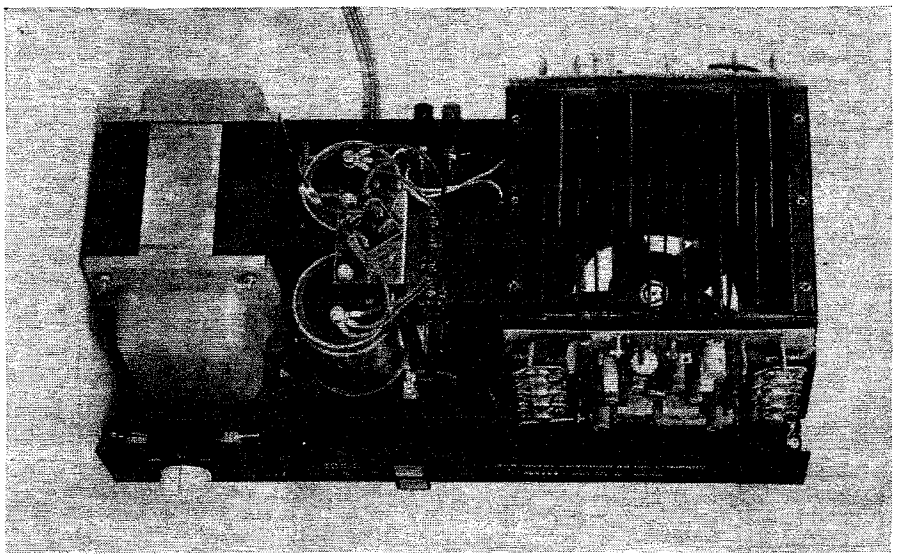
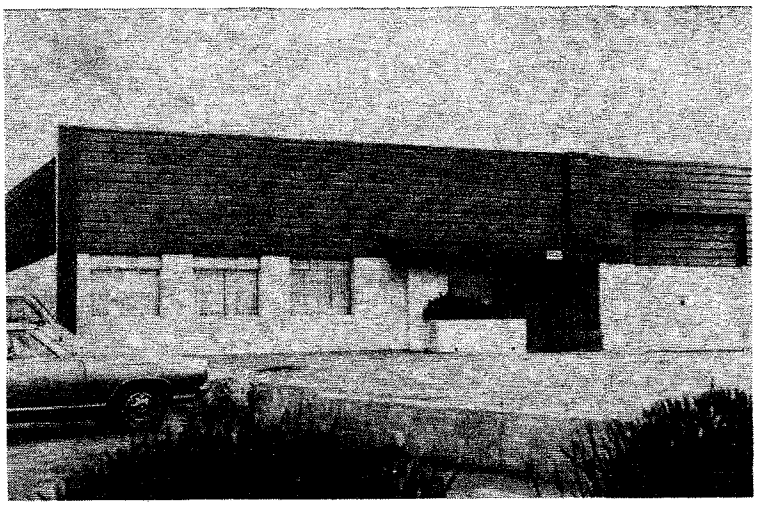
An integral fan has been included to keep the unit cool for greatly extended operating life. The cooling fan further enables Ampzilla to meet with ease the new stringent long-term continuous-duty requirement specified by the U.S. Federal Trade Commission. (Other high-power amplifiers lacking fan generally do not meet the new FTC conditions.) A massive 1.5 kilowatt transformer of very unique design has been provided which almost approaches a power supply with electronic regulation. The construction of the amplifier is like a battleship and is most well suited for rugged environmental conditions.



Warranty:

Wired Units:
5 Year Parts & Labor
Kits:
1 Year
(exclusive of semi-conductor when returned to G.A.S. CO., INC., Factory Authorized Service Center.)

What's in Back of the G.A.S. Company?



A new company has been born to bring to the high fidelity enthusiast the greatest achievements in audio equipment. The first three amplifiers offered by the G.A.S. Company certainly fulfill these goals. With specs like 1000 watts (2 Ohms) at less than 0.25% distortion (Godzilla) or 200 watts (2 stereo channels driven simultaneously into 8 Ohms) at 20KHz with less than .05% distortion (Ampzilla), there is little else available to provide direct comparison. Of greater importance than the outstanding specifications maintained is the truly fantastic listening experience available with either an Ampzilla or the super-powered Godzilla.

Who are the people behind the G.A.S. Company; The G.A.S. Company founders are six outstanding engineering experts who have joined ranks to combine their expertise in the design, development, and manufacture of high-fidelity equipment.

