THE HORN DOCTOR
INSIDE THE N3

IT WAS SWANSON'S MOST ELEGANT HORN, BUT WAS ITS BEAUTIFUL DESIGN HIS GREATEST FAILURE?

By KEN KANNE, DH*

Robert Swanson was a most prolific inventor, and his passion was air horns and whistles. He was constantly experimenting with different designs, materials, and construction methods in a never-ending effort to make his designs better, louder, more durable, and even simpler. Although most of his designs had their own rugged appeal, none could be called 'pretty' (except by us collectors) save one; the Nathan Airchime N3.

Not all his horns were "function before form". In fact, 'pretty' is too tame a word for it. "Elegant" is the term that comes to mind when I see one of the two remaining examples in collectors' hands. Swanson had a little Industrial Design Engineer in him, sort of the Raymond Loewe of the horn world, and on the N3 he let his imagination run wild. It wasn't all style and smoothness, however. The internal design was a step above anything else Swanson had created. Built to be assembled without gaskets, the machining was extremely precise to assure the assembled horn would not leak air when in use. As well made as the horns were, the very thing that made them a mechanical marvel was the very same thing that caused Swanson to abandon the design. This may well have been Swanson's biggest error in horn design. The close tolerances with no gasket between led to almost immediate corrosion due to galvanic action, essentially locking the parts together.

According to Jodie Wells' excellent article in the last issue of *H&W* #113, Swanson knew the design would not hold up in the industrial (railroad) world. Quoting Jodie's article from the interview with Ernie Cannon† [owner of Cannon Machine, and later Airchime, where the horns were actually made]: "One question Deane [Ellsworth] was quick to ask: 'Do you remember the early batch of N3 horns? Why did Swanson change the design so early on?' According to Ernie, 'the whistles [they still call them whistles, a carryover from the steam era. Ed.] were finely tuned as well as precisely machined..... [The] metals needed room to breathe, and, with no gaskets, [and that precise machining. Ed.] that wouldn't happen. After a short time the touching surfaces started to corrode which led to fouling. The M whistles utilized gaskets that apparently prevented this from happening, which turned out to be an improvement over the N style close-clearance fits'."

After seeing Jodie's article in print, and having her Nathan Airchime N3 #95 here for cosmetic and a little mechanical restoration, I saw a unique opportunity to give you, our subscribers, a chance to see what makes the N3 so special.

I hope the following pictures will help you see just how amazing the N3 was. The close clearance fit was similar to the Leslie Supertyfon design, with the 'neck' portion of the horn bells fitting in the manifold, but the real seal was formed by the flat portions on the front and rear of the manifold mating with the flats of the bell flanges and the flats of the front face of the diaphragm chambers. [See pictures one and two, next page.] While working on this horn I found the distance from the mating face to the nozzle ring face was within 0.002" of being identical on all three chambers. This was some outstanding machine work.

Notice the tiny pits (the 'freckles') in the sealing face on the chambers. This was where the corrosion would start. The bells likewise had tiny pits in the flange sealing surface. Oddly enough, the manifold was pit-free.

Inside the chambers there was very little corrosion, but what was there was primarily on or near the clamp ring. A VERY light touchup of the machining brought fresh, unpitted material to bear against the diaphragm. Notice the battered and bent spanner wrench lugs on the cap. The lugs were restored to like-new on all three caps.

