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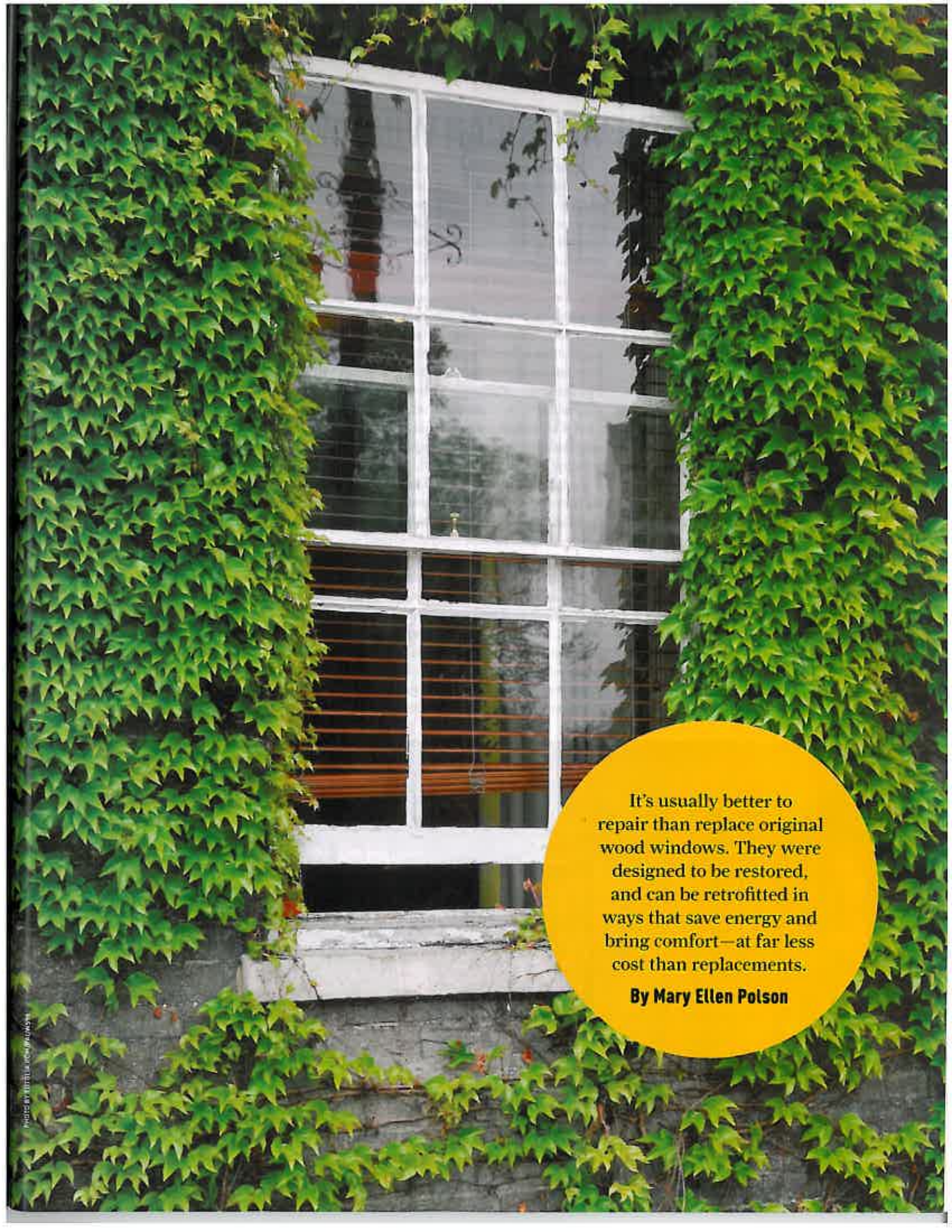
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It's usually better to repair than replace original wood windows. They were designed to be restored, and can be retrofitted in ways that save energy and bring comfort—at far less cost than replacements.

