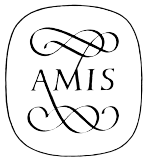
Journal of the American Musical Instrument Society

VOLUME VIII • 1982



The Restoration of a 1608 Trombone by Jacob Bauer, Nuremberg

GARY M. STEWART

FEW musical instruments from the early seventeenth century survive in their original condition; as a result, appropriate decisions must be made concerning the restoration of most of the rare examples of the period which are preserved in public and private collections. It is the purpose of this report to document the restoration of one such instrument, an important trombone in the Rosenbaum Collection of Musical Instruments, which was made by Jacob Bauer of Nuremberg in 1608.

Jacob Bauer (d. 1612), one of the earliest members of the Nuremberg guild of trumpet and trombone makers about whom we have information, received his title as "master" in 1595.[1] The present trombone is the only instrument by Bauer currently known. In age and workmanship it must be counted with surviving instruments by his contemporaries Conrad Linsser (1587; in the Museum für Hamburgische Geschichte, Hamburg), Jörg Neuschel (1557; private collection, Vienna), Erasmus Schnitzer (1551; Germanisches Nationalmuseum, Nuremberg), and Anton Drewelwecz (1595; Germanisches Nationalmuseum, Nuremberg).

The path followed in restoring the Bauer trombone was not a conservative one, but a less radical approach would have failed to achieve the philosophical intent of the restoration: to preserve the original spirit of the instrument and to be sensitive to all details.

The instrument came into this country several years ago from Europe. Judging from wear patterns on the slide handles and slide tubes, it had been well used; and, as with any delicate object not provided with a case, it had received a few knocks. It had in fact deteriorated to the point of being held precariously together with brass patches and a lot of soft solder. From this stage it had been completely disassembled, for some unknown reason, and left as a collection of bits and parts in a shoe box, plus the slide tubes. The trombone was in this condition

1. Willi Wörthmüller, "Die Nürnberger Trompeten- und Posaunenmacher des 17. und 18. Jahrhunderts," *Mitteilungen des Vereins für Geschichte der Stadt Nürnberg* 45 (1954): 208.

when work was commenced upon it. Figure 1 shows the parts of the instrument, including some curious pieces which had been used in the past for repair.

The trombone is made of brass, but the metal does not exhibit the brittleness and tiny fractures one usually associates with brass instruments more than 300 years old. While no analytical tests were made to determine the composition of the brass, it seems likely that it contains a fairly high percentage of copper and perhaps some silver, judging by its strength, light color, and apparent resistance to stress cracking. Before the decision was made to use high-temperature solder (gold solder at 1270°F. and silver solder at 1250°F.) to repair the bell, inner-slide handle, and cracks in the inner and outer slides of the first leg, the metal was tested by silver-soldering a small crack, hidden under a ferrule, which was opened during the removal of the ferrule from the bottom end of the first-leg outer slide. There was no detectable negative reaction. Then followed some practice with a micro-flame, oxy-acetelyene torch on 0.003 in. brass stock, butt-joining pieces of various sizes together. From this it was learned that such thin material could indeed be butt-joined (the bell of the trombone is about 0.008 in. where damaged) with minimal risk of damage. A slip of the hand or sudden fluctuation in gas pressure, possible when using small oxy-acetelyene torches, would result in no more than a 0.10 in. diameter area of scorching, or, at worst, a 0.005 in. hole; and, by playing the torch upon the material carefully, all such mishaps could be avoided.

A special problem, when using high-temperature solders, is the need to remove all traces of soft solder (tin-lead) near the area to be soldered. Failure to remove the soft solder completely will result in a weak or failed joint, and splotches of scorched lead will be burned indelibly into the base metal. The Bauer trombone had been generously covered with soft solder at every crack, break, or fracture where hard soldering was now desired. Removal was complicated by the profuse engraving of the inner-slide handle and the ragged edges of the damaged bell. Most of the solder at these locations was removed with small gravers under one- or two-power magnification. Concentrated nitric acid allowed to remain on the metal for five seconds at a time removed traces not accessible with tools.

