The Making of a Verdin Bell

by

Marilyn Grismere and The Verdin Company Contributors

Editor's Note: A special thank you to The Verdin Company who helped in the assembling of this article. A special thanks to the following Verdin employees: Ralph Jung, Paul Jung, Tommy Robinson, Marsie Rowan, Tim Verdin, and Tommy Verdin.

This article began to develop in October 2009. The Verdin Company designed a Veterans Tribute Tower™ for the Green Township Veterans Park located on Harrison Avenue on the west side of Cincinnati. That day, I met several of the Verdin family…it truly is a family operation. The Veterans Tribute Tower™ was erected, the bell was poured on site, and dedicated over a two-week period of time. However, I wanted to see the process of how the actual bell casting mold was made before it arrived on site. So we will backtrack a bit and then continue the Veterans Tribute Tower story in another article in the November/December 2010 issue of *The Bell Tower*.

Verdin began making clocks and bells in 1842. The Green Township tower is Ohio's first Veterans Tribute Tower™. Verdin expects to have a Veterans Tribute Tower™ in each of the states. There are Veterans Tribute Towers in Rising Sun, Indiana; Ogden,Utah, and in Miami, Florida.

I met Marsie Rowan at Veterans Park in October. I arranged with Marsie, graphic artist for The Verdin Company, to visit the Verdin foundry in Cincinnati, Ohio, for the purpose of writing this article. We met early one morning in May 2010 at the Verdin foundry and spoke with Ralph Jung, clock maker/bell founder. On this particular day, Ralph was casting a 24-inch Verdin bell for the purpose of this article.

The pattern for the bell was basic with no inscriptions on the bell. The Green Township bell had an inscription which would take a bit more time to complete.

CASTING THE BELL AT THE FOUNDRY

An aluminum bell pattern is used over and over to produce undecorated 24-inch bells. The bell pattern shown in Figure 1 is placed on a bottom board, which sits on a movable cart. The *drag flask* is lowered over the pattern. Silica sand, combined with three epoxy materials, will make the mold. Figure 2 is an inside view of the bell pattern inside the drag.

Ralph then makes a test sample of the sand mixture to make sure the chemicals are blended correctly. He turns on

Figure 1. Bell pattern on bottom board; drag flask lowered over bell pattern.

Figure 2. Inside view of bell pattern inside drag flask.

Figure 3. Test mold being prepared.


Figure 4. Solidified test mold.

the sand machine and collects the mixture in a small bucket (Figure 3). After a short period of time, Ralph dumps the test mold onto a bench. Figure 4 shows the test mold has formed and has turned solid. The mold sets up in a matter of minutes. The temperature in the foundry affects the mold in the set-up process. The hotter the day, the faster the mold will set.

Figures 5 through 9 show how the drag flask is filled. Sand fills the drag as shown in Figure 5. In Figure 6, Ralph holds a flat piece of metal to deflect the sand mixture to distrib-


Figure 5. Silica sand added to the drag flask.


Figure 6. Metal bar deflects silica sand into the flask.

ute the sand around the base of the bell. Figure 7 displays the sand mixture about halfway up the drag. The mixture must be firmly packed around the bell pattern. Ralph uses a sledge hammer to tamp down the sand into all of the bell crevices.

Ralph then recycles some of the old mold material used in previous bells as filler on the outside edges of the drag as shown in Figure 8. Figure 9 shows the outside of the mold finished and allowed to cure.

Figure 7. Another inside view of the flask filling.

Figure 8. Chunks of previously used material placed on the outer edges of the flask.

Using an overhead crane, Ralph turns the drag mold over so the cope can be made using the same process (Figure 10). The cope in this case is the inside profile of the bell (Figure 11). Figure 12 shows Ralph with an air hose cleaning the inside of the pattern.

The *cope* section is then secured to the original drag section (Figure 13). Figure 14 shows the *gate* being added to the cope. This will form the channel for the molten bronze to enter the casting cavity.

Figure 9. Leveled flask waiting to cure.

Figure 10. Drag lifted and inverted to expose inside of bell.

Figure 11. Inside profile of bell pattern.