**By Mary Ellen Polson**

# EVOLUTION OF THE AMERICAN WINDOW

The windows on historic homes are products of the materials and technology available at the time of construction. Before roughly 1850, the materials were simple: old-growth lumber, precious hand-blown glass, and linseed oil-based putty. Building a window was challenging but low-tech, the task of highly skilled sash makers working with hand tools to compose a complex framework designed to hold individually cut panes of glass.

All of the wood components—bottom and top rails, the vertical side rails called stiles, and the dividers known as muntins—were through-mortised. That means that the connecting joints, the tenons, extended completely through the adjoining stile or rail and were visible along sash edges. In an era before water-resistant glues, joints were secured with pegs and tightened with wedges. As Steve Jordan writes in *The Window Sash Bible*, outfitting a house in 1750 or 1800 with windows was easily the most expensive component of construction.

The further back in time you go, the more expensive the glass and the smaller the window panes, or lights. The shaped wood dividers called muntins that held the glass in place changed over time, too. Eighteenth-century muntins were thick

with short and rounded ovolo mouldings. By late in that century, as glass became slightly more affordable, window panes grew larger and longer, and the proportions of the muntins more grew more graceful as well.

Machine-blown cylinder glass became widely available near the end of the 19th century, about the same time that advances in millwork technology led to standardization in building components from door casements to interior colonnades. The thickness of window sash went from a variable  $1\frac{1}{4}$ " to a uniform  $1\frac{3}{8}$ ". After the Civil War, weight-and-pulley counter balances made it possible to operate a sash window with the lift of a hand.

Construction methods and materials for residential window construction changed little for the next hundred years—despite various inventions that claimed to improve on the rope-and-pulley system. They include some technologies you may find in your windows, including spring balances, spring-tension wheels, and pivoting hardware.

Window construction began to change in the early 20th century when the first flat-drawn sheet glass went into production about 1917, putting an end to varia-

tions in thickness and flaws that effect clarity. Clever manufacturers introduced metal windows. Some, like steel, held up well over time; others were composed of metals with various parts that tended to fail with repeated use or age-induced fatigue. Finally, large sheets of flat, perfectly uniform glass made by the float method transformed the window glass market in the early 1960s.

## APPLIED HISTORY

What does all this history mean for the windows on your house? If the originals are still there and in good condition, count yourself lucky. Original windows on a house built before 1950 are usually well matched to the rest of the house in terms of building materials, quality, and appearance. They are also sustainable and expensive to replace with windows of similar quality.

If, however, your home has suffered the loss of original windows to "replacements", a dilemma is coming, and sooner than you might realize. Even the best replacement windows aren't guaranteed to last for more than 25 years. If your windows are failing or an addition is in the works, shop wisely.



It's important to ensure that the new windows on an existing home "read" properly. Depending on your budget, the ever-expanding range of custom options available from window manufacturers makes it possible to replicate historical styles at any scale, in virtually any wood or combination of materials. That said, new windows are still one of the most expensive parts of any house. Prices for a wood double-hung window in a standard shape and size start at \$400 or \$500. Custom windows can cost \$2,500 or even more.

When shopping for new windows for an older home, take your cues from surviving original windows. Windows long gone? Look for homes of a similar age and style in the neighborhood; another house may still have windows you can use as models. Pay extra care to the number, placement, and overall dimensions of the panes of glass (lights) in the window you are replacing.

Getting the proportion or placement of the panes wrong is a common mistake. On older windows, the panes tend to be taller rather than wider. In many replacement windows, the opposite is true. Once installed, the new fenestra-

tion may make your house look dramatically different, and not necessarily for the better. Fortunately, it's relatively easy for a window maker to scale new windows of different sizes to the proportions of older, smaller ones.

Another key element in matching the appearance of old-style windows is to copy the depth, width, and moulding profiles of the muntins that define the windowpanes on your sashes or casements. Whether real or snap-in, these dividers do more than separate the glass into three, six, or more divided lights—they throw shadows that add to the architectural relief of the façade.

Those looking for a true historical replication will want to match historic muntin profiles as closely as possible. The difference between the width, height, and shaping of two 18th-century muntin profiles—say, Georgian versus Federal—can be astonishing. For those with a more modest old house, the goal may be dividers that are roughly as wide and deep as those on typical houses of the period. That way, the shadow lines aren't noticeably different than they were before.



