



## The Original Internal Resonator Banjo: the Dobson Great Echo

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C. E. Dobson designed, patented in 1888, produced, and marketed a banjo, the Great Echo, whose unique feature was an internal resonator. Although the instruments he made had a single-piece spun-over metal rim, his patent acknowledged that it could be made of wood and achieve the same desired goal: a more mellow sound and a slight “echo.” In spite of the fact that examples survive to this day, the Great Echo is never mentioned in discussions of the history internal resonators, which always begin with F. Bacon’s 1906 patent and ensuing production of his ff Professional. Nor does the Great Echo appear in any current histories of 19<sup>th</sup> Century banjo.

Starting with a salvaged  $9\frac{3}{4}$ " Great Echo rim, I cobbled together a 20" scale 5-string. Sound samples of this and of a full-size instrument are included.

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Invention of the internal resonator has always been attributed to Fred Bacon. His patent was granted in 1906[1]. A virtuoso stage performer, Bacon originally contracted out the actual manufacture. The growing popularity of his internal resonator 5-string banjo, the “ff Professional,” led him eventually to organize his own production facility. The Bacon Banjo Company grew to be large and very successful in the jazz age, producing deluxe 4-string resonator banjos. The internal resonator design continues to have its enthusiasts among 5-string players. Over the years, small companies and individual luthiers have produced copies and variants.

These are “open-back” banjos. The internal resonator does not make them louder or given any impression of being louder. This is in contrast to the wrap-around, solid-back resonator of bluegrass and jazz banjos. Rather, the internal resonator is thought to make the sound a bit more mellow and bestow some sort of enhanced “presence” to the instrument. In his patent application, Bacon described his invention “whereby a more lasting tone is produced and the quality of same improved. ...[The design provides] the rim with a peculiarly-constructed annular chamber within which the partly-confined air can vibrate in harmony with the strings and cooperate therewith to produce a strong and resonant tone.” Unlike the many fanciful and hyperbolic design claims from the late 19<sup>th</sup> and early 20<sup>th</sup> Century, this one certainly has basis in acoustical science, both from analysis of recordings and from basic theory.[2]

But Charles Edgar Dobson, Jr. was awarded a patent in 1888 for the same idea.[3] In that patent he wrote,

“The hoop B is preferably made of metal such as brass, German silver, or nickel **though it may be made of wood**, and is of the usual dimensions. Extending from the back edge of the hoop B and flaring inward is a second or supplemental hoop or rim, *b*, which terminates about a half an inch (more or less) from the head O. The hoop *b* is made of the same material as the hoop B, and when metal is employed it is preferably made integral with the hoop B, it being turned inward by the spinning process. The flare or angle of the hoop *b* is such as to leave a considerable space between the two hoops, as shown, and **it is found that the effect of the air partially confined in this space between the two hoops is such as to greatly modify and improve the tone of the instrument by causing a kind of echo which deprives the tone of much of its harsh and metallic quality.**” (Boldface is my edit.)

