A LEGEND IN SOUND
klipsch
KLIPSCH AND ASSOCIATES, INC

P. WOODY JACKSON
National Sales Manager

Dear Sir/Madam:

Thank you for your inquiry about KLIPSCH® loudspeakers. Enclosed, you will find some literature on KLIPSCH products. We hope that you will have some time to look over these materials as well as visit the authorized KLIPSCH dealer nearest you. The attached mailing label contains the name, address, and phone number of your authorized KLIPSCH dealer. He will be happy to assist you in any way with KLIPSCH products. Thank you again for your interest in KLIPSCH loudspeakers.

Sincerely,

P. WOODY JACKSON

PWJ/mt
Enclosure

... TWX 910 720-6885

DOPE FROM HOPE

Klipsch & Associates • P.O. Box 688 • Hope, Arkansas USA 71801 • 501/777-6751 • TWX 910-720-6885

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DOPE FROM HOPE

Vol. 1, No. 4
16 December 1960

Room acoustics can affect the overall quality of a sound reproducing system. This should go without saying. Yet, it happens some times that a fine system is installed in a poor environment and the system is blamed. One such room, nearly 50 feet long and 15 feet wide, resembled an overscaled tibia pipe.

I recently tried to demonstrate a speaker system in a room with excess treble damping. The bass was excessive at all points in the room and piled up especially at the back of the room.

I have a 16 x 25 foot studio which exhibited excessive bass. I tried damping material which made it worse. I reduced the damping and put up 300 square feet of convex cylinders of Masonite ranging in size from 3 x 4 feet to 4 x 8 feet bulged from 4 to 15 inches. The room is excellent for play-back and tolerable for recording.

One can tell if a room is good or bad by listening to someone talk in it. If natural voice sounds bad, its reproduction will be bad, too.

Choosing the room for a good sound system appears to require a preference for rooms that have a length to breadth ratio of less than 8.5. I still prefer to put a stereo array on the long wall in most cases. A ratio of 6:5 is preferable to one of 8:5.

Room treatment is the subject matter of "Acoustical Design of Broadcasting and Recording Studios", The Celotex Corporation, Chicago 3, Illinois. The means and methods appear to me to be as applicable to homes as to studios. You should order a copy of this paper and use it as an aid to your clients.

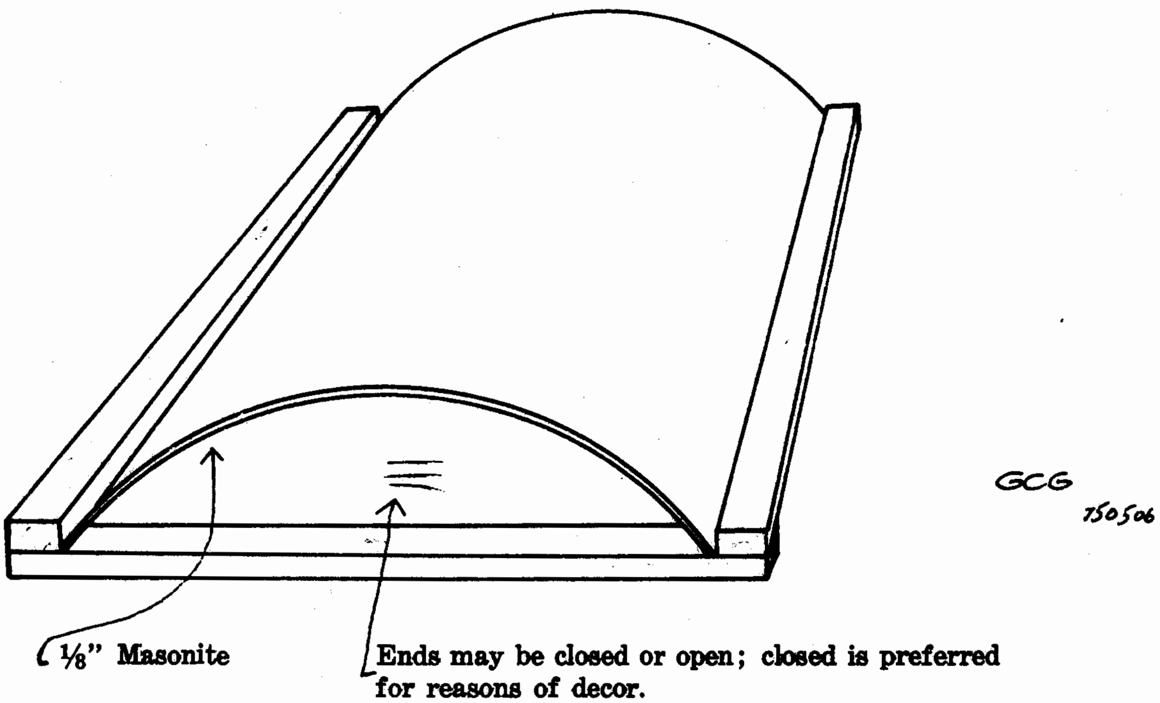
I would appreciate experiences of each of you; it is my plan to "build a file" of these experiences and try to make them available to all. For the time being, this will be on a basis of "on request" but eventually if there is sufficient interest, I will try to produce it as a bulletin.

Paul W. Klipsch, Editor

. . . The mark of integrity in loudspeakers!

The Dope From Hope is a spasmodic publication of Klipsch and Associates, Inc., Hope, Arkansas, U. S. A.

Sketch of one of Dr. Boner's "polycylindrical surfaces" for improving room acoustics.



It is suggested that random sizes, depth of bow, location and orientation be used such as:

4' x 8' with 7 to 11" bow,
3' x 6' with 5 to 9" bow
3' x 4' etc.

and that about 5 to 10% of wall surface be covered.

To accompany DOPE FROM HOPE
Vol. 1, #4 Dec. 1960 and
Vol. 5, #1 Feb. 1964.

A LEGEND IN SOUND™

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DOPE FROM HOPE

Vol. 2, No. 2
20 February 1961

TOE-IN

The necessity for canting or toe-in of flanking speakers in a stereo array has been recognized for some 20-odd years. Pointing the axis of maximum radiation near the diagonally opposite corner of the room has the effect of reducing the lateral shift of the virtual sound source as the observer's position is laterally changed. Corner speaker placement lends itself most naturally to this and other features of good stereo.

Steinberg and Snow established the "Physical Factors" of stereo during the years 1931 - 1933, reporting their work as part of the famed Symposium on Auditory Perspective in 1934. Snow's Patent 2 137 032 of 1938 (application September 1936) discloses the correct principles of toe-in of the flanking speakers. Those opposed to corner speakers, or those proposing toe-out and other bizarre speaker geometrics, should be subject to scrutiny for motive, for certainly their views are the opposite of the scientists who have been mainly responsible for the creation of the art and of evaluation and advancing its features.

Our own philosophy is that any speaker is a corner speaker; that the sacrifice of non-corner application is too great to be endured, and this applies alike to stereophonic and monophonic sound reproduction. Part of the reason behind this philosophy is the natural toe-in of corner speakers.

Paul W. Klipsch, Editor

DOPE FROM HOPE

Vol. 2, No. 7
1 June 1961

The frequency modulation distortion resulting from 0.21-inch diaphragm excursion at 50 cycles per second can be highly irritating. See my short article "Subjective Effects of Frequency Modulation Distortion", JAES Vol. 6, No. 2, p 143 April 1958. (Shall we have this reprinted for you?)

In 1931 E. W. Kellogg proposed 1/16-inch diaphragm excursion as a limit for good quality. This seems prophetic in view of the fact that frequency modulation distortion did not become a subject in Audio literature until 1943. To produce 115 decibles peak intensity in a 3000 cubic foot room of 0.8 second reverberation time required one acoustic watt of speaker power output; Frank Mason indicates this as the peak sound pressure needed for realistic music reproduction. To produce this power down to the extreme bass limit with only 1/16-inch excursion would require a direct radiation diaphragm of 66 inches diameter.

Our big horn will produce one acoustic watt at 32.7 cycles per second with 1/16-inch cone motion. We aver this represents transient response, peak power response and lower distortion of all types which are superior to what can be achieved with any other speaker at any price.

Our CORNWALL, deriving some power output below 50 cps from the back of the cone, can produce 1/5 watt output at 45 cycles per second. By contrast, contemporary small speakers would be limited to 0.0005 — half a thousandth — of a watt output if the cone motion is limited at which low level of modulation would occur.

You have known for years that our speakers are the best. The above may be useful as a partial explanation.

* * * *

Last month we offered a MODEL H for the best name. So far we have had only 4 (a few) replies — can it be our "DOPE FROM HOPE" goes unread? We extend the offer to 1 July 1961; Please give us your ideas — if you have a second or third idea send them along, too. Read the rules in Vol. 2, No. 6.

Paul W. Klipsch, Editor — The Dope From Hope

DOPE FROM HOPE

Vol. 2, No. 12
10 November 1961

Bob Rorer of High Fidelity Unlimited, Portland, Oregon, must be given the credit for discovery of a response dip in the region of 250 - 500 cycles per second in the KLIPSCHORN woofer.

This has resulted in quite a search for causes. The major cause appears to be proximity of the woofer horn to the walls at a corner. A one inch gap on one side can cause a 7 decibel loss at 500 cycles per second. Where a fit cannot be affected, one may apply a "flap" of flexible but firm sheeting, such as U. S. Rubber Company's 1/8-inch gasket. This may be stapled to the tail board so as to project 2 or 3 inches. It then bends to conform to wall irregularities, if any, and forms an adequate seal.

A minor cause of loss at 400 - 500 cps was traced to driver unit variations within type and between types. This was minimized by a change in throat structure involving a multitude taper. This was investigated in 1953 but the improvement was not then regarded as significant. Considering the driver variations and the minimizing of the effect with the throat change, it was desired advisable to be put in production. Woofers with the change are designated "G" thus K-3-G means KLIPSCHORN, woofer unit, G modification.

Mr. Rorer's discovery also has given rise to a tighter control on driver units and a slight modification of the specifications.

Most important, however, is the fit against the corner. Whenever there is a known performance loss in the 250-500 cps range, the flap seals are suggested.

Back in 1948 we were aware of an interference effect from the right and left sides; a 40° off-axis microphone placement under anechoic conditions (such as an inside corner outdoors) results in a deep response dip at about 280 cps. Also under similar conditions with a hard floor or ground there is an interference between the horn radiation and its mirror image below ground, and a microphone at 4 foot height will show a dip at 350 cps.

These are typical standing wave phenomena; in spite of such effects the system radiates power and does so smoothly if all precautions are observed. In fact our claim of "10 db peak-to-trough ratio" can be bettered by several decibels.

We recommend attention to seal at the corner; the flexible gasket sheet or a felt pad or other sealing means will reduce the peak-to-trough ratio as much as 7 decibels.

Paul W. Klipsch, Editor
KLIPSCH and ASSOCIATES
Hope, Arkansas

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The Dope From Hope is a spasmodic publication of Klipsch and Associates, Inc., Hope, Arkansas, U. S. A.

DOPE FROM HOPE

Vol. 4, No. 4
12 September 1963

THE LOUDNESS CONTROL
PROPER AND IMPROPER USE

The Loudness Control is a specialized form of volume control in which, for low level or "background" music, the treble range is attenuated more than the bass.

The principle involved is based on the studies by Fletcher and Munson that human hearing response at low volume levels drop at low frequencies. The Fletcher-Munson Curves are used as a basis for compensating bass equalization at low volume levels.

Application of this idea in the form of the "Loudness Control" has been controversial, the purist contending that as music is played more softly it should resemble a live orchestra at a distance; most amplifier manufacturers take the opposite viewpoint of preserving the bass regardless of how soft the treble is cut.

These philosophic viewpoints may be argued at great length. Right or wrong in the usual sense, the Loudness Control is always wrong in the case of highly efficient speakers which call for low volume control settings to achieve normal listening levels. The "Loudness Control" is intended to produce the enhanced bass compensation appropriate to soft playing levels, but actually does so at high speaker output levels when using efficient speakers. The resulting unbalance may be as much as 20 decibles.

The better amplifiers, if they provide "Fletcher-Munson Compensation" or "Loudness Control" or "Audio Compensation", do so with provision to bypass this feature, so as to regulate the magnitude of "Correction" down to zero — in other words, whatever devices of this sort one finds on high class amplifiers, one finds a switch to render the feature inactive. Thus all good amplifiers can be adjusted to play "flat".

A specific example may be described. Speaker A is reasonably flat in response, and exhibits an efficiency of 20%; speaker B is similarly flat in response, but is only 0.2% efficient. The difference in efficiency is 20 decibels and to play one speaker, then the other, at the same output level, requires a difference in volume control setting of 20 db. The Fletcher-Munson Compensation for 20 db level change might be of the order of 10 db. Thus the more efficient speaker will sound boomy because of the equivalent 10 db bass boost.

To compound the error, as one examines the more expensive speakers apt to show higher efficiencies, the bass response is apt to be better than for the cheaper speakers of lower efficiency. This difference sometimes as great as 5 or 10 db, which combined wih the "Loudness Control" could accumulate an error of the order of 15 to 20 db.

In practice it is well to start a system with everything as near "flat" as possible and use this quality as a reference or a point of departure if one compensation is to be the subject of experiment. Thus the "Loudness Control" should be disabled and a simple "Volume Control" used for at least preliminary installation adjustment and initial evaluation of system components.

Paul W. Klispch, Editor
The Dope From Hope

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DOPE FROM HOPE

Vol. 4, No. 6
26 September 1963

NEW K-400 HORN

A paper presented for publication in IEEE — Professional Group on Audio (Transactions) described a new acoustic horn which was originally designed to improve low midrange response and which yields a bonus benefit in extended upper range. This horn was originally primarily proposed for midrange application, but experiments with limited-power mid-tweeter driver units indicate that polar and amplitude response is useful out to at least 16000 cycles per second.

Applications include 2-way and 3-way full range loudspeaker systems for theater-auditorium-convention environments. In one configuration, a single horn covers the 200-16000 cps range for high clarity voice re-enforcement. Design parameters may be chosen to optimize performance deemed desirable for audio reproduction. This horn with a wide-range driver would afford high intelligibility voice reproduction and re-enforcement.

A comparison of claims and actual performance may be of interest at this point. The wide-range driver unit used in some of the experiments was claimed by its maker to afford response to 22000 cycles per second. Using the recommended horn, the measured response was down to ;0 db at 10 KC. Peak-trough range was about 18 db between 600 and 1000 cps. Our experimental prototype horn reduced the peak-trough to less than 10 db over the 300 - 15000 cps Range.

We feel that this is a significant step forward; it may open the door to practical 2-way loudspeaker systems; it may constitute a technological and/or economic "breakthrough" in the true sound reproduction art.

It should be pointed out that the KLIPSCHORN has afforded superior performance characteristics since about 1948. "The Hard Way" may have been the way it was done; "The Hard Way" is not necessarily "The Right Way", but where the question arose, "The Right Way" was the choice. Perhaps the new horn will offer an easier means to maintain "The Right Way".

Brief Specifications: — low cutoff 230 cps; crossover 400 upper limit, none, length under 21 inches

Robert L. Moers
The Other Dope From Hope

A LEGEND IN SOUND™
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DOPE FROM HOPE

Vol. 5, No. 1 24 February 1964

ROOM ACOUSTICS

Reference is made to The Dope From Hope, Vol. 1, No. 4 of December 1960 which is made a part of this issue.

The evolution of Studio 116 at Klipsch and Associates, Inc., plant has been going on for several years. Our first mistake was to paint the Celotex ceiling and walls. We were assured the paint sold to us would not hurt the acoustic properties. But the room became "hooty", with fairly dead upper frequencies and less absorption in the range of frequencies containing the "00" sound in "hooty" as spoken by a baritone voice. We then tried additional sound deadening in the form of dished card-board rectangles which made the situation worse. The cure was in the Convex polycylindric surface suggested by Dr. Charles Paul Boner of the University of Texas: see "performance of Broadcast Studios Designed with Convex Surfaces of Plywood" Journal Acoustical Society of America, Vol. 13, No. 3, pp 244-247, January 1942.

The convex cylindric surfaces afford maximum diffusion of sound; the decay is more nearly logarith-mic than for simple rooms with plane parallel surfaces; absorption of the cylinders is greater for bass and less for treble ranges, and this in combination with sorptive materials may be used to af-ford desirable bass-treble reverberation: a "room response which is nearly flat" can be obtained; Dr. Boner lists 17 comments under "results", including effects of rugs, etc. While this paper aims at good microphone pickup for broadcasting or recording, the same principles apply to a listening room.

Over the years Studio 116 has acquired a new wall-to-wall carpet on Ozite, 186 square feet of the Boner polycylinders of 1/8 inch Masonite, and Fiber-glass curtains over about 100 square feet of window glass. At present, it is possible to record and play back in the same room with close enough similarity to fool more than half the people more than half the time. A measure we feel is significant is that response curves of loudspeakers made at 2, 4, 8 and 16 feet all show similar major char-acteristics, indicating that the room liveness or reverberation is optimum over the audio spectrum.

Since the room is perhaps the second most important or critical entity in achieving good audio, music listeners would do well to expend as much effort on the room as on the selection of the dynamic acoustic elements like loudspeakers.

We feel the Celotex publication mentioned in the earlier Dope From Hope, and the Boner paper men-tioned above, afford working tools for creating a good listening room.

The polycylindrics in particular offer considerable challenge in both acoustic and novelty of decor.

Paul W. Klipsch

DOPE FROM HOPE

Vol. 7, No. 2
26 February 1966
Revised March 1972

QUALITY CONTROL, HOME CONSTRUCTION AND TRADE MARKS

We do not furnish drawings of our loudspeaker systems. If we did we could have no control over the product.

Six years in development, our CORNWALL (R) (enclosure) was standardized. Only after making hundreds of pressure response curves, distortion tests and output level measurements for each experimental change in structure could we commit the design to production. Then after production we test again. We are still introducing improvements in the KLIPSCHORN (R) after 26 years.

Some people feel all they need to do is to buy a woofer (motor) and some advertised tweeter, make a box for them and they have a "speaker". They write for design to fit some named driver unit, or they even ask us for drawings on boxes we have already designed. They realize the box is important but perhaps they do not realize the box is about 90% and the driver 10% of the end result.

We sell quality. Even if a person bought our drivers he would not get our quality: quality control of the box (either horn or enclosure) is necessary before, during **and after** manufacture. Even our own hand-made prototypes do not fall properly between design limits assigned to our machine cut and jig assembled manufactured units. Dr. Irving Gardner said, "You can't make what you can't measure because you don't know when you've got it made".

There is no short cut to quality; nobody but KLIPSCH and ASSOCIATES, Inc. makes the KLIPSCHORN (R) loudspeaker system.