## Light Reading

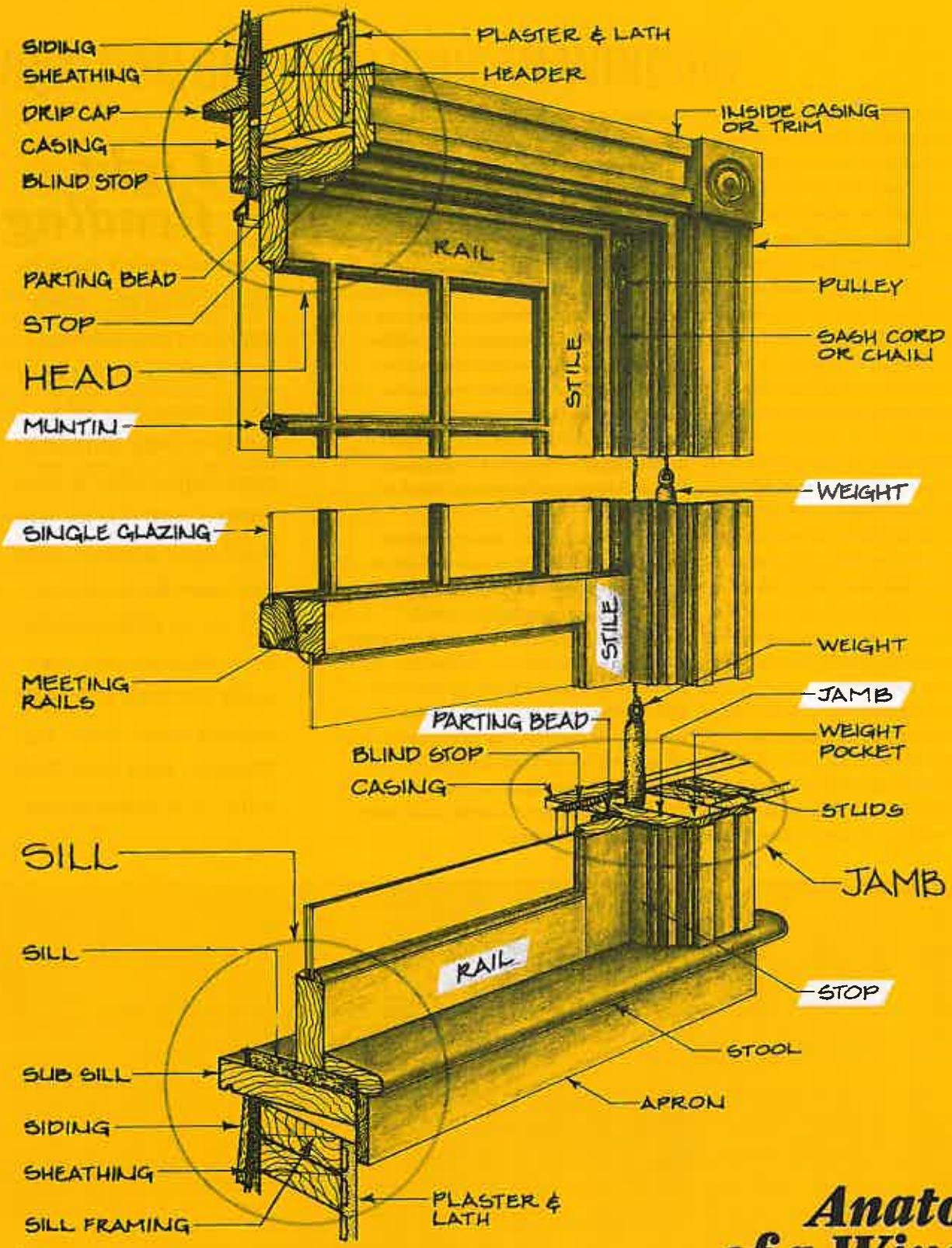
Want a detailed guide to maintaining and restoring historic windows? You can't go wrong with *The Window Sash Bible* (2015) by long-time OHJ contributor Steve Jordan. Packed with tips for windows built between 1800 and 1940, the book is a primer on understanding how old windows were made and how to evaluate and repair them. \$45. Through your local bookseller or at [amazon.com](http://amazon.com)

## Pop Quiz

Think you know the ins and outs of windows? Here's a chance to test your assumptions about windows old and new. True or False?

