NEW HAMPSHIRE DIVISION OF HISTORICAL RESOURCES
State of New Hampshire, Department of Cultural Resources 603-271-3483
19 Pillsbury Street, 2nd floor, Concord NH 03301-3570 603-271-3558
Voice/ TDD ACCESS: RELAY NH 1-800-735-2964 FAX 603-271-3433
http://www.nh.gov/nhdhr *preservation@nhdhr.state.nh.us*

HISTORIC WOODEN WINDOWS

JAMES L. GARVIN
NEW HAMPSHIRE DIVISION OF HISTORICAL RESOURCES

THE WINDOW SASH AS A CHARACTER-DEFINING ELEMENT OF A BUILDING

Few elements of a building contribute more to its architectural character than do the window sashes. The character of the sash is obvious from the exterior even when (as was often the case) its exterior face was painted black or another dark color. There is a great difference between a window opening filled with twelve-over-eight sashes and one filled with two-over-two sashes.

The character of the sash is even stronger from within the building, where the grid of muntins interposes itself between the eye and the view from the window. The inner faces of the muntins are moulded, and the profiles of these mouldings evolved over time, contributing much to the expression of style or period in a structure. As indicated on the accompanying chart, the muntin profile provides a useful means of dating a building as well as helping to define the aesthetics of the window and the room.

Yet sashes are meant to be looked through. It is easy to look past the grid of muntins and to ignore their beauty and the size and character of the glass. Perhaps because sashes are largely transparent, they are often undervalued as a contributing element to the style and character of a building. People often assume that all old windows are much alike, or that the character of the sash is unimportant. Coupled with the common idea that old sashes are loose, fragile and drafty, the assumption that they are insignificant makes the sash the most vulnerable and often-replaced element of a historic building.

In fact, the character of the sash has always been integral to the style of the building. While that fact may have been missed by the owner of a building, it was not lost on the architect or joiner (finish carpenter). In compiling the first American builder's guidebook, *The Country Builder's Assistant* (1797), joiner Asher Benjamin signaled his break with the eighteenth century by illustrating three new muntin profiles that were appropriate for the incoming federal style of architecture. As shown in the accompanying chart, new sash designs appeared every ten or fifteen years during the nineteenth century, lending their character to succeeding architectural styles.

Any historic building with its original sashes and glazing therefore retains a higher degree of architectural integrity than a comparable structure in which the sashes have been replaced. Where original sashes survive, their preservation should be a paramount concern of the building's owner.

A BRIEF HISTORY OF THE WOODEN WINDOW SASH

The sliding window sash was introduced into the British colonies of North America just after 1700. Prior to that time, window openings had been filled with casements. Casements are sashes that are hinged on their sides to open outward. The lights or panes of glass in casement sashes, called "quarrels," were usually small and diamond-shaped. The quarrels were held within a latticework of lead members, called "cames," which have an H-shaped cross section. To stiffen the somewhat flexible assemblage of cames and quarrels, a few wooden sticks were placed across the sashes between the outer stiles of the casements, and the lead was wired to these stiffeners at intervals.

The sliding sash first appears in written records in Boston and Philadelphia just after 1700. Some sliding sashes were apparently filled with leaded glass, but most were glazed with square lights of glass held within a grid of moulded wooden members called "muntins."

