number: "CS6"

title: Case Study 6

subtitle: Medicine Whip (Indian on Horseback): The Making of an American Sand-Cast Bronze through Contemporary (and Modern-Day) Eyes

contributor:

* first\_name: Ann

last\_name: Boulton

bio: Ann Boulton (Associate Conservator, Gilcrease Museum, Tulsa, Oklahoma) has been a practicing objects conservator for thirty-five years. She received her MA in art conservation from Buffalo State College in 1985. While objects conservator at the Baltimore Museum of Art, she researched nineteenth- and twentieth-century French art bronze technology in her study of the sculpture of Antoine-Louis Barye and Henri Matisse. In 2009 she shifted her research focus to American bronze sculpture at the Gilcrease and curated the exhibition *Frontier to Foundry* (2014). She contributed the essay “A Tale of Two Foundries”toSharon Hecker’s *Finding Lost Wax: The Disappearance and Recovery of an Ancient Casting Technique and the Experiments of Medardo Rosso* (2021).

abstract: In preparation for the 2014 exhibition *Frontier to Foundry* at the Gilcrease Museum in Tulsa, Oklahoma, research revealed that *Medicine Whip*, a sculpture in the museum’s collection, had been the subject of an unusually well-illustrated technical article in a contemporary industrial trade magazine in 1912. Such documentation is quite rare and offers a unique opportunity both for a detailed comparison of the actual bronze with the written description and for consideration of the technology transfer of a nineteenth-century French technique to the early twentieth-century United States.

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## Slide 1: Introduction

In preparation for the 2014 exhibition *Frontier to Foundry* at the Gilcrease Museum in Tulsa, Oklahoma, research revealed that *Medicine Whip*, a sculpture in the museum’s collection, had been the subject of an unusually well-illustrated technical article in a contemporary industrial trade magazine in 1912. Such documentation is quite rare and offers a unique opportunity both for a detailed comparison of the actual %%bronze%% with the written description and for consideration of the technology transfer of a nineteenth-century French technique to the early twentieth-century United States.

**Fig. 529**

## Slide 2: Context: The magazine article

Sometime in 1912, E. A. Suverkrop, a reporter for *American Machinist*, toured the art bronze foundry of Auguste Griffoul & Bros. Co. in Newark, New Jersey. The article that ensued, titled “The Molding of Bronze Statuary,” is an extraordinary document that provides a step-by-step, photo-illustrated, detailed explanation of the French sand-molding process that had been brought to an extremely high degree of perfection for the casting of sculpture in nineteenth-century Paris. Indeed, a few years prior to moving to the United States in 1899, Griffoul had operated a foundry in Paris, where he %%cast%% *The Thinker* for Auguste Rodin (French, 1840–1917). By 1905 he had established the one in Newark, which is reported to have been the last foundry in the United States using French sand. By the date of this article, the %%lost-wax casting%% process was overtaking %%sand casting%% as the preferred method for elite sculptors, and %%founders%% of art bronze by sand casting were on the defensive and eager to advertise their careful surface-replication methods.

**Fig. 530**

## Slide 3: Context: The sculpture

The sculpture in the *American Machinist* article is identified only as “Indian on Horseback” and the base of the Gilcrease %%cast%% is marked “Cast by Griffoul Newark, NJ” and the artist’s signature. The extensive photographic documentation makes it possible to identify the sculpture as *Medicine Whip* by the artist Charles Russell (American, 1864–1926), who modeled it in 1911. It has been estimated that fewer than ten casts were made of *Medicine Whip*, three of them by Griffoul, although the article makes clear that a bronze %%model%% or %%chef-modèle%% used in the process depicted in the article had been created in anticipation of a larger production, as was common practice in France.

**Fig. 529**

## Slide 4: Main questions motivating the technical study

• Was the equestrian sculpture indeed cast as indicated in the article?

• Is this the actual cast illustrated in *American Machinist*?

• How does this process compare with evidence of other French sand casts?

• Might one distinguish any particular adaptations resulting from the US context?

**Fig. 531**

## Slide 5: Diagram of sand casting (based on the Suverkrop article)

Sand molding is an exacting, complex, highly skilled endeavor. Itrelies on sand from specific deposits in France—fine grained and naturally mixed with clay that becomes cohesive when tightly packed. Because a densely packed sand %%mold%% is rigid, it has to be made in as many pieces as necessary to account for undercuts in the model so that the pieces might be disassembled and reassembled without breaking in preparation for casting. It is destroyed to remove the cast; the sand mold has to be made anew for each cast. The mold is created within multiple, stacked, sand-filled iron frames called flasks. The process that Suverkrop witnessed might be summarized as follows.

