PALACE HOUSE MANSION

PALACE STREET, NEWMARKET, SUFFOLK

Report Outlining the Analysis and Interpretation of a Late Seventeenth-Century, Solid-Frame, Counterbalanced, Sash Window

by

Andy Wittrick

Historical Analysis & Research Team

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ENGLISH HERITAGE

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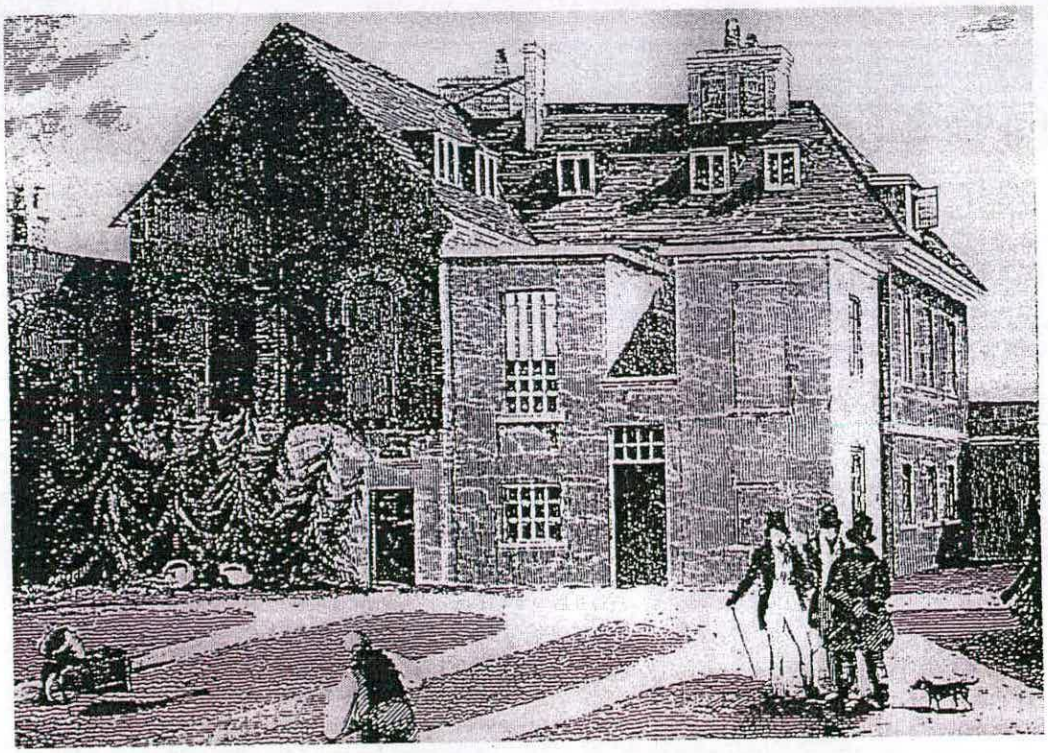

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1. Introduction

English Heritage, Conservation Group:Eastern Region, sought further advice as to the importance, condition and value of the surviving window frame, discovered recently in the East Pavilion of this building and requested a detailed analytical record to be prepared, both in advance of the preparation of a specification for its conservation and reinstatement/relocation. The building is currently undergoing a programme of adaption and repair, part-funded by English Heritage.

This paper offers a descriptive account of the fabrication of this window and its components and is supplementary to the paper by A.P. Baggs, published in The Georgian Group Journal, Vol VII (1997), shortly after the window was discovered. It forms a large part of a multifaceted and multidisciplinary study and elements of this report may be combined to form a future comprehensive publication or archive deposition.

The window was examined during a visit to the site in July 1997. The frame had been removed from its former location and was stored in the lower vaulted rooms of the surviving pavilion, enclosed in an improvised timber casing. The surviving balance weights had been removed. The extant glazed panels found with the window had been detached and sent to conservators. The fixing cramps and elements of the glazing assembly had also been removed and were not available for analysis on site.

Unfortunately, when the window frame was removed from its opening, most of the adjacent decorative and plaster surfaces were lost, destroying in turn a great deal of potentially important archaeological information.

2. The Site

The pavilion appears to be all that survives of Charles II's royal hunting seat at Newmarket. Only the lower two storeys remain of what is now largely a nineteenth-century house known as Palace House Mansion. It was an enlargement of a house purchased in 1668 by the king on the High Street, formerly in the ownership of the Earl of Thomond. The architect William Samwell was appointed to supervise the works which were begun late in 1668.

The building is constructed in a soft red brick in Flemish bond. The extant window openings have gauged brick cambered arch heads and stone cills, many of which survive from c.1670. The solid-frame window was located on the principal floor of the northern facade, set back 1 brick (215mm), behind a projecting brick nib which limited the exposure of the main framing components.

3. Significance

Without doubt, the discovery of this window may as yet, be the most significant find concerning the origin of the counter-balanced, vertically sliding sash window, not only within this country but also within continental Europe. Past research has mainly used, sometimes unreliable, documentary sources with little hard evidence of how these windows were assembled. We now have reliable visual material, a surviving example of late seventeenth century carpentry which gives us both the typical countenance of such frames and their precise constructional details.

There is no evidence to suggest that the frame is an adaptation of an earlier window. The head, cill, jambs and central mullion are clearly of a piece. The initial drilling of the circular shaft of both jambs in which the counter-balance weights travel - an ingenious carpentry technique - could not have been undertaken with the frame in-situ. With the exception of the central mullion - which has a planted guide - glazing rebates and sash guides are all cut out of the solid. There is therefore no reason to doubt that the construction of the solid frame, sash and counter-balance mechanism was contemporary with the construction of the northern facade in which it was accommodated.

William Samwell's works to the royal hunting seat at Newmarket for Charles II were complete by 1671. The window had therefore been positioned by this date. Its solid framing must place it amongst the first experimental designs to have been used in this country. The declared accounts of the Office of Works suggest that after 1675 no solid frames were being used in the manufacture of sash-windows following the development of the standard cased frame (ref:).

4. The Frame

(References to the frame are taken from the external view).

The frame is constructed principally from oak (standard in first-class work). The jambs have been worked from scantlings in excess of 127mm (5"), the cross-grain pattern of both suggest that they have been cut from quartered timbers. Bark edge remains on the upper part of the left framing jamb. The standard of carpentry is high, as could be expected for a building of this status, although no carpentry identification marks were observed or numbering for site location.

The window is divided vertically into two equal halves by a substantial central mullion, worked again from a scantling in excess of 127mm (5"). Each half is subsequently cut by a transom placed in the centre, so creating four equal sections. No provision was made for sashes in the upper sections; instead a glazing rebate was simply run externally to allow direct glazing.

The internal faces of both jambs, have central, staggered 'U' shaped guides run from the solid in which the sash slides. The jambs have a further central groove cut which housed the braided sash line (*Fig.2*). The central mullion also has corresponding guides, but here a planted piece forms the rear section of the guide, fixed in position by three iron coach-bolts - two of which remain - which pass through the mullion and appear to have the same painted application, applied to their exposed head, as the frame itself and would therefore seem contemporary. Baggs (1997) suggests that these planted guides were an aid to the easy removal of the sash. However, although the removal of these guides would indeed have provided suitable access for maintenance and cleaning, the head of each securing bolt (and presumably securing nut - now missing) was set flush and lost within the frame, suggesting that once placed there was no intention that they should be removed. Clearly the sash could not be accommodated without the removal of part of a guide, the design also provided for a certain amount of flexibility and allowed adjustment during installation. Both planted guides remain but have been re-located.

The frame head, 127 x 87mm (5"x 3.5"), also has the central, staggered 'U' shaped guide run from the solid (*Fig.1*). The exposed cill, 127 x 83mm (5"x 3.25"), was prepared with a slight bevel which gave a weathered upper surface and an upstand, married to the jamb guides, to retain the lower rail of the sash and offer protection from wind-blown rain. The transoms, 63 x 57mm (2.5"x 2.25"), have a simple rebate, 19 x 19mm (0.75"x 0.75"), cut in their upper external face to receive the glazed lights.