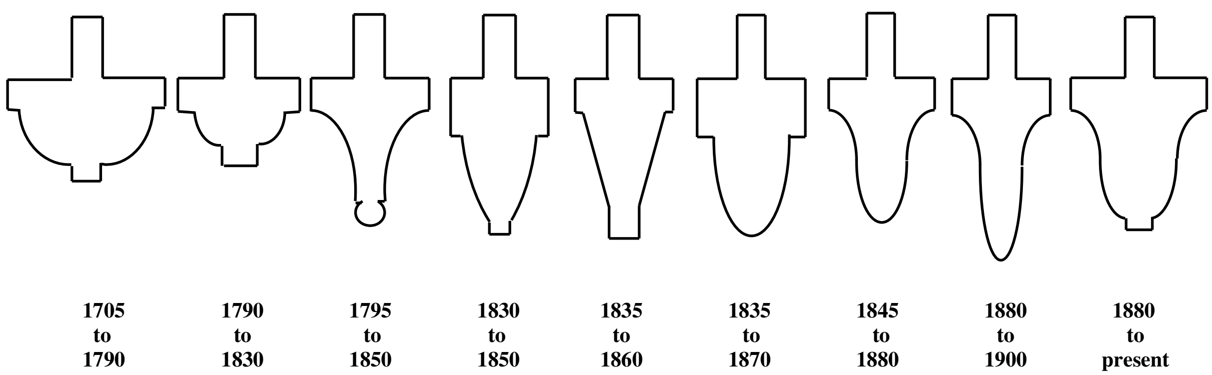
The accompanying chart shows the profile or cross sectional shape of the earliest muntins. This profile remained relatively unchanged until near the end of the eighteenth century, although every joiner had his own set of tools and different sets of sash moulding planes were seldom exactly alike. Thus, there is some variation in this early cross-sectional profile and all later muntin profiles. This variation diminished when machine-made sashes were introduced in the latter half of nineteenth century.

The eighteenth-century muntin was heavy and thick, interposing a strong grid between the occupant of a room and the outdoors. Because of the high cost large sheets of early glass, panes were usually small (often 7 by 9 inches or 8 by 10 inches). The proportion of wood to glass in early sashes was quite high, and tended to diminish through the nineteenth century as larger glass sizes and thinner muntin profiles were progressively introduced.

For the most part, eighteenth-century window sashes were not counterbalanced by weights. The upper sashes in a pair were usually fixed in place, being supported by strips of wood placed below their sides in the window openings. Only the lower sashes could open. They slid up and down between the strips of wood that supported the upper sashes and similar strips of wood, called "sash stops," that were nailed against the sides of the window frames. The lower sashes slid upward against the inner faces of the fixed upper sashes and the sash stops; the latter created a groove or channel that restrained and guided the moving sash.

EVOLUTION OF WINDOW MUNTIN PROFILES IN NEW ENGLAND 1705 TO THE PRESENT

(The profiles shown below are derived from dated buildings. Some profiles may occasionally persist beyond the end of the usual date range as shown in the chart.)



Because sashes were usually not counterbalanced, they were held open, or partly open, by sticks or other props placed beneath them, or by spring catches of various designs attached to their side members or stiles.

Occasionally one will encounter an extraordinary eighteenth-century dwelling in which the movable lower window sashes were counterbalanced by weights that are attached to the sashes by cords. These cords run over a wooden sheave set into the tops of the side frames of the windows, allowing the weights to rise and fall in pockets on each side of the window opening. Such early weights are almost always found to be of cast lead. In contrast to later cast iron window weights, which are usually round in cross-section, older lead window weights were usually square or rectangular in cross-section.

These rare counterbalanced windows of the eighteenth century gave rise to the common double-hung windows of the latter part of the nineteenth, described below.

EVOLUTION OF MUNTIN PROFILES IN WOODEN SASHES

The earliest sliding sashes, introduced to North America shortly after 1700, had heavy muntins that were often over an inch in width. These muntins were often relatively shallow in relation to their width, so the sashes were not excessively thick. The considerable width of the muntins, however, combined with the tendency to use small lights of glass in these early windows, gave eighteenth-century sashes a heavy appearance that is quite noticeable from inside or outside a building.

Although there is no hiding the heavy grid of muntins in early sashes when seen from within a building, painters often took steps to diminish the effect of heavy sash bars and small lights of glass as seen from the outside. Records make it clear that the outside faces of such windows were often painted black, clearly in an attempt to disguise the heavy grid of bars against the dark void of the room within. This practice continued throughout the nineteenth century, although in Victorian times sashes might be painted dark red or green or some other color that contrasted yet harmonized with the color of the exterior window casings and of the body of the building.