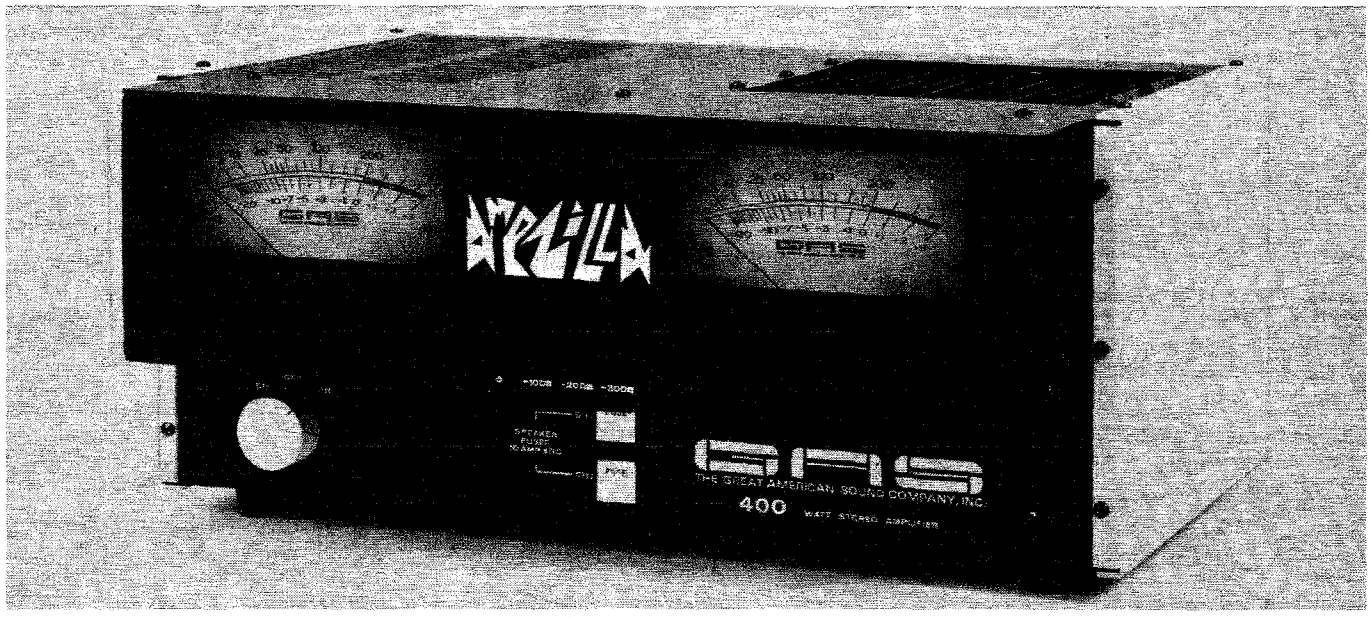
We think it is important that you should know something about our President, James Bongiorno. Jim was most recently the Director of Engineering at Scientific Audio Electronics, Inc., where he designed an entire line of outstanding audio amplifiers. Prior to that, he served as Director of Research and Development for Dyna Co., Inc., and earlier he served in the same capacity for Rectilinear Research Corporation. In still earlier days, Jim was part of the highly acclaimed engineering staff of Marantz Company as well as Hadley Laboratories. Presently, Jim is still a contributing author to both Popular Electronics and Audio Magazine. Both Ampzilla and Godzilla are the result of Jim's latest efforts. We wish we could let you in on some of the secrets of the many exciting new products Jim is now developing. Keep in touch with the G.A.S. Company so you do not miss hearing about their introductions.

THE GAS-ETTE

VOLUME 1 1975
NUMBER 2

THE GREAT AMERICAN SOUND COMPANY, INC.
8780 SHOREHAM DRIVE WEST HOLLYWOOD CALIFORNIA 90069
(213) 659-2486

AMPZILLA IS HERE!



From its circuit design to its appearance, Ampzilla is bold, strikingly different. This is the dream unit that we, as engineers audiophiles, have wanted to make for years. It is impossible to describe Ampzilla with just a set of specifications. Anyone can cl great specs and everybody does. Why, then, are all amplifiers **NOT** created equal? Why do they **NOT** all sound alike? The truth lie more subjectiveness in listening. **Then** add a higher order of sophisticated engineering to find the **real** qualities that improve listenability of a product.

Compare These Specifications

POWER OUTPUT

8 OHMS	Minimum 200 watts per channel, both channels driven, 20 Hz to 20 KHz
4 OHMS	Minimum 350 watts per channel, both channels driven, 20 Hz to 20 KHz
16 OHMS	Minimum 125 watts per channel, both channels driven, 20 Hz to 20 KHz

TOTAL HARMONIC DISTORTION & I.M. DISTORTION

8 & 16 OHMS	Less than .05% at any frequency or combination of frequencies, and at any power level to clippi
4 OHMS	Less than 0.25% at any frequency or combination of frequencies, and at any power level to clippi

INPUT SENSITIVITY
1.6 volts R.M.S. for 200 watts into 8 OHMS.

INPUT IMPEDANCE
75 K OHMS.

CROSSOVER NOTCH – NON EXISTENT

FREQUENCY RESPONSE (Power Bandwidth) at rated power or any level less than rated power.

8 & 16 OHMS	Better than ±0.1 dB, 20 Hz to 20 KHz Better than ±1 dB, 1 Hz to 100 KHz
4 OHMS	Better than ±0.2 dB, 20 Hz to 20 KHz Better than ±2 dB, 1 Hz to 100 KHz

RISE TIME AT 8 OHMS
Better than 2μ seconds. AT FULL POWER AT 20 KHz.
Slew rate equal to 40 Volts per μ second.

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

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

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

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

SIZE: 17½" (W) x 7"(H) x 9"(D).

SHIPPING WEIGHT:
50 lbs.