* DH = Doctor of Horns

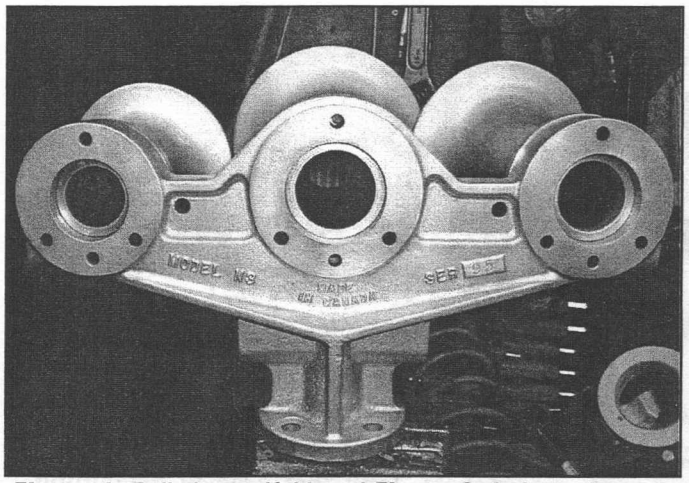
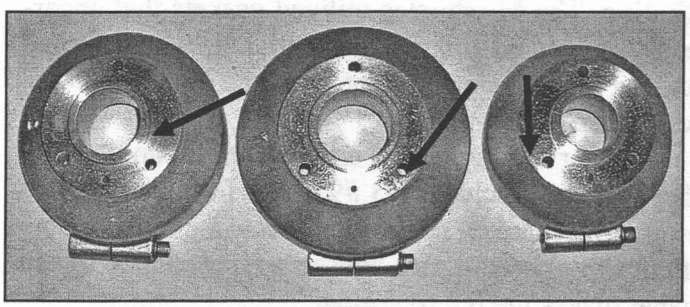


Figure 1. Bells in manifold, and **Figure 2, below,** the mating surfaces of the heads where, if you look closely, you'll see some pitting (black arrows.)



Some odd things to look at in and on the chamber.....the little 'nub' on the outside surface was for the safety wire. Likewise the drilled lug on the

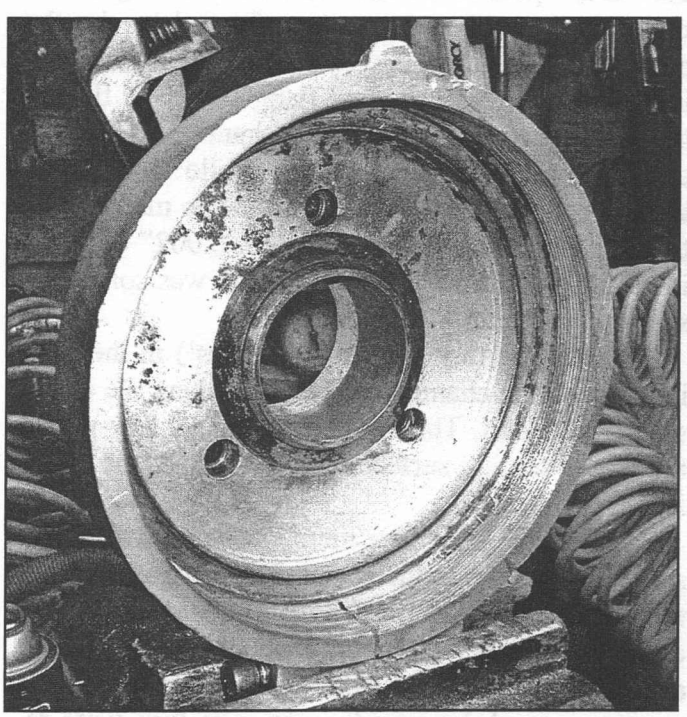


Figure 3. Number one head as found. Note internal corrosion and other details [see text.]

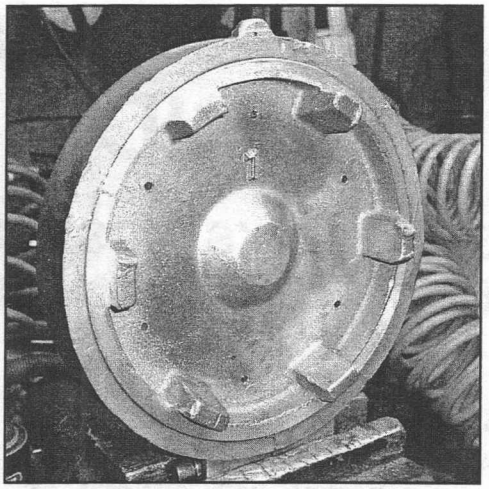


Figure 4. head with cap in place [before repairs.] Note damage to some of the lugs on the cap.

