49 PRESERVATION BRIEFS

Historic Decorative Metal Ceilings and Walls: Use, Repair, and Replacement

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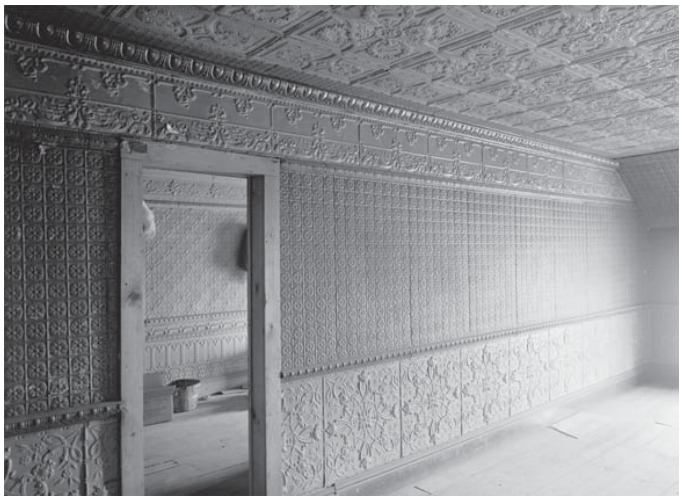
It looks like a decorative-plaster ceiling, yet it is not susceptible to cracking. "Durable, handsome and fireproof," it was touted as being cheaper and quicker to install than decorative plaster. It could even be used to cover deteriorated plaster. For owners of commercial, manufacturing, and institutional buildings, these attributes made pressed- or stamped-metal ceilings quite appealing in the late 19th and early 20th centuries. Commonly known today as "tin ceilings," decorative metal ceilings were widely used during this era in such diverse structures as Main Street shops, offices, restaurants, and manufacturing buildings, as well as in churches, homes, stables, and even passenger ships.

The term "tin ceilings" is actually a misnomer, perhaps stemming from the tradition that anyone who worked with sheet metal was called a tinsmith. The sheet steel commonly used for ceilings and walls was neither tin-plated nor galvanized. While the derivation of "tin ceilings" is subject to debate, manufacturers and suppliers of the period did not use the term. A product of the late Industrial Revolution, decorative metal ceilings and walls were mass-marketed through trade catalogs, home-improvement journals, and builders' magazines, and even by Sears, Roebuck and Company. The product became available in many patterns, both plain and elaborate, and emulated the popular architectural styles of the period. It was used to repair and upgrade existing spaces as well as in new construction. A common substitute for decorative plaster and decorative woodwork, pressed metal was most widely installed as ceilings and cornices, and to a lesser extent as wainscots and wall finishes.



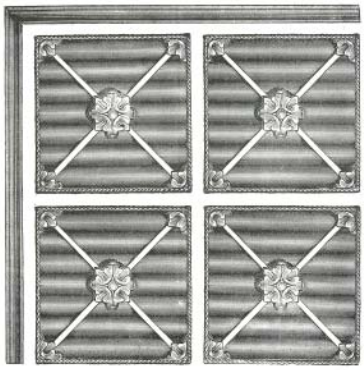
Interior of the Sig Sautelle Circus Training House, South Main Street (State Route 11), Homer, Cortland County, NY (HABS NY-5599)

To anyone window shopping along Main Street in the 1920s, its popularity was readily evident. Stop inside these same buildings today and one often finds that this decorative, practical material still is in place. Though mass-produced and inexpensive, it turned out to be very durable.

Today there is a resurgence of interest in this product, both as a historic finish material and for new applications. This Brief provides a short history of decorative metal for ceiling and wall applications; outlines information on appropriate maintenance and repair work; describes methods for paint removal; and includes guidance on replacement. While focusing on "pressed" or "stamped" steel, which was and still is the most common form of decorative metal ceilings, much of the same information applies to the lesser-used zinc and copper. The early use of decorative iron ceilings is discussed, but, because they are far less frequently found today, special treatments are not covered in detail.

History

Commercially available decorative metal ceilings appeared in the United States by the early 1870s, and initially were made of corrugated iron sheets—a product already in use in the roofing industry. Corrugation added stiffness to sheet iron, allowing the sheets to span longer distances and eliminating the need for sheathing



An illustration from the Philadelphia Architectural Iron Company trade catalog of 1872 showing a corrugated iron ceiling, paneled and ornamented with applied decoration.

or closely spaced framing. As a ceiling treatment, it was marketed as a fire separation between floors.

An early patented system for corrugated iron ceilings appeared in the Philadelphia Architectural Iron Company trade catalog of 1872. One style consisted of arched panels arranged in a series of alternating convex and concave arches, with the panels supported on an iron frame. The metal ceiling could also be installed flat, extending from beam to beam, and was available with ornamental applied moldings and center pieces. Their advertised projects included the Howell & Brothers Wallpaper Warehouse, Philadelphia; Chicago Tribune Printing House, Chicago; and Macoupin County Courthouse, Carlinsville, Illinois—all uses where fire protection was vitally important.

The installation method that the Northrop Company of Pittsburgh patented in 1884 (#303,438) more closely resembled what would become the industry standard. Consisting of small panels of finely corrugated iron, the system was designed to be attached to furring strips laid across ceiling joists. The panels could even be laid in varying directions to create a decorative pattern. To cover the seams, special metal molding strips could be applied.

In response to critics who disliked the "unfinished" nature of these early ceilings, companies offered more decorative elements that could be bolted to the corrugated iron panels and used to cover seams. These elements were commonly made of machine-pressed sheets of zinc. A malleable metal, zinc could be easily and deeply embossed. Some companies offered decorative borders of tin plate as well. Applied decoration, however, increased the cost and slowed the installation, both contrary to the main selling points of metal versus ornamental plaster and wood ceilings. Few examples of these ceilings remain today.

In the 1890s, significant advances in sheet steel production that reduced costs and increased availability revolutionized the metal ceiling business. Stronger and able to be produced in larger and thinner panels than iron, sheet steel became the industry standard. Even more significant, sheet steel could be die-pressed or stamped to create ornamentation as part of the panel, eliminating the need to attach separate pieces of ornamentation. Sheet steel also held-up better in the stamping process.

In 1888, the W. E. Kinnear Company of Columbus, Ohio, purportedly became the first company to patent and offer pressed decorative steel panels instead of relying on sheet iron with applied decoration. Other similar patented systems soon appeared.

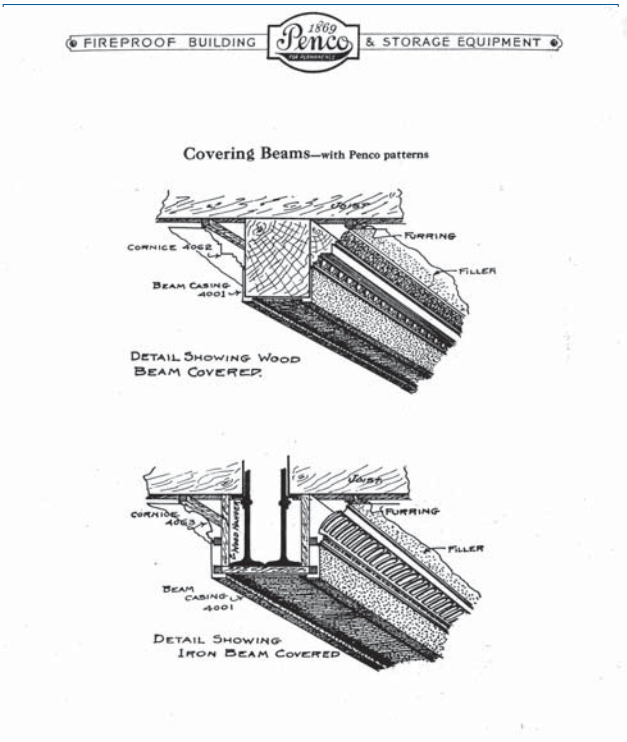
Sheet metal and roofing companies already in business making sheet metal roof cornices, storefronts, and roofing soon saw a market opportunity for decorative steel as an interior finish in a wide range of buildings. The most common size of the decorative panels was 24″ wide with a length of 24″, 30″, 48″ or 96″. While longer panels were readily available, the 24″ and 48″ lengths remained predominant for ceilings, while wainscots utilized 30″ and cornices the longer lengths. According to some longtime manufacturers, panel size was a function of the press and die size. Most panels were intended to be painted to imitate plaster or wood. Besides factory-primed paint coatings, a few manufacturers offered factory-applied finish coats and baked-on finishes.

By 1911, the Edwards Manufacturing Company of Cincinnati was producing 28-29 gauge mild-steel decorative panels, formed between dies with a powerful hammer blow, a process said to produce a crisper repoussé than the slower hydraulic pressure method. By using large trip hammers, higher reliefs could be achieved, enabling more elaborate patterns as well as additional variety in moldings and other pieces. After die-stamping, the panels were trimmed over a template to ensure a perfect fit.