Figures 15 and 16 show the cope mold with the silica mixture being added, and Figure 17 shows the sand leveled across the cope.

After a short period of time, Ralph uses his hands to form a puddling hole. He scoops some of the sand mixture out of the casting while the sand is just setting up. This step must be done shortly after the sand mixture is added, but before it is totally set. Figure 18 shows the puddling hole and gate where the molten metal will be poured to enter the mold. If this is not done, the molten bronze would spill over the drag onto the floor.

Figure 19 shows the sprue hole. This is where the molten bronze will enter to form the bell.

Figure 20 shows the completed mold with the pattern still in place. The cope and drag section combined is called the *flask*. Figure 21 shows the cope mold being separated from the drag mold exposing the pattern inside.

Figure 12. Inside of bell being air pressured to remove any dirt particles.

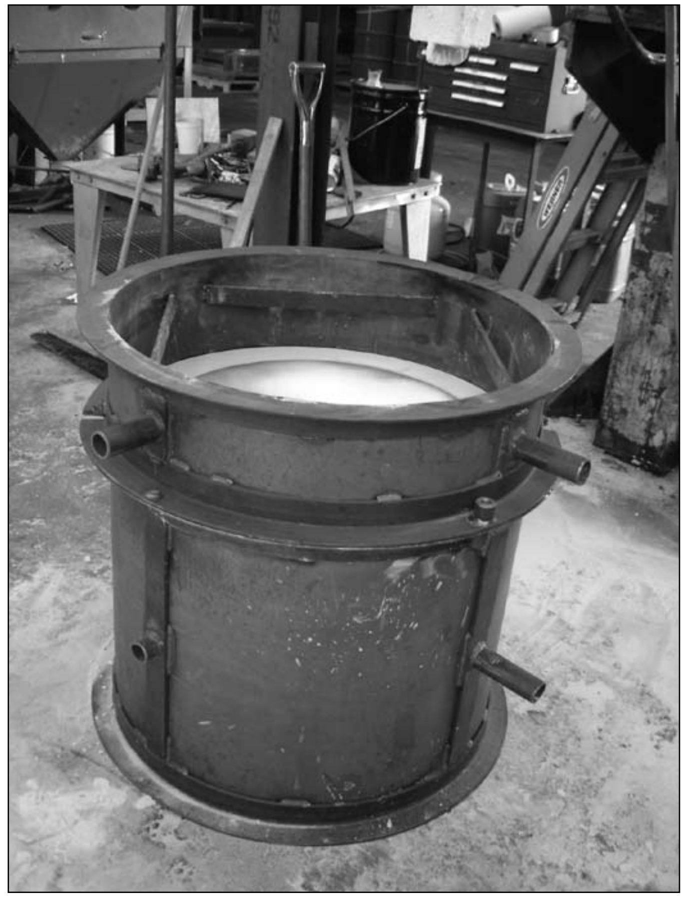

Figure 13. Cope section added to the drag section.

Figure 14. Gate added to the inside of the bell pattern.

Figure 15. Inside of bell filling with silica sand.