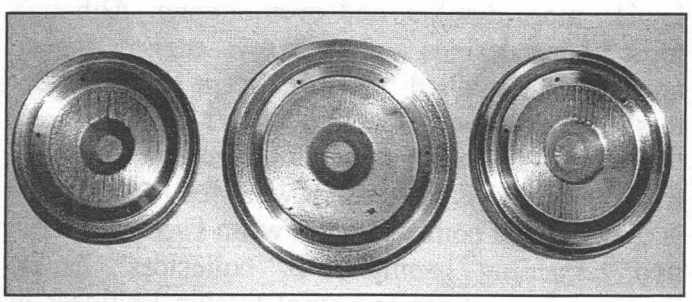
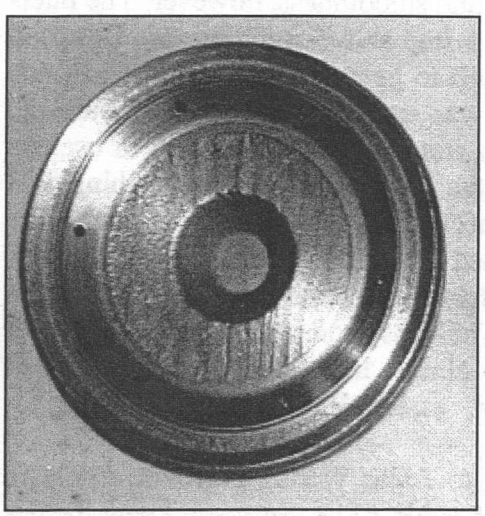


Figure 5, above, inside of caps, **figure 6, below,** a closeup of one of the caps showing wood grain from original wood pattern or mold master.



cap. No drilling through the threads to safety-wire it like on the M horns. Observe the nozzle..... pressed in, and the wide flange below the nozzle itself forms an integral diffuser ring, to spread the incoming air flow evenly around the diaphragm. The air inlet hole is completely hidden on the inside. The three assembly bolts are socket head cap screws, and fit in countersunk holes so that the bolt heads are out of the air stream. It is unlikely that had much effect on the horn's efficiency, but it is another example of the 'elegance' of the overall design.

Look closely at the picture of the inside of the caps. The wood grain of the mold masters is plainly visible. By contrast, the outside surfaces of the caps show no grain patterns, and the finish is relatively smooth. The clamp rings on the caps had been ma-

chined in that picture. It took very little to "freshen" the contact surfaces.

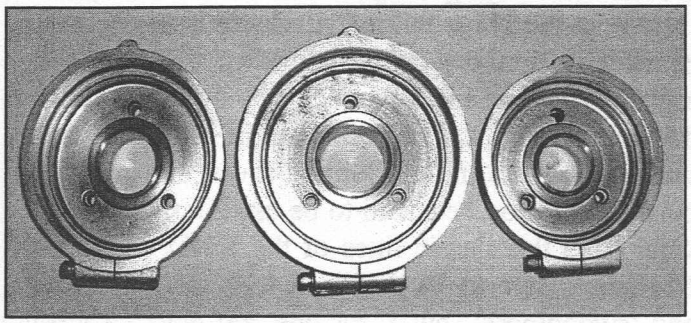


Figure 7. Inside of heads. See text for details to look for in this picture.

Comparing Fred Berry's N3 with Jodie's, I found very little that was different, but one very noticeable difference was the discovery that there were two holes in the manifold on #95, but no 'extra holes' on Fred's #88. I believe the holes were for a machining setup, for securing the manifold while the milling operations were performed on the casting. The mark where the nut/washer was tightened is still visible. Incidentally, When Jodie, Deane Ellsworth and Bill Williamson went to British Columbia in late June/early July of 2006 and visited Airchime, Ltd., the folks at Airchime brought out the record books from the beginning of the air horn production and made copies of the first few pages. This has been a Godsend for us trying to determine when these early horns were put in production, and how many were made. It has also been an eye opening experience! For years we've accepted the conventional wisdom that only 20 N3s were made. In actuality, one BATCH of them was a 20 horn run, but all told, there were at LEAST 57 of them made concurrently with the H series. In addition, several N1s like Bob Packer's, and even some H2s are shown in the records. Here are the confirmed N3 serial numbers (MANY thanks to Jodie for supplying this list), all interspersed with the H5 production: after H5 #76 came the first-serial numbered and shipped-N3, #77, then #78-#81 (5 horns) in December 1949. Continuing in Dec '49, the next batch of N3s, #88 through #107 (20 horns), then the series skips to #110 and goes through #115 (6 horns), then #136 through #151 (16 horns). On January 12th, 1950 the next run came through, #154 through #162 (9 horns), and the last N3, #167, rolled off the assembly line that day. A cryptic note was added alongside the record of the #88, now owned by Fred Berry as noted above. It was the only N3 to have a notation in the production record. The note reads: "Pilot Model Not STD". It obviously wasn't the first N3 serial numbered or shipped, but it may(!) have been the first produced. Just speculating, but it might have been held for testing before being given a serial number and shipped. If and when another N3 surfaces, so that we have another example to compare with, we may never know what was " Not STD" about #88. Did the 57 N3s (and the N1s and H2s) undergo a running series of changes like the H5s did? The H5 had several major changes during its production, and I'll bet the N3 was likewise "tweaked" during its brief run.