Depending upon the manufacturer or supplier and the complexity of the job, a contractor or building owner could measure the rooms where metal ceilings and walls were to be used, specify either the overall pattern or the specific components from the manufacturer's trade catalog, and, along with the room measurements, telegram the order directly to the manufacturer or supplier. In addition to providing detailed instructions on how to measure a room, many manufacturers and suppliers offered design services and even provided installation.

Orders were shipped with a parts list and assembly or "working" plans for the installer. Some offered furring strips, nails, wood blocking for high-relief cornices, and even a special line of paint for pressed metal to complete the order. Once installed in a building in town, the product helped to sell itself. It was new; it was appealing; and it could serve a broad range of purposes and applications.

Decorative metal ceilings and walls enriched the most humble of buildings. The wide range of available decoration and patterns meant that the desired look of fine plasterwork or elegant woodwork could be achieved at much lower costs with less skilled labor and



Early catalogs provide how-to instructions for "fire-proofing" beams of both metal and wood, incorporating them into decorative ceiling patterns.

installation time. While complex patterns in commercial applications required skilled installers, a handy homeowner could measure a room, choose a pattern, and order a ceiling by mail, and, upon delivery, read the enclosed installation instructions and then install a new decorative ceiling in his house, or so it was advertised.

The early 1900s witnessed an unparalleled appetite for decorative metal ceilings. From small towns to big cities, from manufacturing lofts to department stores, pressed-steel ceilings became commonplace. By the late 1920s, the popularity of metal ceilings and walls began to wane as "contemporary" design styles preferred less decoration and as new building products created greater competition. Trying to keep abreast of market changes, manufacturers introduced "modern" designs that were far less ornate and reflected the architectural trends of the time. The Great Depression led to the collapse or consolidation of numerous plants, and World War II accelerated the demise of the industry. During the war, non-essential new construction nearly came to a halt, and sheet metal was diverted for military use. Most of the remaining pressed-metal molds for ceilings and trim were melted down for the war effort.

By the early 1950s, the taste for simpler interior treatments continued, and the market for this product largely disappeared, despite the efforts of the few remaining companies to adapt and revive the business. Soon, production essentially ceased. The increasing popularity of historic preservation beginning in the 1970s and a renewed interest in decorative steel ceilings enabled a small but viable market to re-emerge. Several manufacturers responded and, with designers helping to rekindle an interest in decorative sheet metal, found a market in the rehabilitation of older buildings.

Manufacturing

While early decorative metal ceilings were made of iron or iron dipped in molten tin, steel overtook iron by the 1890s due to its lower cost, greater strength, and its ability to be die-pressed into thinner, larger sheets with greater decorative relief. Most decorative metal ceilings and walls that we see today are steel. Though zinc and copper ceilings were available, typically by special order, they were most often used in elaborate public, commercial, or residential spaces.

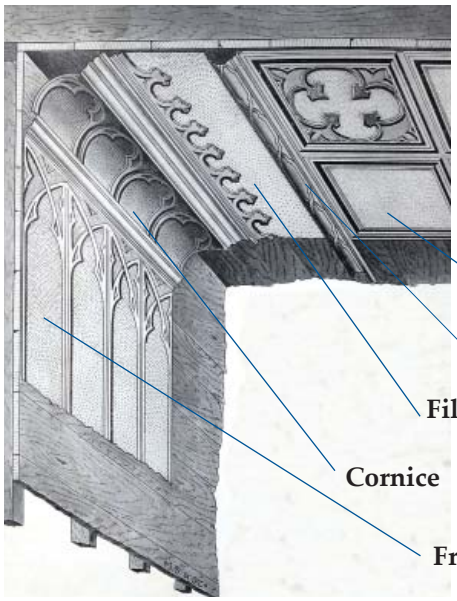
While custom-designed decorative pieces could be ordered, this was a costly process, due to the need to create molds and then dies for individual parts. More often, manufacturers would rely on existing dies to create a stock line of pieces that could be mixed and matched into a series of different designs. They would advertise the different overall designs as well as the availability of individual pieces so that a purchaser could create his or her own room pattern using stock components. Since manufacturers usually published their unit costs for each piece that comprised the overall pattern, pricing was easy to understand. Stock room patterns were also advertised with cost per square (100 square feet). The larger the room, the cheaper the cost would be per square. Some manufacturers advertised a discount to the trade.

The production process began with flat sheets of steel that large manufacturers made themselves and that smaller companies purchased from suppliers. Presses or stamping machines formed the decorative metal components, after which shearsmen trimmed the pieces to size. Each piece was then checked for "squareness."

Rope drop hammers at the turn-of-the century factory in Nevada, Missouri, that W. F. Norman Corporation still uses to stamp individual panels, resulting in high quality pressed metal sheets. (Photo: W. F. Norman Corporation)

Stamping molds used in drop-hammer presses began on the artist's design table. Once a design was approved, it was transferred from a full-sized paper drawing to a slab of molding clay and sculpted into a 3-dimensional model. The artist then cast it into plaster, first in a shell cast making a negative, and from that a positive, replicating the original clay model. This last mold was carefully leveled and smoothed and coated with shellac. Molten iron was next poured over the positive plaster mold to create a negative metal die. After the iron die was cooled, milled, and smoothed, workmen poured liquid zinc over the bottom die to make a separate positive metal mold. When cooled, the 2-part die was fastened to the hammer heads of the press with the strong iron die on the bottom and the more malleable zinc die on the top. (Photo: W. F. Norman Corporation)

Since nearly all pressed-metal ceilings and walls were to be painted, the individual pieces were factory primed with a base coat of white lead paint, although at least one manufacturer by 1942 was using an aluminum primer. Some manufacturers offered finished-coat colors as varied as colors of plaster ceilings. Factory-applied powder coatings were introduced in the late 1940s and early 1950s, just as decorative metal walls and ceiling were disappearing from the marketplace.



Anatomy of a decorative metal ceiling and upper wall.

The Ceiling Design and Its Parts

Pressed-metal ceilings generally consisted of four principal parts—a field, molding around the field, filler, and cornice. A number of manufacturers offered fillers that included the molding, thereby creating a three-part ceiling. Some ceilings, such as those emulating an overall beaded board or a Spanish-stucco finish, could avoid the filler and molding, and instead terminate the field with a suitable cornice. The ceiling design was often supplemented by decorative center pieces, special corner pieces, and even pieces to accommodate ventilation and lighting. The field was made of square or rectangular metal tiles, typically stamped with a floral or geometric pattern and cut to modular sizes.

The metal tiles were commonly referred to as plates and panels, with individual plates typically measuring 24″ x 24″ and panels being 24″ x 48″. Plates also came in larger sizes in multiples of two feet. Fields differed in complexity, with some tiles representing complete motifs in themselves and others presenting only part of a larger design. Whether complex or simple, the motif was repeated throughout the field and could be expressed in the border around the field and the cornice. The depth of the repoussé of the field patterns typically ranged from 3/8″ to 3/4″.

Moldings, fillers, and combination moldings and fillers formed the perimeter around the field, and typically complimented the pattern of the field. The fillers, and at times even moldings, came in a variety of widths and completed the overall design while compensating for irregular room sizes. This avoided cutting the field tiles, which would compromise the decorative pattern. Moldings, fillers, and molding/filler combinations came in relatively long lengths, with 48″ and 96″ being the most common.

Many ceilings included a cornice, which could have a wide range of elaboration. While most cornices were stamped from a single strip of sheet metal, cornices could extend a considerable length down the wall by adding additional moldings and borders. Cornices helped dress any protruding structural beams and reinforced the sense of depth. Coffered elements could also be incorporated into the design of the ceiling that likewise could incorporate the cornice.

The overall design and individual pieces comprising the ceiling and walls were commonly classified as Classical, Rococo, Colonial, Greek, Gothic, and Mission. By the l930s simpler Modern patterns were marketed. While many ceilings were chosen from room patterns shown in catalogs, Americans also freely combined a panoply of styles and patterns to create new designs. Patterns would have repeats as small as 3″ but those with repeats of 12″ or 24″ were more common.

As the industry grew, wall treatments, including special pieces for partially enclosed stairs, were also marketed. Usually referred to as "side walls" or "sidewalls" to differentiate them from ceiling components, they were commonly based on the traditional tripartite wall design of frieze, field, and wainscot. Walls could incorporate a chair rail, and even a metal baseboard, though more often a wood baseboard was used for practical reasons. Decorative metal walls were mostly used in tandem with metal ceilings. While never matching the popularity of metal ceilings, metal sidewalls did enjoy varied applications, from homes to factories to even churches. Certain pressed-metal wall patterns, particularly beaded boards, ceramic tiles, and stucco finishes, were successfully marketed for use in bathrooms, kitchens, and similar applications where there were special sanitary concerns. Wall pieces tended to be larger than those commonly used in ceilings. A simple grid pattern that emulated the concave grout lines of square ceramic tile was available in sheets as large as 24" x 96" for ease of installation and to minimize seams.