PRICES: Denver/West Kit: 599.00 — Factory Wired: 799.00

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

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

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

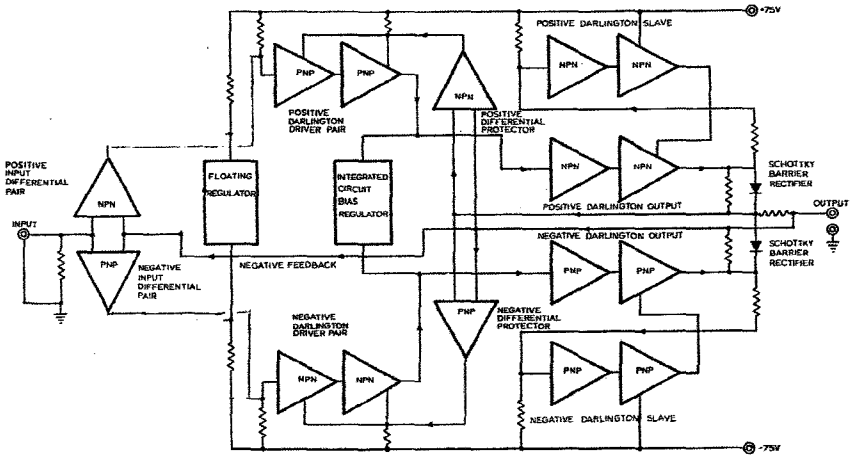
The output stage of Ampzilla operates partially in a class-A mode, while the driver and e output stages are operated class A for the full cycle. Only the driven output transistors operated class B. However, these transistors do not switch from positive to negative. her, they traverse back through the class-A region at the zero-crossing point. This inates the crossover notch customarily found in most other power amplifiers.

The complementary differential input pairs are supplied current by a floating regulator uit which provides a delay that eliminates any possibility of sound thumps at turn-on urn-off.

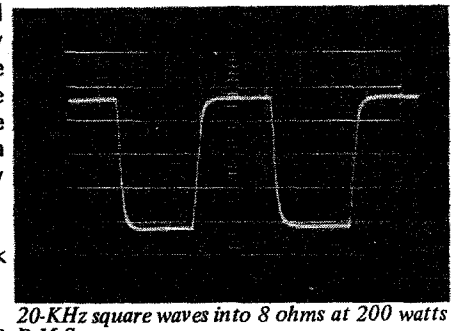
The output stages of the amplifier are full-complementary series operated, employing taxial-base power transistors that feature high-frequency response five-fold that of ventional output transistors.

The power transformer has a special bilfilar winding of heavy-gauge copper with a square ss section. The bifilar winding technique locates the center tap exactly to eliminate und loops thus minimizing any evidence of power supply hum.

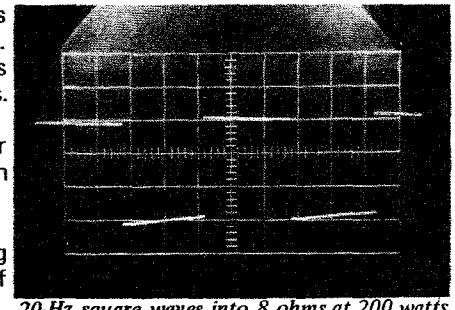
The main filter capacitors have unusually high capacity values of 16800 μF so that only minimum amount of feedback need be used to optimize the stability factor and also vide no loss of power output at 20Hz. Other circuit details have been included which vide stabile operation even when driving electrostatic speakers which are equivalent to 0 μF load.



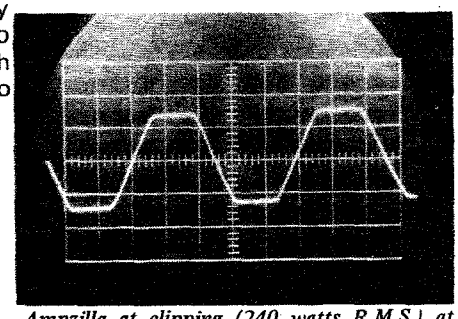
latch-up of any kind, at any frequencies, as shown in these photos.



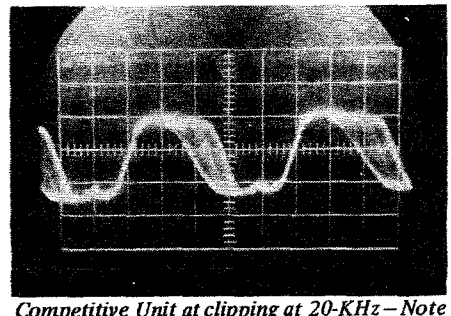
20-KHz square waves into 8 ohms at 200 watts R.M.S.



20-Hz square waves into 8 ohms at 200 watts R.M.S.