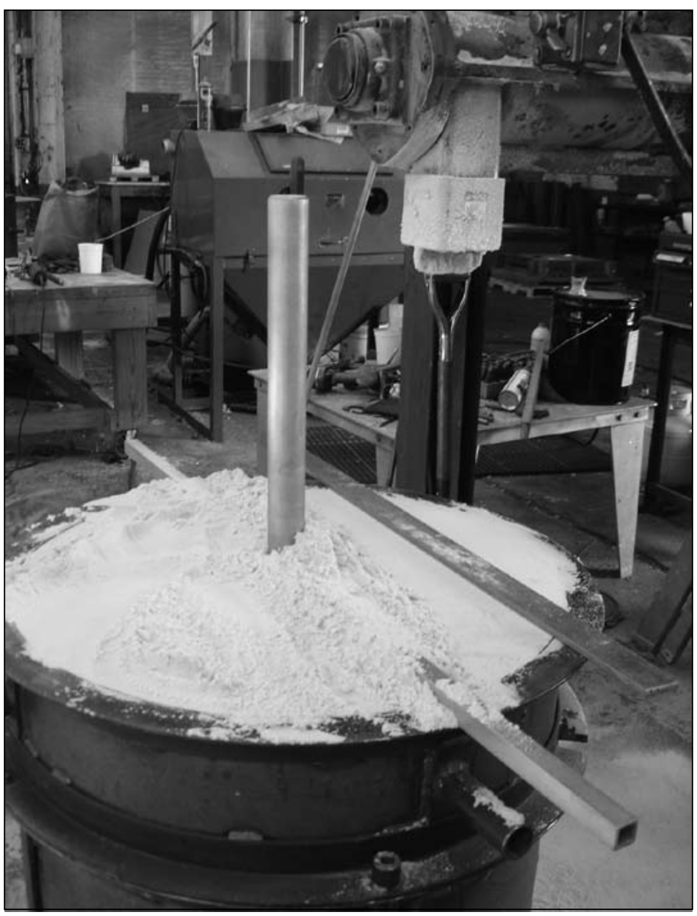

Figure 16. Cope/drag filled and leveling begins.

Figure 17. Cope leveled while the sand mixture begins to set up.

Figure 18. Puddling hole prepared for the pour.

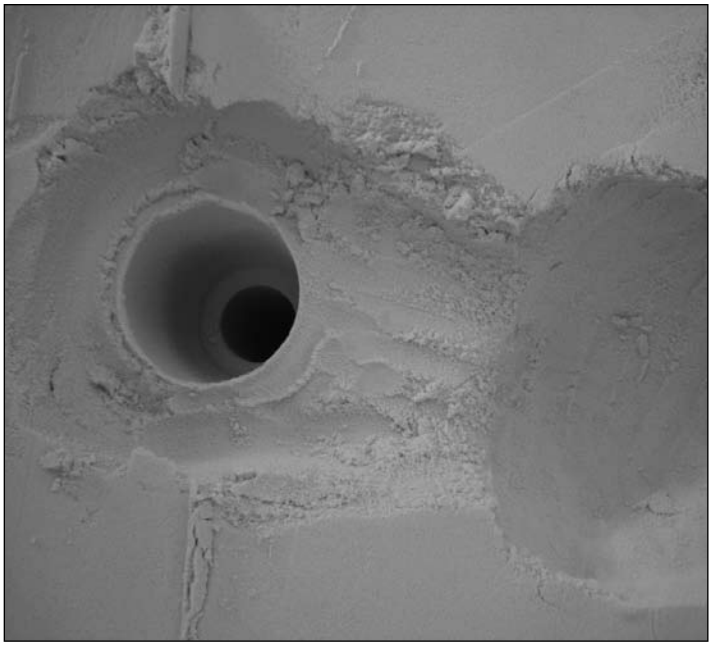

Figure 19. Gate after the sprue has been removed.

Figure 20. Completed mold with pattern in place (flask).

Figure 22 shows the bell pattern being removed from the cope section.

Figure 23 illustrates the cope section, which is hoisted by a crane, inverted, and lowered and rejoined to form the completed flask.

Ralph measures and cuts a piece of ceramic material to the proper dimension in Figure 24. Figure 25 shows a mesh filter that will fit into the ceramic material. This will filter dirt

Figure 21. Cope being removed from flask.

Figure 22. Bell pattern being removed from bell mold.

Figure 23. Cope section being inverted.

Figure 24. Ceramic material cone being cut to proper dimensions.

Figure 25. Mesh filter.

Figure 26. Filter placed into the ceramic cone.

Figure 27. Ceramic material with glue applied to outside.