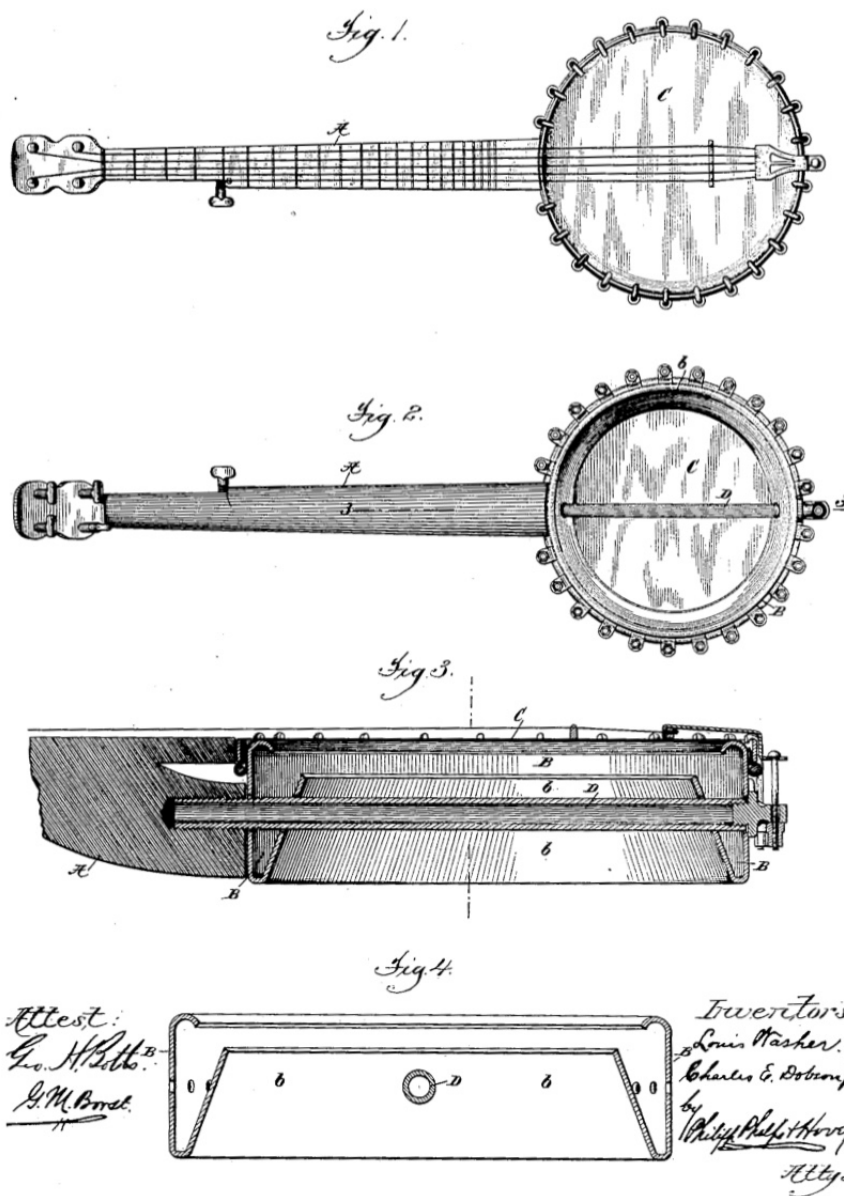
(No Model.)

L. WASHER &amp; C. E. DOBSON, Jr.

BANJO.

No. 392,381.

Patented Nov. 6, 1888.



N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

FIG. 1. C. E. Dobson's 1888 patent; see the **APPENDIX** below for the full text.

Dobson went into production of this design, christened “The Great Echo Banjo.” Judging by photos on-line of surviving instruments, the rims were all constructed from a single, spun-over piece of metal. But Dobson emphasized that the same idea would work when fabricated out of wood. Of the half dozen photos I have seen, the serial numbers range from 188 to 4063. However, there is no telling whether all the numbers in between were Great Echos nor how many more Dobson actually made.

The half dozen Great Echoes mentioned above are from recent years’ seller’s advertisements and collectors’ photos. They seem to be regarded as rare but not unheard-of. Nevertheless, I do not recall it ever having been mentioned in any discussion of internal resonators or more general banjo histories. (I’ve read quite a few.) The book that comes the closest is the fine 1999 history by Philip Gura and James Bollman, *America’s instrument: the banjo in the nineteenth century*. The five Dobson brothers are featured quite prominently, a reflection of their renown and impact that spanned the second half of that century. Gura & Bollman describe many of the Dobsons’ patents and include photos of extant examples and reproductions of the patent sketches. They describe three of Charles Edgar’s patents and imply that those three are all he ever filed. They missed the Great Echo.

### **The Dobson Brothers**

The five Dobson brothers of New York, New York collectively had a huge impact on the banjo in America. Their ages spanned twenty six years. Charles Edgar was the second oldest. Starting in the 1850’s and running into the 20<sup>th</sup> Century, they were renowned performers, teachers, writers, innovators, and manufacturers. Between them, they were awarded a great many patents. The metal tone ring, frets, fingering tablature, top tensioning, and a solid back are among the many things for which one of the Dobsons has reasonable claim for the innovation. They pursued patent protection. One case, pressed by Henry Clay and Charles Edgar, the two oldest brothers, famously went to the U. S. Supreme Court in 1893. They lost.

That the U. S. Patent Office would approve Bacon’s application in 1906 is not extraordinary, but why no Dobson response? In 1906, the eldest Dobson, Henry Clay, was 74, and he passed away in 1908. Charles Edgar was then 67 and passed away in 1910. And in 1910, Bacon’s operation was not yet in full swing. He was still contracting out the manufacturing.