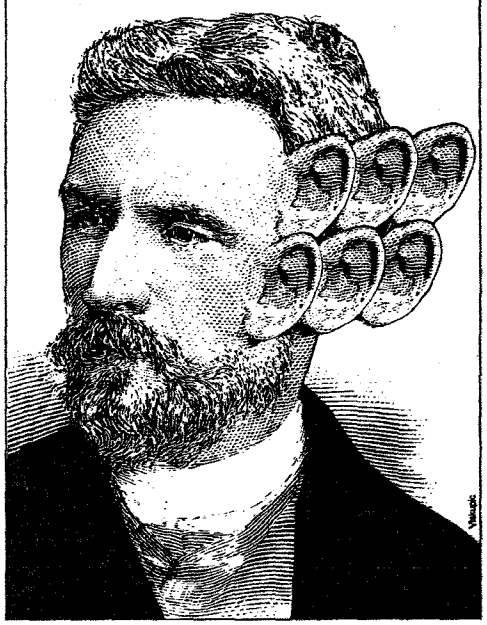
Ampzilla at clipping (240 watts R.M.S.) at 20-KHz—Note practically zero recovery time.



Competitive Unit at clipping at 20-KHz—Note breakup instability and oscillations.

the absolute sound

volume 2 number 5 fall 1974



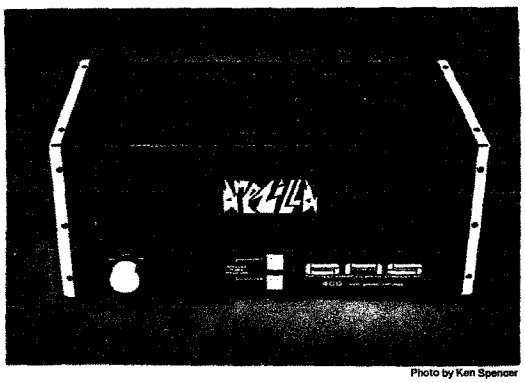


Photo by Ken Spencer

Editors Choice

The components listed here do not, in any absolute way, reflect some sort of high-fidelity truth. They are the notions of the editor alone (hence, the new name, Editor's Choice), who has ranked equipment, not on the basis of cost, but on the basis of low coloration and low distortion.

State-of-the-art is the category reserved for those rare components that are significantly beyond the best performance of nearly all other equipment. Class I indicates components of very low distortion and colorations — components with one or more shortcomings when measured against what can be achieved by present technology. All Class I amplifiers, for example, are less good in some major aspect, than any one or more of their competitors, none of whom themselves have created a significant advance in the state-of-the-art without at least some noticeable compromise. Class II indicates, in our order of preference, considerably more coloration in considerably more bands of the audio spectrum, but euphonic colorations that may, when matched, add considerable reality to the reference sound. Special Merit is a new category for low-price components that, in one man's opinion, give significantly accurate sound at a price well below what one would expect. In our estimation, for example, Magneplanar's low-cost new speaker could successfully hold its own against a single pair of KLH Model Nines, which

STATE-OF-THE-ART

Preamplifier ..... Audio Research SP-3a [a]
Speaker System ..... Magneplanar Tympani IIIa[a]

CLASS I

Turntables ..... Panasonic SP-10
Arms ..... SME 3009 II (non-detachable shell)
The Vestigal arm
Preamplifiers ..... Soundcraftsmen 2217
Levinson LNP-2
Amplifiers ..... Audio Research Dual 76
Ampzilla
Speakers ..... Dayton-Wright XG-8 Mk II
Dahlquist DQ-10

CLASS II

Turntables ..... Sony TTS-3000/3000a
Sony 2251 LA
Arms ..... SME 3009 II Improved (S/2)
Decca International
Cartridges ..... ADC XLM
Supex SD-900
Decca Mk V Export
Preamplifier ..... Marantz Model 7
Amplifiers ..... SAE III CM
Marantz 500
Dyna 400
Speakers ..... KLH Model 9 (two pair)
Dayton-Wright XG-8 Mk I
IMF Monitor III

SPECIAL MERIT

Speakers ..... Magnepan 2167
Amplifiers ..... Marantz Model 9
Marantz Model 8b
Dyna Mk III

RECOMMENDED

Turntables ..... Philips GA-212 (w/arm)
Cartridges ..... Ortofon SL 15 Mk II
Amplifier ..... Phase-Linear 700 B
Pre-amplifers ..... Dyna PAS-3x
Marantz 3300 (later models)
Speakers ..... Double Advent system
IMF ALS 40 (not the 40a)
Hegeman 1 (not the 1a)

RATIONALIZATIONS

***The Dual 76 was removed from the state-of-the-art category because its extreme low end response has been surpassed by Ampzilla. Ampzilla, whose low end response sounds like the 76's mid-range and high frequency response does

***The ranking of the Vestigal arm is conditional. Design difficulties discovered by PHD may, if not solved, force us to remove the Class I listing.

Manufacturer: The Great American ınd Co. (The GAS Company, believe t or not.) 8780 Shoreham Drive, West llywood, California, 90069. **Prices:** version; $340; $375 (with meters). red version: $475; $525 (with ters). **Source:** Manufacturer's loan. **its tested:** (PHD) (HP) Unnumbered.

)ne of the most facinating elements the audiophile neurosis (that ne of us admit to) is the pursuit l discovery of not just new or radical ices but more **accurate** ones with ich to produce the music that we e. In the past few months, Trans-)tors have made things a little aner and more airy with their stigal arm; Mark Levinson has oothed and opened up his little JC-1 id amp and Audio Research has ne up with a significant improve-nt to their SP3 preamp (now iignated the SP-3a).

