

19th Century window with horns and margin lights

INTRODUCTION

Sash windows are an important feature of many historic buildings. Where original examples exist they should if at all possible be repaired, rather than replaced. If new sash windows have to be made for insertion in a historic building their design should be in keeping with the date and style of the building.

A sash window consists of a pair of glazed panels which slide, usually vertically, in a case or frame. Weights housed in the case balance one or both sashes, to which they are attached by cords passing over pulleys fixed in the case. Horizontal sashes, often called 'Yorkshire sliding sashes', can also be found in many parts of the country.

This leaflet gives an outline history of the sash window, followed by advice on repair methods. A follow-on sheet gives more detailed information on the setting-out of purpose-made replacement sashes.

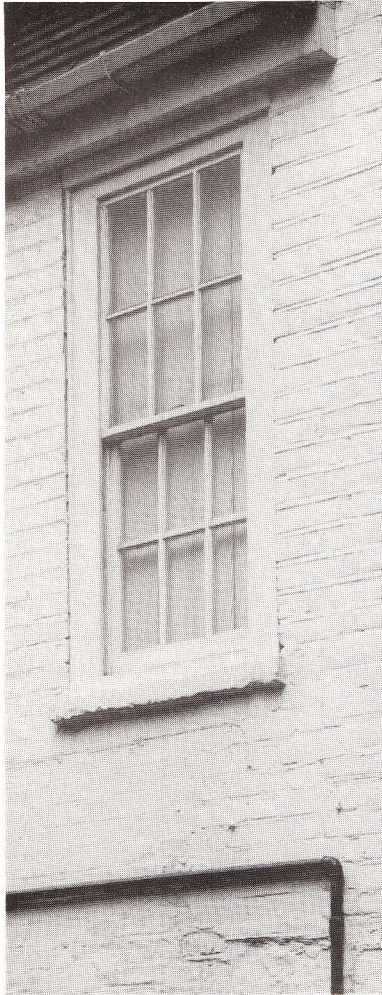
HISTORY

The most important influences on the changing appearance of sash windows in England were the London Building Acts of 1709 and 1774, introduced to check the spread of fire by reducing the amount of exposed timber in a facade. These Acts did not apply outside the immediate vicinity of the Cities of London and Westminster, and their adjacent suburbs, but the styles they produced became fashionable, and spread throughout England within about twenty years. From 1709 wooden window frames in the capital were required to be set four inches