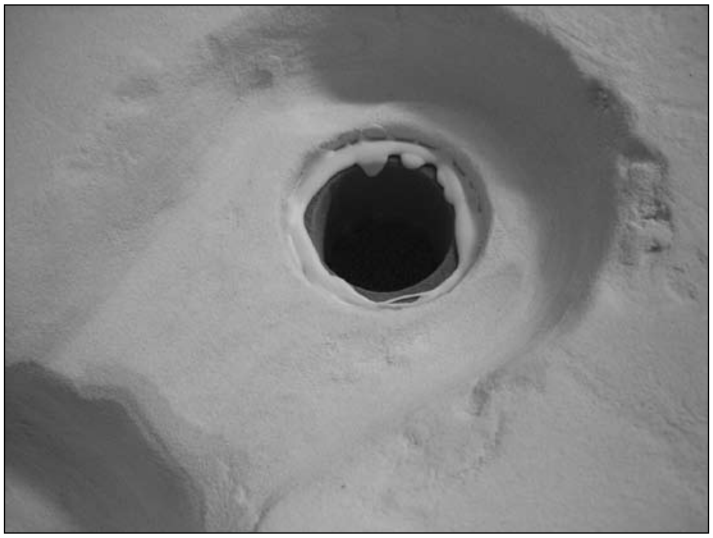

Figure 28. Top edge of sprue hole glued.

and grit particles from entering the bell mold as shown in Figure 26.

Ralph then glues the outside diameter of the ceramic cone (Figure 27) and inserts into the sprue hole. He then glues the top edge of the sprue hole (Figure 28). Again, molten bronze metal will pass through this hole and into the bell mold cavity. The mold now needs to rest for a day or so before the molten bronze is added.

POURING THE BELL AT THE FOUNDRY

Ralph indicated he was going to do a pour of various sizes of Verdin bells two weeks later. There would be large bells—20", 24", and 26" bells, smaller 8" garden bells, as well as other size bells in the pour. In the foreground of Figure 29, you can see the large bell molds. The number 20 shown on the mold to the left will be a 20" bell. Figure 29

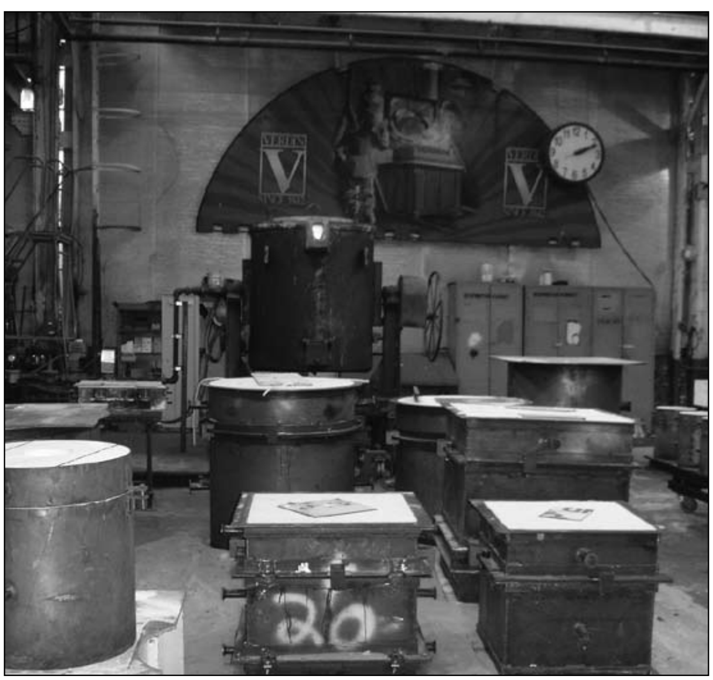

Figure 29. Various bell molds prepared for pouring.

Figure 30. Paul Jung holds a bronze ingot.

also shows the furnace in the background. You can see the orange glow at the pour spout at the top of the furnace.

The previous day approximately 85 bronze ingots totaling 1,700 pounds were placed in the furnace. Figure 30 shows Paul Jung, brother of Ralph Jung, holding a bronze ingot. At 6 a.m. in the morning of the pour, the furnace was turned on to melt the bronze. This is a long heating process. Target time for the pour was 3 p.m., approximately nine hours later.

We arrived a little after 2 p.m. to watch the setup for the pour. The temperature in the furnace must reach 2,200°F for the pour to begin. Figure 31 shows a side view of the furnace with the lid being lifted. The orange glow shows at the top.