1. Windows are the biggest source of energy loss in the house. **T/F**
2. Historic windows are costly and difficult to repair. **T/F**
3. Old windows don't operate smoothly and are difficult to open and close. **T/F**
4. Historic windows are a lead hazard. **T/F**
5. New replacement windows save more energy than restored originals. **T/F**
6. Houses built before 1950 use more energy than newer homes. **T/F**
7. Replacement windows offer a better return on investment than retrofitting existing windows. **T/F**
8. Replacement windows will pay for themselves in 5–10 years. **T/F**
9. Replacement windows are a good value because they require no maintenance. **T/F**

TURN THE PAGE FOR ANSWERS



# Anatomy of a Window

The double-hung sash window is still the most common window found on American homes. Once the technology had been perfected about 1850, window components and construction methods didn't change much for over a hundred years.

THIS PAGE ILLUSTRATION FROM THE OGL ARCHIVE: OPPOSITE ILLUSTRATIONS BY RBB LEANNA

## WINDOW TERMINOLOGY

**CASEMENT** A window that swings on hinges, opening like a door.

**DOUBLE HUNG** A window with an outside sash that slides down and an inside one that slides up, usually controlled by chains or ropes on pulleys, with a counterbalance weight.

**FENESTRATION** The art of placing window openings in a building wall, and one of the most important elements in creating the exterior appearance of a house.

**GLAZING** The process of installing glass panes in windows and applying putty to hold the glass in position; also, the glass surface of a glazed opening.

**JAMB** The upright pieces or surfaces forming the sides of the window opening.

**LIGHT** The pane of glass in a window sash.

**MUNTIN** The shaped wood strips that separate (and hold in place) the panes of glass in a window sash.

**MULLION** Not to be confused with muntin, this is a dividing member between individual windows in a group.

**PARTING BEAD** A long narrow strip between the upper and lower sashes in a double-hung window frame, which enables the sashes to slide past each other.

**RAIL** A horizontal member in a door or window sash.

**SASH** The framework that holds window glass in place.

**SASH WEIGHT** A heavy cast-iron counterweight that, together with a sash cord and pulley, holds a window sash in the raised position.

**STILE** The vertical side members that interlock with rails in a window frame.

**STOP/STOP BEAD** A vertical wood strip on a window frame against which the sash slides.



GEORGIAN



EARLY FEDERAL



LATE FEDERAL



GREEK REVIVAL



COLONIAL REVIVAL

## MUNTINS THROUGH TIME

Even if you've never noticed them before, the shape of the window muntins may be the key to identifying the style of an entire house. The earliest muntins were squat and fat, and they grew more graceful in the early 19th century. By the early 20th, the muntin profile on Colonial Revival houses had evolved into a composite of several styles.

## POP QUIZ ANSWERS

**1. FALSE.** Even single-glazed windows in poor condition account for less than 20 percent of the energy loss in a typical house—significantly less than the attic and roof.

**2. FALSE.** Old windows were designed with easily repaired components. Individual panes of glass, sash cord, pulleys, and hardware are usually available from a local hardware or builder's store. Even the frame can be patched or repaired with epoxy. When properly maintained, a well-built historic window will last for more than a century.

**3. FALSE.** The weight-and-pulley counterbalance system used in windows built before 1900 has never been improved upon, says Scott Sidler of Austin Home Restorations ([thecraftsmanblog.com](http://thecraftsmanblog.com)). Kept in good working condition, windows with this system open and close easily and are simple to repair (see "Restraining Sash Weights," p. 46). Spring tension and sliders made from plastic or metal become harder to operate over time; they require full replacement once worn or broken.

**4. SOMETIMES.** Unrestored old windows with decades of paint may pose a lead hazard, but once the paint is removed or encapsulated through restoration, the windows should no longer pose a health threat.