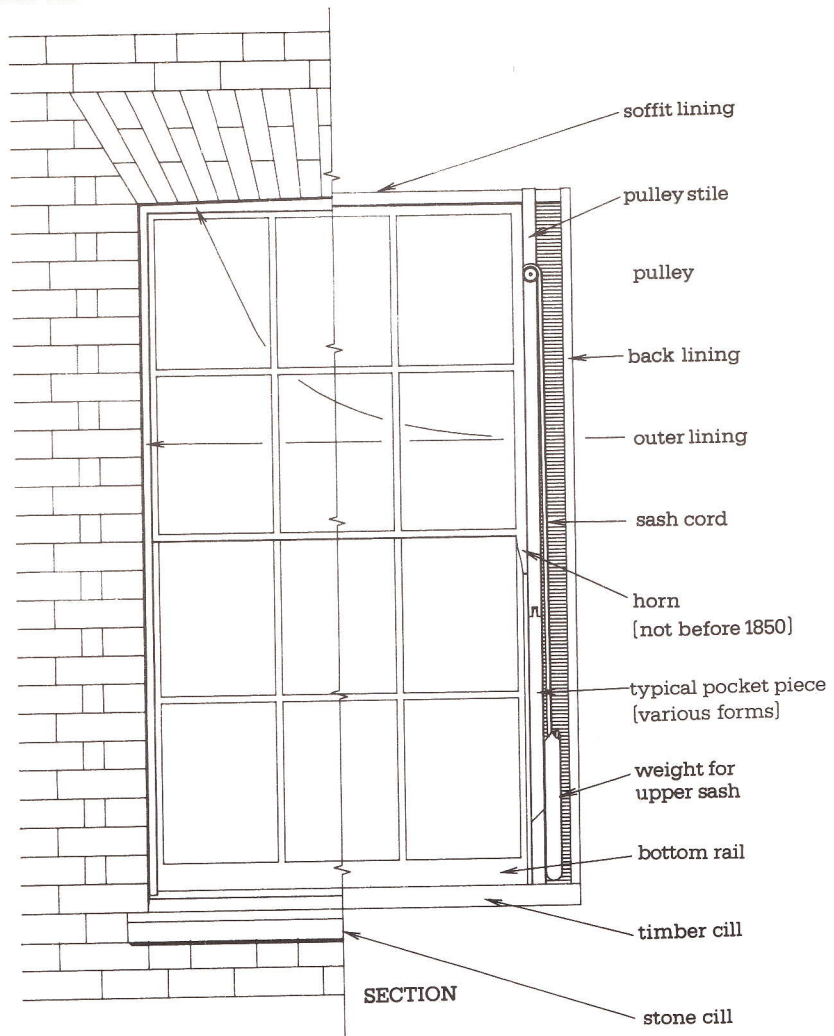
behind the face of the wall, instead of being flush with it. Whilst windows of the late seventeenth century could be quite large, in the early eighteenth century they were relatively small, sometimes with a curved top, with thick glazing bars and small panes of glass. Very many examples are set under red gauged-brick heads, and often in red brick surrounds; these contrast with the brick of the rest of the building and are themselves attractive features of this period. Half width windows (sometimes left 'blind') are also characteristic of the late seventeenth and early

eighteenth centuries. Thick glazing bars are of considerable interest and should be kept wherever they survive.

During the eighteenth century glazing bars became ever thinner, the panes of glass rather bigger, and the design of window surrounds plainer. Larger rectangular windows became fashionable (unless the building was in the gothic taste). In 1774 another London Building Act required that windows be not only recessed, but that sash-boxes be externally covered by brickwork, greatly reducing the amount of wood visible from the



An early 18th Century sash with exposed boxes



The main components of a sash window

street. It is unclear to what extent this was an acknowledgement of an existing trend. From the 1790s technological advances encouraged an even greater desire for thinner glazing bars and bigger glass panes. Windows also became larger, or rather, longer; owners of older houses could update their property by 'dropping' their window sills and installing new sashes. Gauged-brick heads became more played from about 1790, until in the mid nineteenth century they were superseded by a variety of heads, including stone and rendered brick. 'Gothick' windows, often with 'Y' shaped tracery, and round-headed windows with a round-topped central light are often found in the late eighteenth and early nineteenth centuries: it is particularly important to repair

and retain these more unusual windows.

In the nineteenth century the trend towards more glass and less frame continued. Whilst windows with even-sized rectangular panes continued to be produced, from the 1830s it became fashionable to have a central large pane surrounded by long narrow strips known as margin-lights; and after the removal of tax on glass in 1845 new processes for the cheap mass-production of plate glass made large single sheets universal. Many earlier houses were 'modernised' by the replacement of glazing bars with single sheets of glass, to the detriment of their appearance and eighteenth-century character. Mid nineteenth-century and later windows are readily identifiable by having 'horns': little scrolled

brackets at each end of the bottom rail of the upper sash. These were designed to strengthen this vulnerable part of the sash, particularly against rot, and to support the larger and heavier glass panes now used.

At the end of the nineteenth century there was a revival of interest in windows with small panes and thick glazing bars, particularly in the upper sash, as part of the 'Queen Anne' style and subsequent classical revival. Window design is as important to the character of these buildings as it is to Georgian ones, sometimes being rather idiosyncratic. Surviving examples on the building should be carefully studied, and retained in place as an essential element of the building's design.



