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DEVELOPMENT AND IMPLEMENTATION OF A NEW METHOD OF WAX APPLICATION FOR OUTDOOR SCULPTURE USING AN AIRLESS SPRAYER

Nicolas F. Veloz

Abstract

Waxes have been used for centuries to protect outdoor sculpture. Through the development of microcrystalline waxes and adjustments to formulations there has been a notable improvement in their serviceability. In a few instances, such as very smooth surfaces or rough textures, the application method has a significant effect on their longevity. This paper describes the development and implementation of equipment, materials, and techniques which allows the successful spray application of wax to outdoor sculpture.

Introduction

For almost 20 years we have used multiple coats of a variety of waxes as a protective coating for outdoor bronze sculpture conservation. Throughout that period, success (defined by uniformity of color and longevity of an effective, protective coating) has been increased through modification of the wax formulas and in the techniques used for the more traditional method of application (*i.e.* brushing the wax onto the surface). We have regularly attained two years plus serviceability from wax applied with brushes on sculpture having “normal” sculptural detail or surface finishing; however, very smooth finished pieces have not lasted as long because it has been impossible to get a smooth, uniform film thickness using brushes. Despite the type, shape, or size of brush, or what technique was used, we have always had some variation in film thickness because of brush-marks. Additionally, the surface has not appeared to be smooth, depending on light reflectance. These differentially thick coatings have also subsequently weathered in a manner corresponding with the brush marks and have consequently allowed streaky, localized corrosion. Similarly, such brush applied wax coatings has also affected the aesthetic appearance of plaques, particularly those with small sharp edged raised letters. No matter in what direction wax coatings are brushed, some portion of the letters scrapes the wax off the bristles resulting in significant unsightly areas of wax in the centers of “o”s, “p”s, “b”s, “a”s, lower case “e”s, and any other closed loop letter or figure, in addition to any excess wax elsewhere outside of the letters.

Spray Application of Wax

From almost the first use of wax as a protective coating, and realization of these problems, it has been felt that the spray application of wax coating would eliminate many of these problems; however, earlier attempts to spray wax using a variety of air-wax delivery systems proved to be unsuccessful. These efforts included the use of standard air-supplied spray guns (both pressure and syphon feed) and the use of a variety of hand-pumped sprayers such as

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garden sprayers. In all instances these attempts have failed because the equipment required the wax be suspended "water thin" in solvent for it to be sprayed. This resulted in very thin coats, significant run off, puddling of wax in hollows and textured areas, and other similar problems. Since first learning of airless sprayers and their ability to spray thicker, more heavily bodied materials, I have wanted to assess their potential for spraying a thicker mixture of wax.

Airless sprayers operate differently from more readily recognized spray guns. Rather than atomizing and mixing paint (or other material sprayed, such as wax) in an airstream, which acts as a propellant; they are essentially high pressure pumps (operating at 1000 to 6000 pounds per square inch-gauge [psig]) and the material is atomized as it passes through a nozzle. This is similar to atomization produced by small hand misters such as those used for spraying cleaners and misting plants, albeit they operate at a constant flow and at *much* higher pressures. Due to cost (having to buy, with no return, an airless sprayer to even see if it would work), or having to rent one which had unknown materials previously sprayed through it or was in questionable mechanical or operating condition, and a variety of other factors, it was not possible to assess the potential for the use of airless sprayers on outdoor sculpture until the summer of 1995.

Preliminary Tests of the Airless Sprayer

For the test, the wax mixture normally used for brush application in the conservation of outdoor bronze sculptures was thinned and remixed to a thinner mixture, somewhat approaching the consistency of yogurt. Preliminary tests were carried out on newspaper and pieces of corrugated cardboard. There was some experimentation with nozzle sizes to see how the material flowed, and after determination of what was felt to be an acceptable flow rate was established it was possible to spray an even, uniform coating on the surface of the test materials. Following these preliminary tests, an old, no longer used cast iron plaque having raised lettering was sprayed. Further tests were conducted spraying the inside of a closed spaces, with small corrugated boxes used to simulate closed recesses of sculpture such as areas beneath coats, etc. This was done to assess the potential of "blow-back" which occurs when a conventional air/fluid sprayer stream is directed into a confined space. With conventional spray equipment the volume, turbulence, and velocity of the airstream/fluid is redirected or bounced from the walls or back of the space causing it to forcefully exit any opening through which it is sprayed. Later, additional tests and practice sessions for development and improvement of actual application techniques were carried out on kraft paper — shown in Figure 1. Standard commercial spray guns use approximately 5-7 cubic feet of air per minute, at pressures of 30-50 psig. Due to such blow-back little or very uneven deposition of material is actually deposited on the surfaces of confined spaces being coated. Since an airless sprayer does not have this large quantity of pressurized air transporting the coating material, there is little blow-back. Through these tests we found that

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despite the air turbulence caused by the atomized wax spray, it was possible to uniformly coat the inner surfaces of confined spaces similar to those often found on outdoor sculpture.