The material used to make the various bits and parts needed to restore the instrument was in all instances standard cartridge brass. Its robust gold color is not a perfect match for the lighter, pale yellow of the original material, but this serendipitously serves to mark the restor-

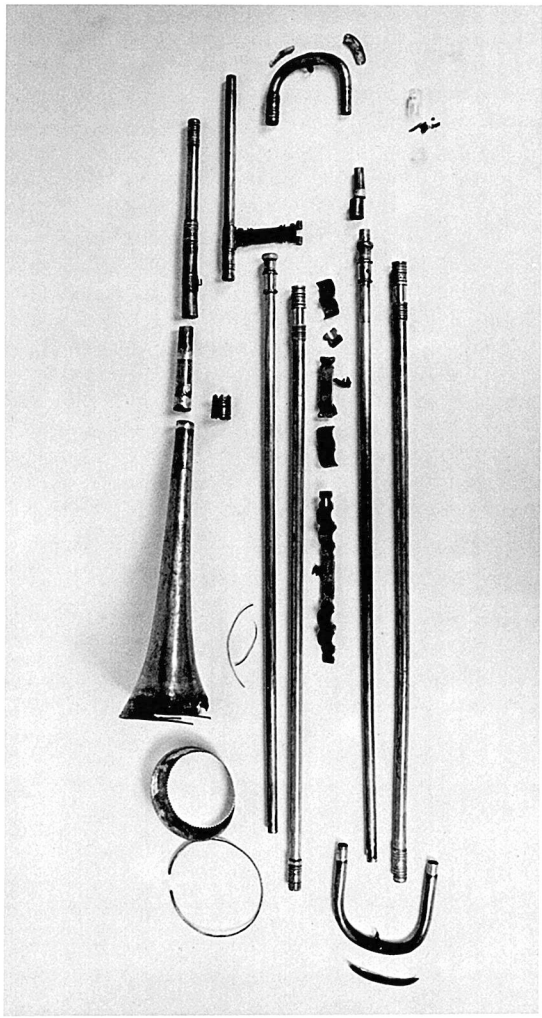


FIGURE 1. The parts of the Bauer trombone before restoration.

er's work. The difference in color is not readily apparent in normal interior lighting, but stands out in sunlight to the trained eye. Most replacement parts are also marked with the conservator's initials and the date, engraved in a hidden area.

The inner- and outer-slide tubes were straightened as much as possible, using a straight-edge as a guide and mandrels to ease out deep dents. A bad fracture was found in both the inner and outer slides of the second leg. The tubes had obviously been bent nearly double at some time. The cracks were repaired with silver solder (1250°F.), using a micro torch to localize heating.

Two pieces of outer slide or original slide bow that had been broken off at some time were found inside the ferrules where the slide bow is inserted (fig. 2). These had probably been cut or broken off when an ill-fitting replacement bow was soldered in place. The pieces, each approximately 3/4 in. long, were removed and saved. One is marked with the symbol: ///, as are several other parts of the instrument.

The ferrule on the mouthpipe side of the outer slide (fig. 2) was removed with low torch heat and penetrating oil. The tubing just inside the ferrule cracked on removal. This was where silver solder was first

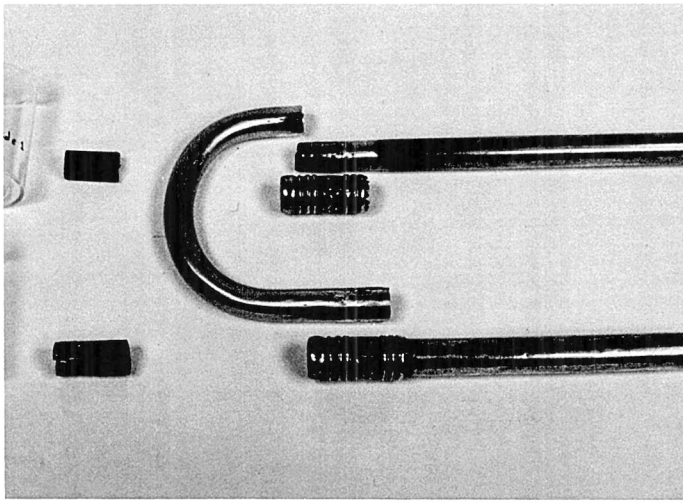


FIGURE 2. The slide bow of the Bauer trombone, with the extra pieces found inside the ferrules.