Photographic evidence from the 1840s onward shows, however, that exterior window casings were often painted white, often in contrast to unpainted clapboards or to clapboards painted with inexpensive red or yellow ochre. In such cases, the outside faces of sashes were often painted white as well. Thus, two contrasting approaches to the exterior treatment of multi-paned sashes—one intended to hide the sash bars and one to emphasize them—flourished simultaneously during the 1700s and early 1800s.

The evolution of the muntin profile after the end of the eighteenth century was generally one of increasing delicacy. At the same time, production of window glass in the United States reduced the cost of glazing and permitted sashes to have fewer but larger lights. Thus, window openings tended to become larger, sashes became lighter and held larger panes, and interiors generally became brighter. This increasing illumination was characteristic not only of rooms, but also of entries or stairhalls. The late 1700s saw the introduction of fanlights in doorways or "frontispieces." After 1800, these windows became larger, often taking the form of a wide semi-ellipse. Sidelights flanking doors also became popular at this time, and fanlights often spanned not only the door opening but also the sidelights on each side of the door. In contrast to the dark entries of the 1700s, in which a small transom sash above the door was the only illumination provided, this new fashion filled hallways with light.

The advent of the federal style in the late 1700s and early 1800s was accompanied by several patterns of window muntin. The most common type, popular until about 1830, was nearly identical in profile to the heavy muntin of the 1700s, but was smaller in dimension. Its profile consists of quarter-round mouldings and flat fillets. Another muntin type first seen just before 1800 had a cove-and-bead profile. Generally restricted to more expensive buildings or urban areas, this profile is much less common than the traditional quarter-round-and-fillet pattern.

The quarter-round-and-fillet pattern did not disappear with the advent of the Greek Revival style in the 1830s. Instead, it evolved, adopting an elliptical moulding in place of the quarter-round.

The Greek Revival style was, however, accompanied by alternate muntin profiles that were noticeably different from those seen earlier. Perhaps the most distinctive was the flat, angular profile. Like some mouldings seen in Greek Revival joinery, this muntin relies on its faceted surfaces rather than on curves for its character. This type of muntin is often seen in conjunction with woodwork that is similarly decorated with flat surfaces rather than with curved mouldings.

Also popular during the Greek Revival period, as well as in buildings of a Gothic character, is the Gothic muntin. Often assuming the profile of a rounded or pointed arch, this simple muntin appeared in the late 1830s and persisted from the 1840s through the 1860s.

A profile that enjoyed nearly the longevity of some of the older quarter-round-and-fillet shapes was the sharp ogee muntin. Composed of S-curved mouldings that meet in a knife edge, this was the sharpest and thinnest profile ever used in American windows. First seen in the late Greek Revival buildings of the 1850s, the sharp ogee muntin persisted up to the turn of the twentieth century, appearing in six-light sashes in the earlier years and in two-light sashes at the end of the century. When used in large sashes, as in churches or public buildings, this muntin profile is usually given added depth to compensate for its inherent weakness in the face of the wind pressures that larger windows must resist.

Another muntin profile that has enjoyed a popularity rivaling that of the earliest quarter-round-and-fillet muntins is still in use today. This is the ogee-and-fillet profile, first seen in early colonial revival buildings. Having a strong cross-section, this profile came into its own as two-over-two sashes became popular in the late 1800s. The shallow ogee or S-curved moulding of this muntin bears a superficial resemblance of the early quarter-round-and-fillet designs, making the new profile ideal for buildings in the colonial style or for use with any other architectural style. The profile is often seen in modern windows with true divided lights, and is most commonly encountered in the ever-popular Brosco "Boston" sashes, available in configurations ranging from two lights to multiple lights.

Because window sashes are fragile and easily damaged by neglect, they frequently deteriorate more quickly than other elements of a building. Because they strongly reflect the architectural style of a given period, sashes were often replaced during remodeling even if they had not deteriorated beyond usefulness. Thus, it is not unusual to find old buildings with sashes that are much later in date and style than the majority of other architectural features.