1. The process requires a specially designed model for sand casting that is hard and can withstand the repeated handling and ramming of sand. This is often made of metal, and is called a chef-modèle.

2. The first flask, or “cope,” is filled loosely with sand, into which a solid model of the sculpture—or “pattern”—is buried halfway. This pattern and the leveled surrounding sand are then coated with a fine powdery separating agent that defines the “parting line.” Smaller mold pieces are created one by one around the pattern, accounting for undercuts, making sure that they will separate and slot together again precisely. “Keys” or recesses scooped into the sand along the way are molded by the subsequent section and ensure their perfect registration. The entire exposed part of the pattern is molded thus, by ramming the sand with mallets onto each carefully defined area of the model, thereby imprinting it in all its detail in the sand.

3. The many smaller mold pieces are eventually backfilled with more sand that is tightly rammed within the upper metal frame, or “drag,” which slots onto the cope and is affixed to it.

4. When the molding of that initial exposed side is completed, the cope and drag are flipped. The cope, now on top, is removed to release the sand and clear access to the back side of the model. A similar piece-molding process now takes place until the cope is filled with rammed sand. (In the case of this sculpture, a third flask was needed.)

5. Once all the rammed sand mold pieces have been created, the flasks are parted and the mold pieces carefully disassembled to remove the pattern.

6. In order to produce a hollow cast, it is necessary to create an internal mold or %%core%%, which will essentially define the thickness of the bronze walls. To make a core, the mold pieces are reassembled in the cope and the drag respectively. Sand is carefully rammed into the hollow impression left by the pattern. Wires or internal %%core supports%%—some in the form of loosely rolled tubes or “core vents”—are laid across the new sand, extending out into the surrounding mold pieces. The cope and drag are joined, uniting the two halves of the sand %%replica%%, then disassembled again to remove the sculpture.

7. The sand replica is shaved down evenly overall to form the core.

8. The mold pieces and core are baked, coated with a fine layer of soot to ensure a smooth flow of the metal, and reassembled in the cope and drag. The gap formed by the paring down of the core determines the thickness of the sculpture’s bronze walls. The embedded internal core supports projecting from the core will serve to suspend it in place in the mold during casting. Channels are cut strategically into the mold to ensure that the metal flows through and fills it efficiently.

9. The cope and drag are reassembled and locked together. The metal alloy, which has in the meantime been liquefied, is %%poured%% into the mold.

10. Once the metal has solidified and been allowed to cool, the sand mold is broken away to reveal the bronze sculpture, which will be one with the network of %%sprues%% formed by the metal-filled channels. The sprues are cut off. The surface is cleaned and repaired as needed. Holes in the bronze created by the core supports are %%plugged%%.

11. If a bronze is cast in numerous sections, or separately from a base, it will be joined at this stage. The final steps consist in little, if any, %%chasing%% and decorative coloration through the application of a chemical %%patina%% or some form of %%coating%%. (In this sculpture, the reins were made of metal wire and added at the end.)

**Fig. 9**

## Slide 6: Visual examination: Evidence of the original modeling (1 of 2)

The bronze cast reproduces the loose modeling of the artist’s original design, which, judging from the quality of the details and what we know of the surviving models of other Charles Russell sculptures, would probably also have been fashioned in wax around a wire %%armature%% embedded in a plaster or wooden base. The crisp-edged, rounded facets and soft, indented outlines suggest that the artist used a fine, round-tipped modeling tool, and the faint parallel striations on the horse’s belly behind the rider’s left heel may be traces of a fingerprint drawn across the surface or of a serrated tool.

**Figs. 532, 533**

## Slide 7: Visual examination: Evidence of the original modeling (2 of 2)

A partial fingerprint from the original model of the base is discernible above the artist’s signature, which was drawn with a pointed tool in a soft material—probably wax. Both the finer inscription that reads “copy v. 1911” and the foundry information marked on the base are in the same hand, which is different from that of the artist. They too appear drawn in a malleable material, rather than %%engraved%% or stamped into metal, as was more often the case with casts of that period. All of these marks must have been already present in the original model before the metal pattern was made. The subtle rows of rounded, shallow indentations between the artist’s initials and the sketch of the horned skull may have been made in the wax, or could represent %%punch%% marks done in the metal during the finishing process.