Repair

Careful repair is always preferable to new work. Decay in sash windows by moisture penetration can be prevented by thorough painting, regular maintenance and prompt repairs. Wet rot in windows is recognisable by cracked and wavy paintwork, the timber beneath being very soft. Replacement sections can be pieced-in, taking care that the original profile is accurately reproduced. At the same time it is essential to remedy the cause of the dampness.

Sash windows were usually of deal (pine), painted white or grained. Only in the most prestigious houses, and a few early examples, was oak used. Repairs and replacements should be of the same type of timber as the existing, although a hardwood is acceptable for the cill. Where glazing bars of iron, lead, brass or bronze have survived every effort should be made to retain them.

Open Joints

Open joints allow moisture to enter and cause decay. Loose joints should be resecured by cramping, glueing, rewedging and pinning. Decayed joints should be taken apart and defective members repaired by piecing-in. Before fitting, new wood and as much of the existing as possible should be treated with a solvent-borne preservative. Metal angle repair plates, let in flush, may be used as a temporary repair to the corners of sashes.

Joints between window frame and walling were traditionally filled with haired lime mortar. Modern mastic sealants can be particularly disfiguring if carelessly applied or if joints are overfilled. Open joints requiring filling should be cleaned out and compressible 'backing rods' inserted to provide a firm background against which the pointing can be applied. Where a window frame is removed for repair it may be possible to insert a damp proof course to isolate it from surrounding masonry.

Cills

Timber cills are particularly susceptible to decay. New cills should be made of a durable hardwood, such as oak, thoroughly primed and painted and where appropriate incorporating a drip. To avoid removing the whole window, the outside half of the cill alone can be replaced; the butt joint between new and old work should be covered by the bottom rail of the sash when it is shut.



Glazing

Sashes should be glazed using steel sprigs and traditional linseed oil putty; glazing beads and modern glazing compounds are unsuitable. Sometimes a window may retain its original crown glass or cylinder glass. This is not completely flat and has slightly curved ridging or air bubbles which give depth and character to a facade. Original glass should always be protected while work is in progress. Crown glass is no longer manufactured, so original pieces should be retained if at all possible. When the glass is removed by chipping away at the putty there is a risk of cracking the glass. Consideration should be given to having the putty softened with solvents or infra-red heat treatment. This work can be carried out by a specialist contractor. Cylinder glass has recently become available again from specialist suppliers. A good and cheap substitute is colourless 2mm or 3mm 'horticultural'-type glass, when available. Alternatively, glass which has been heated and deliberately distorted can be obtained. 'Bulls eye' glass should *never* be used.



Windows are a useful guide to the dating of a house: here it can be clearly seen that the bay on the right has been added to an earlier house. The window with horns is an even later replacement

The sash mechanism relies on the weight of the window-sash and its counterweights being almost the same, although for efficient closing it is suggested that the weights should be a little heavier than the upper sash and a little lighter than the lower sash. If by reglazing you increase or decrease the weight of the window you will have to carefully adjust each counterweight.

Ventilation is important to a building, especially if a gas appliance is fitted in the room, and owners should not expect or attempt to draught-proof a sash window completely. Allowance must be made for easy movement, shrinkage and expansion. Proprietary draught strips which are concealed behind staff and parting beads are recommended. Secondary glazing is thought to be as effective as double glazing and means the original window can be retained; but care must be taken to avoid damage to the reveals, or to window shutters when these are present.