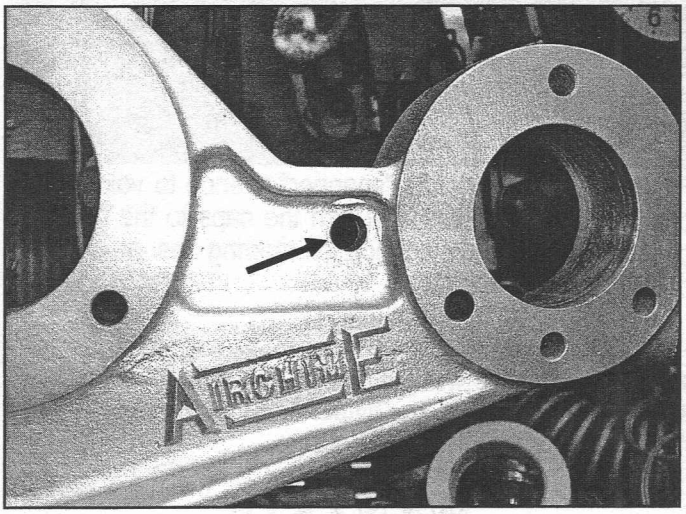


Figure 8. Extra hole in casting (arrow).

Once all the machine and cosmetic work was finished on #95, and all the parts were clear coated, assembly began. With the #1 and #2 air ports

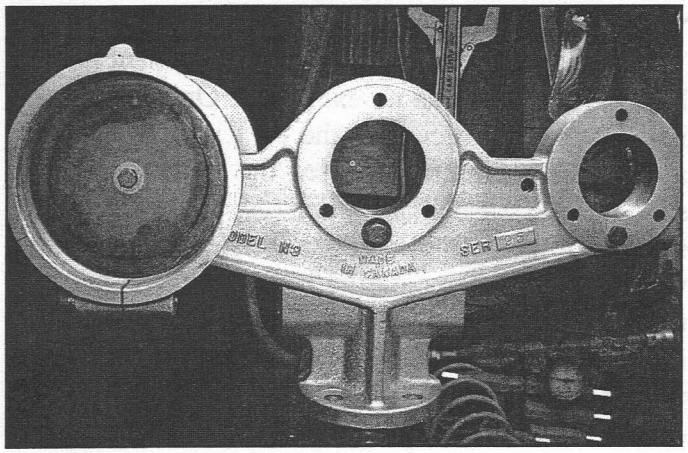


Figure 9. Number four head bolted on. Notice the $^{5}/_{16}$ bolts and rubber washers in the air holes for the other two bells to protect them. [See text.]