4.1 Assembly

The frame measures 2745 x 1448mm (9'0"x 4'9") overall. It is assembled using traditional mortice and tenon joints with securing timber pegs *(Fig.5)*. No assembly horns survive or appear to have existed and the frame would seem to have been 'squared' to allow uncomplicated accommodation, during construction, within the opening in which it was placed.

The union of both jambs and central mullion with head and cill has strong double -tenons, cleverly worked to accommodate the continuation of the glazing rebates and sliding guides. The central transoms however, have short tenons located in shallow mortices within both the mullion and jambs.

Spiked, angled cramp irons were used for masonry fixing most of which have survived. However, only one now remains in place, high on the western brick jamb and flattened against this brickwork. It would appear that they were positioned after the frame was placed, by forcing into the soft lime mortar joints and, although there is evidence to suggest a secondary fixing to one and holes in the flattened, cranked section for (nail?) fixing of each, they appear to have simply held the frame in position by abutting.

The frame appears to have been placed after the surviving masonry opening was formed. Close examination of the earliest brickwork, exposed after the removal of the frame and which survives to the head, west jamb and upper part of eastern jamb, has revealed the original struck mortar joints with horizontal scoring as a surface finish - presumably intended internally to act as a plaster key. This clearly could not have been undertaken with the frame in position. Further evidence exists in the form of adjustments which have been made to the opening, at the head and upper part of jambs, where the extant brick faces have been shaved and straightened to remove irregularities, prior to insertion.

4.2 Accommodation of counterbalance weights

The window exhibits an intriguing carpentry technique in the central boring of both jambs to form a circular shaft to allow passage of the counterbalancing weights for the lifting sash. Illustrative accounts exist which suggest that the technology to achieve such a task was available and being used during the seventeenth century to centrally bore out short saplings for water pipes for example (*Figs.21 & 22*). However, the accuracy of the bore considering its length, some 2745mm (9') and small diameter 45mm (1.75"), boring into the cross-grain of the timber and in a single direction, are all accomplishments which I am advised, would present a challenge using modern day technology.

Pockets, giving access to the sash weights, are neatly cut and hollowed out of the lower internal face of each jamb (*Fig.9*). The apertures measure 127 x 45mm (5"x 1.75") and are sufficiently wide enough to allow the threading of the weights and their positioning within the central bore of each jamb.

4.3 Appearance

A slight distortion of the right jamb appears to have been present from an early date and may have been caused with the use of unseasoned timber. However, the distortion has almost certainly been accentuated with the removal of the frame from its former location and it would now be difficult to establish how plumb the frame may have

been. This imperfection would clearly have hindered the movement of the sash and passage of the weights and pulley mechanism and may have caused the surviving sash to become jammed whilst opening and consequently not able to function properly.

4.4 Use

Little wear is evident on the sliding guides of the surviving sash and frame. The corners of these elements appear crisp and sharp suggesting that the assembly may have had little use.

The glazing rebate of the right-hand transom and lower rail of the sash, together with the cill of the main frame, have weathered quite badly indicating a long period of exposure. However, under the closed sash the cill appears relatively sound. This evidence again implies that the sash had little use and may have remained closed for most of its exposed life.

4.5 Architrave

A thin cover architrave survives, nailed to the internal face of the head of the frame, although the upper part has been hewn away. Formerly 76mm (3") in width, it would appear to be contemporary and have the same painted application as survives on the framing. A band, 76mm (3") wide, bereft of paint and set 19mm (0.75") from the sash-guide face, suggest that it covered the internal face of the frame jambs and concealed the weight and pulley wheel access pockets. It also appears to have been placed to cover the internal face of the cill. The surviving moulding, merely 6mm (0.25") in thickness, has a rather plain and somewhat unusual form with an ovolo and fillet at its termination
(*Fig.1*).

4.6 Ironmongery

What appear to be the original sash lifts have survived and are themselves of great interest as they are comparatively rare (*Fig.17*). Metal framing angles, placed at each corner of the sash frame may also be original and appear to form part of an assembly which includes the sash lifts (*Fig.19*). The surviving lifts consist of two gilded, decorative (shell dome) knobs which have been screw-fixed into the lower rail of the sash and through the wrought iron angle assembly. These angles have been set flush with the external face of the sash frame and appear to clamp the stiles to the upper and lower rails, which otherwise are butt jointed. The iron angles on the lower rail have been set slightly proud of the glazing rebate and serve to house the bottom edge of the glazing panel. This arrangement also appears to exist on the upper rail which would necessitate a certain amount of flexing of the glazing panels during installation.

A 76mm (3") diameter, 13mm (0.5") broad, solid brass pulley wheel survives, housed within the frame jamb, turning on an iron pivot pin, which would appear to be simply hammered into the frame (*Fig.18*). It is accommodated in a deep pocket in the extant

jambs and has no frame box or face plate. An access pocket is also provided on the internal face of each jamb.

4.7 Shutters

There appears to be no surviving evidence which would suggest that the window opening was shuttered, which is unusual considering the probable need to secure the building during periods of unoccupancy. Surviving lime plaster on the upper part of the internal eastern brick jamb and the (lime) edge staining of the internal face of both jambs of the frame, suggest an early plastered application as an internal finish here. It has been applied after the window was positioned with a straight thickened edge where it abutted the frame. As the remaining brickwork to this opening has been largely reconstructed, it is important that this plaster is conserved.

5. Sliding Sash

Both the top and bottom rails of the surviving sash frame were cut from solid timber (*Fig.3*), 25 x 63 x 546mm (1"x 2.5"x 1'9.5"). The stiles are similar (*Fig.4*), 25 x 44 x 1360mm (1"x 1.75"x 4' 5.5") only having planted, profiled timber guides, with overall dimensions 25 x 19 x 1360mm (1"x 0.75"x 4' 5.5"). Four equally spaced, horizontal timber glazing bars are mitred and tenoned into the stiles and secured with small timber dowels. All members have a simple quirk ogee bead run along the internal edge and the adjacent face rebated 8mm (0.3125") to receive the leaded glass panel.

The planted timber guides to the stiles are unnecessarily complicated. They are `L' shaped and taper into the corresponding guides of the frame members (*Fig.4*). Each guide has a different pattern which is possibly associated with the purpose that they were intended to fulfil - the extended arm of the jamb stile guide to allow surface fixing of the carrying sash line for example.

It has been suggested that these guides may have been added during a later alteration or repair. However, they appear to show the same painted sequence as survives on both the sash itself and frame. Furthermore, it is unclear why these guides were not worked from the solid - the slenderness of the stiles does not appear to have been an issue. Was the sash frame intended for a more limited opening or was there a mistake made during fabrication? Closer attention needs to be paid to analysis of the sequence of paint layers which relate to the separate members.

5.1 Weights

A set of three cylindrical, cast lead weights had been removed from the frame. Each 102mm (4") in length and 38mm (1.5") in diameter, they have been formed in two stages cast around a small central circular shaft to allow threading of the braided sash line on which they were hung. The malleability of the lead would have enabled these weights to be modified to fit and move freely within the bored shaft of the jambs. However, owing to the length of these shafts, the very limited clearance allowed and

the number of weights deployed, jamming of the whole mechanism may have frequently occurred.

The braided sash cord appears to have been fixed to an iron? hook/fastener, still attached to the side of the sash-frame stile.

Although the glass has been removed, it would seem doubtful that the three weights which were found were sufficient to 'balance' the glazed sash, suggesting that some may have been subsequently removed.

5.2 Glazing

The glazing had not been inspected at the time of writing. Interpretation has therefore been based on inspection of the frame and photographic evidence.

There would appear to be little doubt that the square panel leaded lights that were found, placed within the sash frame and the fixed light above, are original. No evidence was found on the frame to suggest re-glazing. This type of glazing pattern was certainly being employed towards the end of the seventeenth century in this country (Louw.HJ, 1983), the pattern reflecting what was later to become the standard arrangement for timber glazing bars. Furthermore, the extant horizontal timber glazing bars - to which the horizontal cames were tied - and the surviving sash lifts, were positioned to reflect the symmetry of respectively, the horizontal and vertical cames of each glazed pane.