Quality is worth paying for and substitutes are going to be prohibitively expensive.

To repeat, we do not sell drawings. Frankly we don't want people making imitations the quality of which would be mistakenly attributed to us. We have seen and tested some of these "ersatz" loudspeakers and none so far tested here would pass.

There are plenty of kits and mail order drawings you can buy. When you get tired of spending money on these how-to-make it sets, buy one of our measured systems. And this means the whole assembly, not just a part at a time. We have pretested various parts and then rejected an assembly. You don't get our quality control with separate parts any more than you'd get STRADIVARIUS quality control buying a string at a time! After all, there is no substitute for the genuine article with 100 man-years of engineering design, manufacturing know-how and testing integrity behind the product.

Finally a word about TRADE MARKS.

KLIPSCHORN (R), BELLE KLIPSCH (R) LA SCALA (R), CORNWALL (R) HERESY (R) REBEL (R), K-ORTHO (R) and PWK logo are Trade Marks registered with the U. S. Patent Office and owned exclusively by KLIPSCH and ASSOCIATES, Inc. Use of any of these Trade Marks in referring to loudspeakers or sound equipment not made by us is a violation of our Trade Marks and U. S. Patent Law.

Paul W. Klipsch
Editor
Hope, Arkansas 71801

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DOPE FROM HOPE

Vol. 7, No. 3
1 March 1966

DISTORTION

Many requests have been received for explanations of different kinds of distortion in audio systems. Among the several definitions the one I like best is "DISTORTION is the presence in the output signal of frequencies not present in the original or input signal". Thus DISTORTION is distinguished from errors of FREQUENCY RESPONSE. Another necessary definition is "FREQUENCY RESPONSE (usually depicted as a response curve) represents the error of the device in rendering different frequencies at unequal amplitudes". Thus DISTORTION is distinguished from FREQUENCY RESPONSE and the two may be considered, measured and analyzed separately. The simplest form of distortion is HARMONIC DISTORTION (HD) where an input signal of frequency, **f**, passes through an amplifier, loudspeaker or other transducer and comes out with the original frequency, **f**, plus others, 2f, 3f, etc. Harmonic Distortion, **per se**, is not particularly deleterious but the causes of it produce MODULATION DISTORTION where 2 or more input frequencies f_1 and f_2 modulate each other to give an output of not only f_1 and f_2 but also $(f_1 + f_2)$ and $(f_1 - f_2)$. Since these "difference" frequencies are not harmonically related to the original sounds they represent discords, and since the causes of harmonic distortion may produce 3 to 4 times as much modulation distortion, this form of distortion is serious.

The physical explanation of AMPLITUDE Modulation Distortion is too difficult to put in a short resume of this kind. The Mathematics may be found in any qualified text on Radio (see F. E. Terman, Radio Engineers Handbook, McGraw Hill, 1943, pp 531-532 of this edition).

AMPLITUDE MODULATION DISTORTION appears to have been discussed first by J. K. Hillard, "Distortion Test by the Intermodulation Method", Proc. IRE, Vol. 29, No. 12, pp 614-620, Dec. 1941. Dr. Hillard chose to call this INTERmodulation and the term has come to be accepted; it is sometimes abbreviated IM. Since it is a function of non-linear amplitude it has also been called Amplitude Modulation Distortion.

Frequency Modulation Distortion would not occur in amplifiers but does occur in loudspeakers (G. L. Beers and H. Belar, "Frequency Modulation Distortion in Loudspeakers", Proc. IRE, Vol. 31, No. 3, pp 132-138, April 1943). The mathematics is advanced (requiring use of Bessell's Functions) but the physical explanation is simple. Most people have observed that a moving vehicle sounding its horn as it passes the observer seems to have the pitch or frequency of the horn lowered as it goes by. As it approaches, the wave fronts are close together, the wave length is less, the frequency higher, than for the stationary vehicle. This Doppler's Effect is present in loudspeakers. If the diaphragm is vibrating through a large bass amplitude while radiating a higher frequency, the pitch of the higher frequency is alternately raised and lowered so that a flutter results. There has not been much experimental work on this. I experimented with an eccentric capstan and found that a frequency shift as low as 0.35 percent (RMS) was sufficient to cause an annoying flutter in the sound output ("Subjective Effects of Frequency Modulation Distortion", Jour. Audio Engineering Society, Vol. 6, No. 2, Page 143, April 1958). Reprints of this paper are available. Note that the percent frequency shift is a different number than the percent distortion of Beers and Belar.

Of Frequency Modulation Distortion (FM) Beers and Belar say, "The sensation produced is that of a very familiar form of distortion which is still hard to describe. The sound is just not clean". (Page 135).

Both AM and FM distortion in loudspeakers may be minimized by increasing the effective radiating area, reducing the velocity of diaphragm motion, and radiating different frequency bands from different diaphragms.

Although the effects and even the existence of FM distortion has been denied in one quarter, it is easy to demonstrate its existence using a small long-throw direct radiator loudspeaker and feeding it a pure 30 cycle tone and a complex 400 cycle tone. For diaphragm motion amplitudes greater than about ¼ to ½ inch the flutter of the higher frequency will be evident even though the 30 cycle output may be inaudible.

This subject could be elaborated at length but I believe the original reference cited will be more useful and authoritative than anything I could write about them.

Practical aspects of sound power output and distortion are discussed in my own paper "The Eight Cardinal Points in Loudspeakers for Sound Reproduction", IRE Trans. - Audio, Vol. AU-9, No. 6, pp 204-209, Nov.-Dec. 1961. Reprints of this are available.

Klipsch and Associates, Inc.
Hope, Arkansas 71801

DOPE FROM HOPE

Vol. 7, No. 5
June 1966

BLOWN TWEETERS

This is the day of 100 watt amplifiers. The popular low-priced loudspeakers are of low efficiency, but most of these I have tested go from fine to gross distortion at about 25 watts amplifier power. The lowest efficiency speaker I have tested is about 0.1%.

Our lowest efficiency speaker (HERESY) is about 2% so the suggestion arises that if 25 watts is sufficient for a low efficiency speaker, one would get the same sound pressure in our HERESY with about 1 1/4 watt of amplifier power. By the same token, about 0.1 amplifier watt would drive a KLIPSCHORN to realistic sound pressure output.

These numbers are by no means absurd. If you take a sound level meter with you to the concert you will likely measure **peaks** of around 110 db SPL at a seat in the middle of the auditorium. Listening at home to the same program material, you will measure 120 or 90 but not 110 db sound pressure level! In other words, the "hifi listener" exaggerates one way or the other.

For many years this writer used a 10 watt Brook amplifier, and demonstrated sound pressure levels from very low to "Ear Splitting".

Now in this day of 100 watt amplifiers — 40 volts into 16 ohms, one is certain to damage the smaller speaker element if the input to the amplifier receives a switching surge. I know people who play 100 watt amplifiers "wide open" without speaker damage, but remember the smallest of the 3 speakers (the tweeter) gets only about 1/100 of the total peak power. A switching transient, on the other hand, can deliver the entire 40 volts and 100 watts to the tweeter. Tests indicate our tweeters can withstand repeated surges of 8 volts (4 watts) but they do not stand up long under 12 volts (8 watts) and a single 15 volt surge will usually open the voice coil.

It thus seems reasonable to suggest amplifiers in the 25-35 watt output rating, rather than 100 watt power powers. Also, even when using amplifiers of moderate power, Also one should assure himself that no oscillations like tape recorder bias or radio intermediate frequency is entering the power amplifier.

Our tweeters are the best we have tested, and are selected for level and response. Also damaged and repairs are costly.

So adopt the practice of

1. Turning off the power amplifier long enough to discharge the capacitors before switching or changing input connections. (Switching, if done with proper bleeders on switch taps, and if done between inputs of about the same level, may be done with the power amplifier "hot" but be sure these conditions are met before switching a "hot" amplifier).

2. Check for and eliminate sources of noise, pops, surges and oscillations.

3. Especially with 100 watt "stoves" and all high-power solid-state amplifiers, **be careful.**

It costs **you** about $15.00 for us to replace a blown tweeter.

Paul W. Klipsch

DOPE FROM HOPE

Vol. 8, No. 1
11 July 1967

GUARANTEE VOID!

Back in the good old days of 10 and 20 watt amplifiers it was uncommon to experience loudspeaker failures. When 75 watts became common, occasional tweeter failures began to occur. Then with the advent of large solid-state amplifiers with their 240 instantaneous power peaks, tweeter failures became epidemic and woofers began to come apart at the compliance rings and voice coils began to tear loose from cones.

We have run 100 watts of rated amplifier power (at clipping levels) into a KLIPSCHORN for hours with no sign of damage. On the other hand, we witness failures using 60 watt amplifiers. We know the cause is due to surges, we know our speakers will take all the program material a 100 watt amplifier will put out, but we know the peak surges produced by pulling the signal input lead out of the power amplifier will put out square waves that have torn up loudspeakers.

So the time has come to define our so-far unwritten guarantee which has involved replacing driver units without question. In the future, driver units are not guaranteed. We will continue to replace damaged units, without charge, which appear on our investigation to have been due to defective materials or workmanship, but we must make a charge to replace driver units which are being damaged by higher peak power surges than they are intended to withstand.

Our speakers, type by type, will generate more output power without damage than other makes, and our tests indicate input power up to 100 watts of program material is tolerable in our high efficiency systems (KLIPSCHORN and LA SCALA). Reports from owners of other makes of speakers indicate a higher rate of failures than with ours.

Forego the "prestige" of higher amplifier power than necessary. Exercise care when switching input. Avoid accidental open inputs. Keep non-program surges from occuring.

This seems to be a good time to condemn the connectors which are used on even the finest amplifiers; a connector should disconnect the "hot" lead before breaking the "ground" circuit and the nameless things do just the opposite. When one pulls a lead out of the main amplifier there is a split second when the ground is "open" and the input still "hot" and the amplifier output rises to whatever huge overload level its solid state system is capable. No fuse could be quick enough to protect against the hammer blow that is applied by the voice coil to the rest of the moving system.

Paul W. Klipsch
Hope, Arkansas

. . . The mark of integrity in loudspeakers!

The Dope From Hope is a spasmodic publication of Klipsch and Associates, Inc., Hope, Arkansas, U. S. A.

DOPE FROM HOPE

Vol. 9, No. 1, 1 February 1968

Room Proportions and Distribution of Eigentons

For some years I have suspected that the "Golden Mean room"* would display a more smoothly distributed system of low frequency modes (Eigentons) than a room more nearly cubical. Obviously in a cubic room the first 3 Eigentons would be identical, would superpose, and would therefore reenforce each other strongly, whereas distribution of them would be desirable. Computing the first 50 Eigentons for the Golden Mean room showed no "doubling", that is no 2 Eigentons occurred at the same frequency.

Attention was called to a paper by Bolt** who indicates a liking for room ratios ranging from 1 : 1.5 : 2.5 (nearly Golden Mean) to 1 : 1.26 : 1.59.

Using room dimensions of 1 : X : Y Bolt plotted a contour of X vs Y showing "smoothest frequency response", and all the values above fall within the contour.

From the standpoint of stereo reproduction, my own experience suggests a floor plan of X : Y of 1.6 or less, 1.4 appearing to be a good number and 1.26 entirely tolerable.

While the "Golden Mean" may suggest some esoteric magic in numerology there doesn't seem to be any evidence that there is any real magic in the number as applied to room acoustics. The computed Eigenton spacing was well distributed but this may be true for other ratios. Our Studio (10 x 16 x 25 feet) at the factory offers excellence of both frequency response and stereo geometry and this (in part) led to the Golden Mean preference, but other rooms more nearly 1 : 1.3 : 1.6 have also sounded good.

It is interesting but probably not significant that Bolt's $2^{1/3} = 1.26 = 1.618^{1/2}$

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* Golden Mean Ration r = 1.618 so a "Golden Mean" room would have dimensions of (for example) 10 x 16 x 25 feet.

**R. H. Bolt, "Note on Normal Frequency Statistics for Rectangular Rooms", JASA Vol. 18, No. 1, July 1946, pp 130-133.

Probably some lengthy computations for various room proportions would indicate presence or absence of doubling of Eigentons but the suspicion is that there is nothing critical if one is in a good range of values.

It is suggested that these values offer attractive proportions for most uses as well as for reproduction and original rendition of Sound.

It is hoped the above will prove useful to people who are planning new homes and want a good music room, and also to architects.

Reference is made to 2 previous "Dope From Hope" on the subject of room acoustics:

DOPE FROM HOPE Vol. 5, No. 1 — 24 February 1964 "ROOM ACOUSTICS"

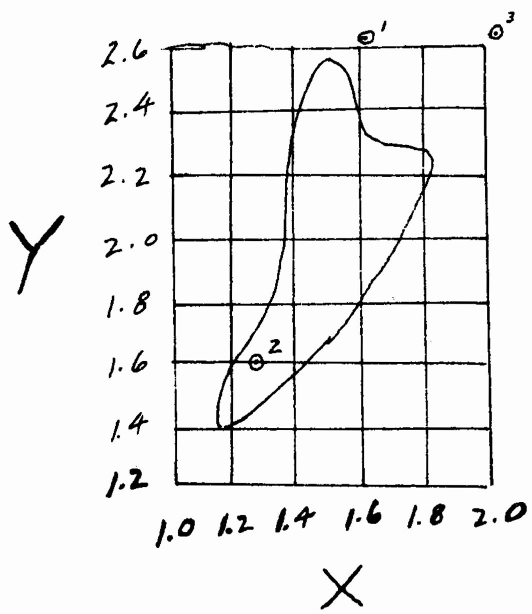
DOPE FROM HOPE Vol. 1, No. 4 — 16 December 1960

. . . The mark of integrity in loudspeakers!

The Dope From Hope is a spasmodic publication of Klipsch and Associates, Inc., Hope, Arkansas, U. S. A.

The sketch is traced from Bolt's paper** and shows a contour within which a room should have good Eigenton distribution and provide good sound if absorption co-efficients are satisfactory.

In the figure, X represents the ratio of room width to room height; Y is the ratio of room length to height. For example, X=1.4 and Y=1.8 would mean that, in a room with a 10 foot ceiling, the room width is 14 feet (10x1.4) and the length is 18 feet. Point marked "1" represents the dimensions of our studio facility 116, which is 10x16x25 feet. This falls outside the contour but is still regarded as a good room.



Another room, this one in a home, is 8x17x21 feet and this also falls outside the contour (point 3). This room is judged by many listeners to be a good one. Thus one can assume the contour encloses "near perfect" rooms in Professor Bolt's estimation.

My personal thought is that the length and width may exceed the height by more than shown by Bolt, but that the length to width ratio should lie between 1.26 and 1.62. The lower limit of bolt's preference, 1:1.26:1.59 is shown by point 2. This happens to be approximately the square root of the "golden mean." As stated earlier, there doesn't seem to be any magic about the golden mean numbers as applied to rooms for music listening. There seems to be a wide range of ratios that are suitable. Obviously the worst condition would be cubical (all 3 major Eigentons superpose). Next worst would be square. Apparently the range from 1:1.26:1.6 to 1:1.6:2.5 can be considered good, and we know of at least two good sound rooms that fall slightly outside Bolt's contour.

My personal feeling is that if a person is building a home and expects music to be a part of his joy of living, he could do well to get his architect to study Bolt's paper.**

Paul W. Klipsch
18 April 1969

** R.H. Bolt "Note on Normal Frequency Statistics for Rectangular Rooms", J.A.S.A. Vol. 18, No. 1, July 1946 pp130-133. Figure reproduced with permission.

A LEGEND IN SOUND™

klipsch

DOPE FROM HOPE

Vol. 9, No. 2
June 1973

DEFINITIONS

Sometimes we (all of us) are guilty of throwing words and phrases around when we are not sure of their meanings. Paul and I started on such a tack the other day when we both discovered I didn't know how to define an acoustic watt. I should have known but didn't, so I suggested a new series of "Dope From Hope" dealing with audio definitions. The first on the **acoustic watt** is below.

Now we solicit your help. What would you like defined? What easy method have you discovered of explaining some of these terms to customers? We'll help where we can. We'll pass along hints and give proper credit. Let us hear from you.

W'AT is a WATT?

First of all a watt is a unit of power or rate of doing work, whether electrical, mechanical, thermal or acoustic. Equivalents are 0.738 foot pounds per second, 0.238 calories per second, or

$$w = e^2/z$$

where w is watt, e^2 is electrical pressure or electromotive force in volts and z is electrical impedance in ohms.

The acoustic watt may be similarly expressed in terms of acoustic sound pressure p in dynes per square centimeter and the acoustic impendance of air which has been derived as the product of the air density times the velocity of sound p c thus $w = p^2/z$. When the sound pressure level is 100 dB, the sound power transmitted is 10^{-6} watt per square centimeter. (The 100 dB level is referred to zero dB = 0.000204 dynes per square centimeter: thus 100 dB = 20.4 dynes per square centimeter).

ACOUSTIC WATT

Translating the above numbers into something quickly useful, it turns out that a sound source radiating from a trihedral corner with a uniform polar pattern will be radiating one watt of power when the sound pressure measured at 4 feet is 118 decibels.

Bob Moers

Vol. 10, No. 1 690520
Reprinted Jan. 1975

ROOM ACOUSTICS IV

Comment on Band and Music Rooms at Arkansas State University at Jonesboro.

My memory, such as it is, indicated to me that sound from one rehearsal room to another had to pass 2 walls. There was a hallway between rooms. But sound was coming "over the top".

American Smelting and Refining Company advertisement in Sound and Vibration Magazine, Vol. 3, No. 3, March 1969, page 6, proposes a cure for sound waves flooding through the plenum or space between dividing walls and floor slab above it.

"Acoustilead" --- sheet lead that is 1/64 inch thick -- is draped, bent, fitted, stuffed around ducts and wires, to seal off sound between rooms.

A brochure on "Acoustilead" may be had by writing American Smelting and Refining Company, 120 Broadway, New York, New York 10005.

Other "Dope From Hope" on room acoustics may be had by writing:

Klipsch and Associates, Inc.
P. O. Box 688
Hope, Arkansas 71801

DOPE FROM HOPE

Vol. 11, No. 1
17 March 1971

IMPEDANCE MATCHING
(SIMPLIFIED?)

It can be demonstrated that you should use the 16 ohm tap "because it is louder". It also can be demonstrated that if you connect a 4 ohm load to an amplifier designed for a 16 ohm load, you will sacrifice ¾ of the power handling capacity of the amplifier.

Let's look at an example. Consider an amplifier rated at 64 watts into a 16 ohm load. This means it can deliver 12 volts at 2 amperes to a 16 ohm load. Now connect a 4 ohm load, and the 2 ampere capacity of the amplifier across 4 ohms gives 8 volts, and the power available is only 16 watts.