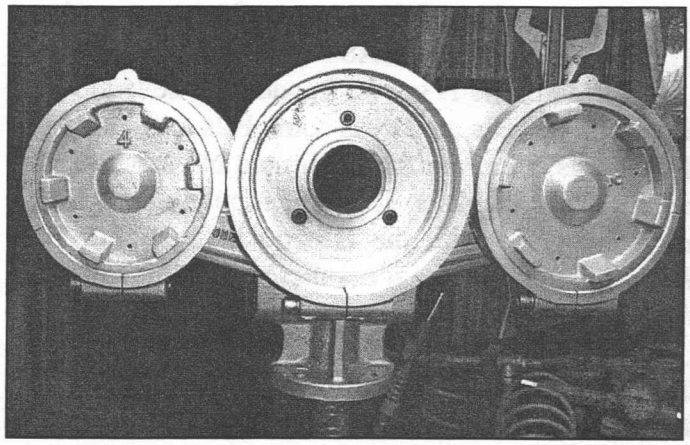


Figure 10. No. one head in place, two and four already set up.

blocked (rubber flat washers on 5/16" bolts with wing nuts for ease of attachment), I bolted the #4 head and bell on, and placed the diaphragm in the head. Plenty of Jet-Lube Zinc Dust Petrolatum anti-seize for aluminum was applied to the threads in the chamber and the threads on the cap. Never, under any circumstances, skimp on the anti-seize. The consequences of not using it, using the wrong kind of lube, or not using enough, can be disastrous. With the threads lubed, I screwed the cap in until it barely made contact with the diaphragm, then I introduced air at about 20 PSI into the manifold through a ball valve air hookup. I slowly tightened the cap using a wooden "spanner" to keep from marring the just-fixed spanner lugs. Just like an M horn, the diaphragm first rattled and then hummed, and finally started an ascending note as the preload of the cap forced the diaphragm against the nozzle and clamp ring. When the chamber/diaphragm broke into resonance the chime was close to being "in voice". Usually it will take a little more "oomph" on the cap after the initial resonant note is heard. This horn was no exception. Once I was satisfied with the voicing of the #4 I put the #2 head and cap in place and repeated the process, making sure the #4 wasn't "stepping on" (blowing at the same time or before) the #2. When the #2 and #4 were voiced so they started in sequence, I installed the #1 chamber and bell, and once again the newly installed chime was voiced. Finally, with the horn voiced so that it was 'stepping in sequence', I put it on the outside test pipe and blew it extensively. Sometimes back-cap adjusted horns will change their voicing after being blown, but such has not been the case with #95. It has (so-far) stayed right on sequence and is "oh-my-gosh!" loud, but oh-so-smooth. The horn stands as a tribute to Robert Swanson's design genius.

Was the N3 a failure? It worked, and worked beautifully, but the exotic nature of the no-gasket assembly doomed it. I wonder why Swanson didn't do the obvious.....put gaskets in it!? Regardless of whether it was a 'failure' or not, it was one beautiful horn. Maybe too beautiful to be used in railroad service! Like the classic lines of the EMD GP30, the N3 didn't have to be designed with all that 'flow' and 'swoopiness', but I, for one, am glad Swanson let his artistic side show through on this one design.

Ken

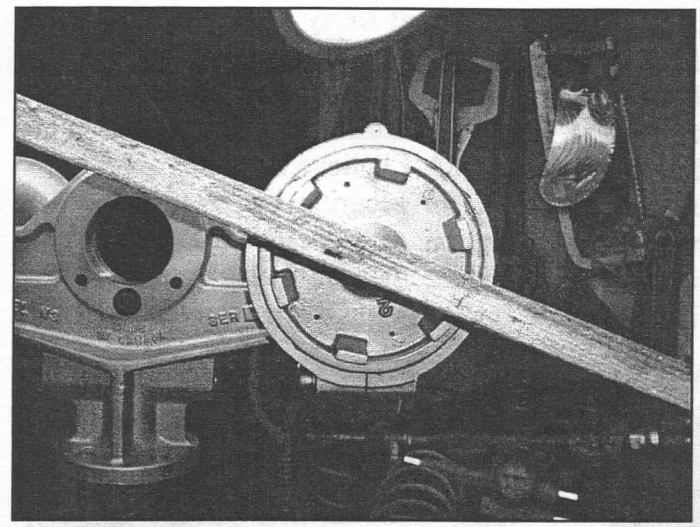


Figure11. A very gentle "spanner" wrench to voice one of the heads. This lets Ken turn the caps to the correct position without any chance of marring the newly repaired lugs on the caps.

† We regret to inform you that Ernie Cannon died shortly after the Airchime article was published. Ernie, along with Robert Swanson was one of the key figures in the early history of Airchime.

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