The upper light was held in position with simple lead glazing ties fixed to the frame and tied back to wrought iron saddle bars, equally set into the mullion and each jamb.

A small panel, containing the diamond quarries, was found above the modified frame. Although apparently of an earlier pattern, it may have been inserted following the creation of the new doorway. Furthermore, it was positioned on what appears to be a replaced transom.

6. Decoration

The painted decoration which survives on both external and internal faces of the frame and would appear to date from the pre-staircase period, was analysed by Tobit Curteis in April 1997. The surviving painted outlines offer important information concerning the historical development of the frame (*Figs.8 & 9*).

Decoration of the exposed surfaces of the frame internally is consistent and survives largely intact. However, externally and almost certainly due to a number of frame alterations, the paint evidence is fragmentary.

No evidence of paint was found on the left-hand transom, either internally or externally. Little weathering, if any, has occurred on the exposed surfaces and the surface

of the timber appears fresher and generally dissimilar to that of the right-hand transom, which is much weathered and retains several applications of paint. It is possible that the left hand transom was replaced when the frame was modified.

7. Alterations

The window was altered when the left jamb, at a point just below transom and the cill, was truncated and removed to create an opening through the wall for access to, what appears to be, an early eighteenth century extension, housing a staircase and (external?) chamber. The sash and balancing mechanism was also removed, the brass pulley wheel cut out and possibly salvaged.

The extant sash and fixed light over survived these alterations. An early eighteenth century plan, attributed to Thomas Fort, indicating the first floor arrangement of the pavilion, clearly shows the window opening to be completely enveloped by a later stair enclosure. An eighteenth century plan of Newmarket would tend to confirm this arrangement (*Fig.10*). Following these works the new door appears to have been divided; with the right-hand side remaining exposed but now serving as a screen between two chambers.

Scars on the surface of the frame suggest that a partition was built up against the central mullion substantial enough to offer support to the new staircase. The frame also exhibits a variety of fixing nails and plaster and lath shadows, indicating many subsequent alterations until its final concealment.

It clearly escaped the recorded works carried out in 1705, during the occupation of the building by Queen Anne, which mainly comprised the redecoration of apartments and installation of new sash windows and was therefore probably, at least partly, concealed by this date. The house itself would seem to have been unaffected by the great fire of 1683 which destroyed half of the town.

8. Condition

Considering its age, the frame is surprisingly robust. One area of weakness is the junction of the central mullion with the central transom tenons. However this is caused due to poor design rather than failure of the timber itself. The removal of the lower section of the left-hand jamb and cill has also put stress on the frame. The glazing rebates of the exposed transom and lower rail of the sash, together with the main cill have weathered with the breakdown of their protective painted application and owing to their long concealment.

9. Discussion

Before the discovery of this frame the first definite instance of counterbalancing appears in descriptive accounts of 1672 for Princess Mary's closet at St James' Palace, where Thomas Kinward, the master joiner of the Kings Works, was paid for all the hardware associated with the sash-window, including pullies, lines and weights. The Newmarket window is a remarkable and ingenious example of late seventeenth century carpentry and displays a wealth of information concerning the construction, appearance and workings of such frames, information which until now has been elusive. Its discovery has also enhanced current knowledge and provides a missing piece in the chronological sequence of the development of these frames.

Close examination has yielded much important information concerning the design of the earliest counter-balanced sash windows and in particular the early and revolutionary thinking applied to the problem of the retention of the window in an open position, without the need for catches or pegs.

In the present example, the window features a lower sliding sash frame only, with a single counterbalance mechanism incorporated within a solid outer frame with channel guides for the sash. Such windows are described as 'single-hung', no upper sash exists and therefore, perhaps, cannot be considered as a true counterbalanced sash window in the conventional sense. It would appear to be a transitional design, certainly innovative but not yet confident enough to dispense with the guides that aided travel of the sash in the earlier, non-counterbalance, form. The guides were still obviously regarded as important in this sense, but clearly became to be viewed as a hindrance and much simplified in the later cased design.

Although substantial, the frame was not intended to serve a structural function as with earlier mullion and transom frames and, like its successor the cased frame could (in theory at least) be removed without disturbing the structural integrity of the opening in which it was housed.

At this early experimental stage, it appears to have been thought that the counterbalancing of each sash could be achieved with a single set of balance weights, hidden and incorporated within each jamb. However, this concept is likely to have hindered the passage of each sash and caused the sash frame to move obliquely as and when it rose. Additionally, the accommodation of another pairing of counterbalance weights, within the central mullion, would clearly have been difficult to achieve without a considerable and cumbersome increase in its breadth.

Additional evidence from the frame, previously discussed, suggests that the window design proved unsatisfactory and was not able to fulfil its intended use. Imperfections with the materials used added to the problems of design.

Lessons were clearly learnt from this early attempt at a suitable design and it soon became evident that by omitting the central solid mullion, both upper and lower

sashes could be made to open. This becoming standard practice certainly from the early part of the eighteenth century.

The exposure of other original and identical structural openings, during the 1996-7 restoration, confirm that other window frames of this nature were almost certainly placed here and formed part of the earliest fenestration. An illustration of how this may have appeared can be found on a drawing of Ham House c.1670, attributed to William Samwell who was commissioned towards the end of his work at Newmarket, by the Duke of Lauderdale, to enlarge this house by adding a new suite of rooms along the South Front (*Fig.20*). The tall narrow design is typical of the latter part of the seventeenth century, the style and surviving moulding profiles would suggest French influence.

Although, the Newmarket window frame would not appear to be the first instance of the counterbalancing system of weights, lines and pullies, it is the only known surviving, relatively complete example from the earliest phase of its development and is further evidence that the sash-window was indeed an English invention.

No comparable surviving examples are known. However, later frames of the cased type, with similar proportions only with spurious transoms have survived at *Boughton House*, Northamptonshire c.1687.

Counterbalanced, sliding sash windows were adopted on a large scale by Wren at Hampton Court (1689-94). A number have survived, little repaired from this period on the upper floors, although close inspection has revealed that no solid-frame units were used, all appear to be of the fully-cased type.

10. Reccommendations:

There would appear to be little doubt that the square panel leaded lights form part of the earliest fenestration. However, further specialist examination may improve our knowledge concerning its fabrication and the possible origins of the small quarried panel found above the later opening cut through this frame. Before the glazing is reinstated we have an ideal opportunity for this study, whilst the glazing remains in storage. The short report from the Lincolnshire Stained Glass Studio, recently received, unfortunately gives us very little useful information.

Commission further detailed paint research with advice from Helen Hughes, EH Paint Conservation Studios, to establish the broad significance of the decorative sequences. It is important that we fully understand the sequence of layers of paint that have been applied to both internal and external faces of this frame, sash and later filling panels associated with the alterations caused by the creation of the door access. Further examination, by sampling the layers of both the stiles and planted guides to the sash frame, for example, should clarify by sequence matching, whether the planted guides are in fact original to its fabrication.

Commission a complete colour photographic record of the frame prior to repair and before reinstatement for display, particularly showing constructional details, ironmongery and polychromy.

Before they are removed, it is important that a specialist study is made of the large and wide variety of iron nails used and applied to the surfaces of the frame. Most are associated with the later alterations caused to the frame and are a valuable source of information concerning its evolution.