Now it is perfectly true that at 8 volts output at the 16 ohm tap you get only 4 volts from the 4 ohm tap, and the signal will truly be louder on the 16 ohm tap, but the amplifier just "runs out of gas" at 16 watts. But if you connect the 4 ohm load to the 4 ohm tap you'll get 16 volts at 4 amps and that product is 64 watts.

> IN THE SPECTRUM WHERE THE MAXIMUM POWER DEMANDS OCCUR, 250 to 500 Hz (CYCLES PER SECOND), YOU CAN CONSIDER KLIPSCH LOUDSPEAKERS AS 8 OHMS.

Your 64 watt amplifier with 4, 8 and 16 ohm taps tabulates:

Tap (ohms)	Maximum amplifier power output into 8 ohms
16	32 watts
8	64 watts
4	32 watts

If your amplifier does not have an output transformer and therefore does not offer an impedance choice, it probably "likes" 4 to 8 ohm loads and should get along fine with KLIPSCH speakers.

Paul W. Klipsch, Editor
KLIPSCH and ASSOCIATES, Inc.
Hope, Arkansas 71801

DOPE FROM HOPE

Vol. 11, No. 2
July 1971

CROSSOVER NETWORK CHANGED

Every so often this subject of crossover networks has to crop up. The latest syndrome has been the rash of blown tweeters. My own earliest break with traditions was in 1942 when reducing the crossover slope improved performance.

The basic argument that 6 dB slope is enough is based on the fact that the spectrum above 6000 Hz contains less than 1% of the total energy in the spectrum. This is based on measurements of symphony, vocal and rock recordings using a spectrum analyzer. The data showed the spectrum above 6000 Hz to be more than 25 dB down referred to the 250-500 Hz octave where maximum power is involved. A slope of 6 dB per octave puts over 20 dB loss between the 6000 Hz frequency and the 250-500 Hz octave. But tweeters blow from accidental causes — switching and disconnect transients — rather than from program material. Zener diode protection reduced but did not eliminate the destruction of tweeters.

The 3-element constant-k network would impose 18 dB per octave loss, and this slope would closely match the natural cutoff of the midrange system. Since the constant-k network design is based on a generator impedance equal to that of the load, a 6 dB insertion loss would exist. An assymetrical circuit permitting zero generator impedance was examined (Butterworth 3 pole) and a series of experiments conducted with typical low-impedance amplifiers and actual tweeter loads. The outcome was a circuit that looks like a constant-k network and behaves like a Butterworth.

Response curves of network alone, network and tweeter, and network with complete speaker indicate a slight overall improvement in amplitude-frequency-response, and an inaudible difference on listening test compared with our previous standard.

This circuit will be incorporated in Klipsch TYPE A networks and the new networks denoted TYPE AA. With zener protectors they will be used in all KLIPSCHORN, BELLE KLIPSCH and LA SCALA speaker systems.

Naturally the price will have to be adjusted soon.

Paul W. Klipsch

A LEGEND IN SOUND™
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DOPE FROM HOPE

Vol. 12, No. 1
February 1972

ON TEST REPORTS

We are frequently asked for "test reports" on our speakers, and by various magazines, "laboratories" and reviewers for some samples of our equipment to test.

We submitted a sample to one laboratory. The published results were shocking. I doubt if sales were hurt; perhaps readers of the report could realize what they saw was not what they heard.

I spent several sessions in our lab trying to simulate the response curve published by the reviewer. I came fairly close, by putting the loudspeaker on a high stool, remote from all wall, floor, and ceiling surfaces, in a medium-live 4000 cubic foot room, with a single microphone behind the loudspeaker. The response was 20dB down at the ends of the spectrum "Just like the reviewer's" curve.

We have been reluctant to submit samples that would get "tested" in this or similar "Laboratories".

I'd like to cite just one more (of many) examples of poor judgement on the part of the reviewers. One reviewer remarked on printed page that distortion increases only sightly with power level, and that modulation distortion in loudspeakers is inaudible. Our measurements show that total distortion is nearly proportional to power output, that modulation distortion usually exceeds harmonic distortion, and our listening tests show that modulation distortion is far more irritating to the listener than an equal amount of harmonic distortion. You can readily see why we'd rather not have this tone-deaf reviewer "measure" our speakers.

Therefore we will do our own reviewing. Accuse us if you will of "conflict of interest" but I feel we honestly and accurately evaluate loudspeakers. Admittedly we like to see our speakers reviewed in a favorable light. But to be honest with ourselves, we have to test the speakers of other makes as fairly as we do our own--- else how could we improve our own products?

I'd like to extend an invitation to witness our tests and to bring speakers not hitherto tested here, but frankly I'm afraid of an invasion that would preclude getting progress in our research. If a reader feels he has a real contribution or challenge, he is invited to communicate with us and if mutually agreeable we can arrange a schedule in our laboratory.

Paul W. Klipsch, Editor
Hope, Arkansas 71801

DOPE FROM HOPE

March 1972
Vol. 12, No. 2

ELECTRONIC CROSSOVER

One of the most detailed and controlled tests ever conducted using the "electronic crossover" took place in October 1969. The result was "Don't waste money on it". A lot of our research has turned out negative.

The inference should be, of course, to buy a good speaker and amplifier for each channel, rather than spending upwards of 3 times as much money for lesser speakers and then try to make them "sound better" with more amplifiers.

The test was in the form of a comparison between 3 amplifiers with low-level crossover driving the bass-middle-treble loudspeaker components of a KLIPSCHORN, and a single amplifier driving the same KLIPSCHORN.

The first listening test revealed a distinct difference which was tentatively attributed to a difference in frequency response. When this difference was reduced to a subliminal value, there was no aurally discernible difference between the output of the speaker when driven by 3 amplifiers or by a single amplifier.

Some very sensitive ears were involved. One individual had repeatedly demonstrated his ability to distinguish between a Marantz Model 9 and half a McIntosh 275.

Another pair of ears balanced a 3 way loudspeaker system which was later altered less than 3 dB by instrumental check. Still another pair balanced a multi-speaker system in a 5000 seat theater, and later instrumental check did not lead to any modification of balance. Perhaps the most eloquent of all was the opinion of the several engineers who had developed the electronics: they certainly wanted to believe their creation, but ultimately had to admit no superiority of the 3 amplifier system over the performance with a single amplifier. Incidentally the single amplifier was of the same type and make as the 3 amplifiers in the electronic crossover system and judged by all present to be of excellent quality.

The "theoretical" advantages of the electronic crossover are mainly:

1. Removal of reactance elements between amplifier and voice coil.
2. Raising the total available power to drive the speakers.

Experiments at Klipsch and Associates, Inc. with switching out the inductor in series with the bass (woofer) voice coil indicates that its removal reduces the overall response curve peak-trough limits by about 3 dB in the 250-350 Hz range. The switching in and out of this coil has been found to be inaudible by all listeners who have made the observation under controlled conditions. Admittedly the removal of the inductor represents a measureable improvement, so it has been removed from the networks of our speakers using horn loaded bass. See Dope From Hope, Vol. 11, No. 1, 8 June 1970* This accomplishes one objective of the electronic crossover, without however, involving the cost of additional amplifiers.

* In 1971 the inductor was restored, but the user may disconnect it. Our demonstration units at the factory have this coil short circuited.

Even if additional amplifiers were employed, we'd still insist on capacitors to protect midrange and tweeter units against accidental surges. The presence or absence of these capacitor elements is not audible except at power levels that would produce speaker overload and probable damage. They would have the same function as the comparable crossover slope ahead of the separate amplifier.

The second argued advantage for electronic crossover and poly-amplification is the increased amplifier power available to drive the loudspeaker. Perhaps this could be some sort of marginal advantage for speakers exhibiting 0.05% efficiency. But with loudspeakers as efficient as our HERESY an amplifier power output of 10 watts is almost "ear splitting" in a typical living room. A typical high quality 100 watt amplifier will be operating at 90 to 99% reserve if listening levels comparable to concert hall levels are duplicated.

Now lets look at the actual disadvantages. In the hands of the user who doesn't have access to acoustic measuring instruments, it is a certainty that he will apply wrong slope, wrong crossover points, wrong polarities, wrong component levels (wrong level control settings), plus of course more than trebling the cost and service problems of his electronics.

Some isolated reports have come in extolling the merits of the electronic crossover, but asking "dirty questions" revealed that the judgement was not based on a controlled comparison or that no comparison at all was involved or that the comparison was with a single amplifier of inferior quality. We know of no experiments of verified validity which would indicate the superiority of a loudspeaker system fed by electronic crossover and poly-amplification.

Small direct-radiator loudspeakers are alleged to be benefited by poly-amplification. About 1956, Mr. William H. Bell put on a demonstration of a speaker system comprising 4 "acoustic suspension" bass units, several mid-range and tweeter units, electronic crossover, and about 300 watts of Marantz power. This was compared to a standard KLIPSCHORN driven by a 10 watt Brook amplifier. This launched Mr. Bell as a leading dealer in KLIPSCHORN loudspeakers.

As Mr. Cecil "HiFi" Farnes once said, "I'm selling entertainment". Six KW of amplifiers are not going to provide entertainment! Ultimately it is going to be the quality of the loudspeaker, not the horsepower of the electronics, that gives the pleasure.

This does not mean that improvement by this means is impossible. It is believed, however, based on both experimental and analytical grounds, that if highest quality electronics are used in each case, the potential improvement by poly-amplification will be marginal or subliminal, at a cost in the order of $1000 per channel greater than for single amplification.

If the electronic-crossover-amplifier were tailored specifically to the individual loudspeaker components, some of the curse would be removed. But the major one remains: the objective is to be able to deliver **more** amplifier power per speaker components, and I know of no tweeters worthy of the name capable of handling more than about 4 watts.

We can not recommend poly-amplification even for the aficcionado who wants the best and "dam' the cost"; most especially the one who would hang three 100 watt stoves on each speaker.

Paul W. Klipsch

KLIPSCH and ASSOCIATES, Inc.
Hope, Arkansas 71801

* Since 1 July 1971, zener diodes have been added for further protection.

DOPE FROM HOPE

Vol. 12, No. 3
720726

CROSSOVER NETWORK
for
HERESY LOUDSPEAKERS

When our HERESY Loudspeaker was introduced in 1957 it was intended solely for use as a bridged center speaker between high efficiency flanking (corner) speakers. In order to obtain a sufficient output and since bass would be supplied from the flanks, we felt we could sacrifice 6 dB of bass below 700 Hz.

Then we began to recognize a demand for HERESY Loudspeakers for primary use (flanking and/or center), so we had to rebalance the output as nearly flat as possible, reducing total level by 6 dB. We found this did not sacrifice performance for center speaker use, so we discontinued the old network which produced the minus 6 dB shelf in the bass range.

While we can tailor the response to any required shape, the fact exists that our HERESY in its standard form is best for either flanking or center use. (Specially tailored response forms for HERESY speakers will henceforth be available only on special order at extra cost with a minimum extra charge of $30).

Therefore, those who have old Catalogs or recall the old "center speaker" network for HERESY speakers are urged to forget it, and consider the standard MODEL H as optimum for center or flanking use.

This brings up a point of philosophy or politics. Amplifier makers are offering preamps with a "center speaker" output, but few offer a monophonic amplifier for the third speaker. If customers and dealers would inundate amplifier manufacturers with demands for single amplifiers to use with stereo pairs, or stereo amplifiers with 3 "channels" instead of 2, the feed for a bridged center speaker would become a simple procedure instead of a problem.

Bridged center speaker circuitry employing 3 amplifiers (for example one stereo pair and one monophonic amplifier) is described in DOPE FROM HOPE, Vol. 11, No. 3, dated 6 July 1971.

Paul W. Klipsch

DOPE FROM HOPE

Vol. 12, No. 5
25 October, 1972
Revised June, 1974

UPDATING KLIPSCHORN LOUDSPEAKERS

Any KLIPSCHORN with serial number 120 or above may be brought up to current performance.

The following changes have been made over the years, and may be retrofitted.

BASS DRIVER MOTORS:

- Stephens P52LX2
- Stephens 103LX2
- E-V 15 WK
- Klipsch K-33-J
- Klipsch K-33-P
- Klipsch K-33-E

Any of the above, if in good condition, may and should be retained. If damaged, repair may be possible; otherwise replacement with current driver is recommended. PRICE $88.00

MIDRANGE DRIVERS:

- WE 713A 1947-1949 — Should be replaced
- Stephens P15 1949-1951 — Should be replaced with 2-way top end (to make 3-way system)
- University SAHF 1951-1961 — Should be replaced by K-55-V PRICE $82.00

TWEETERS:

- WE 713 A
- Stephens P-15 used 1949-1951
- University MID-T-4401 used 1951-1957 — Should be converted to 3-way, current tweeter K-77. PRICE: $55.00

MIDRANGE HORN:

K-5, (K-5-J last of series) replaced by K-400 in 1963. The new horn is marginally better. Some people can not hear the difference. Measurements show improved response and polar pattern. If desired, old horn may be replaced by new. PRICE: $119.00

CROSSOVER NETWORKS:

K-500-5000 used until about 1955. Various modifications aimed at better balance over several years. Type A used to about 1970.

Owing to use of amplifiers of excessive horsepower, the Type AA network was evolved using zener protectors and a steep slope for tweeter filter. If your network is earlier than Type A, a change is recommended. If you have a Type A and your amplifier is over 50 watts, change to Type AA is recommended.

Type AA Network	PRICE: $70.00
Exchange Type A for Type AA No exchange for earlier types.	$50.00

There was a change in woofer horn throat structure about 1963. The woofer designation became K-3-G. The "Type G motor-board" may be retrofitted to improve response in the 200-400 Hz range. Some people regard this as "marginal".

G Motor board	PRICE $15.00

If your KLIPSCHORN is a 1948 model, and you want "the whole works", the conversion entails:

G Motor board	PRICE $15.00
"Top end" including K-400 Horn K55V midrange driver, K-77 tweeter, Type AA network.	$326.00

Considering the fact that the 1949 KLIPSCHORN price (hand-rubbed finish) was $590.00 and the current price is $1,316.00 the upgrading with G board and top end of $341.00 indicates somewhat less than zero obsolence.

Don't you wish you could do that with your 1948 Cadillac?

Paul W. Klipsch
Editor

A LEGEND IN SOUND™
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DOPE FROM HOPE

Vol. 12, No. 5
25 October, 1972
Revised February, 1982

UPDATING KLIPSCHORN LOUDSPEAKERS

Any KLIPSCHORN with serial number 120 or above may be brought up to current performance.

The following changes have been made over the years, and may be retrofitted.

BASS DRIVER MOTORS:

- Stephens P52LX2
- Stephens 103LX2
- E-V 15 WK
- Klipsch K-33-J
- Klipsch K-33-P
- Klipsch K-33-E

Any of the above, if in good condition, may and should be retained. If damaged, repair may be possible; otherwise replacement with current driver is recommended. **PRICE: $88.00**

MIDRANGE DRIVERS:

- WE 713A 1947-1949 — and
- Stephens P15 1949-1951 — Should be replaced with 2-way top end (to make 3-way system)
- University SAHF 1951-1961 — Should be replaced by K-55-V **PRICE: $82.00**

TWEETERS:

- WE 713 A
- Stephens P-15 used 1949-1951
- University MID-T-4401 used 1951-1957 — Should be converted to 3-way, current tweeter K-77 **PRICE: $61.00**

Klipsch & Associates • P.O. Box 688 • Hope, Arkansas USA 71801 • 501/777-6751 • TWX 910-720-6885

MIDRANGE HORN:

K-5, (K-5-J last of series) replaced by K-400 in 1963. The new horn is marginally better. Some people can not hear the difference. Measurements show improved response and polar pattern. If desired, old horn may be replaced by new. **PRICE: $129.00**

CROSSOVER NETWORKS:

K-500-5000 used until about 1955. Various modifications aimed at better balance over several years. Type A used to about 1970.

Owing to use of amplifiers of excessive horsepower, the Type AA network was evolved using zener protectors and a steep slope for tweeter filter. If your network is earlier than Type A, a change is recommended. If you have a Type A and your amplifier is over 50 watts, change to Type AA is recommended.

Type AA Network	**PRICE: $**77.00
Exchange Type A for Type AA No exchange for earlier types.	**$50.00**

There was a change in woofer horn throat structure about 1963. The woofer designation became K-3-G. The "Type G motorboard" may be retrofitted to improve response in the 200-400 Hz range. Some people regard this as "marginal",

G Motor board	**PRICE: $15.00**

If your KLIPSCHORN is a 1948 model, and you want "the whole works", the conversion entails:

G Motor board	**PRICE: $15.00**
"Top end" including K-400 Horn K55V midrange driver, K-77 tweeter, Type AA network.	$349.00

Considering the fact that the 1949 KLIPSCHORN price (custom finish) was $590.00 and the current price for custom finish is $1551.00, the upgrading with G board and top end for $364.00 indicates somewhat less than zero obsolescence.

Don't you wish you could do that with your 1948 Cadillac?

Paul W. Klipsch
Editor

DOPE FROM HOPE

Vol. 13, No. 1
January 1973

FUSES for LOUDSPEAKERS

Fuses to protect loudspeakers from amplifiers of excess power, or to protect amplifiers from short circuits, are viewed with "mixed feelings". For tweeters, it is felt that no fuse is fast enough to protect against the mechanical damage due to a steep wave-front surge. For woofers, one user reports blowing 2 amp fuses, then in desperation shorting the fuse block and blowing a bass driver. Like "putting a penny behind the fuse".

Our KLIPSCHORN speakers have performed for several hours from a 350 watts-per-side amplifier at clipping levels without failing. They have failed on sharp surges and also from continuous heavy pedal tones from a mere 100 watt amplifier.

ANY ELECTRICAL OR MECHANICAL DEVICE CAN BE OVERDRIVEN TO THE POINT WHERE FAILURE **MUST** OCCUR.

The best protection will be the exercise of good judgment in choice of amplifiers. Our KLIPSCHORN, BELLLE KLIPSCH and LA SCALA speakers will deliver 100 dB sound pressure level (SPL) in a typical listening room with one watt input or 120 dB with 100 watts input. (Contrast this with less than 80 dB SPL for an "acoustic suspension" speaker at one watt input: the horns are more than 100 times as efficient. If 120 dB SPL isn't enough, try attending a concert, then go home and find that ¼ watt (a couple of volts) comes close to concert hall level!

Common sense will likely be better than fuses. If fuses give you a sense of security, (we recommend using a lamp fast blow, 2 amps. maximum). Eschew the Kilowatts; settle for good quality and 30 to 100 watts rating per channel. We used to demonstrate before large audiences in half-million cubic foot rooms with a pair of 25 watt amplifiers. Finally, remember that sound pressure levels in excess of 120 dB over considerable periods of time will injure your hearing. Better keep your programs at enjoyable levels and enjoy them longer.