With both conventional and airless sprayers it is possible to have some control of the coating or film thickness through operator application adjustments; such as speed of stroke, variation in working distance, and number of applications or coats. More definitive, rigid, or fixed control is normally accomplished through equipment adjustments or settings. Air flow (volume) of conventional spray guns is controlled and adjusted through the use of a regulator to control the air pressure. They normally have two adjustments on the gun itself, control of the fluid flow rate and an incremental or gradual adjustment of the spray pattern from circular to fan-shaped. While these two controls allow for a wide variation in quantity of material delivered and in the width of the spray pattern, in fact, they both ultimately control the film thickness or buildup of material deposition. In contrast, an airless sprayer only has an adjustment for the fluid pressure (volume) and, since there are critical minimum and maximum pressures at which the nozzle will properly atomize material, in reality any change in flow rate, or spray pattern width (and ultimately film thickness) must be accomplished through the selection of different spray nozzles. A wide variety of nozzles are available which vary according to pattern shape, (straight or tapering at the ends), width (normally rated at a standard distance of 12"), and diameter (controlling flow rate). Thus, adjustment of the application rate is accomplished by selection of the appropriate nozzle, made on the basis on one (or a combination) of these variables according to experience or tables provided by the manufacturer (Figure 2). It has been found during the actual application of wax to outdoor sculptures that sometimes adjustments to the flow rate are required because of temperature changes; the wax solution being significantly thinner in consistency the warmer it is, as the solubility of the various wax constituents in the solvent changes with temperature.

The particular model of sprayer and gun used (Graco 390STS with "Contractor" gun) have an internal wire mesh filter incorporated in the handle of the gun to strain out contaminants. It was found during the initial tests that this was not completely effective in straining out particles of undissolved wax and there was a potential for the tip of the gun to clog. In an attempt to rectify this problem, two alterations were made to the system. A Revers-A-Clean™ tip (a "T"-shaped nozzle that can be rotated 180° to clean any stoppage by a quick pull on the trigger which generally flushes it clear — see Figure 3) was installed, as was a second in-line filter, mounted just downstream of the pump.

Case Study: Low Relief Plaques

Two low relief plaques mounted on the south side of City Hall in Philadelphia, PA, were used for a test comparison between the spray and brush application of a second wax coat. Both plaques were blasted with walnut shells and washed with detergent and water to clean them of previous coatings and loose/friable corrosion products. They were then treated with 2%

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Benzotriazole (BTA), washed again, dried and given a coat of wax using what is commonly called “hot wax treatment” (Veloz 1986; Veloz 1994 describe the process). In both cases they were heated to the melting point of the wax and paste wax was applied using stencil brushes in a scrubbing motion. After the plaques were allowed to cool, the “Swedish Settlements on the Delaware” plaque was masked to protect the stone and a second coat of wax was applied utilizing the airless sprayer. The “Dutch Settlements on the Delaware” plaque was given a second coat of wax using long bristled brushes. In both instances the plaques were then again heated with a torch to level these wax coats and to provide a basic “shine”. They were then cooled with a garden hose utilizing a spray nozzle and buffed using shoe buffing brushes and soft, damp, cloths. The spray coat on the Swedish plaque seemed to buff more easily, and to be more uniform in the appearance of the coating, also, there was no excess wax surrounding the lettering of the plaque as occurred in some areas of the Dutch plaque. The two plaques are shown in Figures 4 and 5.

Case Study: Jacques Lipchitz Sculpture

After the tests were completed on the plaques, the City of Philadelphia Fine Arts Advisory Committee authorized the use of the spray application of the second coat of wax during scheduled conservation treatment of the 35' tall Jacques Lipchitz sculpture, *Government of the People*, located in the Municipal Services Building Plaza, across the street from City Hall. Figure 6 shows the actual spray application of wax to the *Government of the People*. As with the Swedish plaque, the sculpture received the following treatment: washing with detergent and water utilizing a pressure washer, blasting with walnut shells (60/200 mesh at approximately 30 psig pressure), again washing with detergent and water, treatment with a 2% solution of BTA, the hot wax application of the first coat of wax utilizing stencil brushes, and finally the application of the second coat of wax using an airless sprayer. This coat of wax was allowed to remain overnight to allow evaporation of the solvent. It was then heated with torches to incorporate into the coating all wax particles left on the surface by the spray. Following this the surface was cooled with hoses and buffed using rags and brushes.

Because of the sheer size of the sculpture it required about 6 gallons of the wax solution for the application. There was a considerable number of incidences of stoppage of the spray nozzle, however these were easily dealt with utilizing the reversible feature of the nozzle. This problem was felt to be significant and would have to be ultimately solved, if for no other reason than to decrease the operator frustration and annoyance level. As before, the wax for this project was a thinned and remixed paste and it was felt that this did not adequately break-up any particles or “clumpages” of the various wax constituents.