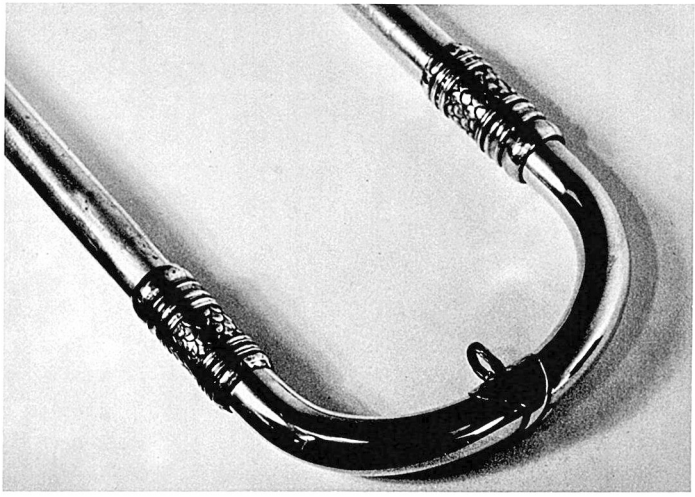


FIGURE 3. The replacement slide bow of the restored Bauer trombone.

tested. The freed ferrule was soldered with soft solder to a new slide bow which had been formed from 19-gauge sheet brass and copied from the original bell bow in all dimensions (fig. 3). (The bows on most early trombones and trumpets seem to have been almost interchangeable.) The new slide bow does not enter the ferrule full-length, but only 1/2 in., because of a piece of original (?) slide bow firmly attached to the ferrule's interior. The other side of the slide bow telescopes into the ferrule of the second leg for a friction fit. The lower banner ring and new tips for both sides of its base were soldered to the new slide bow with soft solder. The new tips were finished and engraved to match (fig. 3). The original tips seem to have been removed to fit the slide bow just replaced, which had been fitted with a rather crude bow guard.

The badly broken inner-slide handle was cleaned of soft solder under a microscope—a tedious procedure. Remaining traces of solder were removed with locally applied, concentrated nitric acid, as described above. The areas near the four fractures were brushed with a glass-bristle brush. Then, held firmly in position with a multiple third hand, the pieces of the handle were silver-soldered (1250°F.) with a micro

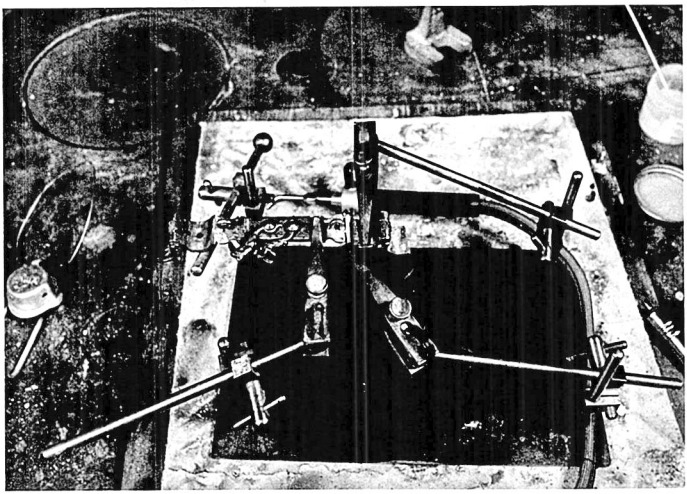


FIGURE 4. Pieces of the inner-slide handle of the Bauer trombone, held in a multiple third hand.

torch to localize heat (fig. 4). A small sliver of brass was added to the right rear break, where the loss of original metal caused improper mating of inner and outer slides (fig. 4). The missing part of the left-side hasp was replaced with a piece of brass cut, fitted, and engraved in keeping with its counterpart on the outer-slide hasp (figs. 5 and 6).