In such cases, it is often of great interest to learn the original style of sash in a building. It will often be found that a few original sashes were left in place in some out-of-the-way location. Odd-sized windows in the back of the building, or attic windows too high up to catch the eye, are often found to be the only survivors from an otherwise-complete renewal of sashes. Also likely to survive are original sashes that are fixed in place and part of a larger architectural feature, or sashes of a size that could not be replaced by stock units of a later period. Thus, transom sashes above a doorway are among the most likely to escape replacement, as are elaborate arched sashes from a Palladian window or a stair landing. One such relic from the original period of construction is enough to indicate the earliest muntin profile of a building.

Older sash styles are seldom available in the retail trade. Almost every style of sash that has ever been made, however, can be acquired on custom order from specialized sash factories or from joiners who have revived the art making sashes by hand. Among the best-equipped custom manufacturers of historic sash reproductions are Kim Doubleday of KSD Wood Products, Penacook, New Hampshire, Littleton Millwork, Inc., of Littleton, New Hampshire, and the Walter E. Phelps Company of Brattleboro, Vermont.

HOW WOODEN WINDOW SASHES WERE MADE BY HAND

A window sash is one of the most delicate and complex building components made by the joiner. Each muntin is a thin piece of wood stock, moulded on one side and rabbeted on the other to receive glass and putty. Each muntin must intersect and be fitted to other muntins and to the outer stiles and rails of the sash. The stiles and rails, in turn, must be firmly mortised and tenoned together at the corners in order to create a rigid frame. If the sash is counterbalanced, recesses for the sash cords must be plowed into the sides of the unit.

Because the inside face of the muntin is moulded, the end of every horizontal muntin must be coped and tenoned to fit against the moulded surface of every vertical muntin, or against the two stiles on the sides of the sash. The two horizontal rails must be coped and tenoned to the sides of the stiles at each corner of the sash. And each vertical muntin must be coped and tenoned to the upper or lower rail of the sash. A six-light sash has twelve of these complex intersections; a twelve-light sash has twenty.

Because the ends of intersecting sash members must be coped and tenoned, sash moulding planes were sold in pairs. The principal plane cut the moulded inside face of the muntin, stile, or rail. The sash coping plane shaped the coped joint at the ends of the members, cutting across the end grain of a board before the board was ripped into thin muntin stock. After the coped joint was cut, the board was sawn into thin strips that were transformed into muntins through the use of the principal sash plane.

Because the making of a sash by hand is painstaking and delicate work, joiners of the 1700s or early 1800s devised a fair method of charging for their labor. They billed a customer by the number of “squares of sashes,” or openings for lights of glass, that they fabricated. The more openings for glass that were required, the more expensive the joiner’s labor on the sash. Thus, a pair of twelve-light sashes would be more expensive than a pair of six-light sashes for a given window opening. Conversely, smaller panes of glass might be cheaper than larger panes, so the ultimate cost of a pair of sashes depended both on the joiner’s work and on the cost of glass. As larger panes of glass became cheaper, the cost of windows became cheaper, since the use of larger panes meant fewer “squares of sashes” in each window unit and thus reduced the joiner’s charges.

Throughout the eighteenth century and much of the nineteenth, the outer frames (the stiles and rails) of window sashes were mortised and tenoned together at the corners and held by wooden pegs or pins placed through each joint. In most cases, the muntins were simply tenoned into the stiles and rails; due to their small dimensions, these tenons were not pinned. Likewise, horizontal muntins were simply tenoned into the vertical muntins without pins or nails, with the entire window assembly depending for its tightness on the pinned joints at the four corners.

Because an “open” or unglazed sash is made of thin members pinned together at only four points, the entire unit is often slightly flexible until it is glazed. The insertion of glass and putty stiffens the sash into a unit that may retain its rigidity through decades of use and thousands of raisings and lowerings.

The type of glazier's putty used throughout most of our history has been whiting or chalk (calcium carbonate) mixed into a paste in linseed oil. Powdered white lead, which has a drying effect on linseed oil, was often added to the mixture in small quantities to make the putty harden more quickly in the sash and thus allow the unit to be primed with paint soon after glazing.