Paul W. Klipsch

. . . The mark of integrity in loudspeakers!

The Dope From Hope is a spasmodic publication of Klipsch and Associates, Inc., Hope, Arkansas, U. S. A.

A LEGEND IN SOUND™
klipsch
DOPE FROM HOPE

Vol. 13, No. 2
June 1973
Revised November 1973

SPEAKER DESTRUCTION

As amplifier power increases, more loudspeakers fail in service. Also, people are rendering themselves partially deaf, and as hearing loss becomes more severe, the volume control is turned up increasing the cause of hearing loss, and increasing the rate of loudspeaker failure.

I am not going to preach a sermon on damage to one's hearing. That is the listener's concern.

I am going to point out that as amplifier power increases, the degree to which the speaker output reproduces the original sound, the sound quality, decreases.

We can build sturdier loudspeakers. Unfortunately, the accuracy of response will decrease. To explain: sturdier construction necessitates a stiffer and heavier diaphragm-voice coil assembly, and this necessitates a reduced output at the lower and upper range of each speaker component. Thus the range of the woofer is 35 to 400 Hz; the "rugged" version would have a range of 70 to 200. The midrange system range is from 400 to 6000; it would be confined to the 800-3000 Hz range. Crossover dips of 10 dB or deeper would exist. Unfortunately (again) the "ruggedized" version would merely invite further power increase until a "satisfactory" level of distortion and ear-pain is achieved, at which level the driver units would continue to be destroyed.

In a typical living room or small theater, our present all-horn systems offer concert-hall levels with a mere 10 watts peak input.

We can offer a choice: the supreme quality of our present products, with the admonition to use less than 100 watts per channel, or a degraded response with (literally) ear-destructive power output.

We can do it, either way, but not both. I leave it up to you, the customer, to make the choice.

Paul W. Klipsch
The Audio Iconoclast
KLIPSCH and ASSOCIATES, Inc.
Hope, Arkansas 71801

A LEGEND IN SOUND™
klipsch
DOPE FROM HOPE

Vol. 13, No. 3
731013

QUESTIONS AND ANSWERS

1. Do we need zero to 100,000 Hz range in audio amplifiers?
2. Do we benefit from zero phase shift in amplifiers?
3. Would transient response be improved by electronic crossover, zero phase shift and infinite frequency response?

These are some of the questions we have to answer almost daily in correspondence and interviews.

1.

Several years ago, McIntosh fielded a show where it was demonstrated that extending the frequency response of an amplifier beyond 20,000 Hz produced no audible change. This is as it should be expected to be: if the microphone, recording, transmission media, loudspeaker, and human ear are band pass devices limited (optimistically) to a range of 30 to 20,000 Hz, isn't it ridiculous to demand one link of that chain to transmit zero to 100,000 Hz?

When an amplifier manufacturer proudly proclaims such a range, there may be advantage in permitting larger feedback and lower distortion. But the benefits are in the reduced distortion, not in extending the range beyond audibility. The fact is demonstrable that insertion of a 30 Hz high pass filter and 20,000 Hz low pass filter does not make an audible change.

2.

Phase shift and band width are not two different things but different aspects of the same thing. Any amplitude-response variations are functionally related to phase shifts. With the exception of all pass filters, the converse is true; phase shifts are functionally related to amplitude-response variations. You can't have amplitude variations without phase shift, or (except in all-pass filters) you can't have phase shift without amplitude variations.

Therefore, since band-pass limiting to 30-20,000 Hz is not audibly different from zero-200,000 Hz it must be concluded that the resultant phase effects are likewise inaudible.

In 1972 I presented a paper "Delay Effects in Loudspeakers".[1] Time Delay and "Phase" are one and the same. You can move your head a foot and change the "phase" of a 6500 Hz tone a matter of 2160 degrees. The delay is only 0.0009 second. The fact that speaker displacements in 2-way and 3-way systems of up to 2 feet are undetected should indicate the insignificance of the delay effect as long as it is within the 2 foot limit. As a matter of fact our experiments here indicate the limits may be of the order of 4 feet or nearly 0.004 second.

3.

The question of improved "phase shift" and "transient response" by means of an electronic crossover can best be answered by our DOPE FROM HOPE on Electronic Crossover[2] The experimental evidence should suffice. If you want "theory" to explain effect, it would take a book. There are a lot of other experimental data that precedes and is referred to in my "Delay Effects" paper. I will cite just one reference (No. 4 in my Delay paper) wherein Dr. Ashley points out that phase shifts are inaudible as long as they do not produce significant "wrinkles" in the amplitude response curve.

This DOPE FROM HOPE is intended to be accompanied with the one on "Electronic Crossover"[2] and the reprint of my paper on "Delay Effects in Loudspeakers"[1]. If you get this "DOPE" without the other material, send 2 bits for the paper; the other "DOPE" is free.

Paul W. Klipsch
President
KLIPSCH and ASSOCIATES, Inc.
Hope, Arkansas 71801

(1) "Delay Effects in Loudspeakers", Paul W. Klipsch, Jour. Audio Engineering Society, Vol. 20, 8 October 1972, pp 634-637.
(2) "DOPE FROM HOPE" on "Electronic Crossover", Vol. 12, No. 2, March 1972.

DOPE FROM HOPE

DOPE FROM HOPE Vol. 14, No. 1 April 1974

The LSH Loudspeaker on the obverse of this sheet was Reprinted by Permission from the Audio Engineering Society, and from the Author and Inventors.

by

KLIPSCH and ASSOCIATES, Inc.
Hope, Arkansas 71801

The author of "The ULTIMATE LSH LOUDSPEAKER" has ably demonstrated that it is a simple matter to build a loudspeaker that can "take" a lot of power. A visit to a local dealer purveying today's "major breakthroughs" will demonstrate that the author is not the only one who knows the trick.

However, to say we disagree with the author would be an understatement. After all, bragging about how much power your speaker can absorb is like bragging about how much fuel your vehicle can burn.

We recognize the FACT that distortion is approximately inversely proportional to efficiency and that high and uniform efficiency relates to "flatness" or uniformity of output with respect to frequency or so-called "flat response". After making thousands of response and distortion measurements we realize the truth of these relationships. So, contrary to "Carver's Law", we aver that quality is proportional to efficiency.

Aren't you glad we build efficient loudspeakers?

Paul W. Klipsch

THE ULTIMATE LSH LOUDSPEAKER

O. Gadfly Hurtz

Hurtz and Associates, Inc., Lost Hope, Nev.

Major Premise[2] and S. P. Canard[3] have made the final major breakthrough in loudspeaker design with their ULTIMATE LSH[1] loudspeaker.

We take the original LSH loudspeaker as a point of departure, build a forced-draft box on which to set the LSH, Fig. 1, and wire a shunt resistor R_2 of 0.1666 ohm rated at 50 W and a series resistor R_1 of 3.837 ohms rated at 1200 W, Fig. 2. This will give an effective load

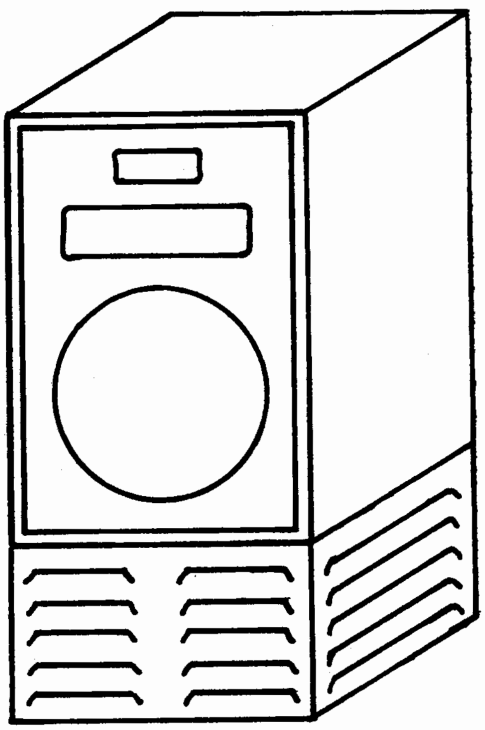

Fig. 1. ULTIMATE LSH loudspeaker on heat-sink base.

resistance of 4 ohms and a continuous power input capacity of 1200 W. The total impedance will vary from perhaps 3.999 ohms to 4.003 ohms peak at the primary speaker resonance frequency. The lay press may be quoted as saying[4] that the more nearly constant the impedance, the better. A small battery of "whisper fans" driven from 115-V 60-Hz (or 50-Hz) house current will dissipate the heat and keep the house warm. A battery of three zero-phase 400-W amplifiers in series–parallel could drive this system to continuous capacity. Electric-to-acoustic efficiency will be desirably low, in full acknowledgment of the modern doctrine that to obtain highest quality the efficiency must be ever lowered.[5]

The acoustic output of the new ULTIMATE LSH at full 1200-W input is 100-dB sound-pressure level at 61 cm. Compare this to the standard LSH system which

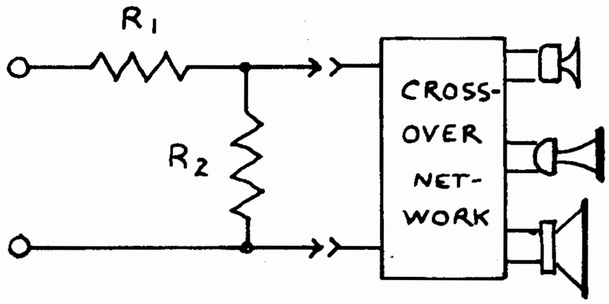

Fig. 2. Circuit for ULTIMATE LSH crossover network. R_1 = 3.837 ohms, 1200 W, continuous, 12 000 W intermittent. R_2 = 0.1666 ohm, 50 W continuous, 500 W intermittent.

produces 100 dB at 61 cm at only 1-W input. Here we have increased the input power handling capacity to 1200 times as much as the standard speaker can absorb. Also the damping factor has been modified to a value of 8/0.16 or about 50, assuming that the amplifier damping factor is infinite. The cost of this breakthrough will be nominal; the 2 resistors and battery of fans should not cost over a couple of hundred dollars (July 1973). Thus for less than doubling the cost of the speaker one has increased its power input capacity more than 1000 fold.

A quad of such speakers in four-channel will be capable of absorbing 4800 W continuous; allow 10-dB head room for transients, and the "music power" rating can be as high as 48 kW (peak). It is proposed to offer the speakers at $2000 in sets of 4, with a four-channel 48 000-W (12 000-W per channel) amplifier at the usual one-dollar-per-watt price.[6] Thus the system will cost just about an even $50 000. This seems to be about the customary ratio of amplifier-to-speaker price of 24 : 1.

Placement of the thermal unit below the LSH assures a dry environment for the voice coils.

The designers feel that this must be the major breakthrough to end all major breakthroughs. If 700 W is questioned as sufficient, here 48 000 W is offered. If low efficiency is the way to achieve quality, then a new low is achieved by three orders of magnitude. Surely a further step in this direction would be milking a mouse. The new ULTIMATE LSH must be hailed as truly the ultimate achievement.

Aftersong: To improve the weight per horsepower ratio, cavities are partially filled with 34.019776 kg of cast iron sash weights. Also a torque wrench is furnished to adjust the tweeter level control. Owner's Manual states that guarantee is voided if calibration is altered from 2200 g-lb.

[1] Loudspeaker and Space Heater.

[2] Major Premise, formerly with the Air Corps Horse Marines, is now Engineer with Hurtz and Associates, Inc.

[3] S. P. Canard, formerly with Proctor and Gamble Inc., is now Vice President and General Manager of Hurtz and Associates, Inc. Mr. Canard was asked to author this paper but was preoccupied with his reverse-feathered wing by which means he proposes to fly forward and backward simultaneously.

[4] A reviewer of equipment cites a loudspeaker as having a commendably low variation in impedance (1972).

[5] Robert Carver (*Audio*, p. 34, Feb. 1972) states, "Whenever a loudspeaker engineer makes an attempt to extend or smooth the frequency response of his design, or lower the distortion, the laws of physics demand that the loudspeaker become ever less efficient." (This law stated without proof).

[6] Hirsch (*Stereo Rev.*, p. 60, Apr. 1972) wonders if 700 W is enough.

DOPE FROM HOPE

DOPE FROM HOPE Vol. 14, No. 2 May 1974

POWER RATINGS

An inquirer (who considers himself a novice) asks about speakers:

> "A speaker manufacturer rates his speakers to handle 15 watts continuously, then says it takes 25 watts of amplifier rating to drive the speaker. What does this mean?"

Practically it probably doesn't mean a dam' thing. Translating what the maker of the speaker seems to mean is that 15 watts steady state power (as during a sustained oscillator test) will not destroy the speaker, and that an amplifier of 25 watts rating will deliver "adequate" transient peak acoustic power.

What the inquirer really wants to know is "What size amplifier shall I buy?" This is really the first of 2 questions. The answer, applied to KLIPSCH speakers, would be a maximum of 100 watts (sine wave rating) per side. If a higher power is used, precautions may be needed to prevent speaker damage. Crown suggests a one ampere fuse for each channel.

The second question, I think we can assume, is fishing for a realistic relation between sound pressure level and amplifier power.

Accept the figure the figure that 115 dB peak sound level pressure at the listener's ear will be as loud as what you would hear at a live concert. (A sound level meter would read 103 dB at "maximum" swings, because a V.U. meter has a "delay" or "lag", and instantaneous peaks are about 13 dB higher than the meter reading peaks).

In a typical 4000 cubic foot listening room, this requires 40 peak amplifier watts to feed a group of high efficiency loudspeakers: assuming this to be 2-channel stereo, 20 peak watts per channel or 10 watts average sine wave power rating per side is required. For a low efficiency speaker (of the typical so-called air suspension type) over 100 times as much amplifier power would be necessary: that makes over one kilowatt of sine-wave rated power for each channel.

Our tests at KLIPSCH and ASSOCIATES, Inc. show a range of efficiency among speakers of 22 dB or 160:1. Obviously speaker efficiency is a factor in how much amplifier power you need.

(OVER)

From known efficiencies, and typical room characteristics, a table may be constructed:

TABLE

Speaker Type

	High Efficiency Horn Type (KLIPSCHORN BELLE KLIPSCH)	Large Direct Radiator of Medium Efficiency (CORNWALL)	Small Direct Radiator of Medium Efficiency (HERESY)	"Air Suspension" Low Efficiency (Various bookshelf speakers)
Amplifier rated Power Required to produce 115 dB Peak Sound Pressure Level in typical room Each Channel of a 2-channel Stereo	10	30	60	1000*

* The chances are this peak power will destroy the speakers, and several speakers would be needed to absorb this much power.

While not related to power input and power output, a word about frequency response should be injected here: high efficiency speakers are capable of design such that they offer a smoother tonal response than low efficiency speakers. This is not always realized: there are good and bad designs and executions in both categories. The point is that one need not sacrifice efficiency in the interest of smooth tonal response.

It is a fact of observation that the higher the efficiency of a loudspeaker, the lower the distortion. This is really the most important attribute of loudspeaker performance. As a natural consequence the very low efficiency speakers exhibit gross distortion at sound pressure levels in excess of about 95 dB.

Only for the Technical Reader

You may wonder how a one ampere fuse can suffice for 100 watts of amplifier power into an 8 ohm load. Since $I^2R = 100$ $I^2 = 100/8 = 12.5$ and $I = 3.5$ amps approximately. The answer is that in music, instantaneous peaks are about 13 dB above the "average peaks" as read on a V.U. meter, and they occur rarely enough so that relatively little heating occurs compared to the heating due to average power. One ampere is 10.9 dB below 3.5 amps, so it should not "blow" on music, and you can surely blow it with 100 watts "steady state".

I once thought that the instantaneous peaks destroyed voice coils by sheer mechanical force, but some work here by R. R. Moore using short "tone bursts" shows that peaks of up to 150 watts can be tolerated by rather delicate tweeter component speakers if the duration of the pulse is short and the heating is not excessive. In numbers, a tweeter rated at 2 watts continuous power withstood over 100 watt peaks when tone burst was of a 20000 Hz signal, one cycle on, one second off.

KLIPSCH and ASSOCIATES, Inc.
Hope, Arkansas 71801

DOPE FROM HOPE

Vol. 14, No. 4 Revised July 1974

Supercedes Vol. 11, No. 3 July 1971

BRIDGED CENTER LOUDSPEAKER

or

WHO PUT THE SOLOIST on A FLYING TRAPEZE?

Benefits of using the bridged center speaker were recognized by Steinberg and Snow (Symposium on Auditory Perspective — 1934)* and their teachings revived and reconfirmed by this writer in 1958. The basic improvement effected by adding a center speaker was analysed in "Stereo Geometry Tests" in 1962.*

The first benefit of center speaker technique is the enlarged stereo listening area. As any listener approaches a wall against which two speakers are operating in stereo, there will be a region in which the solidity of the apparent source divides into two separate sources. Some writers refer to a "curtain" or "waterfall' of sound, referring to an apparent source that is continuous between the speakers. The addition of a center speaker permits the listener to come closer to the wall before perceiving spatial discontinuity.

The second benefit is the localization of the center-stage performer. Whether you are listening to Dylan in front of the Band or Rostropovich soloing with Boston Symphony, two channel stereo yields either two distinct soloists, or an indistinct soloist as wide as the room. The greater the angle from listener to the two speakers, the more prominent the separation or smear. The center speaker will localize the soloist at center stage. This is because the center speaker is fed a mono** left channel plus right channel mix. It closely recreates what would have been picked up by a soloist mike at center stage. Fig. 1 shows one means or deriving the left plus right signal for driving a center speaker. To extol the addition of a center speaker, it eliminates the "hole in the middle" which most stereo systems exhibit. It "puts a leg chain on the soloist". It completes a "curtain of sound" between the flanking speakers. And the "soloist" need not be at stage- center; if the Best Bloomin' Baritone Blower in Buffalo Bill's Big Brass Band By Gosh stands up in his chair at right center stage, that is where you should hear him, and that goes for all the members of the group from flank to flank.

The center loudspeaker provides the ultimate refinement in stereophonic geometry localization.