Missing pins for locking inner slides to the inner-slide handle were made of brass stock and installed with soft solder (fig. 7). The short tube connecting the slide joint to the bell joint was missing, presumably broken off at some time. Photographs and drawings of as many similar instruments as possible were consulted, and the length was fixed at 2 in., plus the length inserted into the bell joint. A piece of tubing was made and fitted to the remains of the original on the inner-slide second leg with soft solder (figs. 5 and 6).

Soft solder around the damaged area of the bell was removed with scrapers and nitric acid. The pattern of the major loss was traced onto a piece of 0.010 in. sheet brass formed to, and held against, the ragged edges. It was cut to fit the loss in a butt joint. The piece was tacked in with several spots of hard gold solder, and the entire joint was soldered

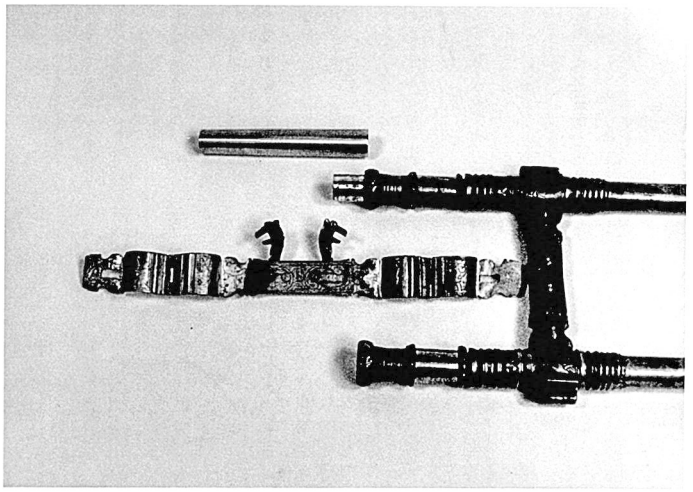


FIGURE 5. The top of the slide of the Bauer trombone, with the restored inner-slide handle and the replacement tube made to connect the slide joint to the bell joint.

in short sections to minimize effects of heat warping (fig. 8). Gold solder was chosen, rather than silver solder, for its color, which is a fair match for brass. A micro torch was used to localize heating and possible damage. Several cracks and fractures in nearby original material were soldered at the same time.

Enlargement of the area of the bell at the apex of the loss—behind the name "BAVER"[2] on the garland—caused the garland not to fit. The enlargement was probably due to the nature of the damage, the repair (and possibly re-repair) of the area, or a combination of occurrences. A cut through the patch and into the original approximately 3/8 in. was made to relieve the enlargement by taking out a **V**-shaped wedge of the patch and overlapping the original material. The closed **V** of the patch and the overlapped original material was soldered with gold solder (fig. 9).

The bell rim, a joined ring of solid, cast, brass wire, had separated

2. The inscription engraved on the bell reads: "MACHT ICH IACOB BAVER NVRMBERG M DCVIII."

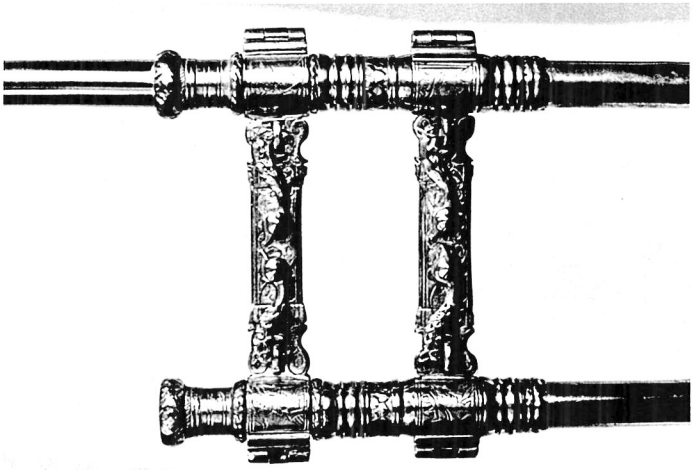


FIGURE 6. The top of the slide of the restored Bauer trombone, fully assembled.