THE MANUFACTURE OF GLASS

Until after World War II, common window glass was made by three methods. Two of those methods depended upon the skill of glassblowers, who made their product entirely by hand. The third method, introduced around 1900, was the first to manufacture window glass partly by machine. Thus, all window glass made before the turn of the twentieth century is a hand-made product, virtually irreplaceable today under normal circumstances.

The first hand-manufacturing technique, most common in the eighteenth and early nineteenth centuries, was the crown method. In this type of manufacture, the blower gathered a mass of molten glass from the furnace on the end of his blowpipe. Blowing the glass into a large sphere, the blower attached the bubble to an iron pontil rod and removed the blowpipe, creating a hole at the point where the pipe had been attached. By repeatedly reheating and spinning the sphere, the blower used centrifugal force to cause the glass to open up into a large disk called a "table" or "crown." When finished and cooled, a crown normally had a diameter of from four to six feet. From this crown, variety of panes of glass could be cut. The center of the crown was thickened at the point where the pontil had been attached. Called the "bull's-eye," this central boss was normally re-melted. Occasionally, glass bull's-eyes were used to glaze a transom sash over a door, or were even substituted for the upper wooden panels of the door, introducing a bit of daylight into a stairhall or entry.

Because of its method of manufacture, a light of crown glass is often slightly convex rather than perfectly flat. Glaziers normally set such glass with the curve or crown outward, carefully setting the pane in a bed of putty that compensated for the contour of the glass. Seen from the outside, windows glazed with crown glass often reveal a visible bulge in each pane, as if the glass were swelling outward from air pressure within the building.

The crown method of manufacturer produces a glass that is often exceedingly brilliant and reflective, having been made without contact with any solid surface. Crown glass remained the favorite type for fine window glazing well into the nineteenth century.

Crown glass is manufactured by the Blenko Glass Company, Inc., of Milton, West Virginia.

An alternate method of making window glass, called the cylinder method, was practiced throughout the eighteenth and nineteenth centuries alongside the crown method. As its name implies, cylinder glass was made from a cylinder instead of a disk. Like crown glass, cylinder glass started with a heavy "gather" of molten glass—sometimes as much as thirty-five pounds—on a blowpipe. The mass of glass was blown into a sphere, and the sphere was elongated into a cylinder through repeated heating, blowing, and swinging of the blowpipe. Eventually, the glassblower would produce a cylinder about ten inches in diameter and from four to five feet long. Other craftsmen would then snap off the constricted end where the blowpipe had been attached to the cylinder, would slit the cylinder along its length, and would flatten the glass into a rectangular sheet on a hot table.

The cylinder method produced a larger single sheet of glass than did the crown method. Being rectangular rather than circular, this sheet had less waste after being cut into lights. Yet, because it was flattened against a surface, cylinder glass lacks the brilliant finish of air-cooled crown glass, and may show wrinkles or inclusions. Even though it was flattened on a hot table, cylinder glass usually retains a slight curve in each pane, just as crown glass retains a slight bulge.

Cylinder glass is manufactured by S. A. Bendheim Company, Inc., of Passaic, New Jersey.

The technique of making cylinder glass improved over time. Yet the size of a cylinder was limited by the strength of the glassblower. A blower had to possess enormous strength, endurance, and lung capacity to fashion a cylinder, especially a cylinder of double-thick window glass. For this reason, hand-blown cylinders never attained a length of over five feet or a diameter of greater than a foot.

By about 1900, machines began to be developed that could produce glass cylinders of immense size. These machines employed vertical blowpipes with large flared ends that attached themselves to pools of molten glass. Compressed air was fed through these pipes as motors slowly raised their ends from the molten bath. A huge cylinder of glass was slowly drawn upward, cooling as it rose.

In its final development, the mechanical blowing process could produce a glass cylinder up to thirty inches in diameter and forty feet tall. The improvement of this process between 1900 and 1928 marked the end of hand-blown window glass in the United States. From the 1920s to the present, all commercially-sold American window glass has been manufactured mechanically, either by the cylinder method or by more recent means of producing flat sheets, losing the element of craft that had long marked the process.