And now a step further down the sig- chain along comes Jim Bongiorno ain) with no less than three new)er power, super sounding ampli-s. Bongiorno did most of the ginal design of the Dyna 400, he nered the SAE III CM and now, with a ne like a Japanese monster gone d and a sound like a thing of the ure comes Ampzilla. This new amp : not been listened to as long as we'd), but it has been here long enough me to theorize that it may well set pace for the rest of the industry.

Ampzilla is a 200-watt-per-channel, -cooled, **full** push-pull transistor p which is in many ways similar to SAE III CM but is in other ways similar from any amp I've ever seen heard.

The first reaction that I had after list-ng to this beast was "Where did all haze go?" Ampzilla is an extreme-open amplifier (I keep feeling like a tube amp!). There appears to be le limit to this unit's slewing ability. umps out transients as fast as one put them in. There is a resultant ase coherency (when listening ough properly phased speakers; ., Dahlquist, Infinity Servos, or ton-Wrights) that is very impres-e.

My reactions to and tests of this new p are only a few weeks old at this ting so they are subject to future dification. So far I have only a few ervations about the amp. First, I lly miss the input gain controls; I nk they are a must when one tries to ance a multi-amped system or when re's a need to reduce the amp's sitivity when using high efficiency dspeakers or headphones. Bon-rno says he prefers not to use input entiometers because of the manner which they color the sound! Second, ile Ampzilla seemed to bring out the st in each loudspeaker that I tested e Dahlquist, the Advents, AR-3, gneplanars, AR-LST's and the nity Servo-Statiks), the Dayton-ight SG-8 MkIIB was another story! Marantz 500. Ampzilla sounded fine at low power levels on the Dayton-Wright XG-8 MkIIB, but not so good at high power levels. At listening levels near 95 dB, the extreme top end rolled off [and distorted] starting at 12,000 Hz. Response was 1 or 2 dB down at 20,000 Hz. This roll-off was a result of the amps's limiters reacting to the 'wierd' things that the D-W does to an amplifier. I then made instrumentation checks with 20 Hz, 1,000 Hz and 20,000 Hz square waves and a wide variety of dummy and actual loudspeaker loads.

Ampzilla performed flawlessly in **every** test except when driven at high power levels and at extreme high frequencies with the Dayton-Wright as a load. (Most amps just can't handle the current demand of the Dayton-Wrights.) Ampzilla clipped at 212 watts at 1,000 Hz very cleanly and symmetrically. Bongiorno agreed to look into the Dayton-Wright problem and has supplied a modification to Ampzilla's limiters which now allows the amp to drive the D-W's to high volumes without limiting. Bongiorno says the change will be in his regular production units. No other speaker system (even double AR LST) seems to cause any problem with the amp (remember that we had a more severe but similar problem with the Dual 76 on the Dayton-Wright!).

Ampzilla is fan-cooled by the same fan that was used in the Marantz 500 and like the 500, it can be heard when all else is quiet. Ampzilla is similar to the SAE III CM since many of the circuit principles and parts are the same. Ampzilla's packaging is very clean and straightforward and its physical appearance (black and white!) is radically different. Ampzilla lacks many of the features of the III CM. Ampzilla does not have an adjustable output power limiter, like Dynaguard, nor a relay for speaker protection; without this relay one does notice a low frequency pulse as the amplifier is turned on. The SAE III CM and the Marantz 500 also have a greater number of output devices to lessen the load on each output device (but then Ampzilla costs less than one-half the price of these amps). Ampzilla will **not** be marketed through local dealers; it can be purchased directly from the manufacturer in a kit or wired version. The price of Ampzilla whether kit or wired is a bargain and Bongiorno informs me that there will be an increase after January 1, 1975.

We intend to do a lot more listening and testing with this new unit. Until then, I can't think of a better way to improve one's sound system than to scare all the problems out of it with an Ampzilla!

—PHD

Reviewer's Addendum:

Bongiorno has supplied one final change to his design (a capacitor) which eliminates the turn-on thump I was hearing in my Hartley woofer. This change too, says Bongiorno, will be in all units shipped. The more I listen to this amp the more I like it.

I would like to extend my thanks to The Absolute Sound for what I believe to be the first "qualitative" review of one of my designs. I have had some of my other designs reviewed in other magazines, but as was expected, they (the reviews) fell into the usual "ho-hum what else is new" category, which is light years behind what I feel this magazine is striving for. After all, it is the **sound** that we are after and, we can't listen to a test bench. I have had a certain reviewer tell me that he cannot tell the difference between any of the last three amplifiers that I have designed. Taking into account that these three designs amounted to over 8 years of accumulated time, I feel very slighted, as if my efforts (and the efforts of others) are totally wasted. It is very possible that under certain circumstances there might be only very marginal differences **but,** this would only be the case where there are other **weaker** links in the listening chain, and I suspect that this is exactly the case as far as other reviewers are concerned, aside from the fact that they just can't hear to begin with.