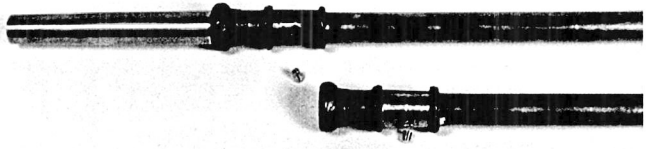


FIGURE 7. The top ends of the inner slides of the Bauer trombone, with the replacement pins.

FIGURE 8. The repaired bell of the Bauer trombone (garland and bell rim removed).

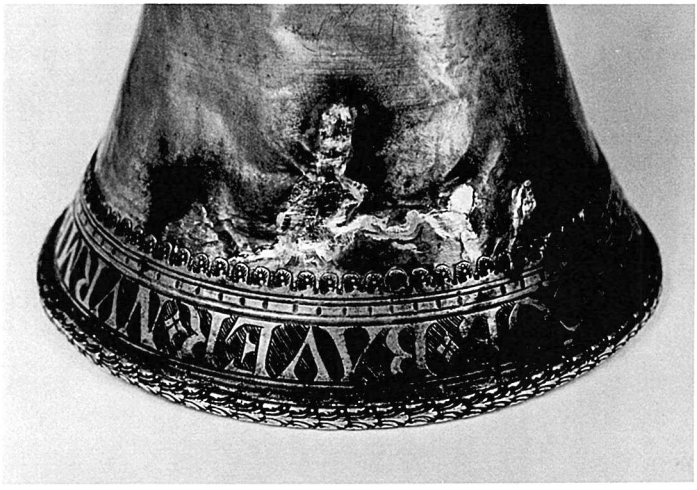


FIGURE 9. The bell of the Bauer trombone (garland and bell rim attached).

at the joint where it had been silver-soldered originally. Soft solder was removed from the area, and the joint was repaired with silver solder. The garland and bell rim were fitted and soldered in place with 40/60 soft solder. The remains of the thin ring of sheet brass on the inner bell rim were resoldered with 70/30 soft solder (fig. 9).

The wrap-around patch soldered to the joint just in back of the bell joint was removed, and no trace of original metal was found. Tracing the two pieces of bell joint on paper showed a piece 7/16 in. long missing in front of the support strut, and a piece 1/4 in. long missing at the end (not including the portion which is the male part of the joint) needed to make the bell joint's parabolic shape complete.

It was originally planned to soft-solder two brass bands to the two original sections of the bell joint and a third section made to finish out the end of the bell joint. However, after considering the way the bands would break the continuity of the bell joint, it was decided to gold-solder the replacement pieces to the original pieces with butt joints—the same technique as that used on the bell.

Pieces of tubing to replace missing parts of the bell joint were made of sheet brass using the same tooth-pattern seam found on the original. The pieces of replacement tubing were fitted to the originals, and only a few snippets of material had to be removed from the front edge of the rear original piece (fig. 10). These were saved. The closely butted seams were then gold-soldered, using a micro torch (fig. 11). The rear edge of the front bell piece had been beveled at some time, probably to fit a patch around it (fig. 10). No material was removed to remedy this since the bevel was quite long (1/4 in.). The joint between it and the adjoining replacement piece is therefore somewhat weaker than the other joints.

The bell bow was left in original condition; the two patches that had been previously applied to it and removed at some time were resoldered with soft solder. The part of the bell-joint support strut attached to the bell joint proper was soldered to what seems to have been its original location—judging from stress marks in the area—with soft solder.

The support strut and its trailing ferrule had been placed in reverse order at some time, resulting in the ferrule being split halfway down its seam when it was forced forward (fig. 12). It was straightened and the break silver-soldered.