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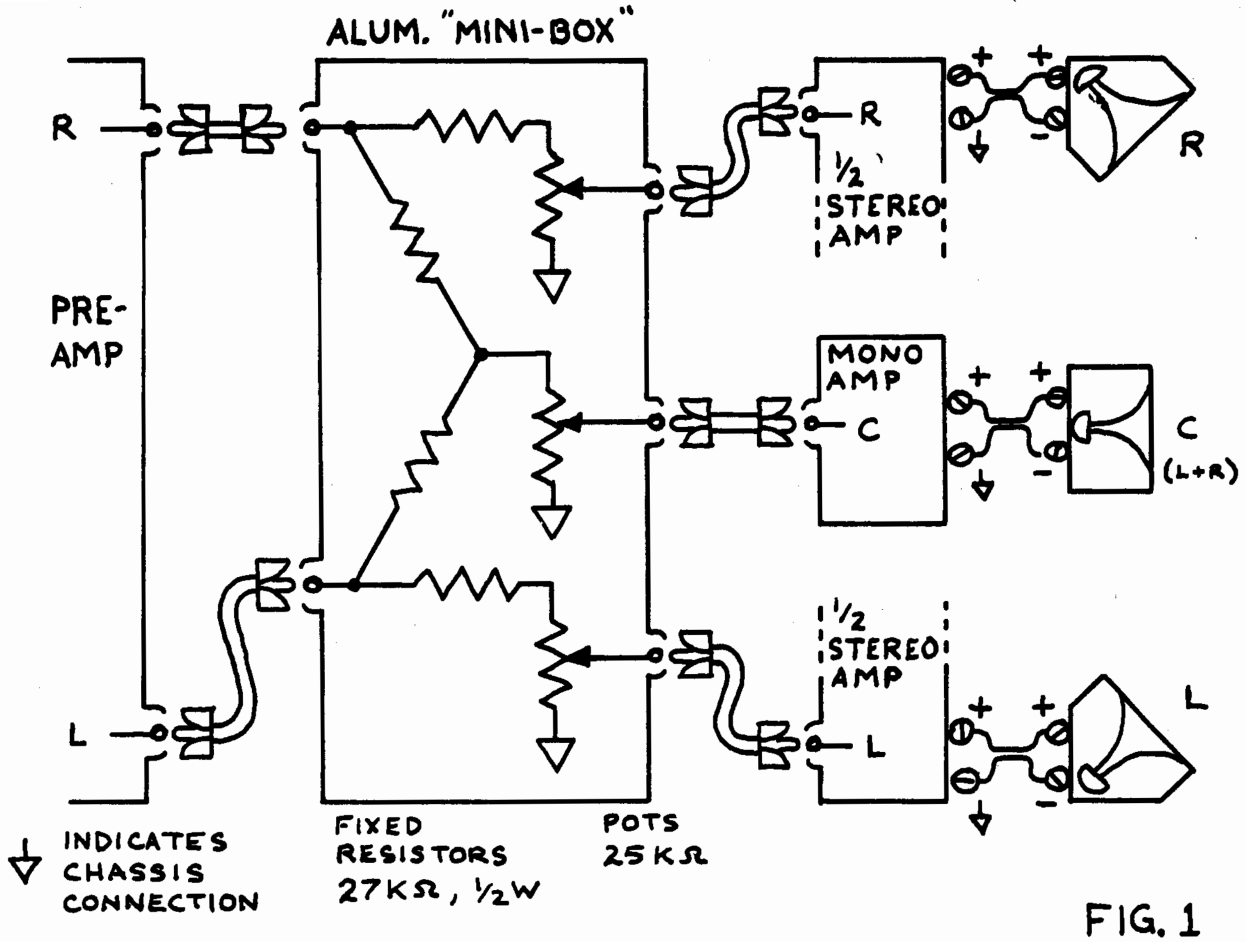
* The Symposium, Stereo Geometry Tests and other papers are available in reprint form at $1.00 for the Symposium and .25 cents each for the papers; or $7.00 for the complete set of AUDIO PAPERS in loose-leaf binder from KLIPSCH and ASSOCIATES, Inc.

** The late W. B. Snow, "Basic Principles of Stereophonic Sound", Nov. 1953, Jour. of the SMPTE, Vol. 61, used the term "mono-phonic" for a single sound source; "mono" is short for "mono-phonic". It is in the "AUDIO PAPERS".

The Dope From Hope is a spasmodic publication of Klipsch and Associates, Inc., Hope, Arkansas, U. S. A.


ALUM. "MINI-BOX"
R
PRE-
AMP
L
R
½
STEREO
AMP
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MONO
AMP
C
C
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½
STEREO
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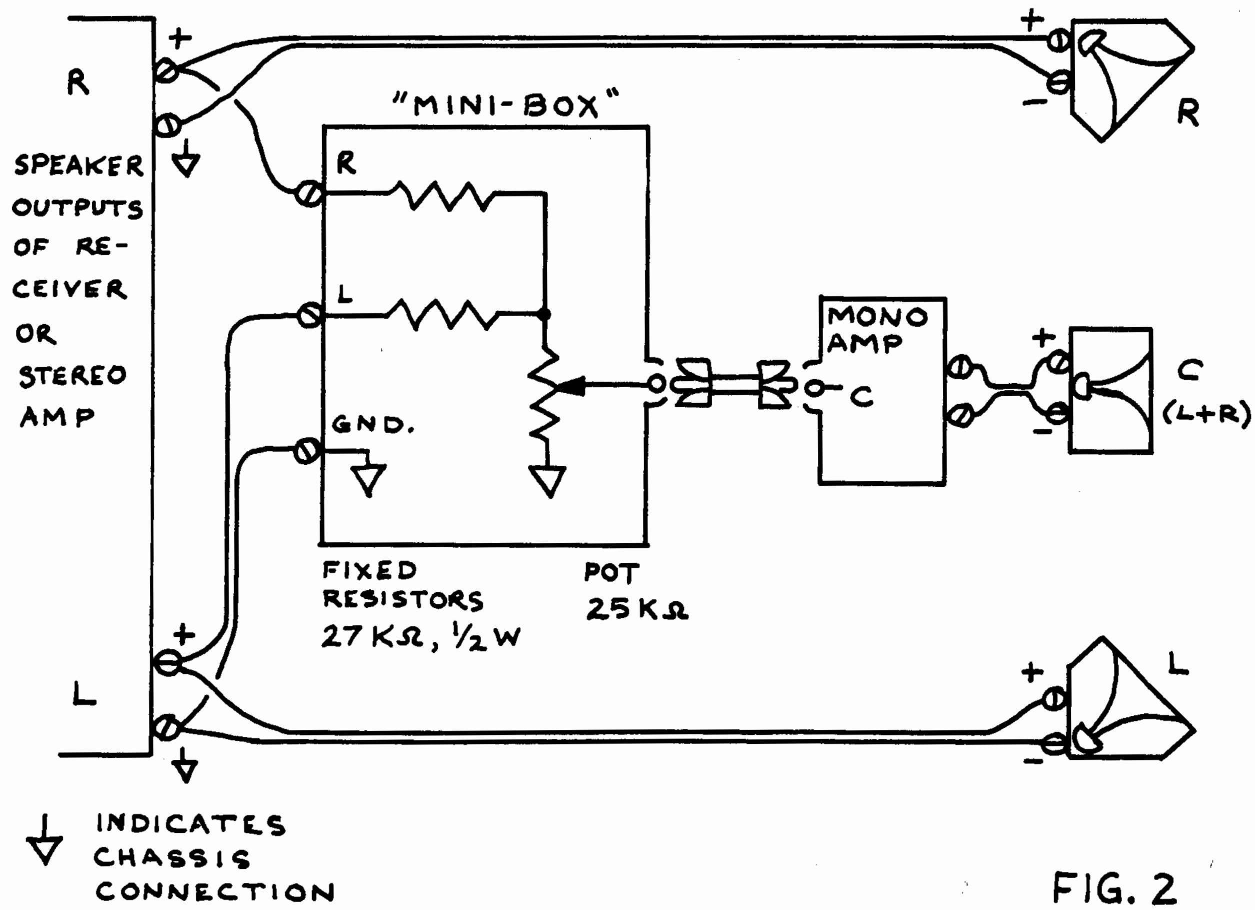
INDICATES
CHASSIS
CONNECTION
FIXED
RESISTORS
27KΩ, ½W
POTS
25KΩ

FIG. 1


R
SPEAKER
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C
(L+R)
L
FIXED
RESISTORS
27KΩ, ½W
POT
25KΩ
INDICATES
CHASSIS
CONNECTION

FIG. 2

Three speaker stereo portrays most accurately the spatial relations in a realistically recorded program. Of course many recordings are not "realistic" in that the engineer "mixed down" from 16 or 8 or 4 channels to 2 channels and his judgement isn't necessarily representative of the way you would have heard the performance in the concert hall. But 3 speakers do the best with whatever program material is available.

Even if the mix-down from 8 channels to 2 is poorly done, the bridged center speaker tends to alleviate the faults of the mix-down and restore acceptable spatial perspective.

Some preamplifiers have an output for a "center channel". Usually there is no volume control, or if there is one, the control is inconveniently located. Some receivers do not have accessible "preamp outputs".

If an accessible "center channel" control is available, one needs only to add a mono amplifier (or half of a stereo power amp) and center speaker.

If the center channel terminals are not available, Fig. 2 shows the simplest way to obtain a center signal, and again, one needs a mono power amp and speaker. Since only a few quality amplifiers are available in mono form, it may be necessary to use half a stereo pair.

COMMENT on "4 CHANNEL"

So-called 4-channel is aimed at enhanced realism through additional reverberation and ambience. If this is accomplished with 4 discrete channels of good quality it would add realism to a rendition involving an antiphonal organ in the rear of the audience. If this is done with 2 sides of a groove in a disc record, one can expect gross distortion. Some demonstrations exaggerate the "geometry" by having the soloist soar from front to rear, like the "daring young man on the flying trapeze".

Sam Goldman said, "A bad picture in 3D is 3 times as bad". To paraphase this, "Bad sound in 4-channel is 4 times as bad".

WHETHER WE USE ONE SPEAKER OR 2 OR 3 OR 5, THE QUALITY DEPENDS ON THE BASIC QUALITY OF THE SPEAKERS USED, NOT HOW MANY ARE USED. For quality and tonality good speakers are needed; for stereo geometry proper number and spacing are needed. And with only 4 speakers one still needs the center speaker in front; proper deployment of 4 speakers would be 3 speakers in front and one in the rear rather than 2 in front, 2 in rear.

The bridged center speaker is needed just as much in "4-channel" as it is in stereo. The principles drawn from "Stereo Geometry Tests"* tell us that center stage events can be prevented from wandering only by this means. You still need 3 speakers in front regardless of the total number of speakers. And to repeat: for good tonality you need good speakers, and clean program material.

Paul W. Klipsch
KLIPSCH and ASSOCIATES, Inc.
Hope, Arkansas 71801

* Reprint available from KLIPSCH and ASSOCIATES, Inc. It is included in "AUDIO PAPERS".

☆ ☆ ☆

WHAT'S NEW AT KLIPSCH?

Ralph Waldo Emerson said,

"The Excellent is new forever."

☆ ☆ ☆

A LEGEND IN SOUND™

klipsch

DOPE FROM HOPE

Vol. 14, No. 4
Revised Jan. 1981

BRIDGED CENTER LOUDSPEAKER

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Paul W. Klipsch
KLIPSCH and ASSOCIATES, Inc.
Hope, Arkansas 71801

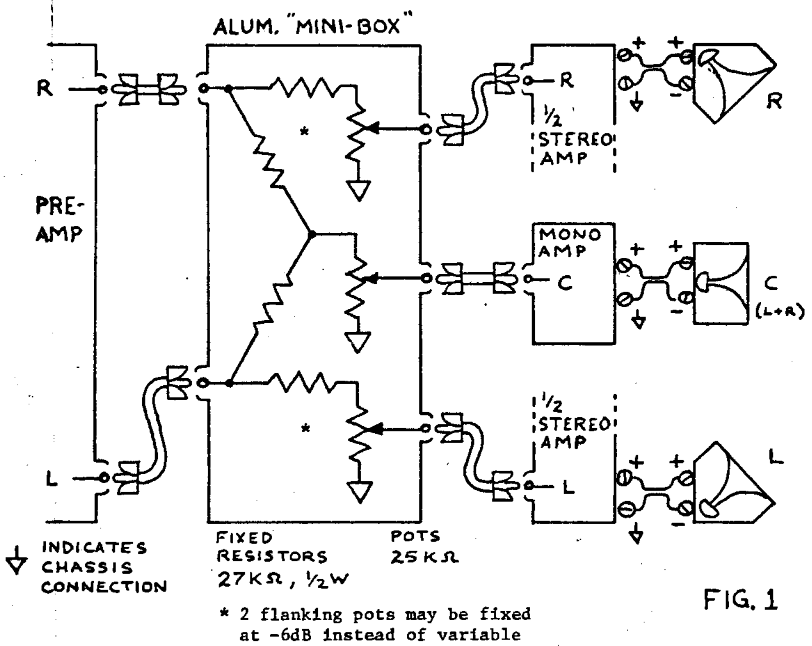


FIG. 1

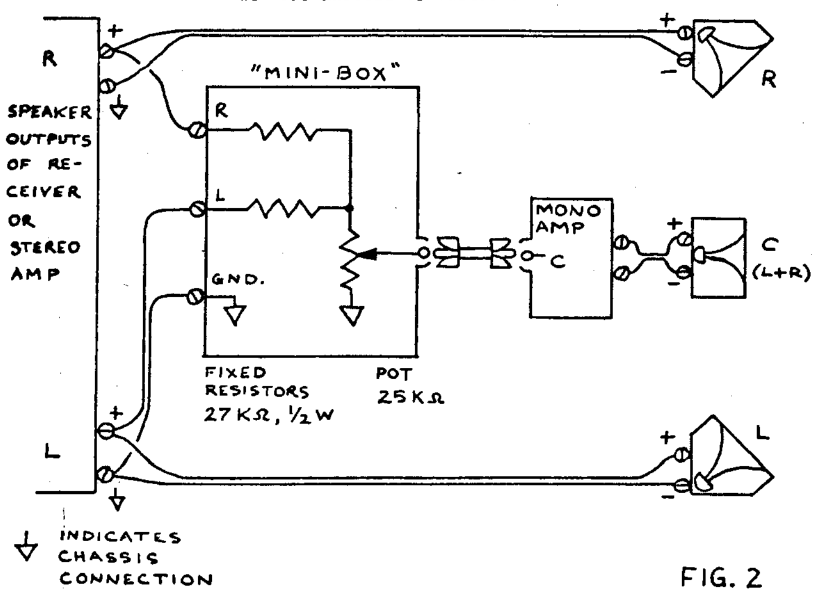


FIG. 2

DOPE FROM HOPE

Vol. 15, No. 1
1 May 1975

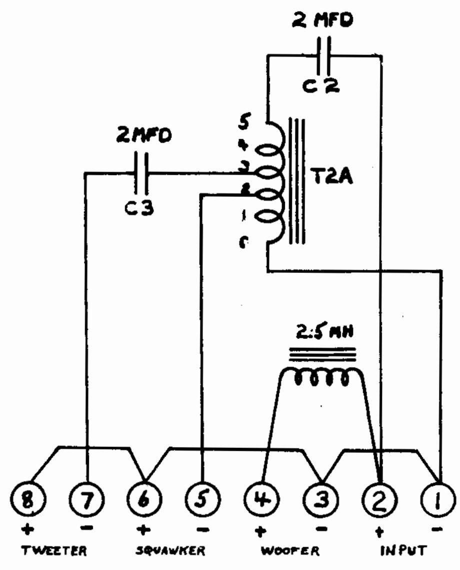
We are in the process of making a change in the HERESY Loudspeaker System. After considerable listening tests and a large number of response curves, we have concluded that there is a marginal but realizable and audible improvement that we can make by reversing the polarity of the midrange and tweeter relative to the woofer driver. Obviously, the only physical change in the HERESY will be to the crossover network.

We recommend that you make this change as per the diagram on the merchandise you have in stock. All HERESY Loudspeakers coming out of the factory after Serial Number 14N617 will have this change effected in them and will be designated as a Type "E" Network.

Happy Listening,

Paul W. Klipsch

NETWORK
TYPE E



. . . *The mark of integrity in loudspeakers!*

The Dope From Hope is a spasmodic publication of Klipsch and Associates, Inc., Hope, Arkansas, U. S. A.

DOPE FROM HOPE

Vol. 15, No. 2
01 August 1975

Toe-in of Loudspeakers and Stereo Geometry

Most well designed loudspeakers exhibit a polar response (angular radiation pattern) similar to Fig. 1. Exceptions would exist in the speakers for which 360° radiation is claimed, but these would have their polar response modified by proximity to walls and the resulting interference patterns would be both complex and variable, dependent on wall material and proximity.

Now consider Fig. 2; a listener at location A would be as far off axis from one speaker as from the other. He will get a good "stereo effect". But a listener at location B is closer to speaker L, and more nearly on axis. He will not hear speaker R at all, and will completely miss the stereo effect. This is subject to experimental verification, and is easy to do. It is suggested that the reader try it.

In Fig. 3 a listener at location A, equidistant from each of speakers L and R, will hear good stereo. The listener at location B is closer to speaker L, but is off axis and the sound pressure level is less because of the off-axis location; he is on thé axis of speaker R, and this compensates for the greater distance to speaker R. He experiences a good stereo effect at either location A or B, and in any other location which is not too close to either speaker. This is also subject to easy verification by experiment and it is suggested that the reader try the experiment.

In January 1934, the Staff of The Bell Telephone Laboratories published the famous Symposium on Auditory Perspective. [1] They used 3 loudspeakers and 3 electrically independent channels. Steinberg and Snow, in their Chapter of the Symposium also described experiments with 3 speakers and just 2 channels, the center speaker being bridged across 2 stereo channels.

Snow [2] appears to be the first to publish "toe-in" of the flanking speakers as a means to reduce the shift of the virtual sound source for different listener locations.

My own experiments in the late 50's [3] showed that good stereo geometry, or the ability on the part of the listener to localize individual sounds, was optimized by the use of 3 loudspeakers, and with the flanking speakers toed-in 45°. It was found that the 3 speaker array with only 2 channel stereo gave substantially the same accuracy of localization as was obtained with 3 speakers fed with 3 independent channels. And whether one used 2 or 3 channels the results were always better with toe-in than with the flanking speakers facing with axis parallel.

The use of the bridged center speaker [4] has been found to simulate quite closely the stereo geometry of a system using 3 electrically independent channels. Fig. 4 shows a stereo listening area of about three fifths of the total room area. Good stereo geometry should exist in the area below the dotted line. Above the dotted line, a listener may be too close to one speaker to get a good stereo effect. After all, you couldn't hear the rest of the band if you had your head in the tuba.

The conclusion is pretty obvious. Whether you are using KLIPSCHORN loudspeakers, or speakers of some other make or type, you will get best stereo geometry and best tonality with corner placement of the flanking speakers (whether you use a center speaker or not), and the corner placement should be with the flanking speakers toed-in at 45°.