I believe that Ampzilla is a bold step forward. It was not meant to be the ultimate total amplifier with all the extra features that are found on most other amplifiers. These other features cost money and our feeling at the G.A.S. Co. is that **they do not** contribute anything towards improving the sound **quality.** We chose to go direct mail order in order to provide the best possible amplifier at the lowest possible price. If Ampzilla were marketed through the normal dealer outlets, it would cost several hundred dollars more and most of the population would not be able to afford it.

As far as some of PHD's nits, I will offer some justifications. The components that were added to the limiters were supposed to be there in the first place but, the draftsman left them out for some unknown reason. And for a further unknown reason these errors got by final approval. It was intended that the amplifier **should** indeed be able to handle high reactive loads at high frequencies into such loads as the Dayton-Wrights, and adding in the missing components does prove this point.

As far as the thump at turn-on goes, it was found that in a few of the amplifiers the time delay transistor would not always function and would oscillate. The added capacitor cures this forever. As far as level controls are concerned, I don't like them and never will. I agree that a **handful** of people would have a use for them but, they are few and all of the rest of the customers would be required to pay for something that they have no use for. As far as bi-amping goes, electronic crossovers have individual levels and therefore none are needed on the amp.

We made a pilot run of 25 amplifiers and sent them out to certain people and organizations such as yourselves **solely** for the purpose of being **used and abused** in order for us to find any pos-

sible problems **before** the regular customers do. It is unfortunate that most manufacturers do not adhere to this set of ethics.

James Bongiorno
President
The Great American Sound Co., Inc.

HP Comments:

I find myself in substantial agreement with PHD on the considerable merits of Ampzilla, so I will content myself with a few notes:

- Ampzilla should be turned on, and left running for 10 minutes before it is tested. It takes that long for the bias in the unit to stabilize. (This is not my imagination. Some of the paleness of my first reactions to Ampzilla were based on impressions just after the unit was plugged in. The manufacturer has confirmed these findings). If you listen to Ampzilla without allowing a decent interval of time, you will hear most curious aberrations in the midrange, a sort of muting of the harmonic structure of many instruments. The trick: Turn the unit on (leaving the internal fan turned off) for about 10 minutes, then quickly move the on-off-on switch from the left on to the right on position (this activates the fan).
- Ampzilla does not have the virtually non-existent grain structure and front-to-back depth of field of Audio Research's Dual 76, although it does better in these two categories than the transistorized units I am intimately familiar with. (The qualification you just perceived is based on this: I have never heard a properly-working Marantz 500 in my reference system.)
- Ampzilla does have, at its extreme low end (below 100 Hz), the sort of definition, fine grain structure, and depth that characterize the Audio Research's midrange and high frequency regions. In this respect, it clearly does better than the Audio Research, prompting us to remove the [illegible] from the Dual 76. Ampzilla's high end is sweet and silky when compared against the more neutral highs from a Dual 76. The high end seems to me a distinct improvement over the dryness typical of many Marantz 500s and the somewhat zingy qualities of a Dyna 400. Also, there is none of the upper middle-to-high end constriction (sometimes bordering on harshness) that seems to be characteristic of the SAE III CM. [In a sort of Quarterly Retrospective on equipment (similar to that done on discs by The Gramophone), FR, PHD, and HP, using HP's references, determined they agreed on the relative ranking of the three Bongiorno designs, with the Dyna in third place, Ampzilla in first, and the SAE in the middle.]
- At the price, Ampzilla clearly deserves a special merit designation (see Editor's Choice), but since it is (to us) unequivocally a Class I amplifier, we have so named it. Still, at this price, it is a best buy in the fullest sense of that term.

Design Considerations: Why Tubes Sound Better

by James Bongiorno
Great American Sound Co.

First of all, I would like everyone to know that I'm writing from a position of subdued authority, this authority of course is vested in me by myself. Now for all of you out there in audio city who want to scream egomaniac, do it. Let us, therefore pass on to more important matters, that is, facts. Facts are always there, bold yet mysterious, and though we can acknowledge the awareness of the fact's presence, we cannot always specifically define what it is exactly.

The first fact is that the human ear is the most incredible piece of instrumentation that we have in aural science. No amount of electronic instrumentation has yet achieved an **awareness** like our own ears can perceive. Obviously the ear is not a quantitative instrument but rather a qualitative instrument. One of its greatest abilities is in perception and memory of ratios. A ratio is a measure of difference, and that is just what the ear perceives — difference.

Now for the first tomato in my act. Practically all engineers that I've ever known fail miserably in at least one aspect of their endeavors; that is interpretation. But then again, maybe they don't know or are not aware of what they're supposed to interpret. Anything that the ear can perceive can be measured or evaluated if proper interpretation is sought. Now we are at the point of discussing: Is there a difference between tubes and transistors?

The answer is of course yes. I'm not going to try to tell you that tubes are better, because in some areas they definitely fall flat on the floor — areas such as longevity, changes in characteristics with age, heat dissipation, physical size and bulkiness, etc. But what about the sound? The answer is not "Yes, they sound better," but rather, "The very best tube equipment sounds better."

I haven't designed a tube amplifier in 15 years (since I was 17 and that wasn't very good) and I'm still trying to design better solid state amplifiers (not better than the tube amp I built when I was 17, but just plain better). Before you jump to any rash conclusions (such as, "all solid-state amplifiers are lousy") I must say that this is simply not true. Solid-state amplifiers are exceptionally good and they're getting better because some of us are learning. It takes a lot of years of learning.