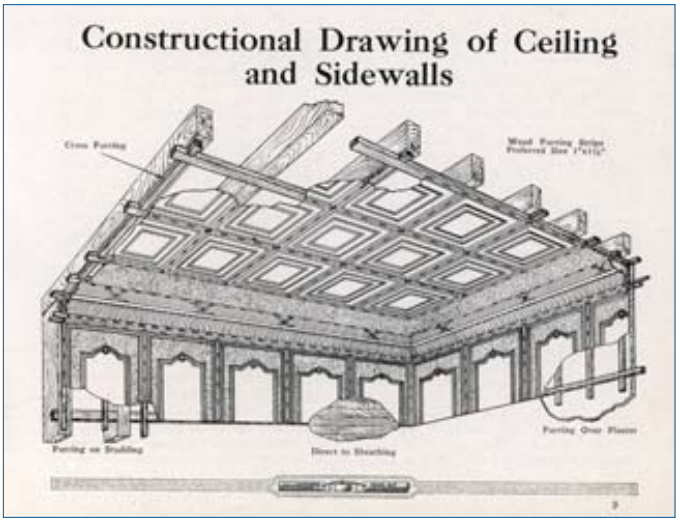
Installation

Understanding how historic decorative metal ceilings and walls were installed is crucial to maintaining, repairing, and replacing them today. First, it is important to identify the metal used. Early ceilings of iron panels or tiles usually were not overlapped, but rather butt-jointed end to end, thereby creating noticeable seams. Where a more finished appearance was desired, special molded strips were applied over the seams. With steel and even copper ceilings, individual pieces were usually overlapped, thereby minimizing seams. Another difference between early iron ceilings and later steel ceilings is the manner of the decoration. Unlike steel where decoration is embossed through machine stamping or pressing, in iron the decoration principally was applied separately and made from malleable materials such as zinc. The decoration was bolted rather than nailed to the iron.

Ceilings

Decorative pressed-steel ceilings were mostly laid over lathing strips that were nailed to joists and beams. The lathing was nailed in grids that matched the locations of the panel seams. Steel ceilings could be laid directly over existing wood ceilings and even over plaster that was attached to lathing. If the plaster was deteriorated, lathing strips for the metal ceiling could be applied directly over the plaster. For small rooms, manufacturers recommended applying 1/2" wood sheathing over the whole ceiling for ease of installation. Common lathing sizes included 7/8" x 7/8"and 7/8" x 1 1/4", though in fact they typically ranged from 5/8" to 1 3/4" in thickness and from 1-1/4" to 1-7/8" in width.

Installing the lathing correctly was critical both for optimum appearance as well as for sound attachment.



A 1928 Berger Manufacturing Company catalog shows the recommended ceiling and sidewall support structure beyond the pressed metal tiles.

In part, probably mainly to avoid open butt seams, panels were designed to overlap their neighbors so that nails were driven through the perimeters of two or more adjacent panels. Depending on the size of the tiles, some were secured just at the corners, while large or heavier tiles required additional edge nailing. Panels usually came with holes set every 6" along the edges. Off-sized panels and specialty pieces, such as factory-made cornice corners, had nail holes located where needed.

This type of attachment required that the lathing be accurately installed and consistently level. Lath strips ran perpendicular to the joists to which they were attached, while shorter headers and cross strips (needed to complete the nailing grid) ran parallel to the joists and were attached to the lath. If the joists were 24 inches on center, the wood headers for 24" tiles could be attached directly to the joists, which is one reason 24" tiles were so popular. For 12" tiles, lathing was usually spaced every 12 inches. Lathing for larger or more deeply ornamented tiles was handled somewhat differently. To ensure that the lathing grid was level, low spots were filled in with wood shims and high spots were smoothed out.

The field usually was installed first, starting at one corner of the room, making an effort to keep the lapping edges running from the light source in the room. There were special considerations where rooms were of irregular dimensions that could not be compensated simply by the use of the filler around the field.

As the industry matured, field patterns evolved that featured re-pressed beads along the edges of each plate and die-cut nail holes located within raised buttons. This detail within an overlapping seam provided for ease of installation and a clean, tight-fitting connection that was also touted as dust-proof. Once painted, the overlaps and nail heads became less apparent from the floor view.

There were other types of installation methods used with steel ceilings. In an effort to hide seams and simplify installation, some manufacturers offered interlocking field patterns whereby each piece was nailed only on two sides and used an interlocking edge to connect to tiles on the other two sides, thus covering the nails. Irrespective of how the pieces in the field were fitted, the perimeter fillers were usually designed to fit under both the molding, if used, and the cornice. Thus the filler could be installed after the field was in place. The filler, molding, and cornice pieces usually ran in longer lengths than ceiling tiles and, therefore, had fewer seams. The cornice usually was the last major portion to be installed, and, since installed at an angle, it often required additional wood blocking. Special corner pieces were available for cornices and, if used, avoided the need to purchase mitered corners or to hand-miter in the field.

Nails for lathing or sheathing varied in size depending on conditions, such as the thickness of the lathing and whether the new ceiling was being installed over an existing one. When nailing the metal directly to the furring, 1″ oval- or flat-head nails were commonly used.

When installing a new ceiling in a room that would have hanging ceiling lights, buyers could note the approximate location for the lights so that the supplier could, depending upon the pattern of the ceiling, provide a layout with special center pieces where the drops were to be installed. Otherwise, the centers of individual field pieces could often be cut out so that eletrical wires needed only be moved a short distance to align the fixture on the center of the tile.

Walls

The support system for decorative steel walls varied from that used on ceilings. Manufacturers generally recommended 1/2″ sheathing for walls, which provided a more rigid substrate than lathing. Alternatively, sheathing could be used along the lower wall that was more subject to wear. Wall lath was usually 2 inches in width, wider than that of the ceiling grid, and installed every 6 or 12 inches. Walls were installed from the bottom up. Where wainscoting was used, a wood or decorative-metal chair rail was applied last and covered the seam between the metal wainscoting and the sidewall above.

If there was no separate wainscot, the sidewall extended from the baseboard to either a frieze at the top or directly to the cornice. For rooms with 8- or 9-foot ceilings, tall sidewall panels were available that avoided horizontal seams. Even these panels often included in their design a high dado decorating the lower half, creating the appearance of a wainscoting. For taller ceilings or patterns that required horizontal rows, skilled contractors installed wall tiles with lapping edges upward, above eye-level, and downward at or below eye-level to avoid small shadows at the seams. There were special techniques in laying out the sidewalls around windows and doors to avoid, where possible, awkward breaks in the pattern. For rooms with numerous windows and doors, a simple wall pattern worked best. For inside and outside corners of walls, many of the wall tiles could even be shaped, usually with a bending brake, to fit the corners.

Condition Assessment

Decorative metal ceilings are highly durable in most interior applications. Typically, damage and deterioration occur because of water infiltration either from exterior sources or leaking pipes overhead. Such damage usually is easily observed and for metal ceilings takes the form of water and rust stains, peeling paint, and metal flaking, pitting, and holes—either in small areas or more widespread—from corrosive action. Similar damage can occur from high humidity and condensation. It is important to eliminate sources of water infiltration, improve air circulation, and reduce levels of humidity, depending upon the conditions.

Some seams were easily disguised with interlocking patterns, whereas others, like butt joints, remained quite visible. Historic decorative metal ceiling at the LaSalle/Van Buren (CTA) station, Chicago, IL. (Photo: Kaaren Staveteig, NPS)

Ceilings need to be checked to see if they are firmly secured. Lathing can deteriorate from prolonged water damage and termites, and the nails that secure the metal to the lath can corrode. While loose metal pieces, sagging, and actual failure of one or more portions of the ceiling are often readily evident, close-up inspection of the ceiling is recommended.

The structural integrity of ceilings can be negatively affected by other conditions. When metal ceilings were applied directly over older plaster ceilings in poor condition, installers were instructed to use a different installation technique. By installing

Prior to repair, a section of the pressed metal was removed to expose the condition of the plaster and lath and to document the earlier finish. (Photo: Kaaren Staveteig, NPS)

wider and more narrowly spaced lath over the existing ceiling, and anchoring it with nails long enough to grab the joists, the wood grid would also help secure the existing plaster ceiling. Where this was not done, and the metal was placed directly on the plaster, the weight of the deficient plaster ceiling can place pressure on the metal ceiling, causing sagging and other problems.

Metal ceilings can be damaged by later penetrations from piping and conduit, resulting in loose and deflecting tiles. Where dissimilar metals are in direct contact with the metal ceiling, galvanic corrosion can occur in localized areas. Plumbing pipes, electrical fixtures, and other apertures over time cannot only affect the structural soundness of the ceiling, but also destroy the visual continuity of the ceiling pattern.

By their location, decorative metal sidewalls and their enclosed stairs are particularly subject to wear and abuse, resulting in unsightly dents, compressed areas, and penetrations, especially where the metal was secured directly to lathing rather than continuous sheathing. These conditions tend to occur at the lower sections.