Discoloration caused by the heat of soldering was removed by local application of 10% sulphuric acid on swabs, rinsed, and the areas di-

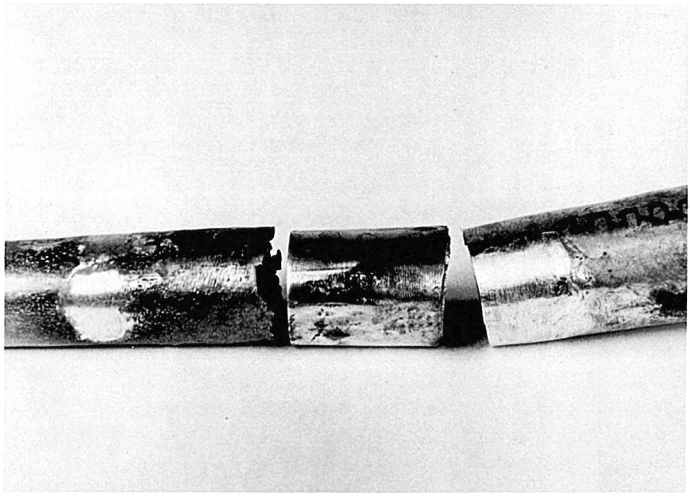


FIGURE 10. A section of the bell joint of the Bauer trombone, with original and replacement pieces.

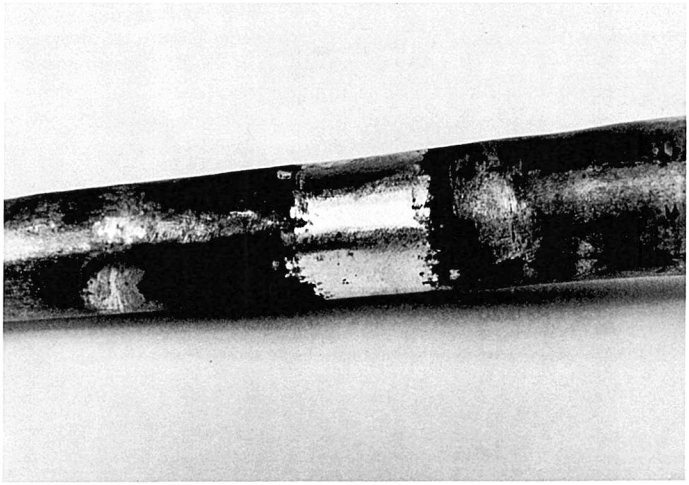


FIGURE 11. The repaired section of the bell joint of the Bauer trombone.

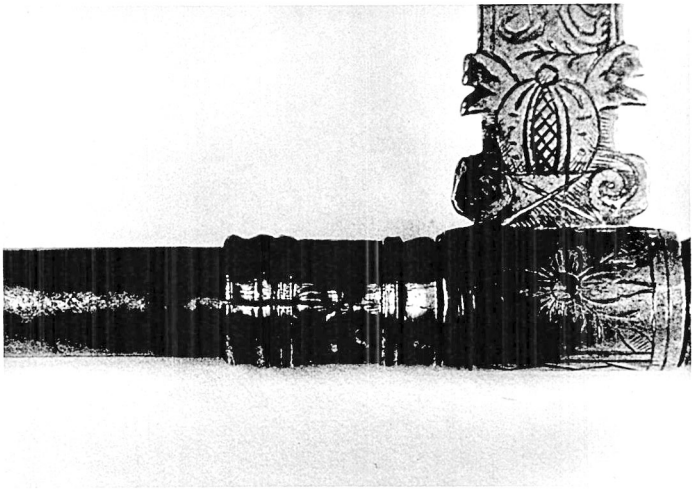


FIGURE 12. The support strut and (cracked) ferrule of the Bauer trombone.

rectly adjacent to the high-temperature soldered areas were smoothed with FFFF pumice on moistened swabs. The entire instrument was cleaned with warm Rochelle salt solution[3] applied with a sponge, making special effort to prevent removal of the darkened background of the engraving on the garland, slide handles, ferrules, and the bell-joint support strut. The instrument was finally cleaned with a solution of 0.3 micron alumina micropolish, benzotriazole in ethanol (3%), and a small amount of deionized water, on swabs; it was then wiped with benzotriazole[4] in ethanol (3%) on swabs. Then the instrument was assembled, using hot shellac to cement the friction joints in the bell section and slide bow (fig. 13).