Removing inner bead

Sash Cords and Pulleys

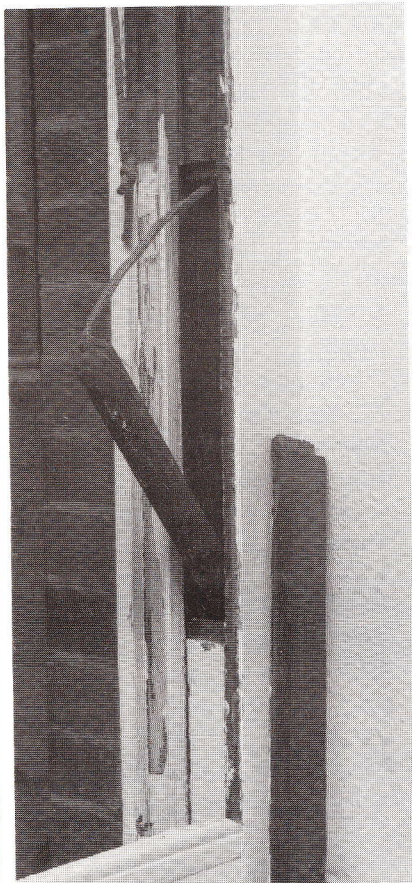
Sash cords can be of cotton, jute or nylon, although sashes from the later nineteenth century may have a metal chain instead. The cord or chain must be taut. Waxing keeps cords flexible and prevents them from rotting. New cord is fed over the pulley wheel by attaching it to a piece of string (with a small weight at one end) which is guided over first. A sash may sometimes not work properly because the pulley has broken or has been blocked with paint, or rubbish has accumulated under the weights.

Pulleys are of importance in dating a building, and original ones should be kept. Pre-1760 examples have wooden cases. They were not mass-produced until about 1780, when they could be of iron, brass, or a combination of the two. Later Victorian pulleys could be partly of steel, with small idler wheels to take some of the extra weight of the plate glass.

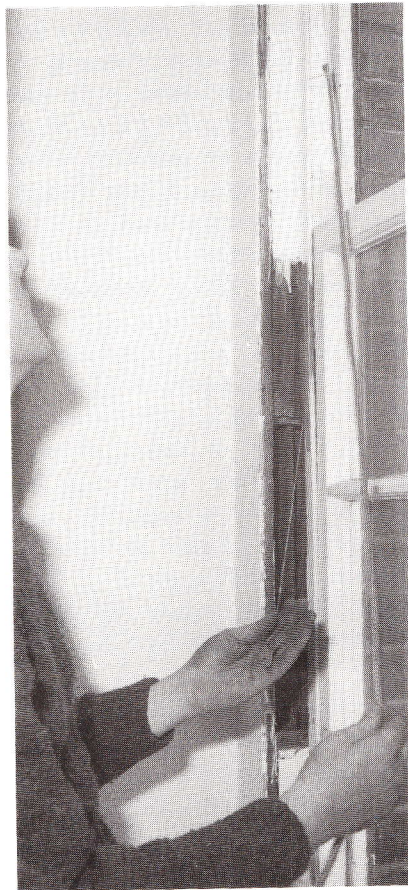
Original fasteners and other ironmongery are also of interest and should be retained if possible.



Removing pocket piece



Pocket piece removed to reveal sash weight



Threading new sash cord through pulley



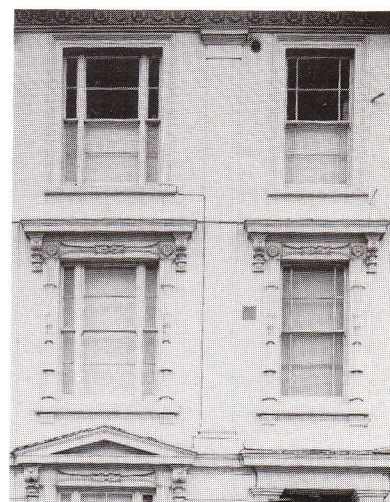
Fixing new cord to sash

HISTORICALLY ACCURATE REPLACEMENT

Normally, old sash windows should be repaired, not replaced. This leaflet sets out what to do if a window is beyond all repair, or if you are seeking to restore a traditional sash window in an opening that has had a different type of window inserted at a later date.