Deferred maintenance, poor workmanship, lack of heat in formerly conditioned spaces, high moisture, and water penetration can result in peeling paint. Where the paint is peeling in isolated areas, simple tests can determine whether the paint on the rest of the ceiling is sound. Care must be taken because of the likely presence of lead-based paints (see sidebar). When in doubt, a test for lead paint is recommended and may be required.

Cleaning and Maintenance

Properly caring for historic decorative metal ceilings and walls is important to their preservation. While ceilings are likely to receive less periodic repainting than walls, unlike walls, dirty ceilings tend to be repainted rather than cleaned. Excessive paint buildup can obscure the decorative detail in the pressed metal. Where dust and dirt buildup is evident, cleaning may be all that is

Working with Lead-Based Paint

Because of the hazards of lead poisoning, special care must be taken when working with metal ceilings and walls containing lead-based paint. Lead-based paints commonly were used as primers for historic pressed metal and in general use for onsite finish work. It is a safe assumption that pressed-metal walls and ceilings with old paint contain one or more layers of lead-based paint.

There are safety requirements that apply to contractors and their employees undertaking work involving lead-based paint. Since young children, pregnant women, and the elderly with certain medical conditions are particularly at risk from lead poisoning, the Environmental Protection Agency issued the Lead Renovation, Repair and Painting Program (RRP) rule, which applies to both rental and owner-occupied housing, and child-occupied facilities, such as day care centers, where lead paint is present. Where a paid contractor is being used in these buildings and more than six square-feet of lead-based paint is being disturbed in a room, RRP requirements apply. For example, the rule applies where loose lead-based paint is being removed by a contractor throughout a metal ceiling but would not apply when repainting the ceiling involves less than six square feet of loose paint in one room. While RRP does not apply to most commercial buildings and to houses where homeowners do the work themselves, it is generally good practice to follow the RRP rule. Other federal, state or local requirements may apply where lead paint is present.

In general the RRP rule provides, among other requirements, that:

(a) The work area must be contained during the job to control the dust and debris prior to removal and that the dust and debris must be disposed of in a safe and prescribed manner.

(b) Certain high-risk paint removal methods are prohibited and certain others strictly controlled.

(c) Workers must be trained in dealing with lead-based paint and use appropriate clean-up procedures, and contractors must be trained and certified to work with lead-based paint.

(d) Building occupants must be informed of the hazards of lead-based paint and safety measures required during the work by the contractor.

(e) Follow-up testing must take place upon work completion.

For more information -- https://www.epa.gov/lead/renovation-repair-and-painting-program

Maintenance and Repair Precautions

Electrical power to the room should be turned off before inspecting ceilings and walls. As part of the inspection, adjacent wiring, outlets, and fixtures should be examined for exposed wiring and signs of electrical shorts and should later be tested with the power on. This is important because steel and copper decorative metal are also good electrical conductors.

Appropriate gloves and protective eyewear should be worn when working with metal ceilings and walls, especially when cutting metal or making repairs, which can produce sharp edges.

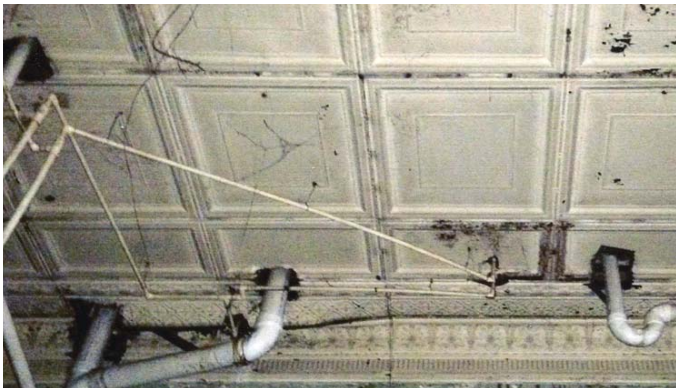
The backsides of old ceilings may have collected rodent or bird droppings over the years. Where ceiling components are being disturbed, appropriate protective measures should be employed and steps taken to minimize air-borne particles to avoid potential illness.

Care should be taken when working with lead-based paint. (See sidebar on page 7)

Most chemical paint-removal products are hazardous, and their use may be restricted by federal, state, or municipal regulations. Where required, appropriate respirators and other safety precautions should be used.

necessary. If the paint is sound, yet the surface is sticky and dirty, a solution of mild dishwashing soap and warm water applied with a wet rag and then wiped dry usually is effective. Cleaning methods should first be tried in a small, less prominent area, to ascertain whether or not they affect the finish or if several applications may be necessary, especially for areas involving deep grease spots.

Cleaning provides an opportune time to examine whether any of the exposed nails securing individual metal pieces have worked loose. Deficient and missing nails should be replaced. Touchup metal paint should be used on the nail heads, as needed. With small areas of old water stains, apply a stain-blocking primer prior to repainting. Mild staining from light rust may merit removing the paint back to the metal surface and then removing the surface rust with fine steel wool or crocus cloth. Surrounding paint edges should be feathered by using a fine sandpaper or wet sanding into the paint so as to taper it into a fine edge. A rust-inhibiting metal primer should then be applied to the exposed surface before applying finish coats.



Metal ceilings can be greatly impacted by later penetrations from piping, electrical, and other such work, resulting in loose tiles and deflections in the ceiling. (Photo: Kaaren Staveteig, NPS)

Repair

Little has been written about repairing decorative metal ceilings and walls, and there are fewer prescribed techniques. The most common type of repairs involve holes and dents, such as those from light fixtures, mechanical pipes and ducts, and plumbing and sprinkler pipes. While the location of these features and fixtures may change over time, the holes in the ceiling remain.

Methods for repairing and patching holes are similar to those used in certain architectural sheet-metal work and in automotive body repair. Nail holes can be soldered or filled with fiberglass-based patching products. Holes that are less than 1/2″ can be filled using automotive body filler, then sanded to match the adjacent surface. Where holes are larger than 1/2″, several methods can be used. One method is to cut a piece of sheet metal to a shape that will cover the hole and at the same time can be inserted in through the hole to the backside and adhered to the back of the metal panel. The new patch should cover the full extent of the hole and be sealed along the inside edges before priming and painting. This method eliminates the hole, though still reads as a patch. Another method is to insert a backing material into the hole and secure it in place. Then spread and smooth filler material edge to edge. Whether working with pressed-metal or older iron ceilings, sheet metal used in patching should be of a similar metal to avoid galvanic corrosion.

Dents in embossed zinc and steel elements are more problematic because they are difficult to draw out and, when working with a ceiling in place, there is no access from behind. With early installations involving decorative zinc elements bolted to an iron ceiling, it may be possible to detach the decorative element and work out the dents. For embossed steel ceilings whose patterns are still available or if a matching piece can be salvaged elsewhere from the building, a patch can be cut large enough to overlap the dent and then glued in place with an adhesive. After the adhesive has dried,

continued page 12

Paint Removal

Removing paint from historic pressed-metal walls and ceilings is not a simple task. While multiple layers of paint applied over time may obscure some of the metal detail, generally such a condition does not merit in itself removing the paint. Even with softened lines and some loss of detail due to paint build-up, most historic metal ceilings and walls retain their overall historic design and character.

The need to remove old paint usually depends upon metal condition and paint adhesion, applicable government requirements regarding building use and lead-based paint, and whether the ceiling is being temporarily disassembled to facilitate other on-site work. Since lead-based paint was widely used on pressed-metal walls and ceilings prior to 1978, paint removal should follow applicable government requirements concerning worker safety, containment, and proper disposal. (See page 7)

Before considering appropriate methods for removing paint, it is important to identify the type of wall or ceiling metal, as this may influence the choice of the paint-removal technique. While steel is by far the most common material in historic ornamental walls and ceilings, other metals and metal combinations can be encountered, including iron with zinc ornamentation, zinc, steel with zinc decoration, and even copper. Besides the metal itself, it is worth considering the sheet-metal thickness or gauge, since this varied somewhat by manufacturer and by material, and the metal's current condition. A thick build-up of paint can hide rusting from behind that has thinned the metal or created small pin holes.

Paint removal methods also vary depending on whether the work is to be done in-situ or under shop conditions where the pieces are removed and then paint stripped. Paint removal typically involves a combination of hand scraping and wiping, wire brushing, and use of a chemical release agent. Some methods, such as that described as a freeze/flex method, are alternatives to the use of chemicals.

Once the nature and condition of the metal are identified, the need for paint removal established, and the decision made whether to temporarily disassemble the ceiling, the next steps are to document the historic paint coatings (where there is possible interest in repainting to match the historic finish), and then choose the best means of removing the paint.

In-situ methods of paint removal using chemical strippers

Prior to undertaking full-scale paint removal, several chemical strippers should be tested for comparison in an inconspicuous area typical of the overall surface condition. This test will help establish which chemical stripper performs best without damaging the metal, and help determine the necessary application thickness of the solvent-based paste and the length of time it should be left to work. Also the test will help establish whether several applications will be needed. Proper safety equipment should be used, including eye protection, breathing mask, and gloves. Containment and other safety procedures when dealing with lead-based paint need to be followed as well.