1. Electrical Engineering, Vol. 53, No. 1, pp 9-32, 214-219.
2. W. B. Snow, "Basic Principles of Sterephonic Sound", J. Soc. Motion Picture & TV Engineers, Vol. 61, 1953, pp 567-589.
3. Paul W. Klipsch, "Stereo Geometry Tests", IRE Trans on Audio, Vol. AU 10, No. 6, pp 174-176, Nov.-Dec. 1962.
4. Paul W. Klipsch, "Stereophonic Sound With Two Tracks, Three Channels by Means of a Phantom Circuit", J. Audio Eng. Soc., Vol. 6, No. 2, April 1958, pp 118-123.

The above papers are included in THE AUDIO PAPERS available from KLIPSCH AND ASSOCIATES, Hope, Ark. 71801. The price of the whole set of papers is $7.50.

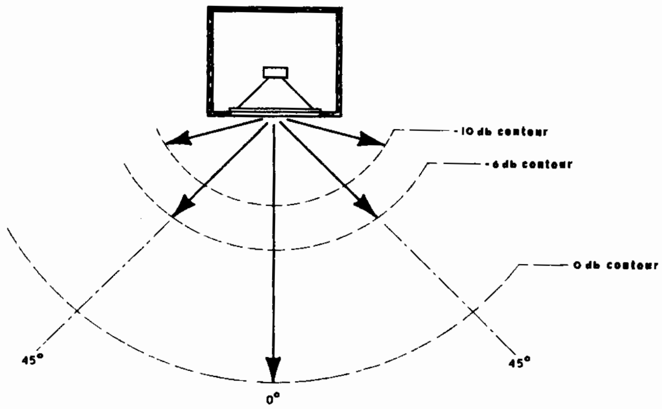


Fig. 1 Ideal Polar Response of a Loudspeaker.

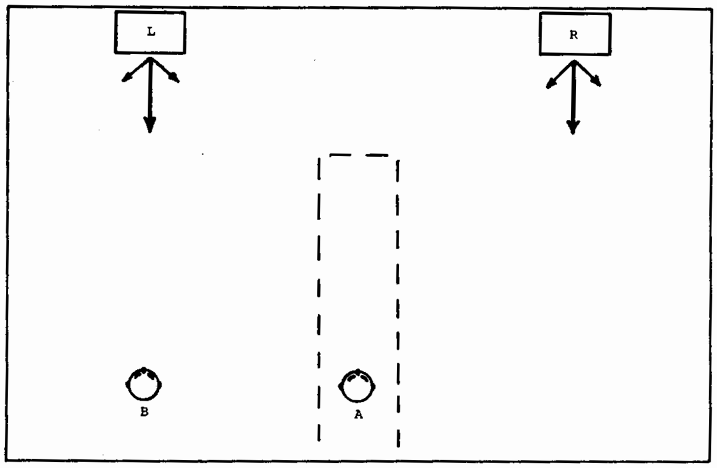


Fig. 2 Loudspeaker Placement for Stereo Reproduction. Note Small Area of Optimum "Stereo Effect".

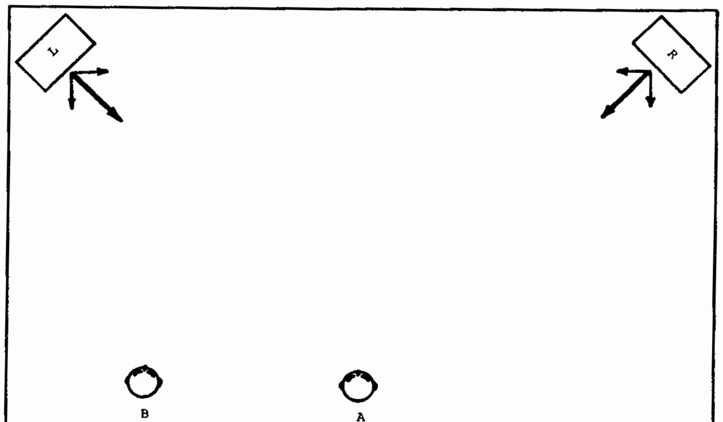


Fig. 3 Toe-in of Loudspeakers Resulting in Improved Retention of the "Stereo Effect" over a wider Listening Area.

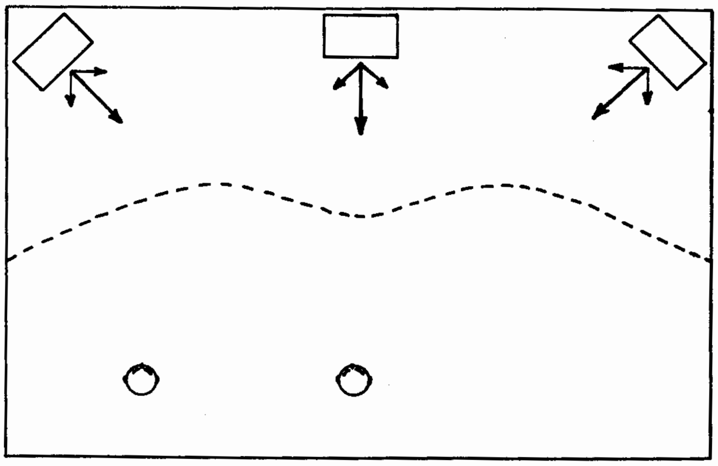


Fig. 4 Utilization of a Bridged Center Speaker for Optimum Stereo Image Localization. Dotted line indicates about 3/5 of the room provides Good Stereo Geometry.

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DOPE FROM HOPE

Vol. 15, No. 3
August 11, 1975

IMITATIONS?

A number of imitations of ours and other manufacturers' loudspeakers crop up from time to time.

I'll pick a sample, which I'll call "Brand X" or simply X.

From the sales sheet, X is a folded corner horn, made of high-density particle board. My comment: Ratio of density of flakeboard to that of fir plywood is approximately 1.3. "High density" is not a virtue. Particle-board will not hold a screw driven into the edge grain. Breaking strength of test samples in bending is 4 lbs. for particle-board vs. 17 lbs. for plywood. Thus, the strength weight ratio of flake-board is only about 1/6 that of plywood. We feel it is being penny wise and pound foolish to use inferior materials in a speaker system costing nearly $1,000.00.

Again from the sales pitch, the midrange horn is "fiber-glass, giving greater internal damping than metal horns." I point out that the damping in a horn system should exist because the horn acts as a proper acoustic coupling to the diaphragm, and the damping should be due to radiation resistance, not due to dissipative "damping" in an absorbtive horn.

Reading specifications is as much a black art as writing them. When a point is made, for example, of "internal damping", an informed reader may reasonably assume the writer of the specification was ignorant of the true function of the horn.

Further in the data sheet is the statement that the midrange driver covers 85 to 7000 Hz. I wonder why he didn't use it for a woofer!

The price of $800 should almost cry out Caveat Emtor. The "saving" of a couple of hundred dollars (compared to our KLIPSCHORN®), may turn out to be a loss of about 8 times that much.

John Ruskin said:

> "There is hardly anything in this world some man cannot make a little poorer — and sell a little cheaper — and the people who consider price only — are that man's lawful prey."

How about Quality Control? One such "manufacturer" had a multimeter for "test equipment".

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One erstwhile licensee had all the necessary instrumentation and skills to produce a good speaker, plus our own specific help. Yet the product was inferior.

Please don't get the idea we are "crying". Our business, based on 29 years of making a quality product, has grown close to 40% per year for quite a few years. If we cry a little it is due to growing pains.

What I'm trying to get across is that the quality of the product of a company may be on a par with the company's research facilities, quality control, qualifications, and integrity. Merely copying a product should be easy, but the copies so far witnessed fall far short of really being copies. What bugs me is the high price for such a loosely approximate copy. It doesn't look like a bafgain.

Paul W. Klipsch

P.S. This was written by the inventor of the most copied loudspeakers in history.

"Shade tree" infringers are copying so poorly and offering such deep discounts, there seems a possibility they will not be around to make good any guarantees which they may offer.

Also remember that a Brand Name (Registered Trademark) is connotive of the source. Merely copying a general style and type doesn't make a Granada a Mercedes, or a collection of lumber a KLIPSCHORN ®.

DOPE FROM HOPE

Vol. 15, No. 4
5 th January, 1976

MORE on "BI-AMP" or "ELECTRONIC CROSSOVER"
Supplementing DOPE from HOPE Vol. 12, No. 2

People continue to ask for data on how to "Bi-Amp" a KLIPSCHORN or other KLIPSCH Loudspeakers. Our answer is "don't". Our DOPE from HOPE on "Electronic Crossover" Vol. 11, No. 3 remains as true today as it did in 1971. In fact, the argument against "Bi-amp" is strengthened with the array of test data on modulation distortion gathered over the past 4 years. Even mediocre amplifiers with all sorts of other faults add modulation distortion by a factor of 1/100,000 to the typical 1/100 introduced by the loudspeakers themselves. (A recent test of a speaker showed 1% TMD and the amplifier was found to be contributing 0.001%). And, the "Electronic Crossovers" requires "active filters" involving feedback factors in the order of 100,000, resulting in a new kind of distortion called "Transient Intermodulation Distortion" (TIMD). Dr. Mati Otala, of Finland, points out that feedback factors in excess of 20 lead to audible amounts of TIM. A feedback factor of 100,000 is 5000 times as much as a feedback factor of 20.

Thus, the "electronic crossover" introduces more distortion than it is aimed to cure. Perhaps it would reduce TMD (sum of steady-state amplitude modulation distortion and frequency modulation distortion in the amplifier-loudspeaker combination) from 1% to 0.999%, while adding audibly perceptible amounts of TIMD.

Where kilowatts of audio power (tens of kilowatts of amplifier power) are "needed" (to satisfy rock groups who are already deaf and wish to induce deafness in their audiences), I can see how the increased TIM distortion could be tolerated — or even welcomed.

Distortion makes a given sound pressure level "sound louder"——. And, TIM distortion, due to its short-duration attacks, apparently adds a pseudo "brightness" to the acoustic output, again, an asset, however dubious, for the purveyers of rock at 130 dB SPL.

J. Figby Blotz (a pseudonym) wrote 20 years ago "The aural difference between a \$200 and a \$500 amplifier is almost negligible; the aural difference between loudspeakers with comparable price tags is almost startling". You are not going to improve the quality of your audio system by spending a lot of extra kilobucks for amplifiers, and you will certainly degrade your system by the "bi-amp" technique. Why spend money to degrade your system?

There are those who have done it and insist "it sounds better". I'd grant that it sounds <u>different</u>, but does it really sound <u>better?</u> Sergeant Jack Riley tells of a visit to a "hi-fi" show when he was stationed in England. A feature was the comparison of various playback systems with a live orchestra. He reported "the live orchestra came in third". What some audio-chondriacs mistake for "sounding better" is the added pseudo crispness of some form of distortion, probably TIMD.

Even in the absence of TIM distortion, remember every piece of added electronics adds its contribution of noise, amplitude modulation distortion and added maintenance.

Spend your money on better speakers, or having achieved the best, buy discs or tapes, or even (ugh!) a new car.

. . . The mark of integrity in loudspeakers!

The Dope From Hope is a spasmodic publication of Klipsch and Associates, Inc., Hope, Arkansas, U. S. A.

DOPE FROM HOPE

Vol. 15, No. 5

FALSE CORNERS

All speakers perform better in a corner.

Unfortunately, not all of us have listening rooms with natural corners.

False corners offer one solution to this problem. Paul W. Klipsch in his "brand new second hand home" has resorted to false corners.

The following is a basic solution for KLIPSCHORNS which may be modified to solve individual problems for other loudspeaker systems.

To build a false corner, one may start with a 2" x 4" framework as shown in Fig. 1. We recommend using standard 4 foot wide sheets of ¾" plywood securely glued and nailed to the framework. The back side may be covered with a thinner material such as 3/16" masonite or ½" plywood.

In Fig. 2, formica has been applied to the top and front edge of the false corner for cosmetic purposes and painted to match the wall color. Use your imagination in finishing or extending the vertical deminsion for use as a planter, bookshelf, etc.

Neglible improvement will be obtained from extending further than four (4) feet from the corner.

If you have specific problems, please feel free to write or call KLIPSCH & ASSOCIATES for help.

Gary Gillum

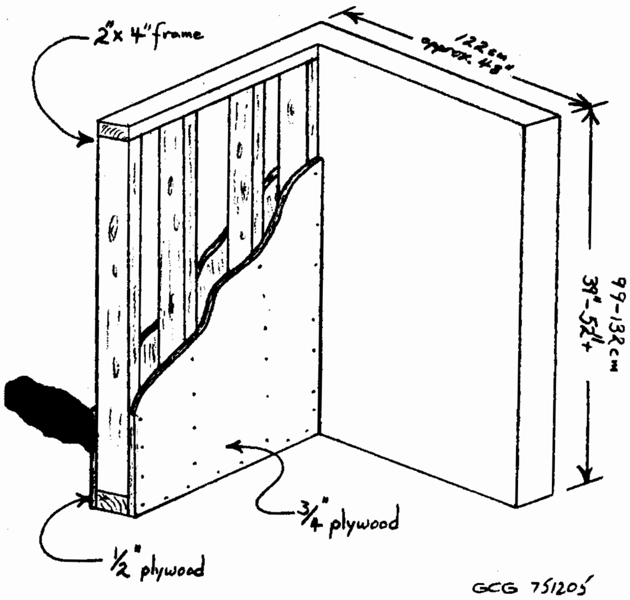

FIG. 1. Suggested dimensions and materials for constructing a false corner.

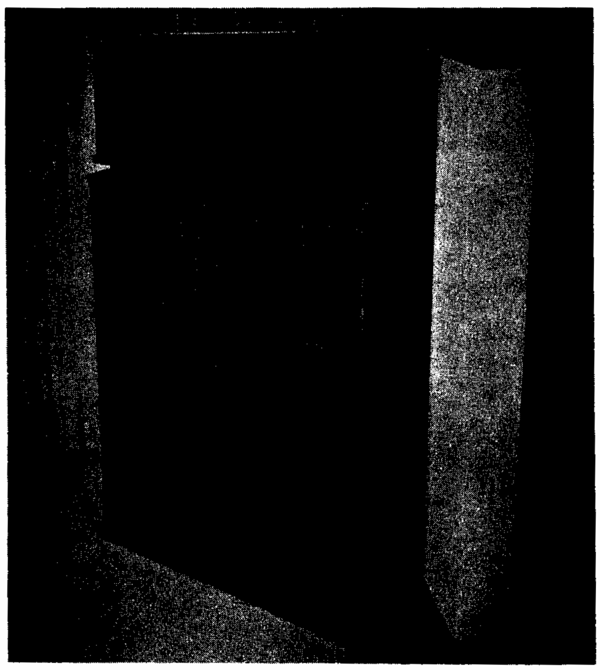

FIG. 2. Complete, free standing false corner as described above.

. . . The mark of integrity in loudspeakers!

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DOPE FROM HOPE

DOPE FROM HOPE Vol. 15, No. 6 June 1976

THREE SPEAKER ARRAYS

More and more people are calling and writing us about a three speaker array. We recommend our BELLE KLIPSCH or LA SCALA as a center speaker between our KLIPSCHORN, LA SCALA or BELLE KLIPSCH as flanking speakers. We do not like to use our HERESY or CORNWALL speakers between totally horn-loaded speakers.

If you are aware of the history of our HERESY speaker, you may wonder why we adopt this heretical attitude. Back in 1955, we were trying to revive the teachings of The Bell Telephone Laboratories in the use of a center speaker bridged across 2 stereo channels[1]. At that time, we built only corner speakers, and I was designing a non-corner speaker for the center channel. Our then Eastern sales representative, Hank Goodman, looked at my sketches and said, "that, coming from you, would be heresy". I grabbed that idea and named the speaker "Klipsch's HERESY". But we found, over the years, that its distortion is perceptibly higher than that of our horn systems. Now, don't jump to wrong conclusions. Our HERESY exhibits lower distortion than any other speaker of its size and price. But it is still not an all-horn system. Having a direct-radiator bass unit, its distortion in the bass range is inevitably higher than that of our horn systems, and the cruel fact remains that the speaker system with the highest distortion determines the distortion level of the entire stereo array. Thus, we recommend an all-horn system, like our BELLE KLIPSCH or LA SCALA for use as a center speaker between flanking all-horn speakers.

Where CORNWALL or HERESY speakers are used on the flanks, it is entirely feasible to use them also in the center of the array.

This would be a good time to remind you that the flanking speakers should be in corners if possible and should be arrayed with about 45° "toe-in".[2,3]

When a customer demands totally horn-loaded flanking speakers, but asks for a less expensive center channel, simply suggest he settle for a two speaker array until he can afford the correct speaker for the channel.

The perceived distortion is that of the poorest speaker in the array. This is especially noticeable for center stage sounds. The center speaker reproduces center stage events, and the soloist, if there is one. It should be at least as good and clean as the flanking speakers.

KEEP IT CLEAN!

Paul W. Klipsch

[1]Symposium on Auditory Perspective, 1934. Reprints of this are available at $1.00.

[2]DOPE FROM HOPE, Vol. 14, No. 4, "Bridged Center Speaker."

[3]DOPE FROM HOPE, Vol. 15, No. 2, "Toe-In".

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DOPE FROM HOPE

Vol. 16, No. 1
January 1977
Revised November 1980

AMPLIFIER RATINGS TO DRIVE KLIPSCH SYSTEMS

Many customers ask, "What should the power rating of my amplifier be to drive KLIPSCH® Loudspeakers"? The answer depends on loudspeaker efficiency, loudspeaker maximum input power capacity, the listening environment, and the listener's preferences in playback level.

This new "Dope From Hope" sheet is not intended to replace previous comments*, but to expand the subject of amplifier ratings in light of so-called "contemporary" listening practice.

We realize that a large number of our systems are now being used to reproduce at very high levels such non-symphonic program material as hard rock and synthesized music. The sound levels experienced by listeners at "live" performances of this type of music often exceed "full symphonic" levels by 10 to 20 dB. The high efficiency and low distortion of KLIPSCH Loudspeaker Systems are found to be a great advantage when reproducing this type of material.

The larger KLIPSCH Systems are all capable of reproducing the original levels of live rock music (average 100 to 115 dB SPL with peaks 10 dB higher) in a typical listening room, all with a modest amplifier of about 50 watts per channel. Although we do not recommend it (either for the customer's ears or his equipment), the all horn-loaded systems, KLIPSCHORN® LA SCALA®, and BELLE KLIPSCH® can reproduce blood curdling high levels in the 115 to 120 dB SPL range when driven by an amplifier of 100 to 300 watts per channel.

To achieve these rather high average SPLs without amplifier clipping requires the use of a power amplifier with a continuous output rating some one to five times the continuous power rating of the speaker system. On normal program material with instantaneous peaks 10 to 15 dB higher than "average peaks" as read on a VU Meter, operation with amplifiers of this size is permissible because the loudspeaker's short-term (50 ms or less) power handling capacity is much higher (by roughly 10 to 15 dB) than its long term continuous rating.