Usually, though not always, it is the original joinery that one is seeking to replicate. *It is essential first to identify the period to which you are trying to return, and to find and study appropriate examples.* Always study the evidence of the building, making sure the details copied are of the correct period. New work which departs, by

intention or mistake, from the character of the existing, draws attention to itself. This information sheet sets out some simple guidelines for designing new sash windows where reliable evidence is lacking. Two examples are given: one from the early eighteenth century (*Example 1*) and one from the late eighteenth or early nineteenth centuries (*Example 2*). As has been stated already, there is an infinite variety of sash windows; *these examples explain the traditional techniques recommended – the details must be taken from a careful study of your own building.*



The pattern of sash windows is an important element in the design of this 1850s terrace

Setting Out

For the new windows to present a satisfactory appearance not only must the dimensions and profiles of the parts be accurately reproduced, the proportions of the glass 'squares' must also be appropriate. These proportions are governed by the dimensions of the brick openings and the number of glazing bar divisions.

In restoration work there is no scope for varying the opening size. The only exception to this is if you are seeking to restore the original opening size where windows have been dropped; such work should never be attempted without consultation, and if your building is listed you will need 'listed building consent' from your local planning authority.

Most sashes have six panes in each sash, but there may be variations, particularly on the upper floors or in basements; or where sashes have been inserted into earlier openings.

Using the drawings (*Examples 1 and 2*), the method of setting out the main divisions is as follows:-

1. Draw the opening accurately to scale. The upper surface of a stone cill (F in all diagrams), if present, is to be regarded as the lower limit of the opening.

2. Make allowance for externally visible thickness of the wood cill (E), say 3" in frames of the early period, 2" in later ones, at the bottom of the opening. Allow also for the width of the box frames at the sides and head. The early C18 frames of smaller domestic windows will show about 4", and very large windows may show 6" or more: however, there must be no variation from storey to storey. In later windows an inch or less will show of the box frame.

3. Make further allowance for the amount by which the depth of the bottom rail (D) exceeds the sight thickness of a glazing bar. This excess will often be about 2" but may be greater on a very tall sash.

4. Draw guide lines within the space left so as to reduce the overall height and width by half the thickness of a glazing bar on all four sides and divide the remaining space into equal rectangles. Using these guide lines as centres draw the glazing bars, stiles and rails. The visible widths (C) of top and meeting rails and stiles should be identical with the sight width of the bars.

Example 1: The bars should be *not less than 1³/₈"* finished width in most cases.

Example 2: The bars should be *not more than 3/4"* finished width in most cases.

Very large sashes, particularly of the early period, may require heavier members. The thickness should not vary from storey to storey. The depth of the bottom rail is greater than a bar width by the amount of the allowance already made.

5. If the setting out is correct, all the resulting glass 'squares' in one window will be of identical dimensions (A × B). If the squares are wider than they are high a mistake has been made. The diagonal of a rectangle of 3 × 3 squares should pass neatly through the glazing bar intersections. If it does not do so, check first that the meeting rail has not been thickened.



IMPORTANT CONSIDERATIONS

1. In replacement work the traditional method of construction and hanging, detailed in most old building text books, will usually give the most satisfactory-looking results. The full size details show unelaborate types of sash windows, that for the later period having 'lamb's tongue fillet' glazing bars, which can readily be made in an ordinary modern joinery works.

Example 1: The box frame H is often completely enclosed with a thin inner lining against the brick jamb. A wood slip is hung between the sash weights (not shown). The outside lining may be beaded and the removable bead on the inside lining may be moulded to give the appearance of a beaded arris. Earlier sashes often have both meeting rails moulded (see broken line at G) and the upper sash was sometimes not hung on lines but wedged in the closed position by blocks (backflap-hinged to the pulley stiles) which could be dropped to allow the sash to fall a few inches onto a stop.

Example 2: The box frame H (not shown in detail) is set in a recess behind the brick reveal. It is usually completely enclosed with a thin inner lining against the brick jamb. A wood slip is hung between the sash weights. As earlier the removable bead on the inside lining may be moulded to give the appearance of a beaded arris.