One of the most common chemical removal processes is a chemical peel. This method typically requires application of a 1/8"- to 1/4"- thick solvent based paste with either a trowel or specialized spray equipment. The paste is then covered with a fibrous laminated cloth, polyethylene side facing out. This material is left in place up to 24 hours, as determined from the sample test findings. Remove the paint layers by sliding a taping knife along the edges of the dried paste, easing the paint, paste, and cloth away from the surface. The remaining chemicals should be removed with a sponge and clean water before applying a neutralizing agent on the surface to return it to a neutral pH condition for best paint results. As with the chemical paint remover itself, it is important to select a neutralizer safe to use on the specific metal.

An alternative approach relies on multiple applications of chemical stripper, using a nylon brush (4" typical)

After applying a solvent-based paint to the metal, a laminated cloth/paper is applied during the chemical-peel process. (Photo: NPS)

or specialized spray equipment. The paste is left on from four to 24 hours, depending on the required activation time. To remove, scrape the softened paint and chemicals from the surface. Repeat this process until the metal surface is exposed. Scrub clean with water and a stiff nylon brush; thoroughly wipe dry; neutralize, if needed; and then coat with a rust inhibitor such as a zinc-rich primer.

(NOTE: Using an oven cleaner to remove paint from decorative metal ceilings is a technique that appears in social media. While oven cleaners are supposed to be safe on metal, they are designed for ovens that are porcelain-coated. When used on old pressed metal and left for more than a few hours, irreversible pock marks may appear. If used only on a small area, proper safety procedures and protective gear for working with lead paint and harsh chemicals need to be followed. When working overhead, eye protection is critically important.)

"Eco-friendly" paint strippers

In recent years a number of biodegradable paint removers have appeared on the market that are characterized as "eco-friendly." Even with these strippers, some of which may include solvents, protective clothing should be used and appropriate safety procedures taken. Whether marketed as citric or soy-based, or simply as biodegradable, these products are applied as coatings or gels similar to traditional chemical strippers. The time required before removing the coating varies according to product and the number and types of paint coatings. Like most chemical strippers, they require considerable handwork to remove paint build-up and to prepare the surface for repainting. Several require a separate application of a cleaning agent, such as mineral spirits, to remove residue prior to repainting. At the time of this publication, little information was available on their use specifically on pressed metal, manufacturers' product data and related information should be carefully researched well in advance of testing. It is important to both test the removal of the paint as well as the preparation of the surface for repainting. Testing can include actual repainting, allowing ample time for the paint to cure prior to performing a paint adhesion test (see ASTM for applicable paint adhesion test on metal surfaces).

Water-based blasting

High-pressure water-based paint removal systems should not be used on pressed metal. Some water-based paint removal systems use very low-pressure water (25-35 psi at the surface) along with a mild abrasive element. Generally, even these are not recommended for widespread use on in-place decorative metal ceilings. Such methods may have limited applications, such as on walls where the individual panels are large and there are fewer overlapping joints. Even so, there are risks involved. Potential damage to pressed metal where a water-based abrasive paint removal method is used includes the appearance of pockmarks, pin holes, or worse. Also, water seepage from behind can occur, leading to flash rusting.

Dry abrasives (sandblasting, walnut shell blasting, soda blasting, and other dry abrasives)

Sandblasting, walnut shell blasting, and most other dry abrasives applied under air pressure will most likely damage the historic metal and should not be used. Since lead paint will be present, government regulations may prohibit the use of specific techniques such as sandblasting to remove paint from ceilings and walls in schools, rental residential properties, and other building-specific uses, and by contractors working in owner-occupied residential buildings. Both soda and sponge media with mild oxide grit may be used in a limited capacity under very controled conditions to remove paint from pressed metal. Careful testing is essential, and, if selected, quality control at the site is paramount.

Dry-ice blasting

There is limited experience with the use of dry-ice blasting to remove paint from pressed-metal ceilings. Dry-ice pellets are sprayed under pressure against the painted surface, causing the paint to lose adhesion and drop to the ground for collection and disposal. The advantage over some other techniques is that the dry ice changes to a vapor, leaving only the paint debris to be cleaned up. Due to its limited track record on historic pressed metal, it should be carefully tested by removing several panels for testing offsite. As part of the testing, varying air pressures and distances from the spray nozzle to the metal panel should be used to help ascertain if the surface of the metal is being damaged. If selected, it should be tested in an approved area that will be used as the control for the rest of the project. Since this method requires a trained contractor with special equipment, its use on small-size projects is not cost effective.

Heat

Propane torches should not be used on metal ceilings and walls, in part because of the considerable risk that they may ignite any hidden combustible materials, as well as vaporize the lead and other paint chemicals. Heat (hot air) guns are generally not recommended because of the same reasons. When used on the lowest setting and at a controlled distance, there are limited instances where heat guns might

Restoring a metal ceiling or wall surface often requires several different techniques. Using a chemical release agent typically requires additional hand scraping, wire brushing, and sanding to completely remove the paint. (Photo: NPS)

be used with considerable caution to remove paint. Ample monitoring time must be scheduled at the end of the day in case of smoldering debris, wood lath, or other materials behind the metal. If a heat gun is used, it is recommended that a monitored fire alarm sensor/s be placed at the end of each day in the immediate area of the work as a precaution.

Heat guns can be more safely used under shop conditions since risks of adjacent material being ignited can be carefully controlled. Heat guns should be used on their lowest settings to minimize the vaporization of paint chemicals, including lead. Heat guns tend to work best on heavy paint build-up.

Hand scraping, wire brushing, and sanding

Careful hand scraping with a chisel and/or wire brush can be effective for removing stubborn paint in the crevices of the repoussé, especially when used in combination with other paint removal methods. To capture lead and paint debris, only wet hand sanding and/or an electric sander equipped with a HEPA-filtered vacuum attachment should be used.

Methods for removing coatings under shop conditions

The temporary de-installation of historic metal ceilings and walls to allow for other rehabilitation work presents a perfect opportunity to remove paint off-site or in a controlled on-site space. Such shop conditions provide an opportunity for better control of the work and are easier than overhead ceiling work.

Once the installation pattern has been recorded and disassembled, each piece should be inspected for any damage that may preclude its reuse. If the method for appropriate paint removal has not been established by this time, damaged pieces can be used for testing.

Chemical removal

Appropriate chemical methods to remove paint from walls and ceilings in place can also be used in the shop, usually with much better control. In addition, some chemicals may be used in a bath solution ("dip stripping") to soften the paint so that it can be scraped off by hand. Through proper testing, steps can be taken to guard against flash rusting, on the steel surfaces.

Thermal contraction—freeze/flex method

Freezing techniques have been successful in removing paint from pressed metal (see Fort Baker case study). The demounted pressed-metal panels are frozen in commercial-sized freezers. The metal contracts at a greater rate than the paint, which breaks the adhesion bond between the paint and the metal. When sufficiently frozen, the panels are removed and gently flexed by hand and tapped with brushes to flake off the paint. Hand picks, small scrapers, and other small tools then are used to remove paint remaining in deep crevices. On any project, this process must be tested on one or more panels to determine efficacy.

As with any paint removal method, once the pressed metal has been cleaned and the surface prepared for painting, a metal primer should be applied as soon as possible, even though the finish coatings might not be applied for some time.

Once the metal panels are clean of previous layers of paint, it is easy to see their original decorative design. (Photo: NPS)

Another option for the replacement of individual tiles that may be irreparable in a field of otherwise salvageable material is digital replication. Through the careful removal of the tile, a skilled artisan can measure the exact dimensions and create a digital copy. Once an acceptable model has been created, the design can be replicated on a suitable substrate as shown. (Photo: Lonnie Coulter, La Bastille)

the patch can then be primed, the edges caulked, and the piece painted.

For larger holes and dents, it may be possible to re-create the decorative appearance out of metal filler or fiberglass. Base materials should be tested beforehand for ease of workability and finishing. The surface appearance can be recreated by carving and sanding, which, depending upon the pattern, can be quite tedious. Fortunately, since ceilings are viewed from a distance, an exact match is not necessarily essential. Where the required filler is relatively thick, a mold technique could be used. Using a section of an existing undamaged piece or a rubber impression of the pattern, which then is stiffened on the outside, the "mold" can be pressed into the filler, backside up. A release agent may need to be applied to the mold before pressing onto the filler.

Where the decorative metal pieces are still manufactured or can be salvaged from elsewhere in the building, a damaged piece can be cut out and a new piece installed. Since the old pieces to be replaced will usually overlap with adjacent pieces, close examination and understanding of how they were installed will help in devising the most suitable means of replacement. It may not be possible to overlap or slip in behind all of the outside edges adjacent to the historic tiles. Therefore, some trimming along the outside edges of new or salvaged tiles may be required before nailing in place. The use of caulk and paint will help compensate for the exposed connection.