SOURCES

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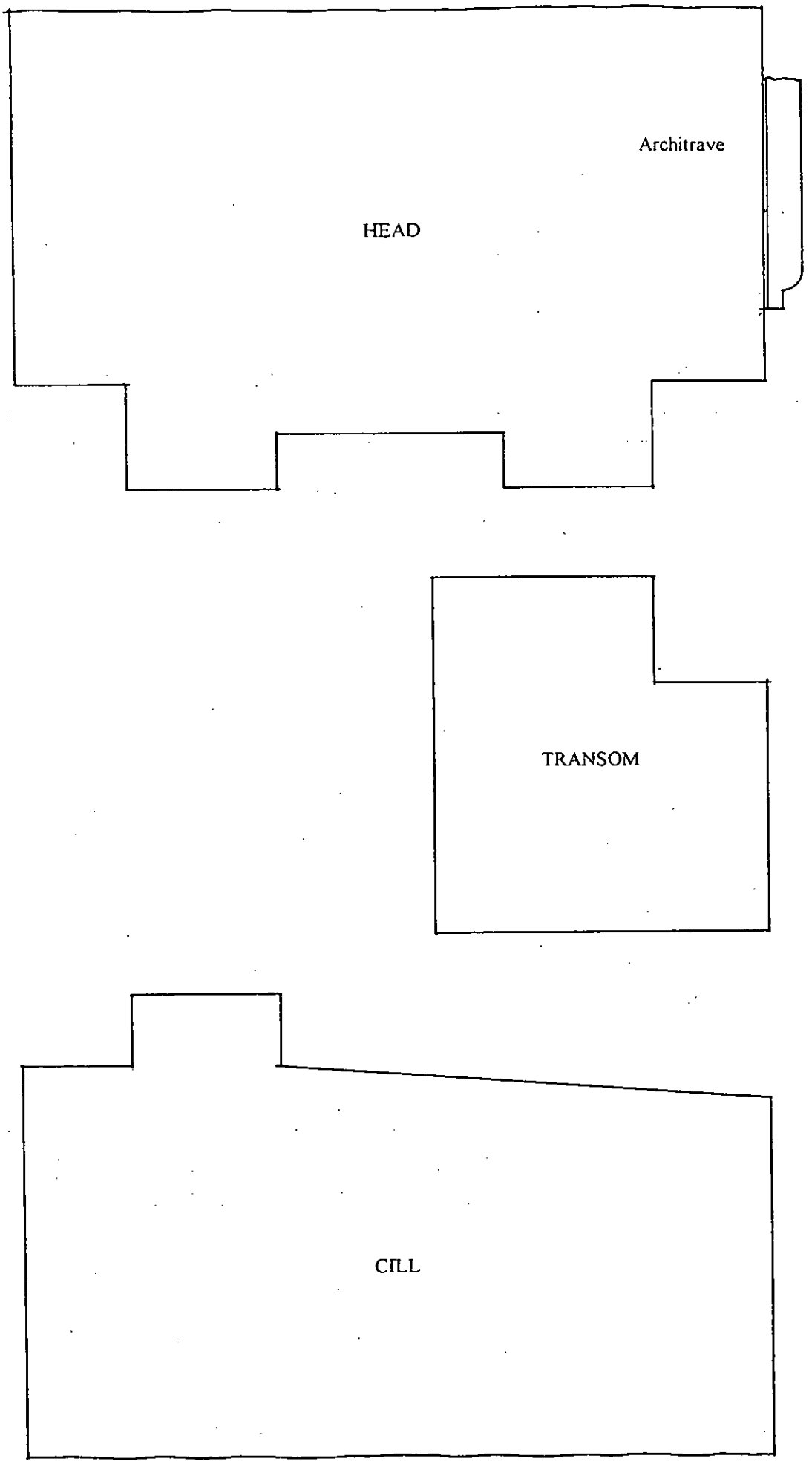
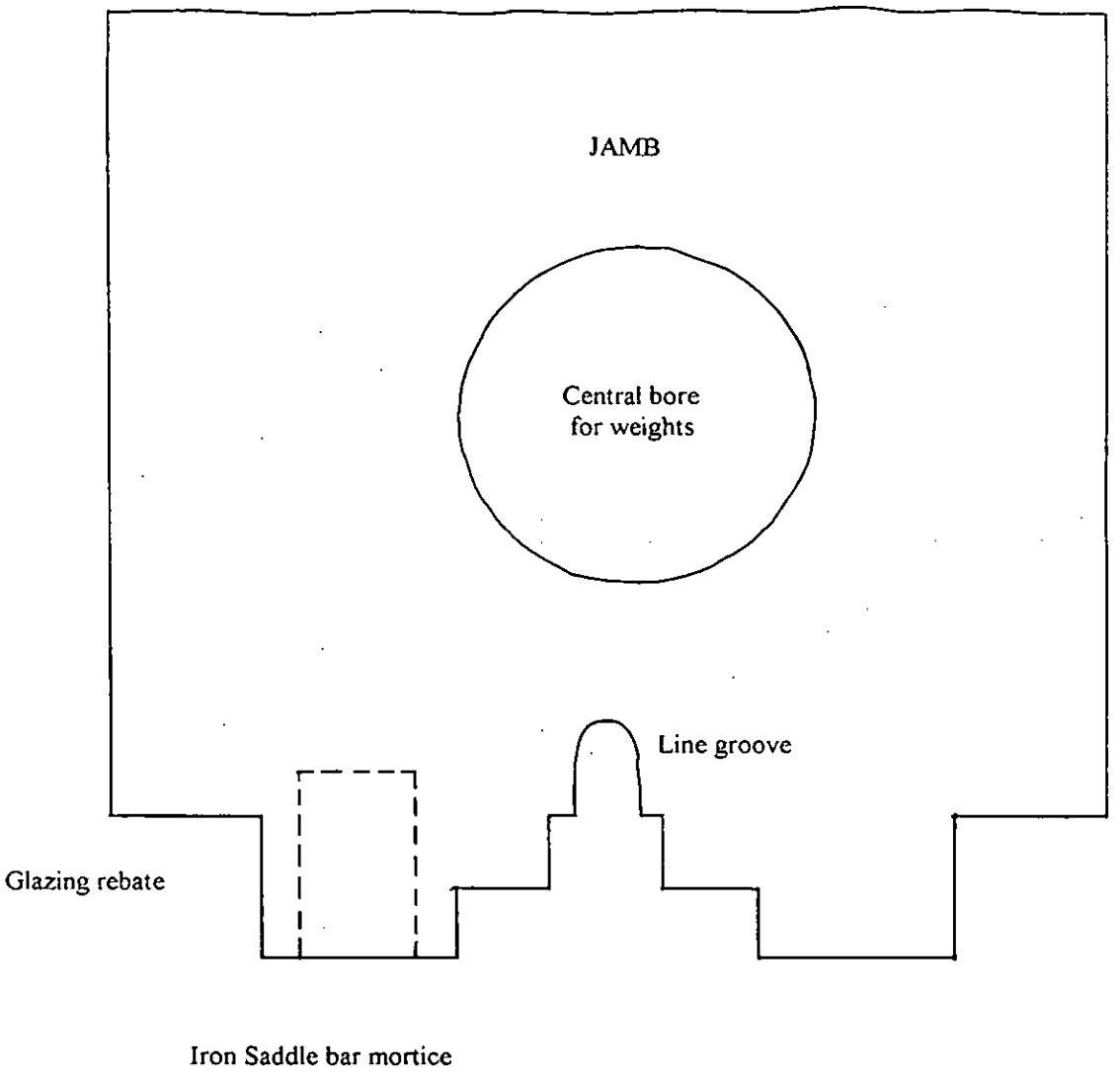