2. Inappropriate mouldings can spoil otherwise competent restoration

Example 1: Mouldings for early, thick bar, sashes should be bold. The curves are all circular and many of them approximate to a quarter circle. Beads are about three quarters of a circle. Glazing bars show broad flat faces between the putties. An external architrave (K) is not always present. If provided it may be narrower and more boldly curved than that shown.

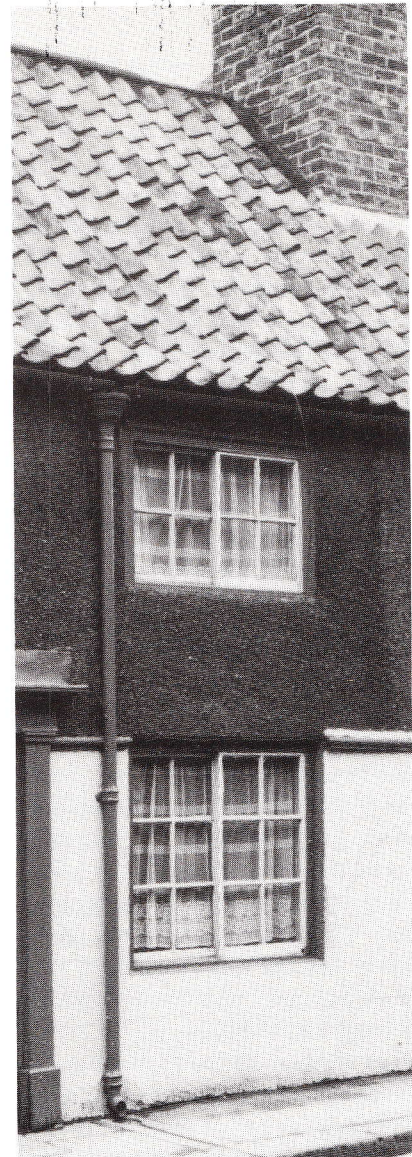
Wood sizes were very often 'full', so that a 1½" glazing bar was finished to that size and was not a nominal 1½" reduced by working. When there are no old remaining sashes to be matched this point may not be critical, but care must be taken not to produce a sparse appearance by using, for convenience, wood sizes which after working, will look too thin.

Example 2: The opposite of the above is often the rule. Care must be taken not to produce a heavy appearance by using, for convenience, wood sizes which, even after working, will look too thick. Mouldings for slender barred sashes should be refined. The curves may be parts of circles or ellipses. Glazing bars show very narrow flat faces between the putties.

Some houses with brick facades have thinly rendered reveals to the window and door openings. When carrying out repairs care should be taken not to make the stucco rendering too thick. It is usually about ½" thick, brought to (or a fraction beyond) the wall face and finished with a bullnosed edge.

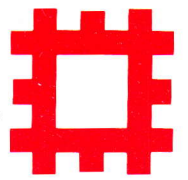
3. Remember that pre-1850 sashes do not have 'horns'. If the sashes are correctly made from suitable materials there will be no need for the stiles to project below the meeting rail. Large sashes with very slender members may need some reinforcement in the top sash meeting rail to bear the weight of the glass but this should be done by 'secret' metal members.