* * *

3. Rochelle salt solution is a mixture of Rochelle salt (sodium potassium tartrate) and caustic soda (sodium hydroxide) in water. It removes corrosion on copper alloys without attacking the base metal.

4. Benzotriazole is a chemical agent that retards the corrosion of copper and copper alloys.

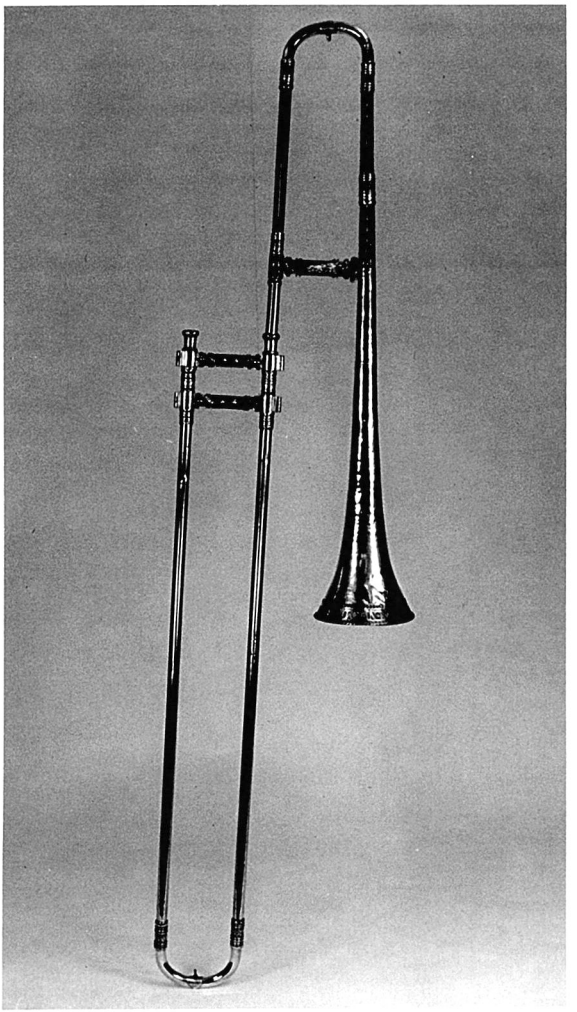


FIGURE 13. The restored Bauer trombone, fully assembled.

In a sense, restoring the Bauer trombone was not a complicated task. The instrument was an accumulation of mishaps and mistakes that needed to be corrected; and, when isolated and treated individually, they boiled down to a matter of careful craftsmanship. As a musical instrument, however, the Bauer trombone is not a mere collection of parts, but a highly important artifact, one that can now produce music and also be appreciated as a visual work of art.

Indeed, it was viewing the instrument as a work of art that led to the most important and difficult decision regarding its restoration—the use of high-temperature solders. The positive effects of a silver- or gold-solder butt joint are obvious: a smooth, unbroken appearance with little color variation, making most other choices, such as soft-soldered collars (outside or hidden inside the bore) or some type of synthetic resin matrix, seem clumsy and anti-craft. The deleterious effects of heating 370-year-old brass to 1270°F. are not to be ignored, and one does not decide to do it in an afternoon. Stress patterns and temper are changed, and some minute amount of the baser constituents of the alloy will be vaporized. But by controlling the size of the flame and thus subjecting only a small area to intense heat, the amount of risk and loss could be lessened to an acceptably low level.

The restoration of the Bauer trombone was carried out in the conservation laboratory of the Shrine to Music Museum at the University of South Dakota.

Vermillion, South Dakota