I will go a step further and state (of course it's only my professional opinion) that the very best solid-state amplifiers available today are superior in just about every way to what is available in tube amplifiers. There is, however, one area where where tubes still hold a lead and that is the ability to drive reactive loads without damage or limiting.

I know of only one solid state amp, one which I designed for another company that has the capability of driving any phase angle from 0 to 90

This unit however, still does possess the full capability that I w like to see.

Why is this capability (0 to 90 grees) needed and why is it important?

All loudspeakers are reactive. are motors and, as such, they c havoc with many, if not m solid-state amplifiers. You woul very surprised indeed, to find out how much the protection circuits being activated in most solid amplifiers. The worst part of problem is the fact that is causes sound. It is also hazardous to amplifier.

It is very sad that most engir seem to think that the amplifier is g to be driving an 8 ohm load resi When I design and make an amplif measure it while driving 100 pe pure capacitive and 100 percent inductive loads. I also measure it driving all power levels, up to clip into a loudspeaker load. These are that are most important, and resi loads are used merely for indic nominal power output and distorti that's all.

I have mentioned the very best amplifier available. I am of cc referring to a unit that I custom and is not commercially availabl this point I would also like to stress I will not supply the plans schematics for this critter bec there are no available transformers use it merely as a reference unit i work. As a matter of fact, a coup Marantz 9s are just about as good if tweaked up, they're hard to beat reference tube unit has a bottom that just reaches down to the cent the earth—it is the most solid bass I've ever heard. The mids and high so silky smooth that it makes me am going to shock you further. This unit has no negative feedback ar the transformer — uncanny. A ha negative feedback, maybe like wc and money, the root of all evil? necessarily so, but negative feed can be an enemy if not carefully us

Tubes and transistors are compl different animals. And we are decided disadvantage with transis Tubes are natural high frequency vices which transistors are not. T do their thing naturally w transistors have to be made t things that are not necessairily rigl them. Tubes, for the most part, ha ven harmonic distortion products transistors, being exponentia nature, have an odd harmonic na Transistors have a transit c phenomenon which is due to inter tion capacitance and if operating p are not carefully chosen, the s quality can be just awful. Tubes o other hand, do not suffer this pro because by nature, they are depl devices. To sum up the problems see them, the three areas of han with transistors involve:

1. Higher order odd harm generation,
2. Transit delay (not to be con

harmonics. That is not to say that don't have any odd harmonics, be- e they do. However, it is much easi- find and adjust operating points to ıce out these odd-order harmonics. extremely difficult on the other to eliminate odd harmonics transistors because they are ex- ıntial devices and they produce harmonics naturally and they do it most of their operating range— h is tens of decades of current. ese elements are developed in arly stage of any amplifier, such as nput stage itself, it is very hard to ɔn feedback to lower the distortion ənt because these odd harmonics and do become the input signal f. Secondly, the circuit topography ıave a lot to do with odd harmonic ıration. Thirdly, when we think of s, we think of large voltage excur- s with relatively small ratios of cur- changes. In transistor circuits ever, the voltage excursions are ırally much smaller, and the ratio of ıges in current are extremely large ɔmpared with tubes. Since transis- are current operated devices, we "looking through" forward-biased tions (exponential) at all times e, with tubes, we are looking into a rved biased grid — strictly etion mode operation. The answer to this first problem will be fo find ; of lowering the amounts of higher r odd harmonic distortion produced ;tly by the transistors.

ıe problem of transit delay is ably the least of the three afore- tioned evils and is also the easiest ;ure. Even though none of my gns exhibit this problem, it is very rising to see that most of the power s presently available suffer, in masking of definition. In other words, it is like looking through a dirty window rather than a clean one. The problem is also greatly magnified by the use of large negative feedback factors. When an impulse is presented to an amplifying stage, it cannot respond instantaneously since the junction capacitances appear as a short circuit and therefore there is a slight time delay before the transistor can respond. In a tube stage we may be dealing with a few picofarads; in a transistor circuit, we are dealing with hundreds of picofarads. (This of course, depends on the individual transistor). Most triple diffused devices suffer from the "Early effect," which is aggravated even more by poor designs that have not been compensated for transit delay. This effect is not to be confused with the phase shift present in tube amplifiers that is caused by the passive elements such as the output transformer. In transistor circuitry the problem is caused directly by the active devices themselves which, of course, have gain, and this amplifies the problem more. Again, having proper operating points and circuit topography are of prime importance in eliminating this problem.