Fig. 1
Full-size frame sections



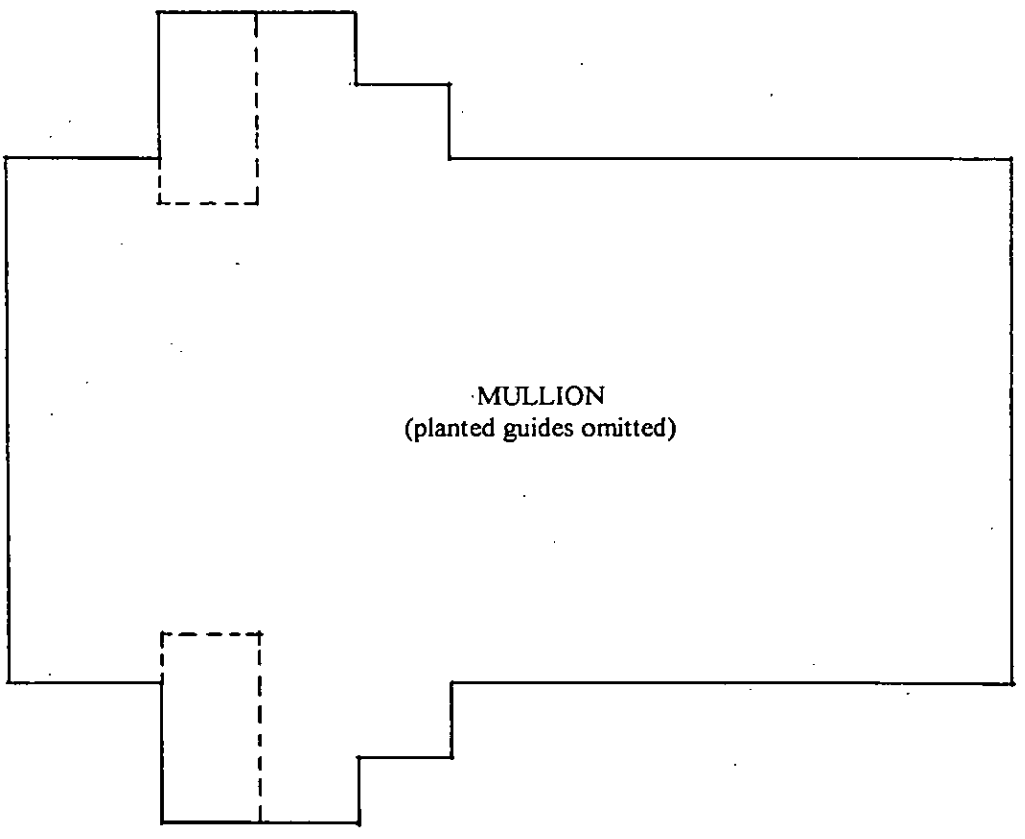


Fig.2
Full size frame sections.

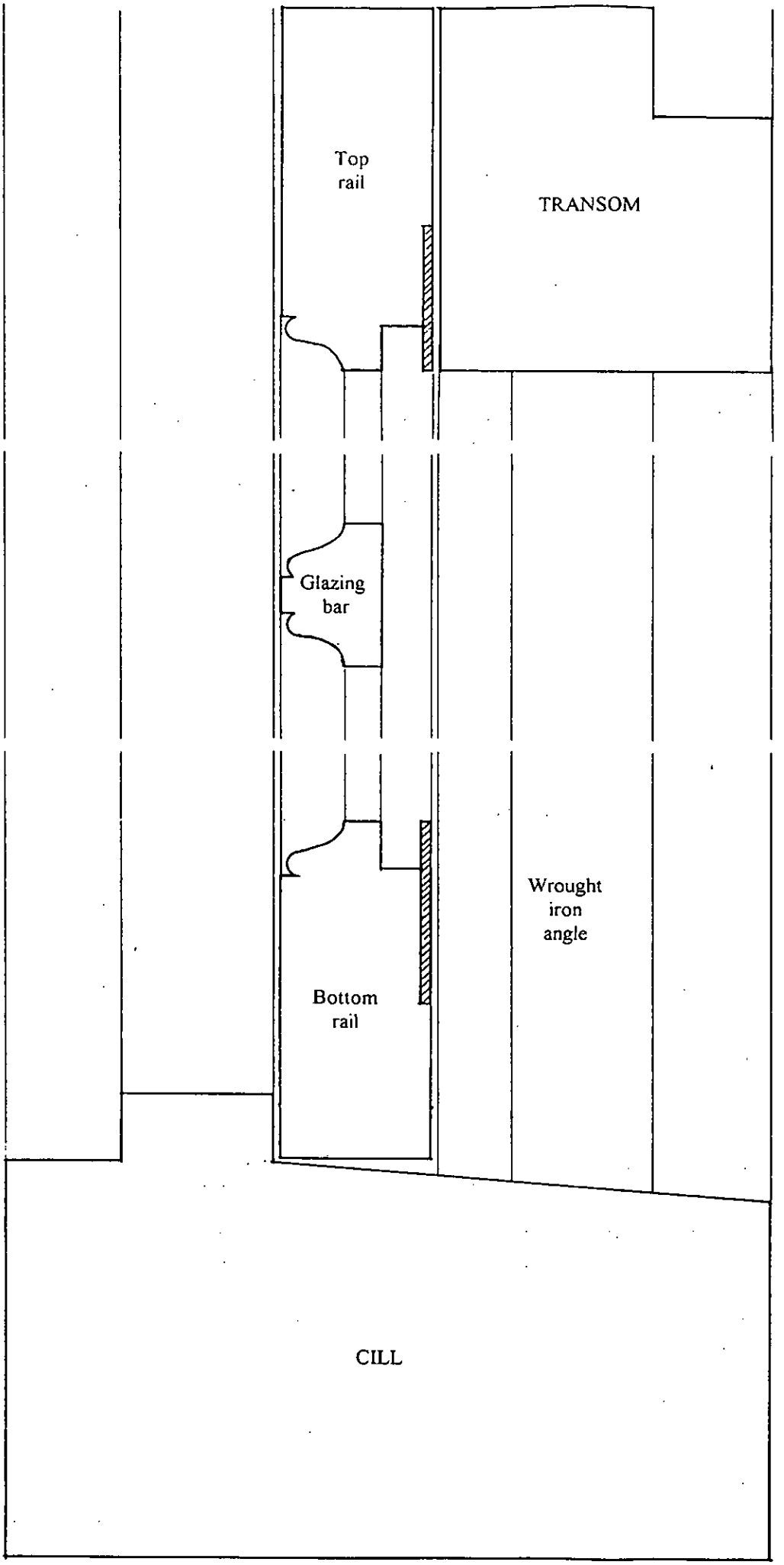


Fig.3
Full size sash/frame sections.