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Additional Experience

Subsequent uses of the technique on several sculptures has utilized a recalculated formula which allows for the additional solvent necessary to make the proper consistency during initial wax preparation, rather than a diluting and remixing of a thicker paste formula. It was also found that if the mixture was stirred for approximately 2-3 minutes each hour during the cooling process there was a significant decrease in the number of times that the nozzle stopped up. In fact, it has been possible to spray a complete life-size or even heroic sculpture without a single stoppage of the nozzle. One of the several sculptures subsequently treated utilizing the airless sprayer for application of the second coat of wax is illustrated in the before (Figure 7) and after (Figure 8) photographs of *Victory*, located in Frederick, Maryland.

Acknowledgments

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References

- Graco Inc. 1992. GREAT TIPS FROM GRACO Form No. 300-248. Revised April, 1992.
- Veloz, Nicolas F. 1985. Cleaning Up the Bronze in the National Park Service. *CRM Bulletin* 9 (1): 2-3.
- Veloz, Nicolas F. 1994. Practical Aspects of Using Walnut Shells for Cleaning Outdoor Sculpture. *Association for Preservation Technology Bulletin* 25 (3/4) [Includes a reprint of: Veloz, Nicolas F.; Chase, W. Thomas; Ruff, A. W. 1987. Successful Use of Soft Abrasives (Walnut Shells) for Cleaning Outdoor Bronze Sculpture by Air Jets. Originally published in *Symposium Papers, Sub Themes 1 & 2, Volume I. Washington, D.C. US/IOMOS*]

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Suppliers

Graco Airless Sprayer Model 390 STS

Duron Paints
6437 General Greenway
Alexandria, VA 22312

Wax used was formulated by author

Formula currently in production by:
Oran Wax Company
902 Carding Machine Rd.
Loudon, TN 37774



Figure 1. Test/practice application of wax using an airless sprayer. Proper material consistency, speed of application, working distance and nozzle selection allowed a smooth uniform application of wax onto a sheet a kraft paper.

Fine Finish Tip Chart

Orifice Size (in.)	Fan Width (in.) at 12 in.	Flow Rate (GPM)	"F" Tip Number
.008	2-4	0.06	163-108
	4-6		163-208
	8-10		163-408
.010	2-4	0.09	163-110
	4-6		163-210
	6-8		163-310
	8-10		163-410
	10-12		163-510
	12-14		163-610
.012	4-6	0.14	163-212
	6-8		163-312
	8-10		163-412
	10-12		163-512
	12-14		163-612
	14-16		163-712
.014	4-6	0.19	163-214
	6-8		163-314
	8-10		163-414
	10-12		163-514
	12-14		163-614
	14-16		163-714
.016	4-6	0.25	163-216
	6-8		163-316
	8-10		163-416
	10-12		163-516
	12-14		163-616
	14-16		163-716
.018	4-6	0.33	163-218
	6-8		163-318
	8-10		163-418
	10-12		163-518
	12-14		163-618
	14-16		163-718
	16-18	163-818	
	18-20	163-918	

Selecting the right orifice size for your job depends on the viscosity of the material you're spraying, the minimum pressure it takes to atomize it and the fan size you choose to do the job.

Filter Chart

The Correct Filter Reduces Tip Clogs.

This chart is a guideline only. Filters do not eliminate tip clogs. Some coatings can pack out finer mesh filters. If that happens, use the next coarser filter and a Graco Reverse-A-Clean™ Tip.

Tip Size	Filter Mesh	Tip Size	Filter Mesh	Tip Size	Filter Mesh
107	200	115	60	121	60
207	200	215	60	221	60
307	200	315	100	321	60
407	200	415	100	421	60
		515	100	521	60
109	100	615	100	621	60
209	200	715	100	721	60
309	200	815	100	821	60
409	200			921	100
509	200	117	60		
609	200	217	60	123	60
		317	60	223	60
111	100	417	60	323	60
211	100	517	60	523	60
311	100	617	60	623	60
411	100	717	60	723	60
511	100	817	100	823	60
611	200	917	100	923	60
711	200				
		119	60	125	60
113	60	219	60	225	60
213	100	319	60	325	60
313	100	419	60	425	60
413	100	519	60	525	60
513	100	619	60	625	60
613	200	719	100	725	60
713	200	819	100	825	60
813	200	919	100		

Figure 2. Tip Chart giving Orifice Size, Fan Width, and Flow Rates allows for proper selection of tips based on desired parameters. (Graco, 1992).