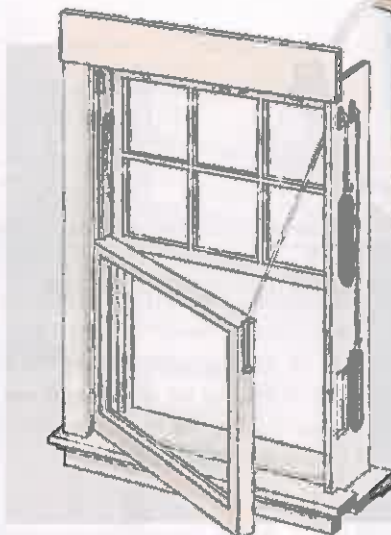
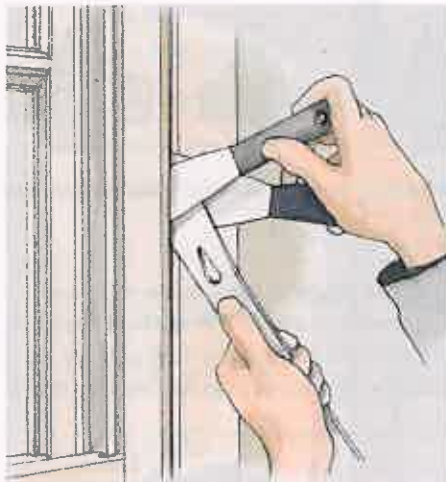
**5. TRUE—BUT JUST BARELY.** A high-performance replacement window will save slightly more energy than a retrofitted existing window on an annual basis. Factor in the energy costs associated with tearing out the old windows and installing new ones, and retrofitting looks like a better bet energy-wise. In a 2012 report, the National Trust's Preservation Green Lab found that restored windows equipped with interior window panels or exterior storm windows paired with cellular blinds perform almost as well as new replacement windows—within three percent, on average, nationwide.

**6. TRUE.** But it's not necessarily the fault of the windows. Older homes consume more energy on both a per-square-foot basis and a per-household basis because they have little or no insulation and are less likely to have efficient heating systems. The trend toward larger home sizes since 1990, however, has offset improved efficiency, showing higher energy use per household.

**7. FALSE.** While well-installed replacement windows may be more energy efficient than old windows in poor condition, replacing all the windows in a house is an expensive proposition: up to \$30,000 for materials, construction, and installation, according to the Green Lab report. You may not own the house long enough to see payback. Further, high-performance glazing and frames can be two to four times more expensive than other retrofit options with comparable energy savings potential.

**8. FALSE.** Research shows that recouping the cost of replacement windows can take up to 40 years, especially when considering the initial carbon expended during the construction process.

**9. FALSE.** New windows are initially maintenance free, but the lifespan of most replacement double-glazed windows is only about 15–25 years. (Startlingly, some manufacturers consider a window lifetime to be eight to 15 years.) In other words, most new windows will need to be replaced before they've paid for themselves. The seals between double-glazed windows will eventually fail and metal components experience fatigue and no longer work smoothly. Once compromised, components essential to energy conservation are difficult to repair. (You can find replacement parts for some brands; see "Fixes for Newer Windows," p. 47.)



## RESTRINGING A SASH WEIGHT

To restring the weights that make a counter-balanced system operate smoothly, you'll need access to the hidden panel that hides the weights and ropes. First, identify the stop moulding, the vertical strip on the window frame against which the sash slides. If it is screwed in place, remove the screws. Score the paint or varnish at any joints to loosen them. Then **pry off the stop moulding** by sliding a flat prybar between two putty knives behind the joint. (The knives protect the wood.) With luck, any nails may pop off with the wood. Once loose, bow the strip to release the ends.

With one stop removed, you should be able to **swing the lower sash out of the way**, dangling from its two cords—if they're still attached—to access the panel. Before detaching the cord from the pulley and weight, **clamp the cord** to keep the weight from falling into the weight chamber.