The user must go to extraordinary means to protect both his loudspeaker system and his ears when amplifiers of this size are used. Please note comments at the end of this sheet, and on the previously cited Dope From Hopes.

To aid the KLIPSCH user in selecting the amplifier he requires to drive his/her system, the following table was created. It relates the required continuous output rating of the power amplifier to the average sound pressure level generated in a typical listening room. The listed power allows peaks some 10 dB above the average level to pass without clipping. Note that for most listening, average levels up to 105 dB SPL will suffice.

* Dope from Hope: Vol. 7, No. 5, June 1966, "Blown Tweeters"
Vol. 13, No. 1, January 1973, "Fuses for Loudspeakers"
Vol. 13, No. 2, June 1973, "Speaker Destruction"
Vol. 14, No. 2, May 1974, "Power Ratings"

AMPLIFIER POWER RATING TABLE

Amplifier power rating (continuous average at 8 ohms) required to generate the following midband average sound pressure levels* in the reverberant field of a typical listening room of 3,000 cu. ft., while allowing peaks 10 dB above average to pass without clipping.

	AVERAGE LEVEL (Peaks 10 dB Higher)		SYSTEM		
			KLIPSCHORN LA SCALA BELLE KLIPSCH	CORNWALL®	HERESY®
	SPL dB (re 20 μPa)		POWER	POWER	POWER
MEDIUM LEVEL	85	dB	0.06 W	0.18 W	0.45 W
LOUD LEVEL	90	dB	0.20 W	0.57 W	1.4 W
	95	dB	0.63 W	1.8 W	4.5 W
	100	dB	2.0 W	5.7 W	14 W
VERY LOUD LEVEL	105	dB	6.3 W	18 W	45 W
	110	dB	20 W	57 W	142 W
TOO DAMN LOUD LEVEL	115	dB	63 W	180 W	---
	120	dB	200 W	---	---
ABSOLUTE MAXIMUM LEVEL	112.4	dB	---	---	250 W
	117.2	dB	---	300 W	
	122.7	dB	375 W		

*Levels cited are for operation of a single system only. For two channel stereo, power can be divided equally between both channels.

Operation with amplifiers rated at from 1 to 5 times the continuous rating of our systems (boxed region of graph) is permissible, if extraordinary means are taken to insure that the long term maximum power capacity of 100 watts is not exceeded. Protection means would include: fusing, low-frequency high-pass filtering, power limit protection circuits, and good user judgment in preventing accidental overload conditions.

Amplifiers with surprisingly low power ratings can be used in most situations particularly for the highly efficient all-horn systems (KLIPSCHORN, BELLE KLIPSCH, and LA SCALA). As an example of table usage, a pair of KLIPSCHORNS driven by a mere 10 watts per channel amplifier (20 watts total) will generate a very loud level of 110 dB SPL (120 dB peaks) in the typical listening room before clipping. The less efficient HERESY system would require a 70 watt per channel amplifier for the same level.

When selecting a power amplifier, factors other than power rating should be considered. Because of the high efficiency of KLIPSCH Systems, the low power (0.1 to 1 watt) distortion ratings of the amplifier become very important. Consideration should be given also to the TIM (transient intermodulation) distortion of the amplifier. For KLIPSCH users, it would be more prudent to buy a super low distortion 50 watt amplifier instead of spending the same amount of money on a mediocre 200 watt unit.

The "official" KLIPSCH recommendation is still to use amplifiers rated at no more than 100 watts per channel on our systems, but that deviations are permissible in some circumstances for the knowledgeable user if he wants to suffer the consequences and be liable for the results! So--watch out!

KLIPSCH AND ASSOCIATES, INC.

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DOPE FROM HOPE

Vol. 16, No. 2, February, 1977

VENTED BOX BASS SPEAKERS AND HORN TREBLE SYSTEMS

Back in 1957 I undertook to design a "vented box" loudspeaker. The work was "cut and try", because the work of Neville Thiele had not yet penetrated the acoustics literature of the United States. His 1961 paper "Loudspeakers in Vented Boxes", Proc. IRE (Australia) was reprinted in the Journal of Audio Eng. Soc. in 1971. Our first experimental model and all subsequent models used horn midrange and tweeter speakers.

Dick Moore, an engineer formerly with KLIPSCH AND ASSOCIATES, INC., and later Don Keele, currently with this company, have gone over the design of our CORNWALL® Speaker and found it to be within a few percent of a Thiele B-3 alignment.

Most of the work of R. H. Small and others working on the Thiele designs have been more concerned with the amplitude vs. frequency response than with distortion. My work was largely directed to minimum distortion. From the results, it appears the B-3 alignment offers the lowest distortion among vented box alignments.

Reviewing our designs from time to time is a habit with us, and the CORNWALL has been reevaluated. The first such review took place, not to improve the existing performance, but to rearrange the structure to put the port on the same face (in front) as the driver unit. Since then, each review has resulted in the conclusion "Don't Change Anything". Well, actually, we have changed bass drivers several times with measurable improvement. In 1963 we adopted a new midrange horn and driver that amounted to a significant improvement. But our 1960 vented box bass systems would compare favorably with our current 1977 speakers.

This brings us to what really sets our CORNWALL apart from (perhaps) all other vented boxes.

The midrange is "where we live"; this is the frequency range where the ear is most sensitive to both tonal anomalies and to distortion. From the beginning of our company we have used horn-type midrange in all our speakers, because we can achieve a smoother amplitude response as well as an order of magnitude lower distortion. This applies to all our speakers from our HERESY and CORNWALL on up through our LA SCALA, BELLE KLIPSCH, and KLIPSCHORN.

You may wonder why we do not use a 2-inch direct radiator midrange and a 1-inch "D.R." tweeter. There are cogent reasons: they won't handle adequate power except at high distortion. One could go to larger sizes, or a plurality of units, but the power output capacity would increase only slightly, and the polar response (dispersion pattern) would look like the spokes of a wheel. The only way to accomplish the treble performance we wanted was with our horns. My papers on MODULATION DISTOR-

TION show that horns display one to three orders of magnitude lower distortion than direct radiators at the same power output level..

When you use our CORNWALL, you are using the best ported box bass speaker available, plus the best, lowest distortion, and most nearly "flat response" treble available at any price. We use the same mid-range driver and the same tweeter in all our speakers from our HERESY to our KLIPSCHORN.

Paul W. Klipsch

PAUL W. KLIPSCH

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DOPE FROM HOPE

Vol. 16, No. 3
March 1977

OTALA DISTORTION

Some 50-odd years ago Dr. Fabian Garcia, director of the Agricultural Experiment Station at New Mexico A & M (Now State University) told the students about his work developing bug-resistant strains of cotton. But at each success, some entomologist would invent a new bug to eat it.

In recent years, solid state amplifiers with 0.01% total harmonic distortion, are so nearly perfect as to defy measurement of the defects. But some of them have compared unfavorably with tube types on listening tests.

Why?

I think Dr. Matti Otala has discovered the bug to eat the new bug-resistant amplifiers.

Dr. Otala calls his discovery Transient Intermodulation Distortion (TIM for short, we'd like to see this called Otala distortion after its discoverer). This is a form of distortion which is exhibited when an amplifier is called on to amplify large amplitude signals with rapidly changing characteristics such as transients. Because of inherent time delays and slew-rate limitation in an early stage of the amplifier, the input stage of the amplifier actually blocks or turns off during the time the siganl is rapidly changing. This momentarily blocked characteristic causes audible distortion which imparts a "gritty" or "fuzzy" sound to the high frequencies.

TIM distortion is most often exhibited by amplifiers that use large amounts of negative feedback to flatten response, widen bandwidth, and reduce "ordinary" distortion. This is quite typical of some solid state amplifiers, particulary the ones which use rather slow general-purpose "op amps" that have very high open loop gains of some 80 to 100 dB. Otala points out that feedback in excess of 10 dB may give rise to this type of distortion. This may explain why **some** solid state amplifiers are regarded as inferior to tubes, but should not be construed to mean that all modern amplifiers are bad.

We are beginning a program of bug hunting with some pretty sophisticated equipment and hope in the not-too-remote future to have some comparative answers. As this is one of our non-profit activities, and it may take a few months to get into the project, I hope you will hold off your questions until summer. We hope to release information as it accumulates.

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For those who would study Dr. Otala's work, herewith is a bibliography.

1. M. Otala, "Transient Distortion in Transistorized Audio Power Amplifiers", IEEE Transactions, vol. AU-18, no. 3, pp. 234-239 (19[illegible]).

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4. M. Otala, R. Ensomaa, "Transient Intermodulation Distortion in Commercial Audio Amplifiers", Journal of the AES, vol. 22, no. 4, pp. 244-246 (1974)

5. M. Otala, E. Leinonen, "Possible Methods for the Measurement of Transient Intermodulation Distortion", 53rd AES Convention, Zurich 1975. Available as Report 1/76 in publication series of the Technical Research Centre of Finland.

6. J. E. Solomon, "The Monolithic Op Amp: A Tutorial Study", IEEE Journal Of the Solid State Circuits, vol. SC-9, no. 6, pp. 314-332 (1974)

7. M. Petri-Larmi, "Investigations on the Psychoacoustics of Transient Intermodulation Distortion", To be published.

8. IEC Publication 268-3, clause 20.

9. F. M. Huges, "Seventeen Amplifiers", Hi-Fi for Pleasure, pp. 56-63 (March 1976)

10. Deutsche Industrielle Norm, DIN 45500 B1.6 1.73.

11. E. Leinonen, M. Otala, J. Curl, "Method for Measuring Transient Intermodulation Distortion (TIM)", 55th AES Convention 1976, Preprint No. 1185 (H-6).

See Also DOPE FROM HOPE, "Electronic Crossover", Vol. 12, No. 2, "More on Bi-Amp", Vol. 15, No. 4, and "Amplifier Ratings to Drive Klipsch Systems", Vol. 16, No. 1.

PAUL W. KLIPSCH and D. B. (DON) KEELE, JR.

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DOPE FROM HOPE

Vol. 16, No. 5
July, 1977

MORE ABOUT IMITATIONS

At the risk of lending credence to the ravings of our alleged copiers, a discussion of the philosophy and products are in order.

Back in 1975, a leading restaurant operator was quoted in the Wall Street Journal, "The recipe doesn't mean all that much. It's the technique. No one can duplicate our technique. We're safe".

This seems to apply to KLIPSCH AND ASSOCIATES, INC. Many alleged copies of our loudspeakers have been tested here, and they have proven bad to worse. The "copiers" cut corners, or substituted a "better" driver unit (which evidently they had not tested), or used inferior materials, or failed to design a corner speaker so it could fit a corner — a page of fine print might fail to list the defects. One system was offered at about half the price we ask, and we aver that if it sold for a tenth as much, it would be overpriced.

We used to say the quality of the product of an infringer is on a par with his ethics. The "copier" who leads a customer to believe he has made a "true copy", but falls short of performance, is like an infringer.

Caveat Emptor.

There are some companies with neither the imagination to create their own designs nor the integrity and ability to copy properly. They were enjoined to discontinue the words "KLIPSCH" & "K-HORN" in their advertising and labeling. Only KLIPSCH AND ASSSOCIATES, INC. makes a "KLIPSCHORN®" Loudspeaker. We recently purchased a "factory assembled" unit from what appears to be the largest and most prominent of these companies. Our tests and examinations reveal poor frequency response curves and shoddy workmanship. They even copied some of our own early errors which, while not fatal, we saw fit to correct.

A curve sheet is included for your study — the curves show the copy in the best possible light. At any other network setting, the mid and high frequency performance was even worse. (Yes, they employed a user-controllable network). The materials were ill chosen for cheapness and the speaker looked like "homemade". The driver units were impressive, but their performance "underwhelming."

There is a lot of stir regarding these speakers, especially in the Pacific Northwest.

We thought you would like to know we are paying attention.

Perhaps a few "success" stories would be interesting:

1. Back in 1946, a New Yorker whom we'll call John Doe became a dealer for us, then a licensee, and, since royalties cost money, an infringer. He went broke. Some of his products still exist in the hands of people who wish they had bought the genuine article.

2. A large company (we'll call it Richard Roe Corp.) became a licensee. With extensive technology and facilities, their "copies" fell far short of our standards. Even so, the economic pressure caused them to terminate the license.

3. A foreign licensee did a bad job of copying part of our design, and their innovations on other parts got them some "rave" reviews of a negative nature. Our response curves of their products showed over 20 dB peak-trough ratio with big wide humps at 400 and 4,000 Hz. License canceled.

4. Another foreign company was about to be subject to legal action for the use of the word "KLIPSCHORN", but before the notice could be served, the company had ceased operation.

The thing is that the imitator is in it for the buck, and to hell with the customer. None of the listed four copiers can offer repair or replacement service. Their products are not "bargains".

Bob Moers and Paul W. Klipsch

(See also DOPE FROM HOPE, Vol. 15, No. 3, August, 1975, "Imitations?".)

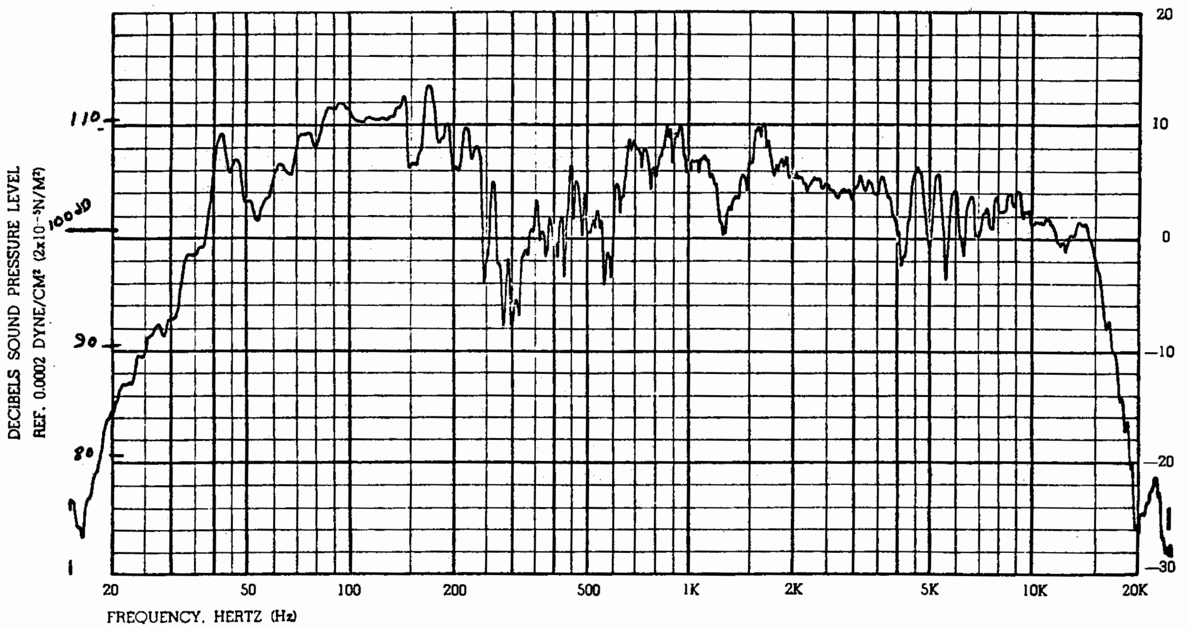

Fig. 1--"Brand X" Imitation.

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DOPE FROM HOPE

Vol. 16, No. 7
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NEW, New, New . . !

NOW IT IS "STEREO IMAGING"

Auditory perspective has been reinvented. Originally published by the staff of the Bell Telephone Laboratories in 1934, its basic principles were reviewed and elaborated upon in 1953, and the principles revived and translated into practical applications in 1958. "Stereo Geometry Tests", published in 1962 shows the comparison in accuracy of placement of sounds by direct listening and by stereophonic reproduction over two or three loudspeakers. A partial bibliography is appended. The papers listed are included in the AUDIO PAPERS from Klipsch and Associates, Inc.

So, the industry has "discovered" stereo imaging at long last! We have been pioneering it since 1954.

BIBLIOGRAPHY:

1. Bell Telephone Laboratories "Symposium on Auditory Perspective," **Trans. Am. Inst. Elect. Eng.**, vol. 53, pp. 9-32 and 214-219 (Jan. 1934).

2. W. B. Snow, "Basic Principles of Stereophonic Sound, " **J. Soc. Motion Picture and Television Eng.**, vol. 61, pp. 567-589 (Nov. 1953).

3. P. W. Klipsch, "Stereophonic Sound with Two Tracks, Three Channels By means of a Phantom Circuit (2PH3)," **J. Audio Eng. Soc.**, vol. 6, pp. 118-123 (April 1958).

4. P. W. Klipsch, "Stereo Geometry Tests," **IRE Trans. Audio**, vol. AU-10, pp. 174-176 (Nov.-Dec. 1962).

The above four papers don't "tell it all" but they come pretty close. There are other papers on stereo in the set of AUDIO PAPERS, and research is an ongoing activity.

But, to take a dirty crack at the contemporary purveyors of "hi-fi", it must be suspected that "stereo imaging" is a new gee-whiz word to sell a dilute form of stereo that has existed in purer form for at least 20 years.

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A NOTE ON LOUDSPEAKER IMPEDANCE AND ITS EFFECT ON AMPLIFIER DISTORTION

(The following was submitted to the Audio Engineering Society as a project note.)

When a horn type tweeter is used with a direct radiator woofer, the power demanded by the tweeter is in the order of 10 dB lower than that of the woofer. By using a matching transformer instead of a resistive pad, the impedance in the tweeter range becomes almost ten times as high as the impedance in the bass range. Some critics deplore this impedance variation. But there are advantages: the high impedance demands less power from the amplifier in the range where TIM distortion is worst.

There are many who advocate the testing of amplifiers with a loudspeaker load. Several amplifiers were tested for Otala distortion (Transient intermodulation distortion) with a resistive load and a speaker load.

The speaker chosen for a load consisted of a direct-radiator bass in a 40 liter sealed enclosure with horn midrange and tweeter elements. The impedance curve is shown in Fig. 1. Fig. 2 shows the Otala distortion using a resistive load, and Fig. 3 shows the absence of such distortion with the loudspeaker load. Both distortion curves were run at about ½ dB below clipping using a square wave of 3.18 kHz and a sine wave of 15 kHz at one fourth the peak amplitude.

The amplifier obviously is an excellent one, showing -76 dB TIM distortion components with a resistive load. But the significant thing is that the TIM distortion disappeared into the analyzer threshold with the loudspeaker load.

A natural conclusion is that a variation in loudspeaker impedance can be highly advantageous if the variation is in the right direction.