4. If the stone cill (F) has to be replaced it should not be 'stooled' at the ends.

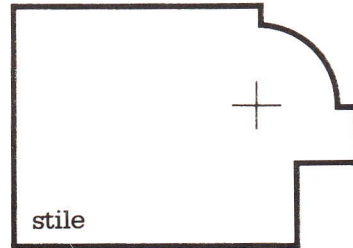
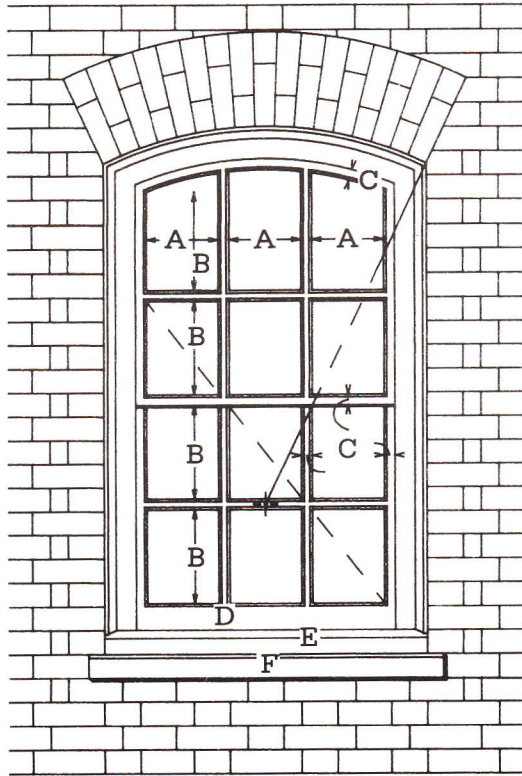


A horizontal sliding sash, sometimes called a Yorkshire sliding sash. This example is from Ripon

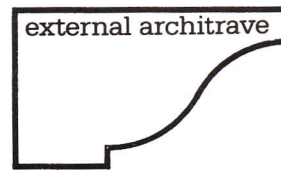
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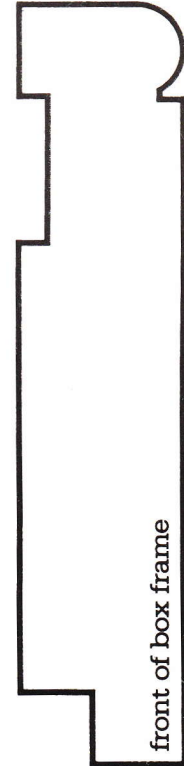
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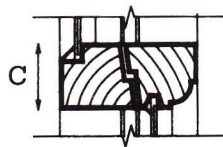
external architrave