For this reason, those buildings that retain old sashes and old glass are doubly rare. Hand-made window glass, so easily overlooked and so easily broken, is the most fragile architectural legacy we have from the eighteenth and nineteenth centuries. Both the sashes and their glazing embody complex craft skills and warrant every effort at their protection and preservation.

WINDOW HARDWARE

Most eighteenth- and early-nineteenth-century windows have little or no hardware. Wooden sashes of this period merely slide up and down in their grooves, being held open, or perhaps wedged shut, by sticks placed under or above the movable lower sash.

Occasionally, one will find sashes that have small wrought iron hooks attached to the lower rails. Staples fixed into the window stools permit the closed window to be hooked shut and locked.

As noted above, a few exceptional houses of the eighteenth century have counterbalanced lower sashes, with cords that run from the movable sash over wooden sheaves in the upper side casings of the windows. Lead weights descending in pockets outside the casings allow heavy sashes to be lifted more easily.

This type of counterbalancing was becoming more commonplace by the early 1800s. In 1806, Asher Benjamin illustrated counterbalances for both upper and lower sashes in his second architectural guidebook, *The American Builder's Companion*, thus prefiguring the double-hung sash as it has remained in production and use until recent times. Yet such arrangements were restricted to urban dwellings or the homes of the wealthy. Most dwellings did not have counterbalanced sashes until after the mid-1800s.

As noted above, most windows of an earlier period were held open, or partially open, by props or notched sticks of various designs. An alternative to such props was the window spring, a device that attached to one of the stiles (side members) of the movable lower sash and snapped into holes or notches cut into the window frame at various heights. Many types of window springs were patented throughout the nineteenth century, and many types are still encountered on old sashes. Probably the earliest pattern of window spring employed in New Hampshire was called Kennedy's patent. A number of New Hampshire joiners were licensed to use and sell this device in 1803. According to its description, Kennedy's spring "allowed one to raise and lower both the upper and lower Sash, and by the assistance of Springs to support it at any height that is wished."

By 1865, the Russell & Erwin Manufacturing Company of New Britain, Connecticut published the first extensive American hardware catalogue, and this book illustrated no fewer than five styles of window spring. Although window springs serve as locks when the window is closed, the Russell & Erwin catalogue also listed sash locks in many designs, most of them intended to be screwed to the upper and lower meeting rails in the same manner as modern helical sash locks.

By 1865, too, the counterbalanced or double-hung sash had become commonplace. The Russell & Erwin catalogue illustrated iron or bronze sash pulleys and cast iron sash weights that are virtually indistinguishable from those used throughout the next century.

Most sash hardware of the nineteenth century was simple in design and rugged in construction. Homeowners who are fortunate enough to retain such window fittings should make every effort to preserve and use these easily-overlooked legacies from the past.

CASINGS, SHUTTERS, AND BLINDS

Although sashes are the principal element of a window, sashes are almost always accompanied by inside and outside casings, and often by interior shutters and exterior blinds. Together, these elements make up the full window unit.

Interior window casings almost always reflect door casings in the same rooms. Often as distinctive as are the muntins in the sashes, window casings are important stylistic elements in any room and are valuable as a means of dating a window. Because window sashes were more often renewed than window casings, it is often easy to detect replacement of sashes when the casings are of one style and the sashes are of a later style.

Sometimes the remodeling of a room was done with such thoroughness that both widow casings and sashes were replaced. This is particularly commonplace during the Greek Revival period from 1830 to 1850. The Greek Revival style required both window muntins and casings that were distinctively different from those of the Georgian or federal styles. In order to maintain the harmony of a remodeled room, the moulded casings of an earlier period were often supplanted by flat casings when a room was modernized in the new Grecian style.

The same is true on the exterior. It is not unusual to find that an older house was updated with a Greek Revival doorway or frontispiece. In such cases, the exterior window casings are often found to have been replaced, at least on the front of the house, to harmonize with the character of the new entrance.

Among the features that are often missing or damaged from eighteenth- or early-nineteenth-century windows are interior shutters. Often mistakenly called "Indian shutters," these features were intended to exclude the cold or to provide privacy in an age before window curtains were common, not to defend a building against attack.