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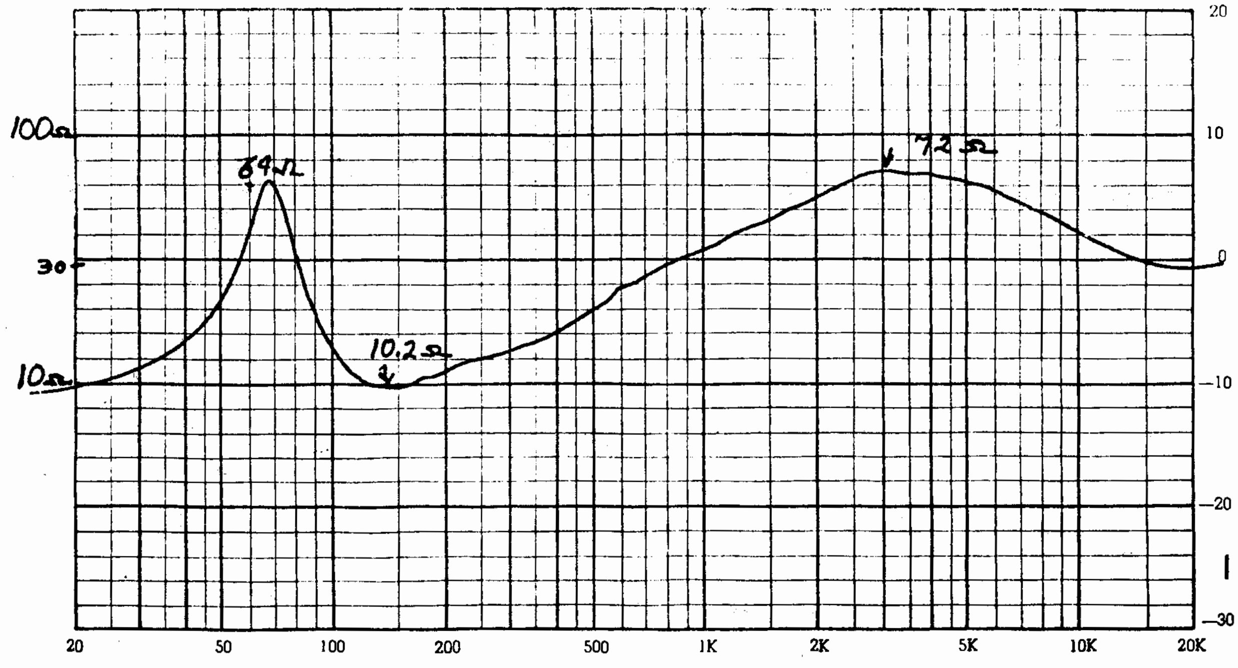

Fig. 1. Impedance of a KLIPSCH HERESY Loudspeaker (log scale).

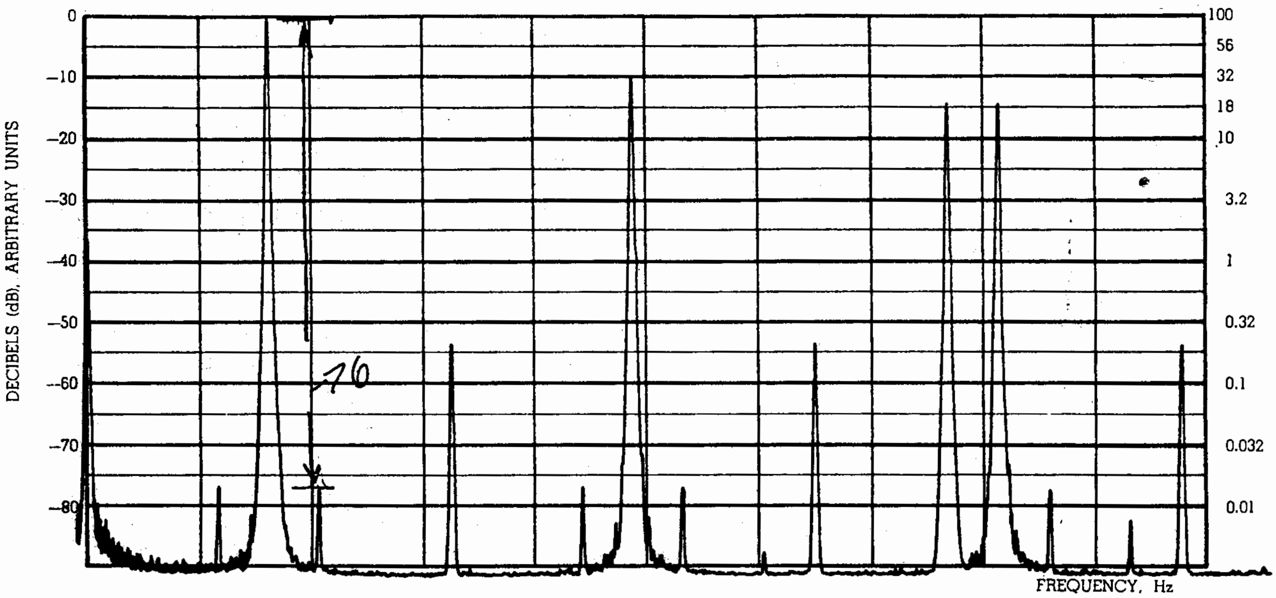

Fig. 2. Otala distortion of BGW 100 Amplifier. 8 Ω resistive load, "hard" signal input (approx. 600 kHz roll off).

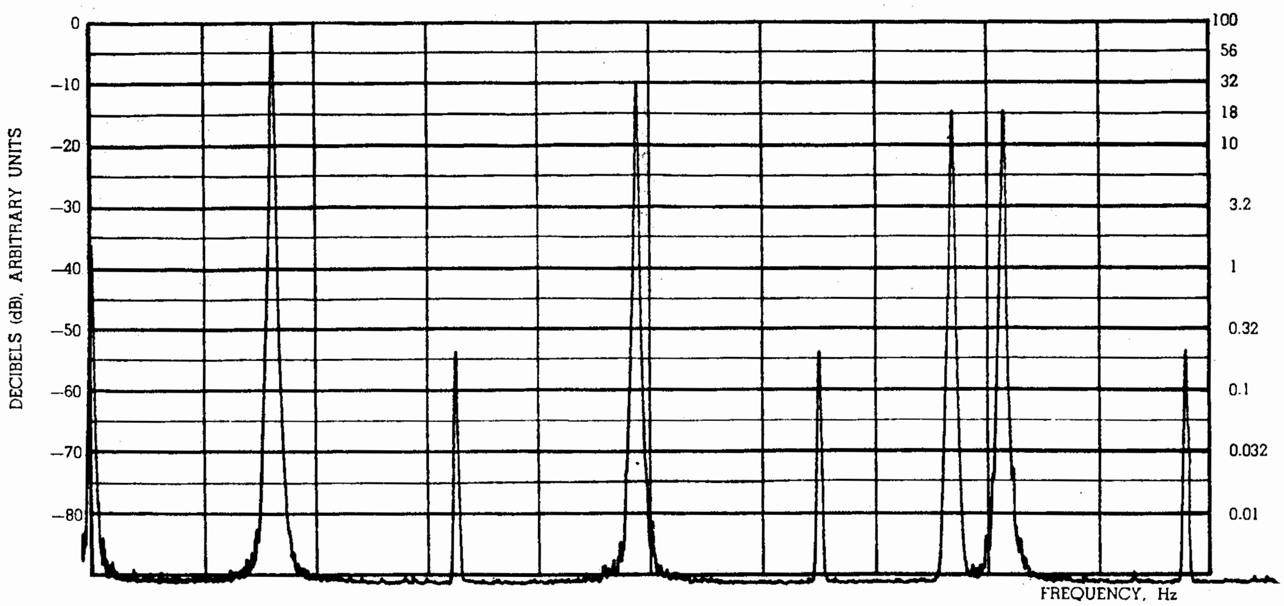

Fig. 3. Same, with HERESY Loudspeaker load.

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CROSSOVER NETWORK CHANGED: CORNWALL

NEW DEVELOPMENT

The product-evaulation program at KLIPSCH and Associates constitutes the lion's share of our Research and Development effort. We are now gratified to add another entry to the long list of performance improvements made in our product line over the years. Advances in the state-of-the-art of sound reproduction frequently result from innovation of new techniques of acoustic measurement, the aim being to utilize quantitative tests which closely corroborate the psychological sensations of the listener. Thus new measurement techniques or bolstered power and convenience of data-conversion bring excitement to the work of design, but always with the sobering constraint that new test results carry import only to the degree to which they have psychological significance. That is, the test format must be such that the genuinely most significant acoustic parameters receive the greatest emphasis during design. The latest in a long series of "technical papers" from KLIPSCH Engineering explains the operation of our unique "Anechoic Chamber With Optional Boundaries" (AES Preprint 1979) which facilitates deeper scrutiny of loudspeaker response characteristics.

The KLIPSCH CORNWALL has taken yet another step in its evolution toward optimum performance. A complete re-design of the crossover network has made possible a significant improvement which we now happily share with the audio public. Briefly, the new design entails the following:

1) Constriction of the electrical signals received by each driver to the spectral band over which the driver displays optimum characteristics is a salient feature of the design.

   A) Boosted woofer output is obtained in the 400 Hz to 600 Hz region, combined with a more rapid transition to an attenuating characteristic at frequencies above cut-off.

   B) Substantially decreased low-frequency energy is applied to the midrange driver. Though tremendous improvements are not possible in this regard, intermodulation distortion is somewhat reduced and the possibility of squawker failure is made even more remote.

   C) Dramatic improvement in the stop-band attenuation is provided by the high-pass filter associated with the K-77M Tweeter. Overall, this means that more energy can be derived from the tweeter above 6 kHz because of reduced current-flow into the tweeter in the mid-band.

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2) Studies of the cross-correlation of woofer and squawker output waveforms have precipitated a substantial increase in coherence near the crossover frequency.

A) The attenuation characteristics of the woofer (low-pass) and squawker (high-pass) filters are associated with a particular set of phase characteristics; the two are mutually dependent and cannot in general be manipulated individually. The roll-off rate of the woofer filter and the spectral location of the cut-off point of the squawker filter govern the relative phase relationship of their outputs in the crossover band. Only a special set of circumstances will allow optimization of filter phase characteristics without an associated deleterious effect on the amplitude attributes of the filters' transfer functions.

B) Driver polarity does not affect the amplitude response of the driver in question, but does in fact greatly affect the steady-state response of the system considered as a whole. In this case, the mechanical location of the sources, the phase characteristics of the electrical filters, and the relative polarity of the drivers are manipulated in a harmonious manner to render the crossover-band response smooth and non-anomalous.

Designated the Type B-2 Crossover, this new network is aimed at genuine improvements to the overall characteristics of the CORNWALL Loudspeaker System. The effective date of this change is approximately June 1, 1981. We plan to make the transition in a smooth manner, hence the early notice. As always, we will maintain stock of Type B Networks and adequate repair facilities for CORNWALL owners. Since in general no change in drivers or cabinet is associated with the network, an update from the Type B to the Type B-2 will be a relatively simple matter. Owners of older CORNWALLS are encouraged to incorporate up-to-date drive components (K-33E, K-55V with nested phasin plug, and K-77M) to maximize the benefits derived from use of the B-2 Crossover. An update kit (Type B to Type B-2) will soon be made available through the KLIPSCH dealer network.

DAN BYNUM
ENGINEER

DB:rh

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DOPE FROM HOPE

CONTROLLED DIRECTIVITY

Some of our contemporaries in speaker manufacturing have come up with "new" Directivity criteria.

We have had Controlled Directivity since 1945 (actually 1947 when we brought our X-5 treble horn into production as the K-5). Then we improved the control in 1963 with our new K-400 and later K-500, K-600, and K-700, and still later, K-260.

What we did, but failed to blow our horn about it, was to keep the horizontal directivity reasonably constant, and reduce the vertical angle of coverage as frequency increased, resulting in an overall flat sound pressure response.

Now I see that Brand X touts their horn as having constant directivity in the horizontal plane and a reduced vertical angular coverage resulting in a "self equalizing horn".

All we need to "compete" with Brand X is a collection of buzz words. Or maybe just get sales behind the product with our controlled directivity.

We have had it for 38 years and our R and D continues to improve the control. Just because we were the best in 1948 didn't lull us into complacency; we continue to improve. Improve the best? Yes!

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DOPE FROM HOPE

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3 August, 1983

LIVE MUSIC

Back in 1940 when I started working seriously with loudspeakers, my aim was to approach REproduction of original sound as closely as possible.

In 1946, when I produced the first components for the KLIPSCHORN® loudspeaker, that was still my aim.

REproduction with accuracy has been my aim ever since. To that end, I "recalibrate my ears" frequently at live concerts, and I urge our clients, factory workers, salespeople, and engineers to do the same. Many of our employees own speakers which they have probably built themselves as authenic KLIPSCH® models.

A notorious magazine obstensibly "devoted to high fidelity audio"* recommends comparing speakers to each other, not to original sound! "Educate your ears" but "listening to live performances is not effective"! How ridiculous can they get? Comparing speaker A with speaker B, then with speakers C, D - etc., can only measure speaker A with a rubber yardstick! Really, now, isn't it pretty clear that the valid yardstick must be live sound?

Yet, I recall a hi-fi addict who liked his BLASTOPHONIC 88 speakers with loudness, presence, absence etc. controls better than live music. That is his privilege; he paid for what he got.

But back to the objective; accuracy of REproduction. Once accuracy has been approached to a reasonable degree, one can always enhance, compress, expand, and alter tonal response. But if such traits are built into the speaker system, can it be restored to accuracy? Probably not. Each increment of "signal processing" adds its contribution of distortion, and restoration would be like trying to "restore" an out-of-focus photograph.

Somewhere in the magazine article the suggestion was to lay yourself in the hands of an "expert", and they even named one! That party happens to deny the existence of modulation distortion and claims even if it did exist, it would be inaudible.

So, go to live concerts and get your ears calibrated, and then listen to speaker A versus B, A versus C, etc., and if one of those happens to be one of ours, your calibrated ears will recognise the cleaness (freedom from distortion) of ours. You may notice also the dynamic range which does not need "enhancement", the genuiness of tone (no need for "tone controls"), and perhaps most of all, the freedom from "listener fatigue".

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* I'll not dignify the magazine by name.

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EDMOND'S MILLION GNAT PRINCIPLE OR DECIBELS SIMPLIFIED

The late Charles M. Edmonds tried to explain decibels to the members of the Colorado House of Representatives. The objective was a workable noise pollution law, but he had to explain noise measurement or sound level measurement to the legislators, most of whom knew nothing about measurement of sound or the units of such measure. He kindly gave me his permission to use his explanation.

He hit upon his "million gnat principle". If one gnat flies into a drumhead, a small sound is produced and this is his "reference level" or "zero level".

Number of gnats (n)	Logarithm	Decibels 10 x log (n)
1 gnat	log 1 = 0	"zero level"

If 10 gnats hit the drumhead simultaneously, a sound level meter would read ten times as much power or ten decibels. The logarithm of 10 is 1. A table may be produced:

		Decibels
1 gnat	log 1 = 0	0
10 gnats	log 10 = 1	10 log 10 = 10
100 gnats	log 100 = 2	10 log 100 = 20
1,000 gnats	log 1,000 = 3	10 log 1,000 = 30
10,000 gnats	log 10,000 = 4	10 log 10,000 = 40
100,000 gnats	log 100,000 = 5	10 log 100,000 = 50
1,000,000 gnats	log 1,000,000 = 6	10 log 1,000,000 = 60

But 60 dB is not enough! So, lets introduce another 6 orders of magnitude. Let 1,000,000 gnats = 1.0 megagnat or 1 Mgt.

1 Mgt	60 dB	Music at ppp
10 Mgt	70 dB	Conversation
100 Mgt	80 dB	Music p (arbitrary)
1,000 Mgt	90 dB	Music f (arbitrary)
10,000 Mgt	100 dB	Music ff (arbitrary)
100 000 Mgt	110 dB	Sound in "Star Wars"
1,000,000 Mgt	120 dB	Rock; threshold of pain

One motorcycle (not defined as to type of muffler, etc.) was measured at 50 ft. and was found to produce 88 dB sound pressure (measured on the "A" scale of a sound level meter). Two motorcycles would produce twice as much noise, or 2 x 88 = 176 dB. Right? Wrong! It would be 3 dB more sound pressure level, or 88 + 3 = 91 dB. 10 motorcycles would produce 88 + 10 = 98 dB. One automobile (type of muffler not stated) measured 60 dB at 50 feet. Tabulating:

	dB
1 Automobile at 50 feet	60
2 Automobiles at 50 feet	63
10 Automobiles at 50 feet	70

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A 50 watt amplifier, operated just below clipping level, into a loudspeaker of 0.1% efficiency would produce 0.05 acoustic watt peaks. In our laboratory listening room, this power would produce a peak sound pressure level of about 97 dB. A 100 watt amplifier could produce a peak output of 100 dB. A 1,000 watt amplifier would produce 110 dB peaks. Again tabulating:

Peak Amplifier Watts Output	Loudspeaker Efficiency 0.1% *	1.0% *	10% *	
	Peak Sound Level in Typical Room			C Scale
1	80	90	100	
10	90	100	110	
20	93	103	113	
100	100	110	120	
1,000	110	120	130	

*Efficiencies of some well known speakers.

"Acoustic Suspension"	0.05% to 0.5%	(typical)
KG^2	0.5%	(approximate)
HERESY	1%	(approximate)
CORNWALL	2%	(approximate)
KLIPSCHORN, LA SCALA, BELLE	9%	(approximate)
KLIPSCH MCM	20%	(approximate)

This is not intended to be a lesson in logarithms. The aim is to enable a salesman to explain the meaning of decibels to a person who wouldn't know a logarithm from a log roller, and cares less, but who wants audio in his home. It might help such a person to realize that choosing between a 50 and 100 watt amplifier is choosing between 97 and 100 decibels, an almost inaudible difference when listening to speech or music, but still costs twice as much, and doubles the danger of damage.

Unfortunately, while a 3 dB increase in sound pressure level is marginally audible, the heat produced is doubled and the loudspeaker failure rate might increase from zero to 100%. Remember that even the most efficient loudspeakers convert 80 or 90% of the power input into heat. If a speaker will stand a 200° C (360° F) rise from 30° ambient and continue to operate indefinitely, twice as much power input could be expected to produce a 400° C rise which would destroy the voice coil supporting structure and failure would be certain. In other words, heating is proportional to power input, and the sensation of loudness is proportional to that funny logarithmic proportion which is called decibels.

Note that speaker efficiency is a measure of its durability. And remember also that distortion in speakers is inversely proportional to efficiency: a 10 times increase in efficiency results in 1/10 as much distortion.

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