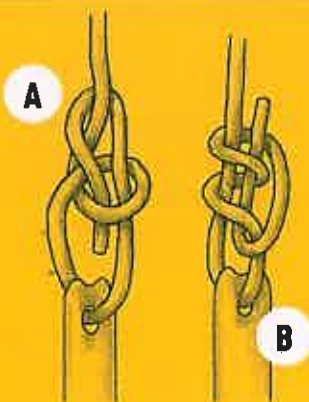
With the stop removed and the sash out of the way, look for a small door sitting in the bottom of the sash channel secured with a screw. Remove the screw. As you reach for the cords inside the weight pocket, note which weight goes with each sash, or mark them unobtrusively. (If you accidentally switch weights among sashes, the balance system won't work properly.)

To restring the top sash, remove the parting bead on one side. The parting bead (a narrow strip of moulding on the far side of the pulley housing) holds the top sash in place. It's usually not nailed, but may be stuck in place by paint. Score the joints and slowly pry it out using a putty knife or pliers.

Once you have the sashes, stop, and parting bead out, you can restring the weights. First, replace worn or painted sash cord with new rope cord (Spot Cord

from Samson Rope, in business since 1888, is one brand: [samsonrope.com](http://samsonrope.com)). Cut the new cord to the length of the old one. If the cord is missing, measure from the knot pocket on the sash stile to the top rail, and from the window header to the sill. (See "Anatomy of a Window," p. 44.) Add the two measurements together to get an approximate length for the new cord.

- After locating the weights, feed a new length of rope through the pulley at the top down into the weight pocket until it reaches the weights. Then thread the rope through the eyelet on the top of the weight and tie it off with a secure knot. **Swing the weight back into the pocket**, then reinstall all the parts in reverse order. Once the sash is in place, nail or screw the stops snug to the bottom of the sash. Slide the sashes up and down a few times to make sure everything fits and works effortlessly.



### Which Knot? It's a Tie!

*Option A*

#### **BOWLINE**

Make a loop near the rope's end, pull the rope through the hole, go around the line on the right, then back through the hole.

*Option B*

#### **POACHER'S KNOT**

Thread through weight. Wrap loose end around twice, then thread the loose end up through loops. Pull tight.

## Fixes for Newer Windows

Is your house already fitted out with replacement windows in need of repair? If the problems are minor—missing or broken locks or tabs, torn screens, lost window stops—you may be able to get replacements from a parts dealer for your brand. Parts for Hurd's awning, aluminum-clad, and clad-wood windows, for example, are available through Hurd Replacement Parts ([hurdreplacementparts.com](http://hurdreplacementparts.com)); parts for Andersen Windows' 200 double-hung sash series are available from Forrest Construction ([awindowanddoorparts.com](http://awindowanddoorparts.com)). A good window or door shop may be able to make more significant repairs for you, provided they can find and order the right parts. Sifting through the possibilities takes a computer search: One current window hardware catalog has more than 40,000 window and door parts in inventory.

## STICKY SASHES

Moving window sashes up and down will inevitably weaken the structure of the sash frames if not done properly. Banging on the sash or jerking up or down when the frame is out of true (or crooked) will eventually destroy it. One simple solution is to install sash lifts on the bottom rail. They should be positioned so that using them lifts the window straight up.

**BELOW** An Arts & Crafts sash lift from Vintage Hardware, traditionally centered on the bottom rail, will help prevent damaging the window.



## RETROFITTING TIPS

Any of the following retrofits will improve interior comfort and reduce energy costs without the need to replace original windows.

### WEATHER STRIPPING

**Estimated Energy Savings: 2-3%\***  
Surprisingly, weather stripping provides only modest gains in energy conservation because it doesn't insulate thermally. It does help improve interior comfort by blocking drafts and keeping out moisture. Easy to install, types of weather stripping include spring metal, plastic strip, compressible foam tape, or sealant beads applied to seal gaps at the head, sill, meeting rail, and at vertical edges of a window.

### EXTERIOR (STORM) WINDOWS

**Estimated energy savings: 17-19%**  
An exterior storm window is a glazed unit of wood or metal that fits tightly over an existing window. Whether manufactured or built by hand, exterior storms improve the thermal performance and airtightness of existing windows, boosting energy savings close to that of new replacement windows. They also reduce drafts and provide some protection for old windows. Fixed-panel types must be installed and removed seasonally in order to use the window.