Preparing for the pour, Ralph heats two ingot molds as shown in Figure 32. These ingot molds will be used to hold any excess bronze that will not be used in the pour. If these ingot molds are not heated, the molten bronze would splatter out when poured into cold molds.

Figure 33 shows Tommy Verdin suiting up for the pour. The material of his suit is made of a heavy cotton-treated flame retardant material. Notice the white shields that he wears over his work shoes. This prevents molten bronze from dropping through his laces to his feet. Tommy will wear protective head gear and face shield, which he is preparing to place on his head. He also will wear insulated gloves to protect his hands from a possible spill. On the floor in front of Tommy Verdin, a small ladle that will be used in the pour for the 8" garden bells as well as other small bells, has been heated to a cherry red. This prevents the molten bronze from splattering when poured into the ladle.


Figure 31.Side view of furnace with lid elevated.

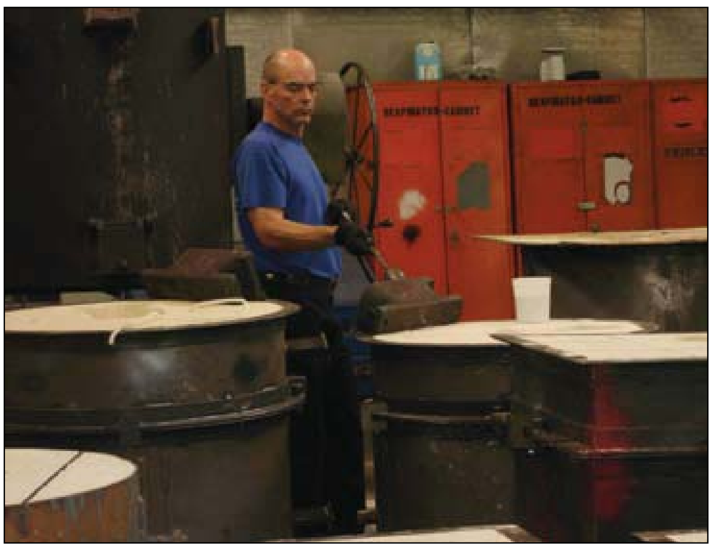
Figure 32. Ralph heats the ingot molds.


Figure 33. Tommy Verdin suiting up for the pour; fore-ground displays heated ladle to pour smaller bells.


Figure 34. Tommy Robinson angles furnace pour spout to the exact location; Ralph and Tommy gather the molten bronze into the ladle.


Figure 35. Various size bells being poured from the ladle.


Figure 36. Ralph Jung and Tommy Verdin pour a small bell while Tommy Robinson waits to assist in another pour from the furnace.

Figure 37. Larger ladle that will be used to pour the 20", 24", and 26" bells.

Figure 40. Twenty-six inch bell being poured.

Figure 38. Ralph adds flux to the large ladle.

Figure 41. Close-up view of the molten bronze with flame shooting from the sprue hole.

Figure 39. First large bell pour.

Figure 42. Smaller 12" bells being poured from the large ladle.

Figure 34 shows the small ladle raised by Ralph Jung and Tommy Verdin and placed under the pour spout of the furnace to accept the molten bronze. Tommy Robinson in the silver insulated suit is at the wheel tipping the furnace to the exact angle which will allow the molten bronze to flow into the smaller ladle. When the ladle is full, it is carried by both men to the molds. Figure 35 shows Ralph and Tommy pouring the small bell molds in a close-up view. They move very quickly to do the pouring making repeated trips to the furnace for more bronze. Figure 36 shows another bell being poured.

Figure 37 shows a larger portable ladle that will be hoisted in the air, transported, and lowered just below the furnace to accept the molten bronze.

Figure 38 shows a side view of the melted bronze pouring into the ladle. Ralph has a small white cup that contains flux. When he pours the flux into the ladle, steam rises from the ladle. The flux causes any dirt or grit to rise to the surface. This is then scooped off the top of the hot bronze and discarded.

Figure 39 shows the ladle has been moved to a larger bell mold. Tommy Verdin operates the ladle wheel to angle the bronze from the ladle into the bell's down gate while Ralph operates the hoist to move to other bells. As you can see from the golden glow in the ladle, this is very hot and one mistake by either man could be disaster.