Where a relatively large section of the steel ceiling or wall is damaged or beyond repair, pieces salvaged from other places in the building or new ones that are a close match can be used. In inserting the new panels or pieces, it is again important to understand how the existing pieces overlap and were installed in order to determine the best way to integrate and attach the replacement pieces. Where replacement pieces that match cannot be obtained, it may be possible to introduce similar but non-matching new ones.

As an alternative to wholesale removal or borrowing tiles from other parts of the project, several digital technologies can be utilized so that full panels can be replaced. Through a method of image capture, a height field image can be manipulated through digital modeling that mimics the pattern of the panel. This technique only works when an image can be taken from directly below a panel in relatively good shape. Alternatively, a single tile can be carefully removed so that a skilled worker can create a digital copy. Once a digital model is obtained, the file can be replicated through rapid prototyping technology, such as 3D printing or CNC routing, on a suitable substrate, such as high-density urethane tooling board. Once installed and painted, the new pieces will closely match the adjacent historic pieces.

Fire Protection

In general, pressed-metal ceilings fail to meet current fire resistance requirements, determined in part by the construction and use of the building, its size, and the locality. The most commonly-used codes applied to historic buildings are published by the International Code Council (ICC). Its International Existing Building Code (IEBC) has a specific chapter applicable to historic buildings, with a classification system that defines different levels of renovation work and relates construction requirements to them. Localities that have not adopted the IEBC likely use the International Building Code (IBC) to determine code requirements. Where the IEBC has been adopted, the IBC and other codes published by the ICC may still contain provisions and requirements applicable to historic buildings by reference. Before proceeding with a project, check with the local code official or fire marshall as to what is required to meet the specifics of the building and regulations regarding metal ceilings.

Simple repair projects and those limited to building systems do not typically trigger an evaluation of the fire separation between floors. Neither does

rehabilitation work involving owner-occupied single-family residences. Buildings that undergo substantial renovations, especially where upper floors above a first-floor commercial area are converted to residential use, will likely trigger a change in the fire-separation requirements.

Fire separations between different occupancies, or separating occupancies from an egress stair or route, are typically required at ceilings or walls in order to prevent or retard the passage of excessive heat, hot gases, or flames (fire resistance). A two-hour fire separation is typically required between residential and commercial occupancies, and a greater separation may be required where at least one occupancy is considered high hazard. Although pressed-metal ceilings installed with dead air space between ceilings and joists are noncombustible, they do not achieve the required rating. A pressed-metal ceiling installed directly on furring strips on wood joists is rated at 30 minutes. If the ceiling was installed over a plaster ceiling, a one-hour rating may be achieved, depending on the integrity of the plaster.

The Historic Buildings chapter of the IEBC provides numerous approaches for historic pressed-metal ceilings to be retained, even without full or partial improvement of the assembly's fire-resistance rating. The code explicitly provides flexibility to small museums where automatic fire-extinguishing systems are provided and where the existing wall and ceiling finish are constructed with wood or metal lath and plaster. A report documenting the investigation and evaluation of code requirements may be required by the code official.

Increasing Fire Resistance

As required or desirable, methods exist to achieve at least a one-hour rating with a historic pressed-metal ceiling. Metal panels can be removed and reinstalled over one or more layers of 5/8" Type X gypsum board. Adding noncombustible insulation in the floor joist cavity to slow down the heat transfer may also be accepted by the local official: the IBC rates the addition of noncombustible insulation, two to three times the thickness of a typical stud wall, as a 30-45 minutes gain.

Intumescent paints and coatings slow down the rate of heat transfer and are sometimes used on existing pressed-metal to help achieve a higher fire rating. Because such paints and coatings tend to be thick when applied, they usually obscure the decorative pressed-metal pattern and should be used only where necessary.

Fire Suppression

New or existing fire-suppression systems in buildings most typically use water-based sprinklers. New systems may provide safety advantages, permit flexibility in applying code requirements, and reduce insurance costs. New and retrofitted systems must be carefully considered to minimize adverse aesthetic impact. For example, sprinklers may be retrofitted by removing (and reinstalling) only limited ceiling sections, or by access from above, if substantial building-wide improvements are planned. Sidewall mount sprinklers are an excellent solution that can require no removal of the pressed-metal ceiling. Depending on the building and the scope of rehabilitation, these can be installed on multiple walls, although they must meet sprinkler standards (NFPA 13: Standard for the Installation of Sprinklers Systems).

Pressed-Metal on Walls

As with pressed-metal ceilings, different levels of interior work or change in occupancy may trigger additional fire separation requirements between adjacent uses and at egress corridors. A sprinkler system, installation of appropriately-rated gypsum board on walls (either the corridor or room side), or a combination of these approaches, may be acceptable.

Replacement

Early iron ceilings with zinc decorations are quite rare today and every effort should be made to preserve them. Where serious deterioration has occurred and replacement is being considered, an architectural metals conservator should survey and recommend the best way, if possible, to preserve the ceiling or, if necessary, how to replicate its appearance.

Historic pressed-steel walls and ceilings are much more common and cannot always be saved. Decisions as to when to repair and when to replace are influenced by a number of factors. Besides condition and cost, other considerations include the significance of the building and the space in which the pressed metal exists; the ornateness and complexity of the ceiling or wall pattern; and the availability of replacement units that match or retain the historic character of the wall or ceiling.

Common reasons for replacing pressed steel are widespread rusting and/or damage from high interior humidity or serious neglect. Where these conditions exist, replacement is often the appropriate option. As discussed in previous sections, the presence of lead-based paint or higher fire resistance requirements usually should not be considered sufficient justification for replacement of historic pressed metal that is otherwise in repairable condition. This is especially true when the wall or ceiling is located in a historic building or considered a distinctive feature in its own right, contributing to the building's historic character.

When the decision is to replace the pressed metal or install a new metal ceiling where one previously existed, a number of considerations come into play, including how closely the historic ceiling or wall can be matched and how the new decorative pressed metal will be attached.

Prior to removal, the pressed metal should be photographed, its components measured, and its overall

continued page 16

Historic Finishes

Contrary to a popular recent trend of leaving new pressed-metal ceilings unpainted or coated with clear polyurethane, historically, metal ceilings were intended to be painted. Since most were made of steel, and not tin-plated or galvanized, the paint not only served as a desired finish but also as a protective coating to deter oxidation and rust. Paint coatings also have the distinct advantage over modern clear-coat finishes in that fillers or caulk can be used prior to painting to fill in any gaps between parts, while the paint helps close small gaps as well as conceals the use of fillers or caulk.

Many pressed-metal ceilings were manufactured with a prime coat of paint, on one or both sides. Primer was cheaper than tin-plating or galvanizing, and, through experience, various manufacturers learned that a protective coating of paint on steel meant fewer complaints from customers. Primer colors varied among manufacturers, but were usually white or grey. Even when not factory primed, manufacturers' instructions emphasized that oil-based, rather than water-based, paints should be used.

Marketers and designers embraced early on the decorative aspect of pressed metal, including how it was finished. In 1891, *The Decorator and Furnisher*, a monthly art-trades journal published in New York City, stated it "need hardly be mentioned that the metal plates after being embossed can be decorated in any tint of color required and wonderful effects have been produced by the use of lacquer tints which, applied to the fine modeling of the plates, produces most artistic and charming effects."

Since pressed-metal ceiling marketing stressed that the appearance was designed to emulate ornamental plaster and wood, painting helped to convey that intent. While some decorators and manufacturers promoted decorative finishes with multiple colors and highlights, most ceilings were painted either a single color or two colors, where the second color was used on the cornice to match the wall paint. It was good marketing to promote a simple paint treatment, lauding that the pressed metal was ornamental enough without an elaborately applied paint scheme.

Most typically, a professional painter brush-applied a finish coat after the ceiling was installed. Still, manufacturers often provided tips on painting. While gloss paint was widely used early on, the introduction and popularity of pre-mixed flat paint in the l920s was embraced by marketers for use on ceilings. Flat paint was described as warm, non-glaring, and "radiating light." White gloss paint remained the preferred finish in rooms where sanitation was a concern, such as kitchens and baths.

By the 1920s and 1930s, some manufacturers marketed their own lines of paint specifically for pressed metal, often offering a range of colors in varying shades of white. The 1930 trade catalog of the St. Paul Corrugating Company (MN) included these fashionable color samples for metal ceilings: white, light green, pink, tan, and sky blue.

Some period literature suggested how to use color in room decoration. The Berger Company (St. Louis) 1927 catalog advised that for ceilings too high in proportion to the room, "the ceiling color should be brought down to the bottom of the cornice." For low ceilings, "the sidewall color should be carried onto the cornice and blend into the ceiling color." It cautioned to "avoid the bold striping of moldings, cornice or parts of members; also eliminate, as much as possible, gaudy colors and the use of gold or silver bronze as these have a tendency to detract from the dignified appearance of the ceiling." Other manufacturers also provided useful painting suggestions: "A very pretty effect can be obtained by a careful stippling with a dry brush before the paint is thoroughly dry, thus giving the whole surface a slightly granular or plaster-like appearance and completely obliterating all brush marks . . . For a ceiling in a large, well-lighted room, where a greater degree of brightness is desired, a judicious touching up with gilt paint of the higher surfaces of embossed patterns, gives a very rich and pleasing effect."