Interior shutters were made in three major types. The earliest, simplest, and least likely to survive are hinged shutters that were attached to interior window casings and opened, like a small pair of doors, against the walls on each side of the window. Because these shutters fold into the room, disrupting any piece of furniture that is placed in front of the window, and because they occupy wall space when open, they were often regarded as a nuisance in a later times and simply removed. More common in the 1700s than later, such shutters were usually attached with H-hinges, and close examination will often reveal evidence of the hinges on the side casings of a window. Because folding shutters need to lie flat against the wall when open, their window casings seldom had projecting mouldings. Thus, absence of mouldings, combined with a casing design that provides for a rebate or recess around the window opening, are clues that a window may originally have been fitted with folding shutters.

The second type of shutter, which often survives unknown to the modern homeowner, is the sliding type. Fitted into thin pockets behind the wall plaster, sliding shutters can be slid out of sight or pulled partly or entirely across the sashes. Sliding sashes are usually made in two units. One covers the lower sash. A second, sliding on a grooved rail at the height of the meeting rails of the sashes, covers the upper sash. Because the shutter rail was often regarded as a nuisance, it was frequently sawn off and the shutters pushed into their pockets, covered with strips of wood, and forgotten.

The third type of shutter, and the most likely to survive in use, is the folding shutter set into a deep window embrasure. Found only in more elaborate buildings, such shutters are hinged and fold into two or more leaves. They require a thick wall that offers the depth necessary to house the folded leaves of the shutter at each side of the window. In a framed building, this extra thickness is achieved by double-studding the wall; in a brick building, the thickness of the masonry usually provides most of the depth needed to house such shutters.

Very rarely, one will find window shutters of a different style, perhaps sliding on exposed rails beside a window rather than in pockets within a wall cavity, or perhaps lifting upward from a pocket below the window opening. A few grand houses of the early 1800s had double sets of interior sliding shutters, one set solidly paneled, and the second set louvered like exterior window blinds, admitting fresh air while excluding sunlight.

Window shutters of every period were fashioned in harmony with the style of joinery of that period. Their design and details almost always match those of the original doors or other paneling in a given room. Their architectural style will be in harmony with the style of the window muntins unless the original sashes have been replaced.

Exterior window blinds, seldom seen until the end of the eighteenth century, became commonplace during the early nineteenth. In New England, almost all exterior blinds except those on stores or warehouses were of the louvered or “Venetian” pattern. Commercial building might have solid, heavy exterior shutters clad with sheets of iron to seal the building against theft or fire.

Because of their fragile nature and exposure to the weather, original window blinds survive in lesser quantities than original window sashes, especially those from the first half of the nineteenth century. In general, the earliest window blinds have heavy stiles and rails. These frames hold thick, fixed louvers whose ends are fitted into slots in the stiles of the blind and are held in place by wooden beads applied over the slots.

Later blinds have thinner louvers, often with rounded rather than sharply beveled edges. By the 1850s, blinds were often made with louvers that are pivoted on dowels attached to their ends. Called “rolling slats,” these pivoting louvers are stapled to wooden rods that link them together and allow the angle of the louvers to be adjusted to improve ventilation when the blinds are closed.

COMMON PROBLEMS OF OLD SASHES

An unmaintained window sash that has been exposed to the weather commonly loses putty on its outside faces. Once the putty has fallen away, the wooden fillet that holds the glass may erode. Panes of glass may loosen or crack from many kinds of impacts. On the interior face, the wood of the sash may soften from condensation running down the windowpanes. Air may infiltrate around the sashes or between the meeting rails. The mortise-and-tenon joints at the corners of the sash may loosen, and the bottom rail of the lower sash may rot from chronic dampness at the windowsill. The sash cords (or the more recent sash chains or steel tapes) may break from fatigue. Sash weights may become jammed in the pockets, and spring balances on newer sashes may loose their tension. Wooden parting beads or sash stops may wear from the friction of the sash. The single glazing of the window may conduct heat and cold. For households with young children, lead paint on the sashes or window frames may be a concern.

