From the heading to Nate Garfinkle's original article in "Hi-fi News".

15-YEAR-OLD IDEA REVISITED . . .

A Column Speaker for super bass

Recent talk of super-bass filters and amplifiers has prompted quite a few readers to ask about appropriate loudspeaker systems. Answers to that one don't come easily but an idea that may appeal to some was suggested, some years ago, by Bernard Simpson, Editor of the erstwhile AWA publication "Radiotronics". Here is a summary of that article, which he prepared for "Electronics Australia".

As Bernard Simpson explained in the original article (May 1975, page 40) he had owned and operated various stereo systems through the years and was as satisfied as an enthusiast ever is with what he currently possesses.

However, being an enthusiast of classical pipe organ music, he had gradually become intrigued by the idea of reproducing, at adequate level, the octave between 30 and 60Hz that might be lurking on some of his favourite records. For sure, his existing system appeared to exhibit a good conventional bass response but, perhaps, it was composed as much of the partials of the big pipes, as of their real, gut-throbbing fundamentals.

What he was after was added weight, plus the kind of sensation that you tend to feel rather than hear. Big pipes and big drums are the main source of such sound.

The seed thought had been sown by Nate Garfinkle in "HiFi News" for July 1969, but apart from verifying that his listening room was large enough to cope with extended bass, Bernard Simpson had done nothing more about it.

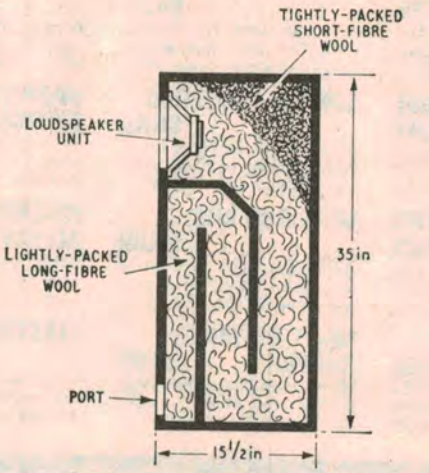
Nate Garfinkle's idea was to pick signal off each of the stereo channels through isolating resistors large enough so as not to affect their normal operation. The combined signal would then be fed to a small amplifier/filter ("active" filter) which would pass only those frequencies below about 70Hz. This low frequency mono signal would be fed to an auxiliary power amplifier and thence to a loudspeaker system which would have a meaningful response in the 30-70Hz region.

But, for Bernard Simpson, there were certain deterrents. which will not be unfamiliar to other enthusiasts:

- While his listening room was fairly spacious, the rather large and chunky enclosure suggested by Garfinkle, as suitable for super-bass, could not easily be accommodated.
- By the standards of the day a KEF B-139 woofer, as recommended, would strain the family budget.
- As a stereo purist, he doubted whether he could be happy with anything but sub-bass in stereo; that meant two speakers and two enclosures.

Impossible!

The idea accordingly languished until suddenly revived by a "For sale" notice offering two unused B-139s at a most attractive figure. He bought them and then took another, much longer look at Garfinkle's article and at the design of the loudspeaker enclosure suggested. It had originally been described by Dr A. R. Bailey in "Wireless World" for October 1965, and was the subject of further correspondence, notably in the December 1965 issue of that journal.



A side elevation of the transmission line enclosure suggested by Dr Bailey in "Wireless World". Width was given as 15½ inches and the port was shown as a wide, narrow slit approximating the area of the cone. Material used was ¼-inch.

The original Bailey enclosure incorporated both woofer and tweeter, being intended for full-range reproduction. Its main claim to fame (arguments aside) was a response substantially flat to 30Hz and only 5dB down at 20Hz. Hence its apparent suitability for super-bass.

In his "Wireless World" article, Dr Bailey stressed that the structure behind the cone should not be regarded as an enclosure, or a labyrinth or a resonant column; rather as an acoustic transmission line which, ideally, should be of infinitive length and therefore incapable either of radiation or of supporting reflected or standing waves.

Since an infinite length was not possible, he had sought to make the line long enough and just lossy enough to approach the ideal at the lowest required frequency. To make the line lossy, he had filled the space with a selected amount of carefully chosen natural fibres.

Looking at the Bailey design, Bernard Simpson noted that the good doctor had rather reluctantly folded the transmission line in order to produce an enclosure of conventional shape. In so doing, he had admitted that discontinuities can, themselves, produce reflections.