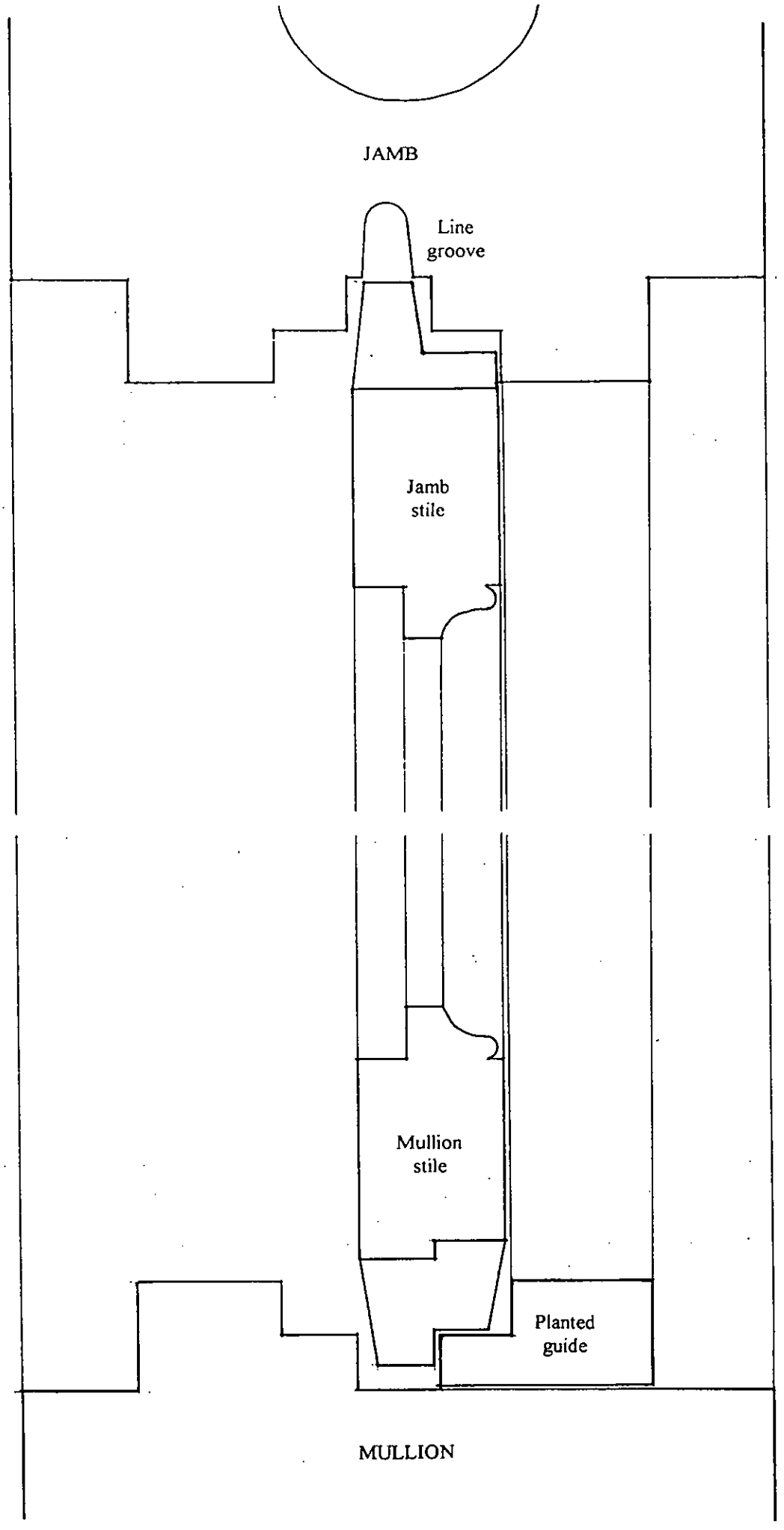


Fig. 4
Full size sash/frame sections.

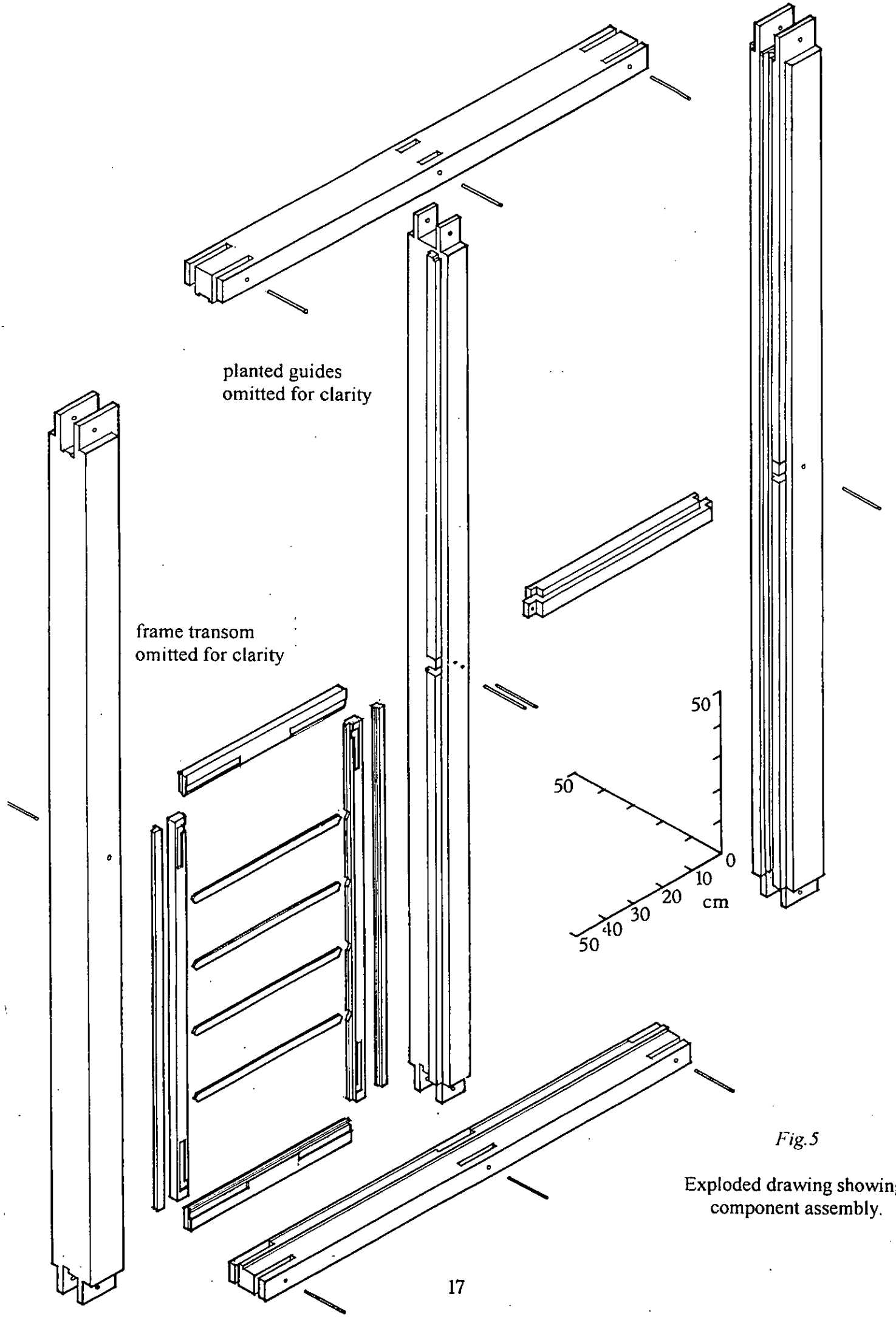


Fig.5

Exploded drawing showing component assembly.