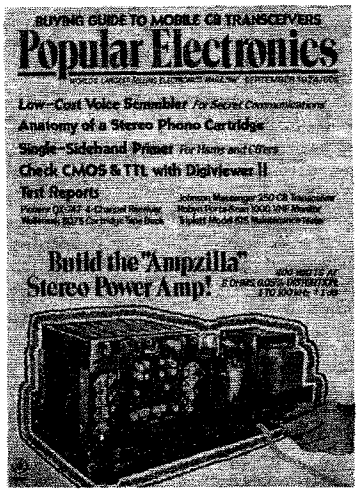
The last problem, which is the inability of practically all solid-state amplifiers to drive reactive loads, is probably the worst one and the most offensive one is not to be construed as cross-over notch distortion, which is in my opinion, nowhere near as "unsonic" as reactive load limiting. If I were to draw a rectangular plot of voltage versus current, positive and negative, we would find that a single tube in an output stage would be perfectly happy operating in all four quadrants. A

ıan the two positive quadrants and in some cases, it doesn't even like that. Tubes have a safe area while transistors cry for help at only fractions of this abuse. One might consider, for example, an electrostatic loudspeaker which in some cases (I know of at least two) looks like around 20 mfd load. At 20,000 Hz this is equivalent to 0.4 ohms reactive lagging.

Practically all amplifiers, even most tube units, will have a hard time driving this load, but a tube unit doesn't have any limiters activating when an impulse occurs. One must understand that if the limiters in a high-power amplifier were removed, fuse blowing or destruction would be commonplace. This is solely because of the fact that transistors have no safe area operating capability compared to tubes. In other words, it would probably take three to five times more output transistors than are already there in order to equal a mere four output tubes.

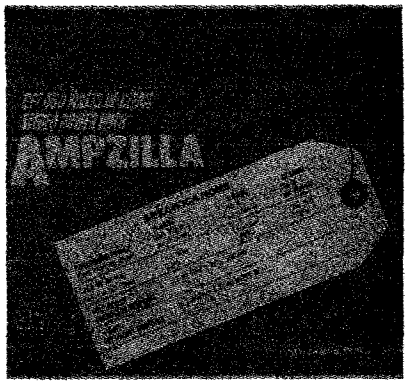
We are saved by the bell however, the number of loudspeakers around which present this horrifying a load are few and far between.

I'm not going to say much about preamps at the moment because I'm still working on ours. I will say that the same problems exist in transistor preamps as with power amps, however, the manifestations are different. I will say that for some strange reason, which I have not yet discovered, mediocre solid-state power amps are tolerable where mediocre solid-state preamps are not. I have not yet heard one that I like completely, but as with power amplifiers, we're getting much closer. Anyway, as far as preamps are concerned, I don't think you will have to hold your breath much longer.



Popular Electronics Features Ampzilla

Illustrated in color on the cover of September 1974 edition of Popular Electronics is the chassis of G.A.S. Company's 200-watt stereo amplifier. Featured inside this issue are the complete construction details for Ampzilla in an 8-page article, which is the longest construction article in Popular Electronics' history. Also included are extensive lab tests by Hirsch-Houck Labs, who are considered one of the foremost authorities in the field of high fidelity. A complete unabridged copy of the tests are reproduced here.



Hirsch-Houck Labs Tests Ampzilla

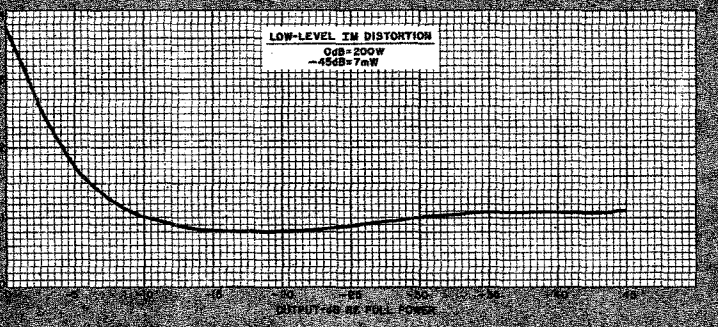
Ampzilla is aptly named. Its 45-pound (20.5-kg) weight and more than 400 watts of output power place it solidly in the audio "monster" amplifier class. The heavy-duty, three-conductor power cord emphasizes the fact that this brute is definitely not to be plugged into an ordinary switched outlet on a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

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.

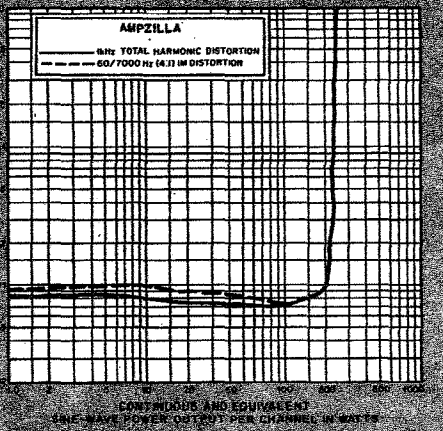
Using 8-ohm loads, the 1000-Hz THD was less than 0.01 percent for all power outputs up to 200 watts/channel. It rose to 0.03 percent at 220 watts/channel just before clipping occurred. The IM distortion followed a similar pattern, measuring just less than 0.01 percent up to 200 watts/channel and reaching 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 0.067 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 input of 0.35 volt (350 mV) was needed to drive it to a reference 10-watt output, while 1.7 volts drove it to the clipping level. The [illegible] 82 dB below



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



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 350,000 Hz. The square-wave rise time was 1.3 μs.

User Comment. Ampzilla is a state-of-the-art amplifier in its electrical characteristics. Unlike other amplifiers [illegible] 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 expensive way of obtaining several hundred watts of cool audio power with truly insignificant distortion than is