Figure 40 illustrates a close-up of the bronze being poured into the down gate discussed earlier in Figure 19. The next figure shows an even closer view of the molten bronze bubbling in the ladle (Figure 41). A flame appears at the down gate as the bronze fills the bell cavity from the ladle and displaces various gases.

Figure 43. Smaller bell molds poured.

Figure 42 shows four 12" bells being poured, and Figure 43 shows the molds after pouring. Finally, the pour is over and all bell molds have been filled. Now the ladle must be emptied of any excess bronze into the two ingot molds as shown previously in Figure 32. Again, these were previously heated before any of the pouring began.

The next step is to wait until the molds cool. The next day the flask is disassembled and the finishing process now can begin.

SEPARATING THE BELL FROM THE MOLD

To release the bell from the mold, the cope and the drag portions of the flask are separated as shown in Figure 44. The bell is then lifted out of the flask. Figure 45 shows Tommy Verdin removing the mold material from the inner profile of the bell.

Figure 44. Cope and drag separated by Tim Verdin.

Photo Courtesy of Verdin Archives

When the bell is broken out of the mold it is charred and dark looking as shown in Figure 46. The black you see is the burnt sand and resin. This is removed using a wire wheel. The hole for hanging the bell is drilled into the top of the bell using a large drill press (Figure 47). The extra metal that is attached to the bell from the pour is removed with a grinder (Figure 48). Using an overhead crane, the bell is placed on a custom polishing machine (Figure 49).

Figure 45. Chiseling out the inner profile of the mold material.

Photo Courtesy of Verdin Archives

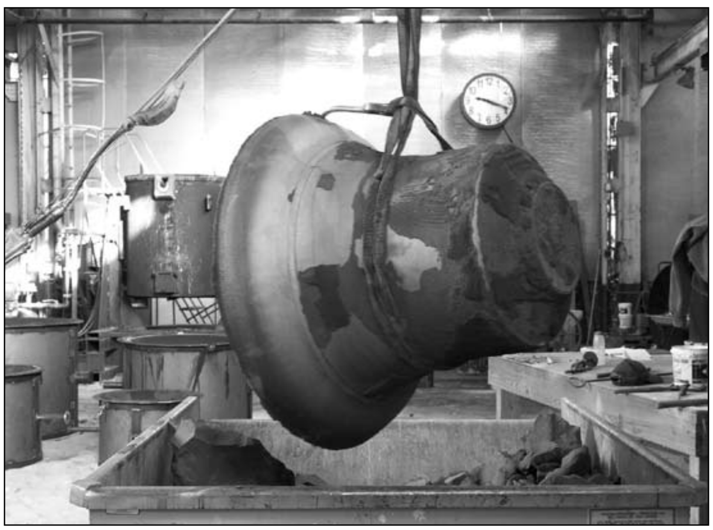

Photo Courtesy of Verdin Archives

Figure 46. Bell broken out of the mold.

Photo Courtesy of Verdin Archives

Figure 47. Hole drilled for hanging the bell.

Photo Courtesy of Verdin Archives

Figure 48. Dean Issacs removes extra metal from the pour.

Photo Courtesy of Verdin Archives

Figure 49. Tim Verdin places bell on a custom polishing machine.

Photo Courtesy of Verdin Archives

Figure 50. Polishing begins on the bell.

Photo Courtesy of Verdin Archives

Figure 51. Custom polishing of bell.

Photo Courtesy of Verdin Archives

Figure 52. Close-up of one of the stages in the polishing of the bell.

POLISHING/FINISHING THE BELL

The first step of polishing is the rough grinding stage. A hand grinder is used for this (Figure 50). The custom polishing machine used to polish the bells spins the bells and uses a grinding belt to start the process (Figure 51 and 52). There are five different stages to polishing a Verdin bell: three different grit polishing belts, then a surface blend pad, and finally a cotton polishing wheel. And lastly shown in Figure 53, the final product—**The Verdin Bell**.

Photo Courtesy of Verdin Archives

Figure 53. Polished Verdin Bell.

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