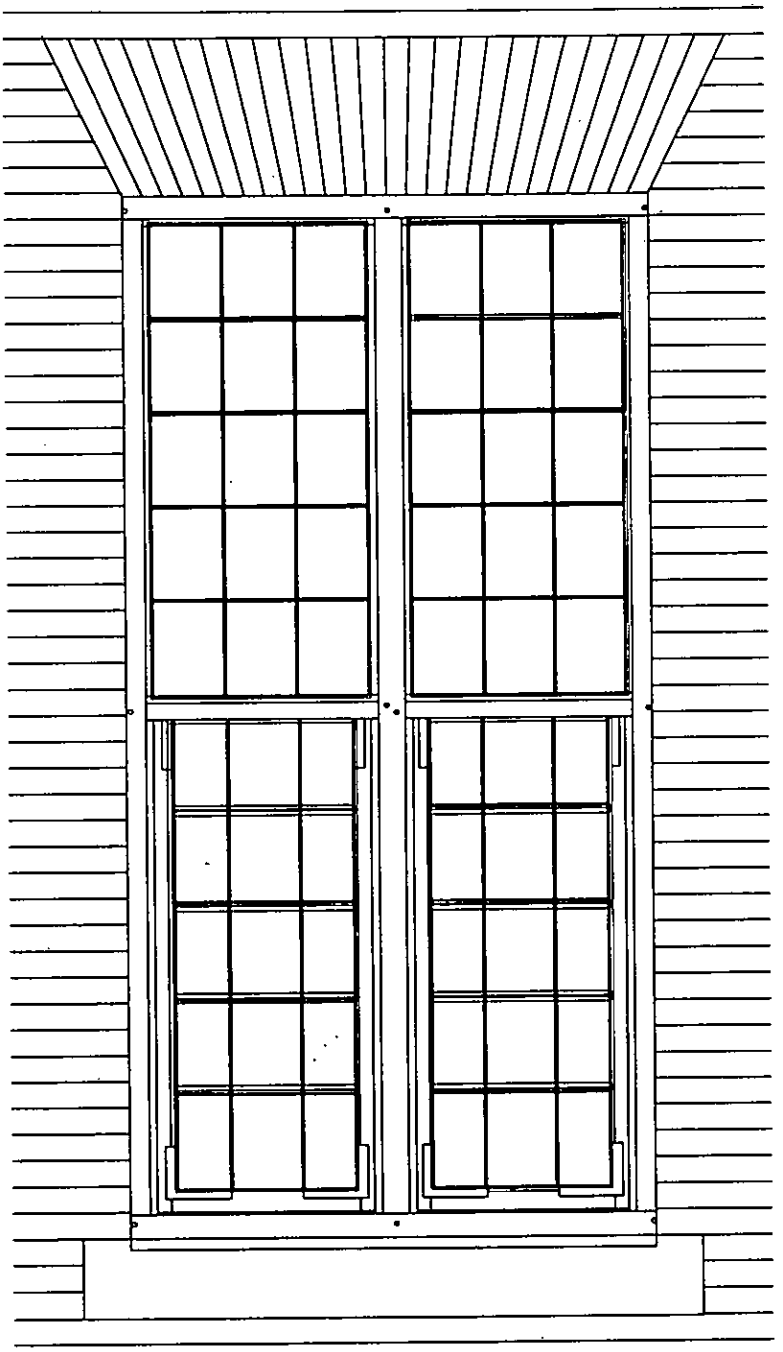


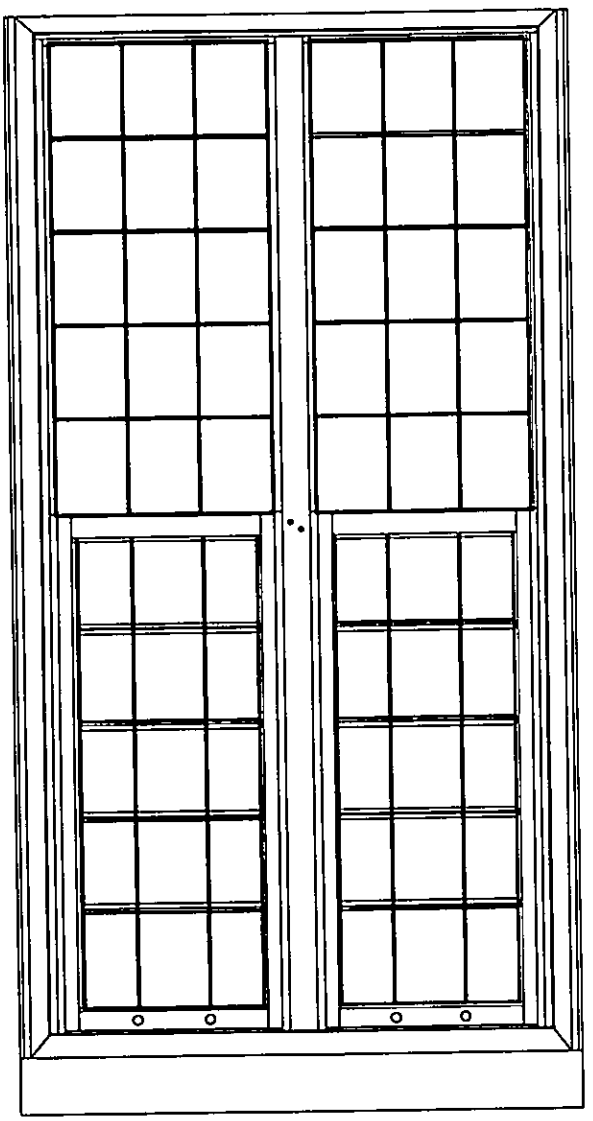
Fig.6

Original form and external appearance of window - based on detailed analysis of frame and extant opening.

(Scale 1:20).

Fig.7

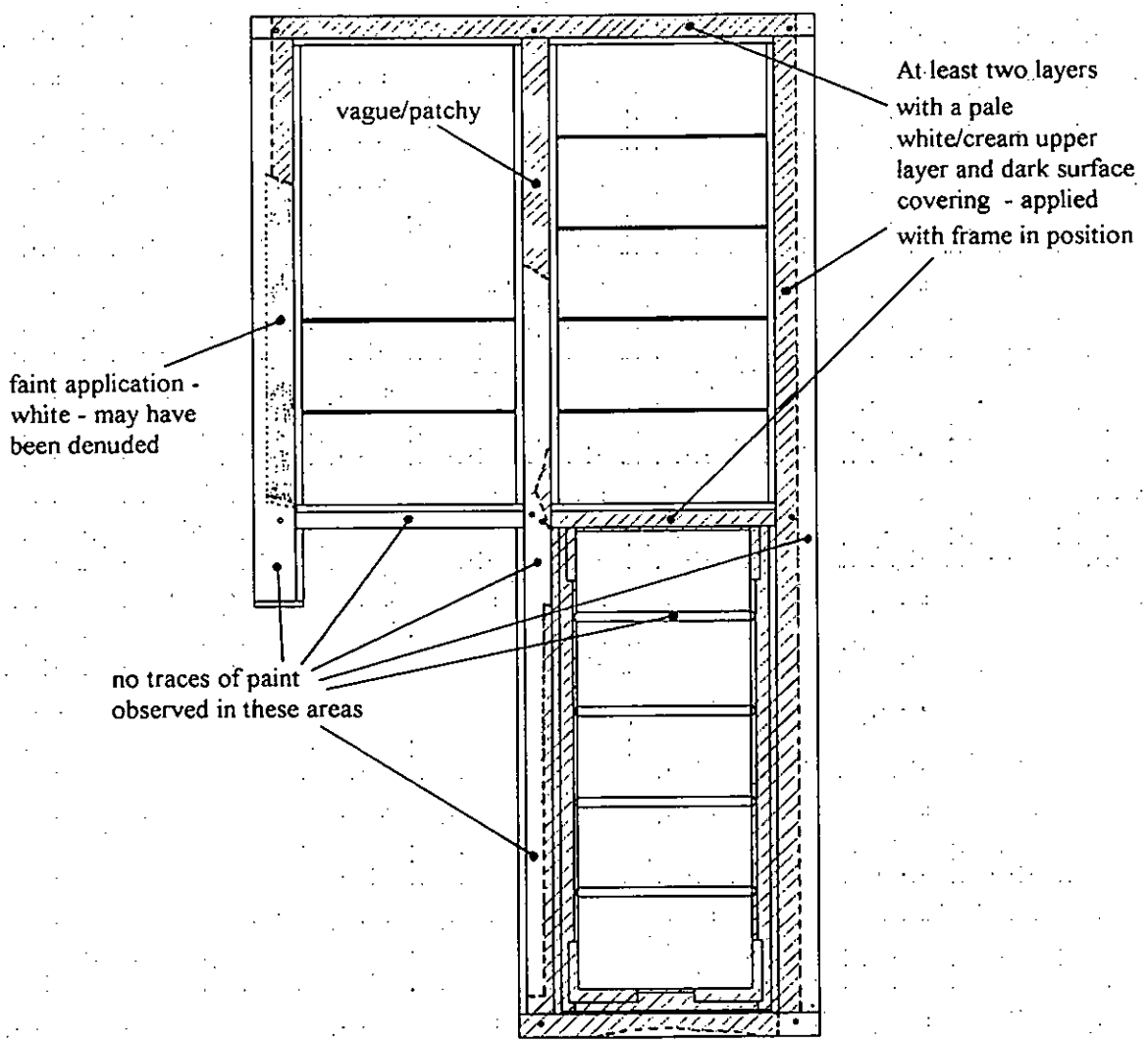
CEILING



FLOOR LEVEL

Original form and internal appearance of window -
based on detailed analysis of frame and extant opening (Scale 1:20).

