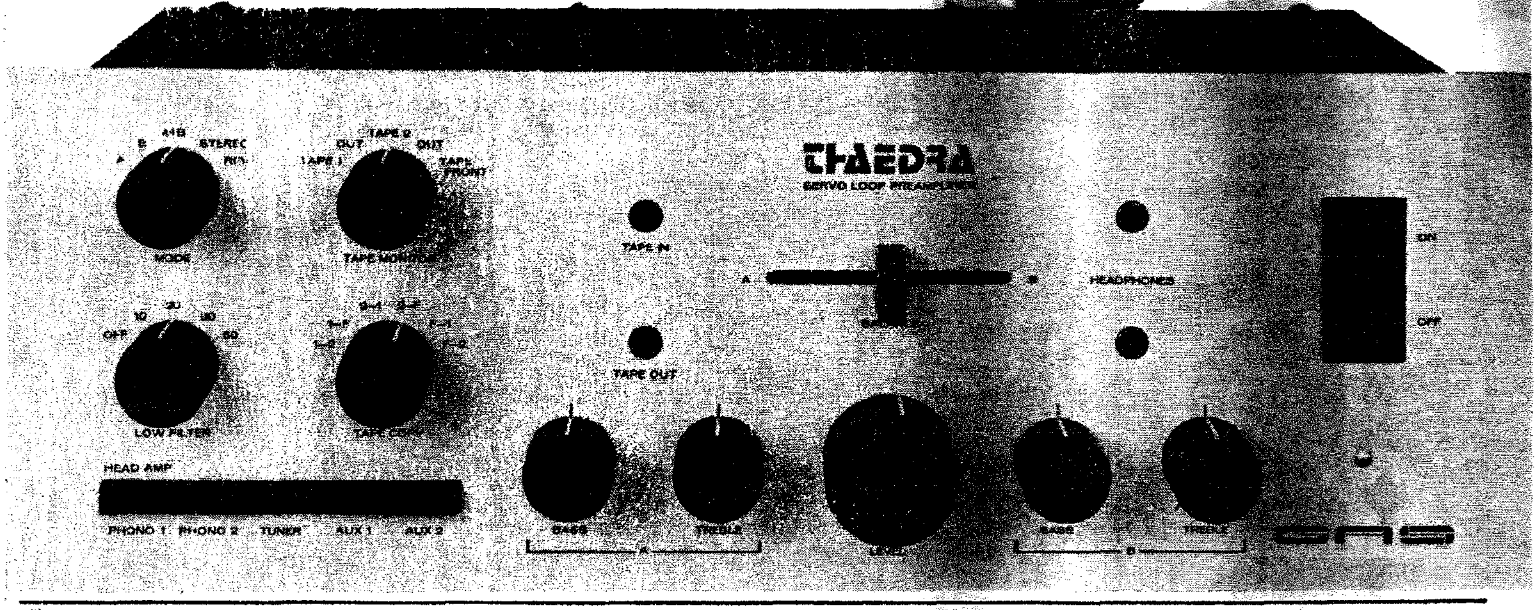


**Fig. 9**—Upper trace, 20-kHz, 80 V P-P square wave into 1 load (scale 20 V/cm, 10 µS/cm); lower trace, 20-kHz sir wave into 8 ohms with 2 dB overdrive (scale 50 V/cm, µS/cm).

# THAEDRA IS HERE






## THAEDRA FEATURES THE INDUSTRY'S FIRST SERVO- CONTROLLED ELECTRONICS

### All complementary circuitry from input to output.

Head amp is servo controlled for absolute D.C. stability (First time in Audio Industry.)

No high-frequency sticking on overload in head amp or phono stages.
Circuits can be fully over driven at 20 KHz with virtually instant recovery.

Distortion components of all circuits are 2nd & 3rd harmonic with no higher order components.

Bass control +12, −15 dB at 20 Hz, turnover point — 200 Hz, 40 Hz shelf-type contour for minimum phase shift.

Treble control +10, -17 dB at 20 KHz, turnover point — 4 KHz, 10 KHz Guassian response in boost, shelf type in cut. for minimum phase shift and rejection of noise and R.F.

Tone controls automatically cancel in flat position.

5 position low frequency filter — off, 10 Hz, 20 Hz, 30 Hz, 50 Hz available on all inputs.

Tape monitor and tape copy for 3 machines, front panel tape in and tape output.

Tone and level controls are metal-glaze-thick-film deposited type. Level, 22 position. Tone, 21 position. Delay relay for turn on and turn off. Total independent regulated power supplies for low level and high level circuits.

Main output will drive low level phones because of total class A operation.

After phono inputs, the total preamp is all D.C. coupled. (Another G.A.S. Co. first.)

Power Transformer fully potted and enclosed.
Entire A.C. power section enclosed in separate housing.
Entire chassis constructed of 16 gauge nickel-plated steel.
All controls and switches are fully environmental proof.

Semiconductor complement — 57 Transistors, 12 FETs, 5 Zeners, 38 Diodes