Then why not unfold the line again with the idea of mounting it flat against something, and hopefully out of the way?

Following this thought, various possible options suggest themselves for a thin column-like system:

- Rest it on the floor, on its side, behind a settee;
- Rest it on the floor, on its side,

beneath a window, partly disguised by the drapes;

- Bury it in a wall;
- Mount it in the ceiling space, venting into the room through two sealed cutouts.

All these suggestions rest on one fortuitous fact: provided the super bass speaker is handling very low frequencies only, it can be located virtually anywhere in the listening area, without calling attention to itself as a source of sound.

One other point should be made, however: a driver should never be mounted in such a situation (eg in a dividing wall, in the ceiling, under the floor) in such a way that there is a pressure differential on the respective sides of the driver. If there is, there is a risk that a gust of wind or a slammed door will pop the cone!

Bernard Simpson's answer was to mount the line (column?), narrow end down against the wall in the least-used, least visible corner of the listening room, so that it became little more than a discontinuity in the wall.

Its size was determined by scaling up Dr Bailey's drawing, taking a mean through its convolutions and coming up with a regular tapered column, large enough to accept the B-139 at the top and diminishing to five inches thick at the bottom. Having two woofers available, a

double column was constructed; but a single woofer and tube would normally be adequate, driven with a summed signal and a mono amplifier.

Having the speaker(s) facing upwards might suggest the possibility of the cone sagging in the course of time, but the B-139 doesn't seem to mind! If you have strong convictions on this score, it could alternatively be mounted on the face or on the least visible side.

Dimensions of the double column are shown in Fig. 1. A single enclosure would be only about 14 inches wide. Construction was with ¾in (now 18mm) particle board with 25mm dressed softwood as cleats. Cut accurately, then glue and screw for airtight, rattle-free joints. For preference, complete all the fitting and filling and, as a final operation, screw on the sloping panel, which will form the front of the unit. It can later be painted or papered to match the wall.

To retain the filling and also to inhibit the entry of "crawlies", the open end

Super bass speaker — continued

should be covered with metal gauze (fly wire), secured internally before final assembly. You will also need to plan how the column is going to be fastened to the wall, with the opening clear of the floor. It is not easy to make a slender tube free standing.

The role of the filling material is complex but it can be thought of as a huge number of independant fibres, all free to vibrate with the air trapped behind the loudspeaker cone. The air behaves as if it is heavier than it really is, artificially lengthening the tube. But at the same time, the material is lossy, tending to attenuate standing wave patterns and propagation through the tube.

For it to behave this way, it must maintain its distribution and springiness, and not sag into a lump at the bottom of the tube. If that were to happen, the lower end of the tube would virtually be plugged. The woofer would then be working into a smallish sealed enclosure, raising its cone resonance and producing a most obvious roll-off in the mid-bass region.

Following Dr Bailey's suggestion, Bernard Simpson used about 1kg of raw long-fibred wool (fibres about 10cm long) obtained from a specialist spinning/weaver supply shop. To transform it into suitable filling turned out to be quite a job: vegetable matter had to be removed and soiled areas cut out, and then the whole had to be teased into what finally ended up as an enormous fluffy mass.

Ever an enthusiast, Author Bernard Simpson built up a twin column with two loudspeakers, one for each stereo channel. For the ordinary domestic scene, a single channel would be adequate, fed with signals taken from both channels. The enclosure needs to be very solidly constructed but the method of assembly can be varied to suit facilities. Dimensions are not highly critical and other high performance, low resonance woofers could be utilised.

The low-pass filter/amplifier suggested in Bernard Simpson's 1975 article, with the parts list set out below. If fed from two stereo amplifiers, isolating resistors of typically 100k or more would be necessary between each source and the input terminal.