Where the desired effect of the ceiling or wall was to convey an imitation-wood appearance, finishes could be applied to the metal in a manner that conveyed the look of natural or stained wood.

Polychrome treatments

While manufacturers tended to discourage agressive polychrome painting, some included color prints of polychrome painting in their literature. Examples of intact historic polychrome painting schemes have been found in buildings across the country, including the Nugget Building, a bank in Telluride, Colorado, and the Trumbull County Courthouse in Warren, Ohio.

In an effort to offer a distinctive line of ceilings and sidewalls, the Wheeling Corrugating Company (WV) offered, as early as 1906, encaustic metal ceilings with a baked-on enamel coating to hold its color and porcelain-like finish for years. The field, cornice, moldings, and fillers could each be ordered in a range of colors. For a more striking appearance, the raised and flat areas of each component could have complementary colors. Once installed, the result would be a richly decorated polychrome scheme combined with a pressed relief that would rival the appearance of ornate, decoratively painted plasterwork.

New Beauty for the Ceiling

The present day trend in art and architecture has brought a demand for a new ceiling treatment in enduring steel. The New Edwards Modernistic is fulfilling this demand in an unusual way.

Architects and decorators have been generous in their praise of this new achievement. The widespread approval of Edwards Modernistic has opened up new fields for the use of steel ceiling.

It is now possible to secure the most striking effects with color combinations without employing costly decorators. Where the quiet atmosphere of an all over color is desired its lines and planes stand out in beautiful relief.

Furnished with re-pressed beads and die cut nail holes Edwards Modernistic has become the most important contribution to the field of decoration in the last decade. Write for prices.

THE EDWARDS MANUFACTURING COMPANY

FIFTH and BUTLER STREETS CINCINNATI, OHIO

Page from a 1920s brochure published by The Edwards Manufacturing Company of Cincinnati, Ohio, promoting polychrome treatments.

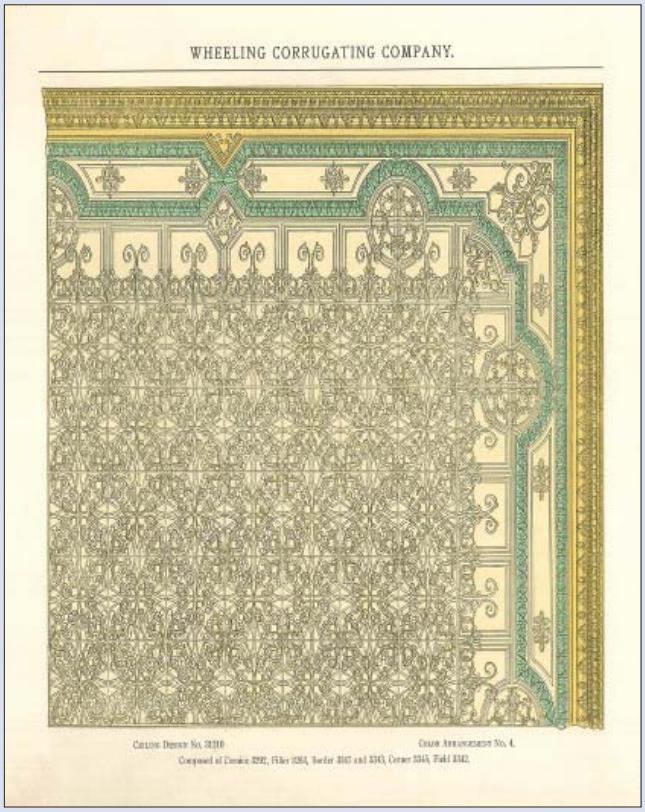
Paint investigation

Whether repainting historic pressed metal, stripping the paint prior to repainting, or replacing the metal, a simple paint color investigation could provide interesting results. Areas to check include a section of the cornice, molding, filler, and the centerpiece, if present, as well as several representative areas of the field. If there appears to be multiple colors used at the same time in any of these areas or signs of gold or similar highlights, it may merit closer examination by a historic paint specialist. Hidden beneath layers of later paint on a ceiling may even be a rare baked-on polychrome finish just waiting to be uncovered.

Tips on finishing today

Pressed-metal steel walls and ceilings historically were painted and not left with their natural metallic surface exposed. While white was the most common color used for ceilings, numerous historic colors can be are found on historic pressed-metal walls and ceilings. At times, cornices were painted a color different than the ceiling, whether the same color as the wall or a separate color complimenting the wall and ceilings. Some ceilings were even more elaborately painted. While a considerable range of compatible color treatments exist today, a raw metallic appearance should be avoided.

Black as a single or predominant color was almost never used. Regardless of its location, historic pressed-metal ceilings, with their plays of light on a bas relief surface, were meant to be seen. Black as a dominant color masks any shadows, flattening the relief, and is not appropriate for historic pressed metal nor for an intended replacement.



Pattern page for color arrangement No. 4 encaustic metal ceiling design from the 1906 Wheeling Corrugating Company, WV.

When carefully removing the historic pressed metal from the original ceiling above, the pieces were numbered and later arranged on the floor in the same was they appeared on the ceiling to aide in their reinstallation. (Photo: NPS file, 423 N Market St., Wilmington, DE)

pattern documented. Individual pieces should be saved for reference when selecting appropriate replacement units.

Design considerations

The field, molding around the field, filler, and cornice are important parts of the design that should be replicated, thus maintaining the original design. If the pieces are not replicated but chosen to coordinate, then the architectural style should be maintained when choosing the non-matching pieces. Simplifying the pattern by eliminating the wall cornice, ceiling filler, or encasement of ceiling beams not only changes the historic appearance in a manner that does not meet preservation standards, but also can make new installation less seamless.

Where one or more components of a historic ceiling may not be readily available today without creating custom dies, alternate replacement pieces may be substituted. In substituting for individual pieces, it is important to choose from the same architectural style, such as Classical or Mission, and, whenever possible, match the width and length. Replacing 24″ x 24″ metal tiles with units measuring 24″ x 48″ in the field will be a noticeable change that usually alters the overall pattern of the historic ceiling. On the other hand, variation in the running length of individual cornice pieces rarely can be discernible.

It is also important to retain the depth or repoussé of the pressed metal, as it can be as character-defining as the overall pattern. Where the historic pressed metal has deep relief, similar replacement units tend to be more costly than low-relief patterns. Also the presence of deep reliefs tends to limit replacement options to steel.

Materials

Today's reproduction pressed-metal usually is made out of tin-plated steel, which is less prone to rust than the basic sheet steel used historically. Although much less commonly used, components are also available in copper, brass, and other metals. Zinc is still used, especially for discrete decorative elements. When reproducing missing or deteriorated historic metal walls or ceilings, these are recommended choices of materials.

In recent years, aluminum has been marketed as a less expensive and rust-proof alternative to steel. It is available in a wide range of patterns and a variety of factory finishes. However, it is generally not a material that lends itself to high relief and may not be available in some of the complex historic patterns. Thus, it has a more limited application when replicating ornate historic ceilings. Aluminum can be a suitable replacement for historic metal patterns of low-to-moderate relief and design complexity. This depends on how closely the manufactured pieces match an existing historic ceiling or wall.

Plastic (PVC) and mineral fiber are contemporary materials used in making ceilings panels and are less expensive than tin-plated steel or aluminum. They are available in faux ceiling systems, including ones that attempt to simulate pressed metal. PVC is available in only low-reliefs and, depending on the manner of installation, has limited application when matching historic ceilings. Mineral fiber rarely matches the important qualities of a historic pressed-metal ceiling and, thus, should not be considered a suitable replacement. Neither is usually a good match for an ornate historic ceiling in a significant historic space or where the existing ceiling is a distinctive feature of a historic building.

Installation

There are a variety of ways to install new pressed-metal walls and ceilings. In applications where there is a required fire separation, a fire-rated dry-wall ceiling is first installed and over it nailing strips are placed for securing the pressed metal ceiling. In rooms where fire separation is not needed, nailing strips, can be used in the traditional manner. Often in small to moderately-sized spaces, a sheet of plywood nailed to the studs or to the underside of the ceiling structure is the most expedient substrate for pressed-metal panels.

Where mechanical or plumbing systems require that a ceiling be lowered, grids for nailing can be fabricated to hang at the desired height. This is the same technique as used even in some original installations.

Irregularities in the ceiling must be adjusted and shimmed as needed for the nailing strips or plywood to provide a level surface for the metal ceiling. For cornices and also certain ceiling panel designs or decorative elements, additional wood blocking may be required. Proper support preparation is essential.