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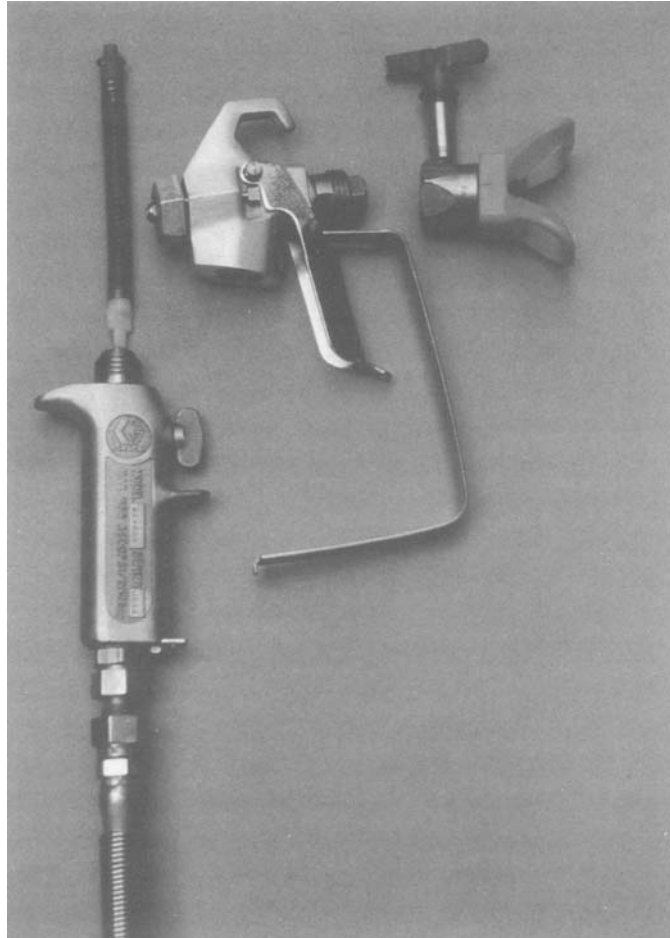


Figure 3. Exploded Graco “Contractor” gun showing control fluid hose, handle containing screen or filter, control trigger, and Revers-A-Clean™ tip.



Figure 4. Plaque commemorating the Swedish settlements on the Delaware (Philadelphia).



Figure 5. Plaque commemorating the Dutch settlements on the Delaware (Philadelphia).

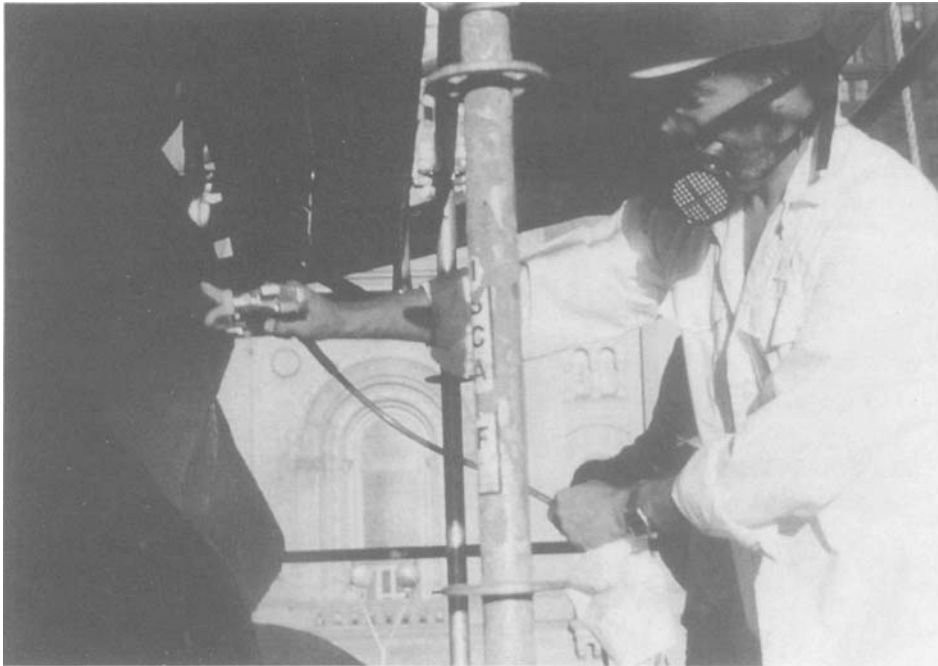


Figure 6. Spray application of the second coat of wax to *Government of the People* (Philadelphia, Pennsylvania).



Figure 7. Giuseppe Moretti, *Victory* (World War I Monument), located in Memorial Park, Frederick, Maryland, prior to treatment.



Figure 8. *Victory* after treatment. Sculpture and commemorative plaques were washed with detergent and water, blasted with walnut shells, treated with BTA and waxed. First coat of wax was applied with stencil brushes, second coat was sprayed using an airless sprayer.