## Dobson and Bacon tone rings

Henry Clay's (earliest?) 1867 patent included a top-tensioned head and a resonator back. Many patents followed. In 1881, he introduced what we now call a tone ring. It featured a horizontal flange, about an inch wide and concave-down. It remains a popular design option to this day, offered by many independent luthiers on their new instruments. Bacon included a similar wide-flange tone ring in his 1906 patent and all subsequent ff Professional production. This tone ring continues to have its enthusiasts, although maybe not as many as the Dobson. The salient difference is that the Bacon flange is concave-up. The resemblance is obvious and often commented upon. And the simplest acoustics analysis would predict similar behavior.[6] However, it is not surprising that people with good ears who care a lot about the sound can hear differences. Both from basic physics and from experience, the geometry of the region right under the edge of the head has significant impact. The simple physics observation is that the highest frequency sounds are radiated from a narrow region near the edge.[7] In practice, many luthiers and their discerning customers are very particular about that edge geometry. For example, they can hear the difference between different radii of curvature of the lip at the top of the rim. And they can hear an effect of a bevel cut into the inside of the rim just below the head.

Curiously, the Great Echo apparently did not feature a Dobson tone-ring-style flange.



FIG. 2. Bill Rickard's Dobson-style ring[4] (left) and Stewart-McDonald's Bacon-style[5]

## Rim Bottoms

Air inside the annular region, i.e., between the inner wall and the rim, resonates at a much lower frequency than the lowest resonance of the same size rim without that wall. That contributes to the more mellow sound.[2] But the very lowest frequency air resonance within the body of any stringed instrument has a qualitatively different origin and behavior. Named after Helmholtz, the first physicist who analyzed it, it involves air going in and out of a sound hole while all the air inside the body contracts and expands. It's responsible for the note you hear when blowing across the mouth of a bottle. The sound hole of an open back banjo is the opening between the banjo and the player's body that allows the air to go through.

The internal resonator design makes that opening smaller. That, in turn, lowers the frequency of the Helmholtz resonance. The Bacon all-wood design tends to make that opening smaller than the spun-over Dobson. However, how the player holds the banjo has an even greater effect on the effective size of the opening. So, that distinction between the two designs is not significant.

## Cobbled Great Echo Banjeaurine

I bought a salvaged but battered  $9\frac{3}{4}$ " Great Echo rim. The inner wall is an inch in from the rim at its top and has a  $\frac{7}{16}$ " gap from the underside of the head. The rim is  $2\frac{3}{8}$ " deep. It came with a set of unmatched hooks and nuts reminiscent of the motley crew of the Hispaniola. I already had a 1925 Vega 4-string neck. (It had come along for the ride when I bought a 5-string conversion some years ago.) The dowel stick was about an inch longer than the rim diameter. Rather than cut it down and end up with the bridge rather close to the tailpiece, I crafted an extension to the neck, a crude block construction. I installed a 5th string tuner and a little side block to support a screw head pip. This sort of bricolage is certainly not my invention. It's no problem that the 5th string floats over thin air if one never frets that string anyway. However, I am fond of fretting the first three strings above the 17th fret, which was as far as the Vega fretboard went. So I included a fretboard extension in my design. Again, this is not my invention but is, in fact, rather common on short scale banjos. This one's scale is 20". It required that I mount a skin head because the rim had more than one dent and was out of round and not flat.

The neck angle as determined by the set of the dowel stick in the neck did not really match the rim. The lay of the dowel stick within the rim is non-negotiable. It's metal and has a unique channel that surrounds the dowel stick. I'm not equipped to re-set a dowel stick. So I had to compensate for the discrepancy with the bridge. 1" high was required to get reasonable string action. (Typical bridge heights fall in the range  $\frac{1}{2}$ " to  $\frac{11}{16}$ ".)

Needless to say, it sounds like a banjo — or, more precisely a banjeaurine. “Banjeaurine” is the instrument and spelling invented by S. S. Stewart in 1885. It has a short-scale and is typically tuned a 4th or 5th higher than standard. Stewart invented it to serve as one of the lead instruments of the banjo orchestra. (Yes, banjo orchestras were a big thing in his day, and he was their most enthusiastic promoter.) The peculiar spelling was to suggest an air of refinement. Stewart's earliest models had  $12\frac{1}{2}$ " rims (to make them louder). For a variety of reasons Stewart and the many other manufacturers who copied his idea soon settled on 10 to 11 inches.

At first I was surprised by the sustain. It was longer than I'm used to. I suspect that's what Dobson meant by “echo” (or Bacon meant by “a more lasting tone”). Then I remembered that the Bacon-style internal resonators I installed on a couple of favorite regular size open backs also produced extra sustain. In those cases, I trimmed that with lighter bridges. The first 1" bridge I made for my Great Echo came out to 1.9 gm, a weight which is already very much on the light side of the typical 2.6 gm. So I left it at that — and appreciate the echo.