Most modern manufacturers provide installation instructions, just as their past counterparts did. Laying

continued page 18

Case Study:

Fort Baker

Golden Gate National Recreation Area, Sausalito, CA

Fort Baker is a 335-acre former U.S. Army post located immediately north of the Golden Gate Bridge. The former military post dates back to 1897and includes over 20 historic army buildings, mostly clustered around the horseshoe-shaped main parade ground. In 1972, Fort Baker was listed on the National Register of Historic Places. In 1995, the U.S. Army transferred Fort Baker to the National Park Service, and the property officially became part of the Golden Gate National Recreation Area.

Under a lease agreement with the National Park Service, Cavallo Point—the Lodge at Golden Gate opened in 2008 as a first-class lodge and retreat, following the rehabilitation of most of the historic buildings. Thirteen buildings were rehabilitated for overnight accommodations and six buildings were adapted for new public functions, including two restaurants, a large conference space, a retail store, a cooking school, and various meeting spaces.

Pressed-metal steel ceilings were extant in a variety of building types around the fort including the barracks, officers' housing, post headquarters, and even in the historic jail cells of the post guardhouse. The ceilings were over 100 years old at the time of the rehabilitation, and all were covered with numerous layers of paint (mostly lead-based), obscuring the details of the embossed designs. Many of the buildings were to be rehabilitated to accommodate new, public uses, which required the addition of sound-proofing insulation to decrease the buildings' ambient noise. As a result, park architects decided that the ceilings would be temporarily removed, at which time each piece individually could be cleaned and stripped of paint.

The ceilings were comprised of a variety of different, intricate design elements, including 20 field tiles, eight medallions, eight cornice moldings, six filler panels, six molding strips, two beam caps, and five different fill patterns. The patterns had a range of parts that offered a consistent appearance within the central field or main area of the ceiling with special transition pieces to accommodate the irregularities of each space.

Medallion pieces often highlighted the placement of ceiling lights, and cornice pieces were used to finish the ceilings at the walls. When combined with the various field tiles, filler panels, and molding strips, these pieces created different design schemes for

Figure a. Removal began with documenting the pieces within each room, numbering and noting their precise location on a drawing. It was important that the pieces were marked in such a way that the numbers would remain legible throughout the cleaning and reinstallation process.

Figure b. On pieces where paint remained after the freezing/flex process, workers carefully hand scraped with chisels to finish the clean-up. Because lead paint was present, workers were required to wear NIOSH approved-respirators.

Figure c. Once the metal was cleaned of over 100 years of paint, it was easy to see the detail of the original design.

each room. The underlying construction system, however, was the same for each room. All panels were nailed to a grid of wood strips (7/8" x 2"). The panels overlapped each other with indentations (or buttons) at the corners to conceal the nail heads within the patterns.

Removal began by assigning each metal component a number and noting its precise location on a drawing. It was important that the pieces were marked in such a way so that the numbers would remain legible throughout the cleaning and reinstallation process.

Using a blasting system of Silver Aero-Alox 320 sponge media with 320-grit aluminum oxide, paint at the perimeter and edges of all metal ceiling components was removed to expose the nail heads.

The corners were then carefully lifted to loosen the nails enough to remove them from the ceiling. Since the cornice and medallions were installed last, it was easiest to remove them first.

As the pieces were disassembled, they were placed into wooden boxes for protection. To clean and remove the multiple layers of paint, the project team experimented with various removal techniques before selecting a method involving freezing the metal pieces. Each box of pressed-metal pieces was placed into commercial freezers. When sufficiently cold, the boxes were removed and each metal piece then was carefully flexed by hand to remove most of the paint. Where the paint-to-metal bond continued to hold, the pieces were returned to the freezer and the process repeated. Where additional freeze-time still was not sufficiently effective, brushes and chisels were used to loosen and remove any remaining paint. During the process, all lead paint was contained and secured, then stored in containers for appropriate disposal later.

Temporarily removing the metal ceilings to facilitate the addition of insulation and any needed fire separation, as well as, updating of plumbing and electrical systems, allowed the paint removal to be undertaken in a shop, rather than working in-situ. The freeze/flex method proved an effective paint-removal method that resulted in little damage to the pattern and repoussé on each metal piece.

Following the installation of the sound-proofing materials and drywall, the pressed-metal pieces were reinstalled using brads and a pneumatic gun. Matching the numbered pieces to the placement diagrams made the reinstallation an easy process. New replacement pieces matching the historic Fort Baker design elements were purchased to replace any damaged or missing pieces. Once installed, the room ceilings were painted, completing the successful preservation and renewal of the historic pressed metal.

Figure d. Following the installation of the sound-proofing materials and drywall, the pressed-metal pieces were reinstalled using brads and a pneumatic gun. Matching the numbered pieces to the placement diagrams made the reinstallation easy.

Figure e. The ceilings were finished with a fresh coat of paint. (Photos a-d courtesy of Kristin Baron, NPS; Photo e: Kaaren Staveteig, NPS)

out all of the pieces on the floor the same as they will appear on the ceiling, determining which direction overlaps should run, and establishing where to attach the first pieces are all essential steps that should be undertaken prior to installation. On larger or custom installations or ceilings with complex designs, deep cornices, or encased beams, the services of an experienced contractor is advisable.

Modern suspended ceiling systems with exposed T-bars offer drop-in panels of various materials intended to evoke historic pressed-metal ceilings. These are not suited for historic applications because the T-bars create an overriding visual intrusion in the overall pattern. Furthermore, moldings and fillers, which traditionally tend to be in continuous runs, are design features that cannot be easily achieved in an exposed-grid system. Certain drop-in systems with snap or interlocking features that cover the T-bar may be suitable, in limited cases. Their application depends on the historic appearance of the ceiling being replaced and the visual qualities of the replacement panels; how well the new panels collectively appear in an overall pattern, including the treatment of the filler, molding, and cornice; and other factors, such as the height of the ceiling and the room lighting.

Where metal ceiling battens are used with aluminum replacements, a combination of rivets and adhesive can be used. Aluminum can also be installed with special adhesives, such as contact cement, RTV silicone, and acrylics, particularly when plywood is the underlayment. Care must be taken to prevent bulges in the panels from too much adhesive, and usually nails help secure the panels in place while the adhesive cures.

Modern Finishes

Even with today's tin-plated steel, back-priming is a good practice, whether done at the factory or the job site. While routinely recommended for areas of high humidity and condensation, back priming of tin-plated steel should be routinely considered, since pipe leakage and other unforeseen moisture events are more likely to occur from the backside. Water-based primers generally should not be used, particularly for tin-plated steel, steel, galvanized steel, copper, and zinc.

As noted when replacing a deteriorated or missing pressed-metal ceiling, the predominant use of black as a finish coating or a "natural" unpainted metal appearance is usually not in keeping with the historic character. One exception is copper ceilings which, though they will oxidize, will not rust. Historic pressed-copper ceilings were more costly and prestigious, and usually meant to be seen unpainted.

The historic polychrome appearance is being recreated and enhances the depth and complexity of the decorative metal ceiling. (Photo: The Madison Courier)

Today's powder-coat factory finishes offered by a number of manufacturers provide a durable and even finish coat. For ceilings, factory-applied finishes are considered desirable compared to overhead on-site painting, whether by spray or brush. Additional care, however, must be taken during installation to avoid scratching or otherwise scuffing. Considering that some field cutting is usually required, such as for electrical hookups for lights and fans, it is inevitable that some touch-up painting will be necessary after installation.

Adhesive caulk or other suitable materials should be used where open joints remain after installation. This is usually done prior to applying finish coats to the room side of the wall or ceiling. Prior to painting, the surface should be cleaned of any residue, dirt, and grime. Two finish coats are recommended.

Upper-floor ballroom of the Bringham Academy, Bringham City, UT, following a 2016 restoration campaign of the building. Standing vacant since 1980, the deteriorated condition of the historic pressed metal required custom replication and replacement of all panels and moldings. (Photo: W. F. Norman Corporation)

Summary

Pressed-metal ceilings and walls are important, character-defining interior finishes that can be found in almost all types of historic buildings, from stores to offices and churches to factories. Unlike their immediate predecessor, corrugated-iron ceilings, pressed-metal ceilings and walls of sheet steel were widely marketed, enjoyed a boom period of use, and now have a resurgence of interest.

Distinctive in appearance, historic pressed metal turned out to be a reasonably durable material that, with appropriate care, can usually be maintained or repaired today, even when rehanging is required. When beyond repair or missing altogether, pressed metal currently is available in sufficient patterns and materials that it is usually possible to replicate or closely approximate the original appearance.

Understanding and copying the distinctive qualities of individual design patterns, utilizing appropriate installation techniques, and creating compatible finishes are important components of good replacement work. While maintenance and repair are always the preferred treatment, available products today enable many historic patterns to be closely matched in cases of badly deteriorated metal walls and ceilings or where missing altogether. Principally used historically in the United States, with smaller markets in Canada and Australia, pressed-metal walls and ceilings are an important part of our architectural heritage.

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