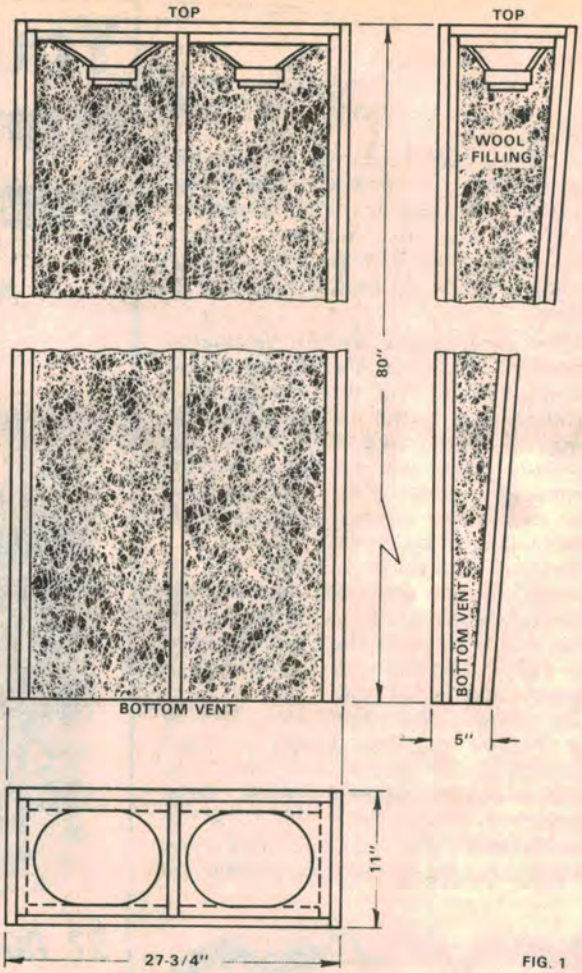


FIG. 1

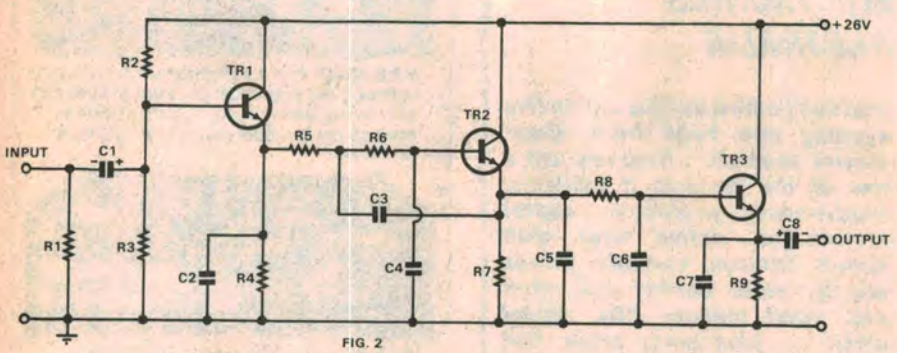


FIG. 2

But its springiness in this state proved little short of amazing.

Long-fibred scoured wool would require less handling but it was not actually tried.

Another option, available now in a greater variety than in '65, would be one or other of the synthetic fibres used widely for loudspeaker enclosures. It would probably be wise to avoid the more tightly compacted versions and go for open, springy filling that can be teased and pressed lightly to fill the total space.

Circuit details of a suitable filter/amplifier are shown in Fig. 2. Only one will be needed, followed by a mono amplifier if the lowest octave is to be handled by a single driver.

(For one channel, duplicate for full stereo)

CAPACITORS
C1, C8 10uF elec, 25 VW
C2, C5, C7 0.001uF poly
C3 0.27uF poly
C4 0.068uF poly
C6 0.15uF poly

RESISTORS
(All ½W, 10%)
R1 470k, R2 68k, R3 82k, R4 5.6k, R5, R6, R8 15k, R7, R9 10k

SEMICONDUCTORS
TR1, TR2, TR3 BC184L or equiv.

The left and right channel signals to feed the filter/amplifier can be picked up from the tape outlet sockets; if they are in use, the signals could be tapped off the live loudspeaker outlets.

Wherever derived, be sure to insert isolating resistors between each pickup point and the input terminal to R1 and C1. We have suggested 0.1 megohm, as being normally adequate to preserve the isolation of the two source channels. Hopefully a supply of something like +25V will be accessible within the main amplifier.

Alternatively, a more up-to-date active filter was described in our February 1980 issue. It has the option of alternative pass bands but the lower curves, rolling off through 70Hz and 50Hz respectively, would normally be preferred.

A mono super bass amplifier would need to be generously rated in terms of power output, at least matching the total power of the two stereo channels. For stereo super bass, the supplementary amplifier should at least match the existing unit.

When setting up a super bass system, be cautious rather than otherwise. The role of a super bass system is to enrich ultra bass where it exists. On a great deal of program material, it will not be making a significant contribution.

Footnote: KEF B-139 woofers are available through Audioson International Pty Ltd, 64 Winbourne Rd, Brookvale, 2100. Phone (02) 938 1186.