Here's what it looks like:





### **The actual sound**

I found a sound sample on-line from Huff & Meade, a banjo-fiddle duet who've recorded some fine tunes that you can find on their site.[8] Here's just a little snippet on a Dobson Great Echo banjo:

Click here or go to

<http://www.its.caltech.edu/~politzer/GreatEcho/Huff-and-Meade-sample.mp3>

When I've tried to figure out the physics of some particular banjo design element, I'd compare the actual sounds with that element altered or removed. For now, I do not have anything that would serve as an experimental control sample to compare to the Great Echo banjeaurine that I assembled. The following is just to confirm that it sounds like a banjo:

Click or go to <http://www.its.caltech.edu/~politzer/GreatEcho/tip.mp3>



## APPENDIX: the Great Echo patent text

## UNITED STATES PATENT OFFICE.

LOUIS WASHER AND CHARLES E. DOBSON, JR., OF NEW YORK, N. Y.

## BANJO.

SPECIFICATION forming part of Letters Patent No. 392,381, dated November 6, 1888.

Application filed January 10, 1888. Serial No. 260,307. (No model.)

*To all whom it may concern:*

Be it known that we, LOUIS WASHER and CHARLES E. DOBSON, JR., citizens of the United States, residing at New York, county of New York, and State of New York, have invented certain new and useful Improvements in Banjos, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

This invention relates to improvements in the construction of banjos, and has for its object to improve the music of these instruments by preventing the harsh metallic tones which are inherent in these instruments as ordinarily constructed. This is effected by providing the instrument with what may be termed a "double hoop"—that is to say, a supplemental hoop or rim which unites with the main hoop or rim at the back of the instrument, and, flaring inward, terminates at about a half an inch (more or less) from the head.

As a full understanding of the invention can only be given by an illustration and a somewhat detailed description of an instrument embodying the same, all further preliminary description will be omitted and a full description given, reference being had to the accompanying drawings, in which—

Figure 1 is a face view of a banjo constructed according to the present invention. Fig. 2 is a back view of the same. Fig. 3 is an enlarged section taken on the line 3 of Fig. 2. Fig. 4 is a similar view of the hoop, taken at right angles to Fig. 3.

Referring to said figures, it is to be understood that as to its general construction and organization the banjo illustrated therein is the same as the ordinary instruments of that class.

The neck or finger-piece A is of the ordinary form, and is provided with the hoop or rim B, over which the parchment head C is stretched and secured in the usual manner.

The hoop B is preferably made of metal—such as brass, German silver, or nickel—though it may be made of wood, and is of the usual dimensions. Extending from the back edge of the hoop B and flaring inward is a second or supplemental hoop or rim, *b*, which terminates about a half an inch (more or less) from the head C. The hoop *b* is made of the same material as the hoop B, and when metal is employed it is preferably made integral with the hoop B, it being turned inward by the spinning process. The flare or angle of the hoop *b* is such as to leave a considerable space between the two hoops, as shown, and it is found that the effect of the air partially confined in this space between the two hoops is such as to greatly modify and improve the tone of the instrument by causing a kind of echo which deprives the tone of much of its harsh and metallic quality.

In order to strengthen the connection between the neck or finger-piece and the hoop, the neck is provided with a metallic tubular extension, D, which passes through and is secured in suitable openings formed in the hoops B *b*, as best shown in Fig. 3.

What we claim is—

In a banjo, the combination, with the hoop B and head C, of the supplemental hoop *b*, uniting with the back edge of the hoop B and flaring inward and terminating in close proximity to but not in contact with the head, the space between the hoop B and the supplemental hoop being open and unobstructed, substantially as described.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

LOUIS WASHER.  
CHAS. E. DOBSON, JR.

Witnesses:  
T. H. PALMER,  
G. M. BORST.

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- [1] Fred Bacon's 1906 patent: <https://patents.google.com/patent/US823985>
- [2] D. Politzer, *Physics of the Bacon Internal Resonator Banjo*, <http://www.its.caltech.edu/~politzer>, HDP: 16 – 02; scroll down to JUNE 2016.
- [3] C. E. Dobson's 1888 banjo patent: <https://www.google.com/patents/US392381>
- [4] Bill Rickard manufactures and sells very fine parts and whole banjos; see <https://rickardbanjos.com/>
- [5] Stewart-McDonald is a major U. S. luthier supply company; see <https://www.stewmac.com/>
- [6] D. Politzer, *A Bacon Tone Ring on an Open-Back Banjo*, <http://www.its.caltech.edu/~politzer>, HDP: 16 – 01; scroll down to APRIL 2016.
- [7] The sounds radiating from adjoining regions of the head as they go oppositely up and down tend to cancel. The regions at the edge have the fewest canceling neighbors.
- [8] For Huff & Meade's music, see <https://huffmeade.bandcamp.com/>