SOLUTIONS TO SASH PROBLEMS

If this litany of problems seems daunting, it should be remembered that the sliding wooden sash is one of the most successful and enduring of architectural features. Sashes of the type that we may expect to find in any old building have been standard building components for three hundred years. Many sashes in use today have provided good service for some two hundred years or more. The behavior of wooden window sashes is absolutely predictable. The maintenance of such sashes has long been part of the repertoire of the building trades and the homeowner.

Conversely, no type of replacement window has been on the market long enough to have proven itself as a worthy successor to the wooden sash. No type of replacement window is as appropriate for an old building as the sashes that were originally made for that building.

The simple secrets of keeping old sashes in use are repair if needed, maintenance, and protection.

Repair of sashes is not complicated; every part of an old window was made to be repaired when necessary. A number of the articles cited in the following bibliography offer general hints and fine points on sash repair.

Maintenance of sashes, though often neglected like any other household duty, is usually a simple matter of re-glazing and painting, perhaps with the occasional replacement of a set of sash cords.

Maintenance goes a long way toward protection as well, but the best and simplest protection for old sashes is installation of an outside storm window.

Storm sashes have been in use since the eighteenth century, and have been common since the late nineteenth century. A storm sash or storm window is a temporary or permanent unit that is affixed to the outside casing of a window, sealing and protecting the inner sashes against heat loss and weather damage. With the addition of storm sashes, old windows often become more energy-efficient than modern double-glazed replacement units, especially if the original inner windows are weatherstripped or otherwise sealed against air leakage.

The most energy-efficient type of storm window has always been the traditional wooden storm sash. Regrettably, such units have fallen into disfavor because of their weight and awkwardness, the need to hang, remove and store them seasonally, and the ease with which their glass is broken in handling. But for those houses that have them and those homeowners who are willing to use them, wooden storm sashes remain an excellent defense against heat loss and an excellent protection for historic inner sashes.

The most universal type of exterior storm window today is the aluminum unit. Aluminum storm windows may be one of the older types with interchangeable storm glazing and screens, or the now-standard triple-track storm window with self-storing storm glazing and screens. Either type greatly increases the energy efficiency of single-glazed wooden inner sashes and protects the wooden units against the effects of weather.

Aluminum storm windows have the added benefit of protecting the wooden inner sashes against condensation. Because their glass is colder than that of the wooden windows, aluminum storm windows collect and condense moisture that circumvents the inner sashes. Because their metal frames cannot be harmed by moisture, aluminum storm windows safely handle condensation as long as wooden window sills are kept painted and the weep holes at the bottoms of the aluminum frames are kept open to drain properly.

Some people object to the fact that the flat, featureless expanse of glass in storm windows obstructs a view of the hand-made glass and muntin divisions of older sashes. While it is true that exterior storm windows obscure the character of historic wooden sashes, the protection offered by outside storm windows may be regarded as an adequate compensation for a bland exterior appearance. Others object to the projecting frames of aluminum units, especially when the bare metal is exposed. Painting the aluminum frame the same color as the window casings can soften the harshness of the metal. Those who want less visible exterior storm window may want to consider storm units that fit within wooden exterior window casings.

Today's marketplace also offers a number of interior double-glazing units. Often glazed with a plastic rather than with glass, these units attach to the interior window casings or fit within the inside window opening.

Inside double glazing is often employed where the exterior appearance of a building is paramount. It is important to recognize that inside double glazing reduces heat loss, but does nothing to protect historic wooden sashes. In considering such units, it is important to decide whether it is desirable to be able to open windows for ventilation. It is also important to consider whether inside humidity levels are likely to cause condensation on the historic sashes (which, being on the outside, will be cold), and whether exposure to weather and sunlight is likely to damage the historic sashes.

Wooden sashes are a three-hundred-year-old technology. They are an important and character-defining feature of any old building. Any building that retains its original sashes and glazing thereby gains in integrity and significance.

Wooden sashes are also a simple technology. They can be protected against deterioration and made more energy-efficient by equally simple technologies. The best method of preserving historic windows and improving their performance is usually the simplest method, and often the least costly one.

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