### INTERIOR WINDOW PANELS

**Estimated energy savings: 15-23%**  
Panels of acrylic, polycarbonate, or glass install by spring tension or flexible compression on the indoor side of an existing window. Like exterior storm windows, they improve thermal performance, airtightness, and interior comfort. While not quite as energy efficient as exterior storms, they're easier to install and do not compromise the appearance of the window. They also provide noise reduction. On the downside, some plastic versions may reduce visibility; fixed panels may need to be changed seasonally.

### INTERIOR SURFACE FILM

**Estimated energy savings: 2-4%**  
Ideal for hot climates or locales with abundant sunshine, this self-adhesive polyester film applied to the interior glass surface reduces solar gain and glare. Surface films block solar heat gain and reduce the UV transmissions that cause fading of rugs and upholstery. Drawbacks include reducing visible light transmission and desirable winter solar heat gain.

### INSULATING/CELLULAR SHADES

**Estimated energy savings: 10-13%**  
These accordion-like blinds improve thermal performance and minimize drafts when in use. They're best for keeping out the cold at night or, in a hot climate, the heat at midday. From an aesthetic standpoint, they rarely complement historic decorating; consider hanging lace panels over them.



### More Online

More on energy at [oldhouseonline.com/8-tips-for-energy-efficient-old-windows](http://oldhouseonline.com/8-tips-for-energy-efficient-old-windows).





Restore

## QUICK MAKEOVERS

# Exterior Fix-Ups

Head outside for three projects: sealing tarnished brass, fixing torn window screens, and installing functional shutters. Get ready for summer!

By Lynn Elliott

**HOUR**

## Clean and Seal Brass Hardware

Brass hardware on front doors weathers and tarnishes from exposure to the elements. Cleaning and sealing the hardware will keep it looking its best. After removing the hardware from the door, wash it with dishsoap and water to remove any dirt buildup. Use an old toothbrush to get in crevices. Dry with a soft cloth. If the piece has a worn lacquer coating, take it off with a paint or varnish remover. Polish off tarnish by soaking the piece in ammonia, and rubbing it with a soft cloth or toothbrush. Rinse and dry with a soft cloth. Leave no fingerprints, and apply brass sealer to the hardware, or spray it with a clear lacquer. Let it dry. Repeat the process and then reattach the hardware.

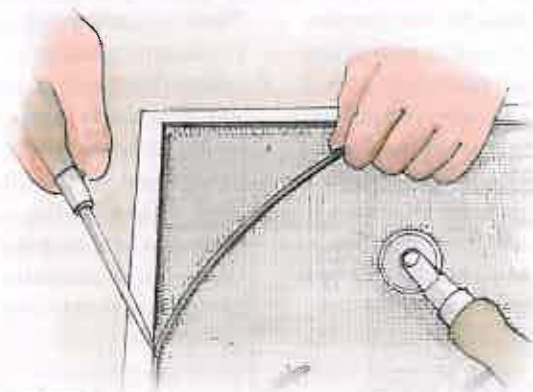


WEAR GLOVES WHEN TOUCHING BRASS HARDWARE; OIL FROM YOUR HANDS WILL ACCELERATE TARNISHING.

**DAY**

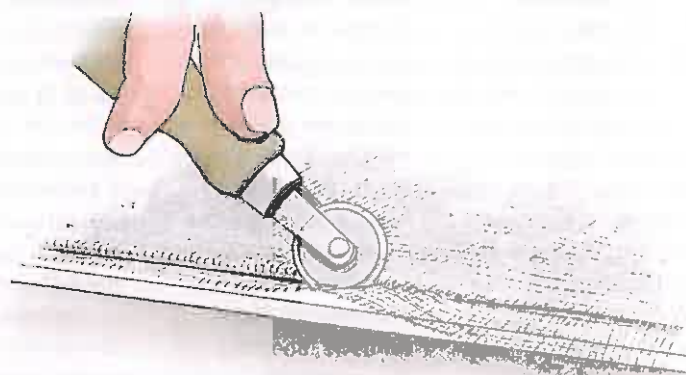
## Repair Damaged Screens

Torn window screens may be a bane of summer, admitting insects we want to stay outside. Take a day to tackle repairs. Window screens come in rolls of fiberglass or aluminum (or old-fashioned bronze mesh). Fiberglass is more forgiving to work with, but aluminum is stronger. Measure all of the windows before purchasing materials to make sure you get the right width.