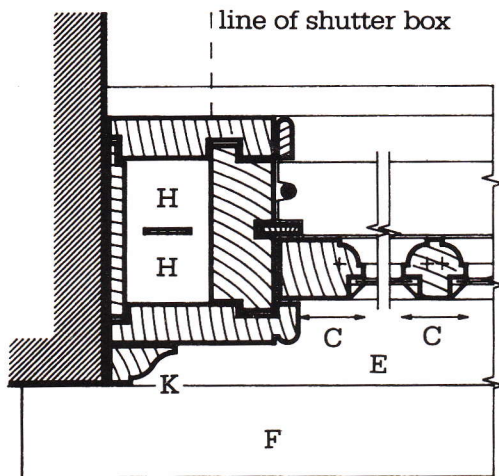
glazing bar



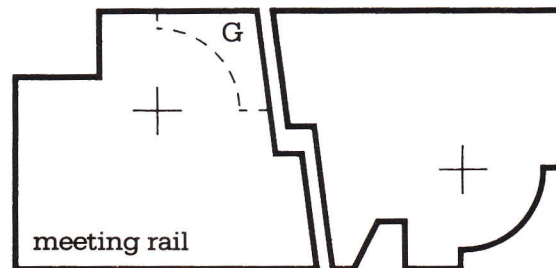
front of box frame



meeting rail



FULL SIZE SECTIONS



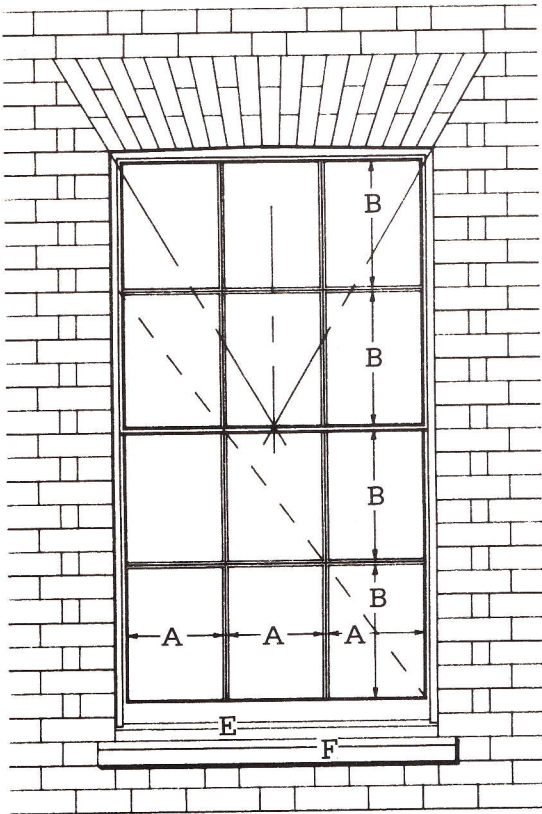
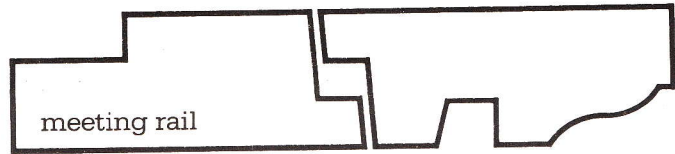
meeting rail

SASH WITH EXPOSED BOX FRAME AND THICK GLAZING BARS

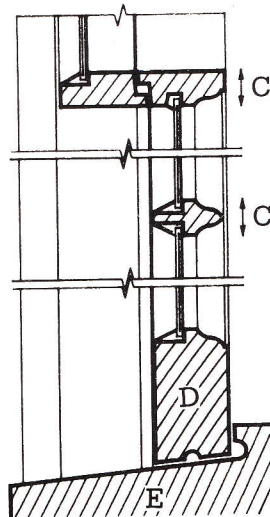
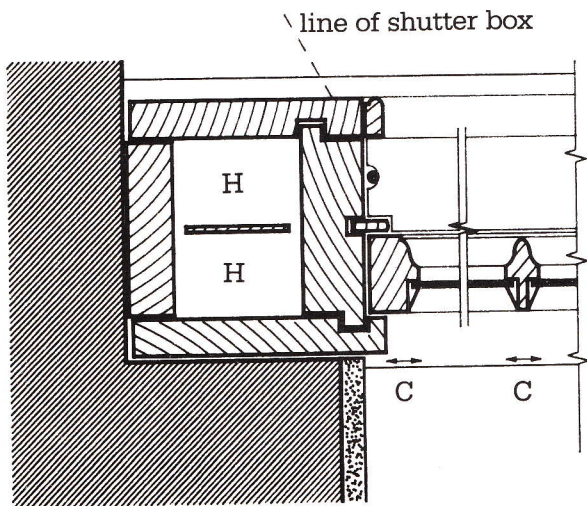
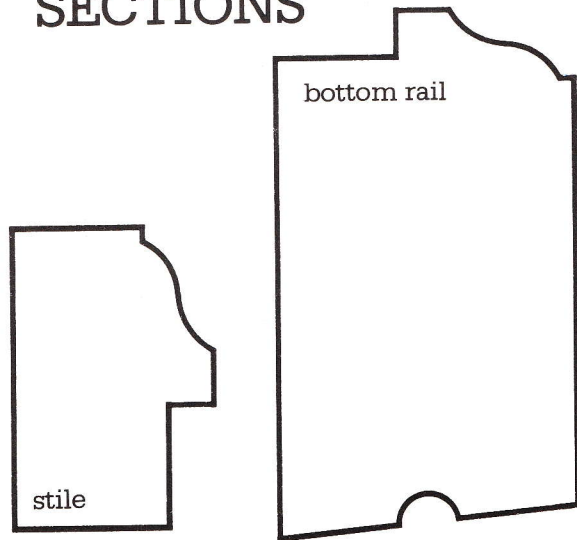
EXAMPLE 1

Listed Building
Guidance Leaflet

Sash
Windows



FULL SIZE
SECTIONS



SASH WITH RECESSED BOX FRAME

EXAMPLE 2