**Figs. 534, 535**

## Slide 8: Visual examination: Evidence of the sand piece mold

More than fifty pieces were required, with a total construction time of fifteen hours, to create the sand mold for one cast of *Medicine Whip,* a small sculpture less than ten inches tall, and yet few if any traces of the mold seams are apparent. When properly prepared, a French-style sand mold should produce a cast that closely replicates the artist’s original model and needs little further repair prior to patination. The sand evenly vents gases to prevent air holes from forming in the metal; additionally, the swelling of perfectly rammed sand pieces prevents the formation of a network of raised metal %%seam lines%% on the surface of the sculpture.

**Figs. 536, 537, 538**

## Slide 9: Visual examination: Evidence of the casting

Discrete areas display quite visible tool marks made after casting. Dense clusters of punch marks mar the top of the Indian’s head and his back, as well as on the rear of the horse. File marks as well were detected on the top of the horse’s rear. The tooling on the back of the Indian and file marks on the horse’s rump correspond to the exact location of the large sprue attachments illustrated in *American Machinist*.

**Figs. 539, 540, 541**

## Slide 10: X-radiography (1 of 2)

Radiography helped to explain the punch marks on the head of the Indian and the forehead and rear of the horse. They mark the locations of bronze plugs that were hammered into the holes left by the internal core vent/supports that were pushed into the sculpture. The radiograph further confirms what the *American Machinist* photographs show: the Indian and horse were molded and cast as one; the legs of the horse did not contain any core, indicating they would become solid metal; the square nuts attached to the screws that the *American Machinist* photographs depict placed into the sand mold at the horse’s extremities and protrude from the horse’s hooves were to serve as attachments to a base. (Visual examination of the interior of the base of the bronze cast is precluded by a sheet metal cover %%soldered%% to the bottom of the base, probably by a collector.)

**Figs. 195, 542**

## Slide 11: X-radiography (2 of 2)

Radiography also reveals that the core vents or “lanterns,” made of a rolled-up sheet of metal bound with fine metal wire to prevent it from unfurling, are not one, as shown in the photographs, but two: one traversing the length of the horse and the other coming down from the head of the rider into his mount. Radiography clearly shows how the plugs align with the vents on the animal’s forehead (rather than the chest, as seen in *American Machinist*) and rump, as well as at the top of the rider’s head. Although not visible, one may also figure at the other end of the vent, in the belly of the horse. This is clear evidence that the Gilcrease bronze is not the one illustrated in Suverkrop’s article.

**Figs. 195, 542**

## Slide 12: Summary and discussion of technical findings

Comparison of the Gilcrease’s *Medicine Whip* with the detailed photographic documentation of French sand casting in *American Machinist* indicates that while the museum’s version must clearly be part of the series cast by Griffoul, it is not the actual bronze portrayed in the magazine.

The visual documentation presented in the article also makes painfully clear how little trace is left on the bronze itself of the skilled mold making that went into its production, and how speculative our technical interpretations and attempts at reverse engineering often are. Suverkrop’s fairly detailed record of the process he witnessed in the Griffoul foundry offers a precious window into the know-how that fed into the Gilcrease sculpture, which would otherwise be irretrievably lost.

Suverkrop’s vocabulary is, it should be noted, more readily associated with that of industrial sand casting of machine parts, betraying his own expertise and that of the readership he was writing for. It may also show a certain lack of familiarity with terms commonly applied to sculptural production. For instance, his substitution of the industrial term “false core” for the more familiar term “%%piece mold%%” element, for example, blurs the distinction between the core and the exterior mold. The dissonance underlines the gulf between these two different kinds of endeavors—one that still exists today. In that respect, even with this detailed documentation, we lack a precise description of the process chez Griffoul.

## Slide 13: Technical study parameters

The sculpture was examined in normal and raking light with low-power magnification.

Photography of relevant features was done in raking and normal light. Gamma radiography was performed at the Gilcrease by Tulsa Gamma Ray with a portable source due to lack of radiography capability at the museum.

## Slide 14: Further questions

• How was the foundry inscription created on the Gilcrease cast? Could comparison with casts of Russell’s works by other foundries help answer that?

• What accounts for the different layout of the core vents in this cast versus the one illustrated in the article? Could it have been experimentation? The result of different “hands” working on the molds in the Griffoul foundry? Or a hiatus in production?

• Might the Gilcrease cast actually be the bronze chef-modèle depicted in the article around which the mold was created? Could comparison of the Gilcrease bronze to another Griffoul cast clarify this?

**Figs. 538, 543**

## Slide 15: Further resources

{Boulton 2006}

{Boulton 2007}

{Boulton 2018}

{Lebon 2003}

{Stewart and Russell 1994}, 192

{Suverkrop 1912}