**STEP 1**

Using an awl or a flat-head screwdriver, pry out the old spline and remove the old screen. Clean any debris out of the channels. Lay the frame on a flat work surface and roll out the new screen. Trim the screen with a utility knife, leaving 1"-2" excess on all sides. Cut a 45-degree angle at each corner from the spline channel outward, to prevent bunching in the corners. Weight the center of the screen with a brick, and secure the screen to the frame with clamps. The brick allows for the right amount of tension when the screen is installed: not too tight or too slack.



**STEP 2**

With a screen roller, run the convex wheel over the screen, pushing it into the frame's channel. Work in one direction only. Small bulges should roll out as you go along; stop and redo the screen for any folds. Use a flat-head screwdriver to press into the corners. Now, using the concave wheel on the screen roller, push the spline into the channel over the screen. Make sure the spline is all the way in and won't come out. Trim the excess screen.



WEEKEND

# Hang Shutters

Functional shutters are not only a charming detail on a home, but also provide protection from strong winds and help keep the interior cooler. Custom wood shutters come in paneled, louvered, and board-and-batten styles, which may be varnished or finished in any paint color. When ordering, follow measuring instructions carefully—shutters should have a 1/4" gap around the window casing when installed. Also do any prep work before hanging them. An assistant is helpful with this project.

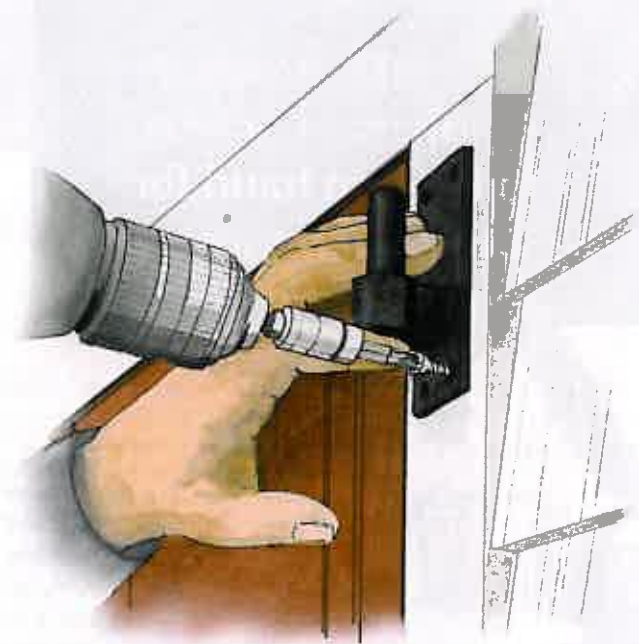


### STEP 1

Position the shutters in the window with wide horizontal rail at the bottom and the plain side of the shutters facing out. Louvers face down when in the closed position. Shim the shutters into place, leaving a 1/4" space around all sides. The shutters should not overlap any of the window trim.

### STEP 2

Slide the strap of the hinge onto the pintle. Hold the strap against the top rail of a shutter and the pintle against the window casing. Center the strap and, with a level, check that the pintle is plumb. Mark the screw holes with a pencil. Remove the hinge. Drill pilot holes into the window casings and then fasten the pintle to the casing. Repeat with the other upper hinge. For the two lower ones, do the same process, but also mark a vertical plumb line so that the upper and lower pintles align.



### STEP 3

Remove the shutters and place them on a work surface. Drill the pilot holes for straps and screw them on. Turn the shutters over and position the latch, placing it so that it is slightly below the center of the shutter, within easy reach. Hang the shutters, and check how they swing and adjust as needed. Open the shutters and position an assembled shutter dog against the siding. A shutter dog should be placed 4" away from the shutter and 1" from the bottom edge of the shutter. Check that it will hold the shutter. Mark the location and drill a pilot hole into the siding. Using a wrench, fasten the shutter dog's bolt. Repeat on the other side.