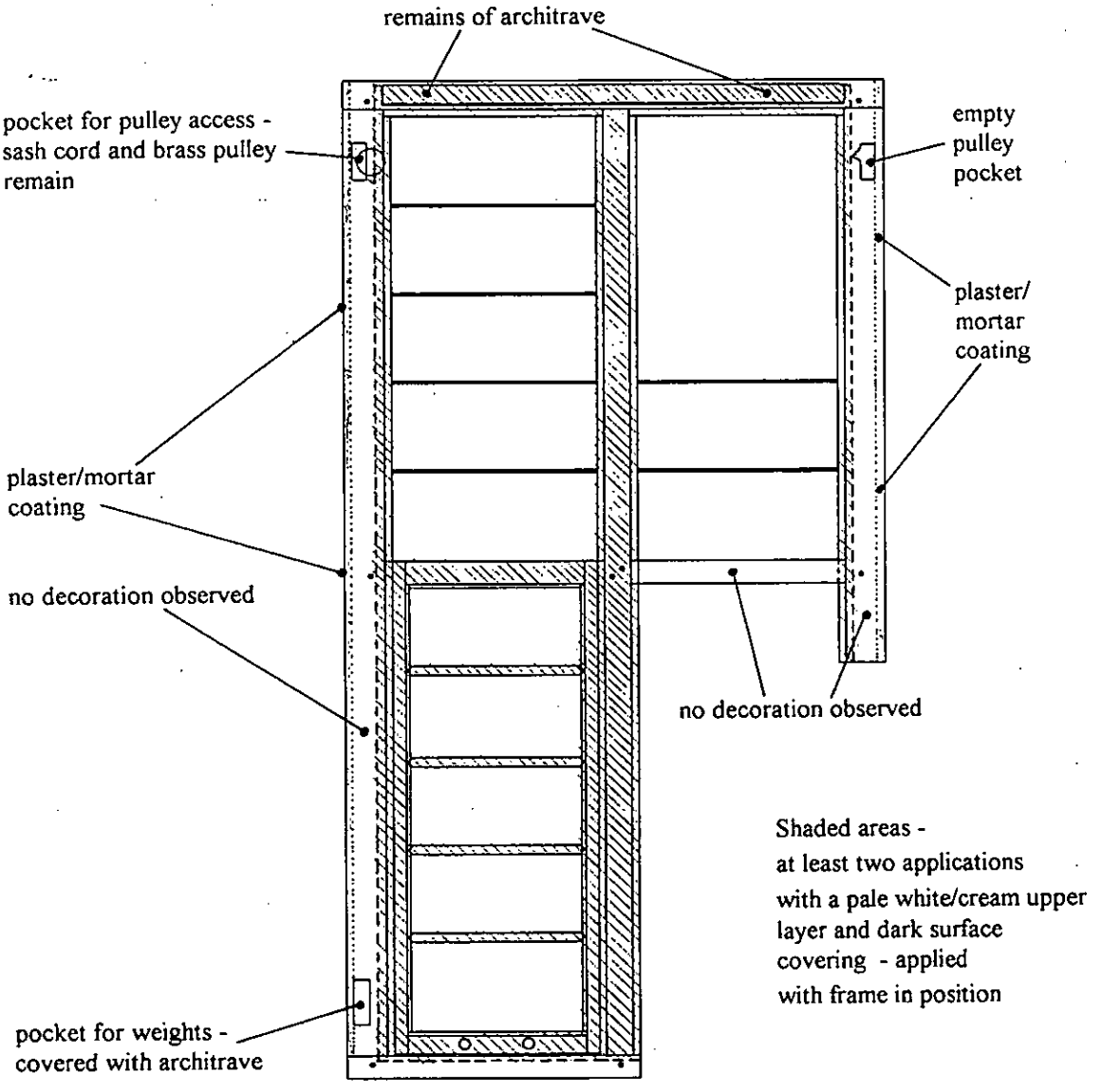
Fig.8



Extant external elevation (subsequent to removal) - showing areas of surviving polychromy.

(Scale 1:20).

Fig.9



Extant internal elevation (subsequent to removal) - showing areas of surviving polychromy.

(Scale 1:20).

Newmarket Palace, from an eighteenth-century plan attributed to Thomas Fort and a survey of 1816, showing principal floor arrangement *(History of the Kings Works*, Vol.5 HMSO 1976).

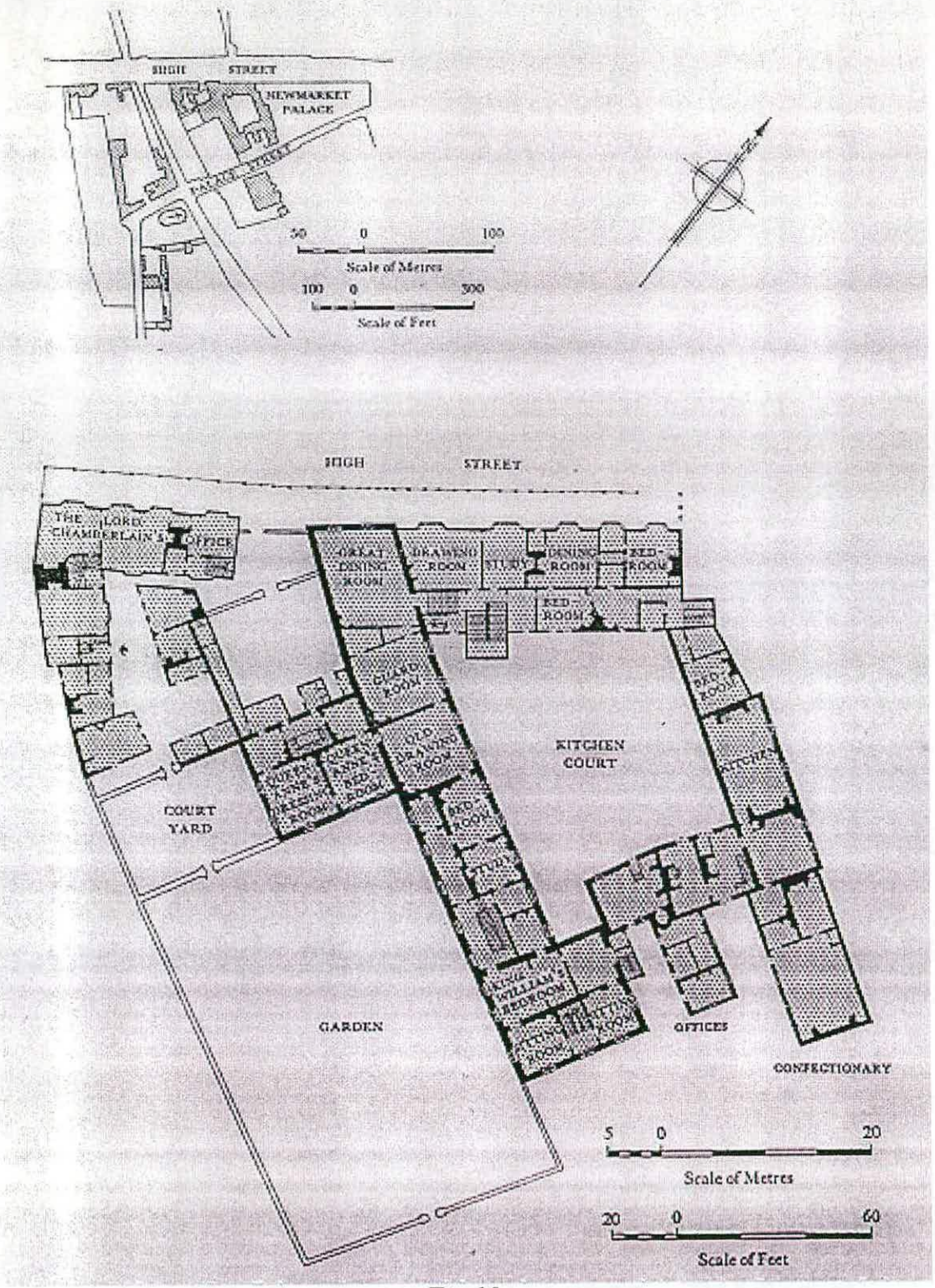


Fig.10

The frame shortly after its discovery
showing damage to glazing and relationship to external brick reveal
(*RCHME*).

Fig.11

The frame shortly after its discovery
showing glazing and relationship to internal brick reveals
(*RCHME*).

Fig.12

The brickwork of Samwell's original pavilion facade
exposed during the restoration programme, showing the window opening
together with the scars of subsequent development.
(1997).

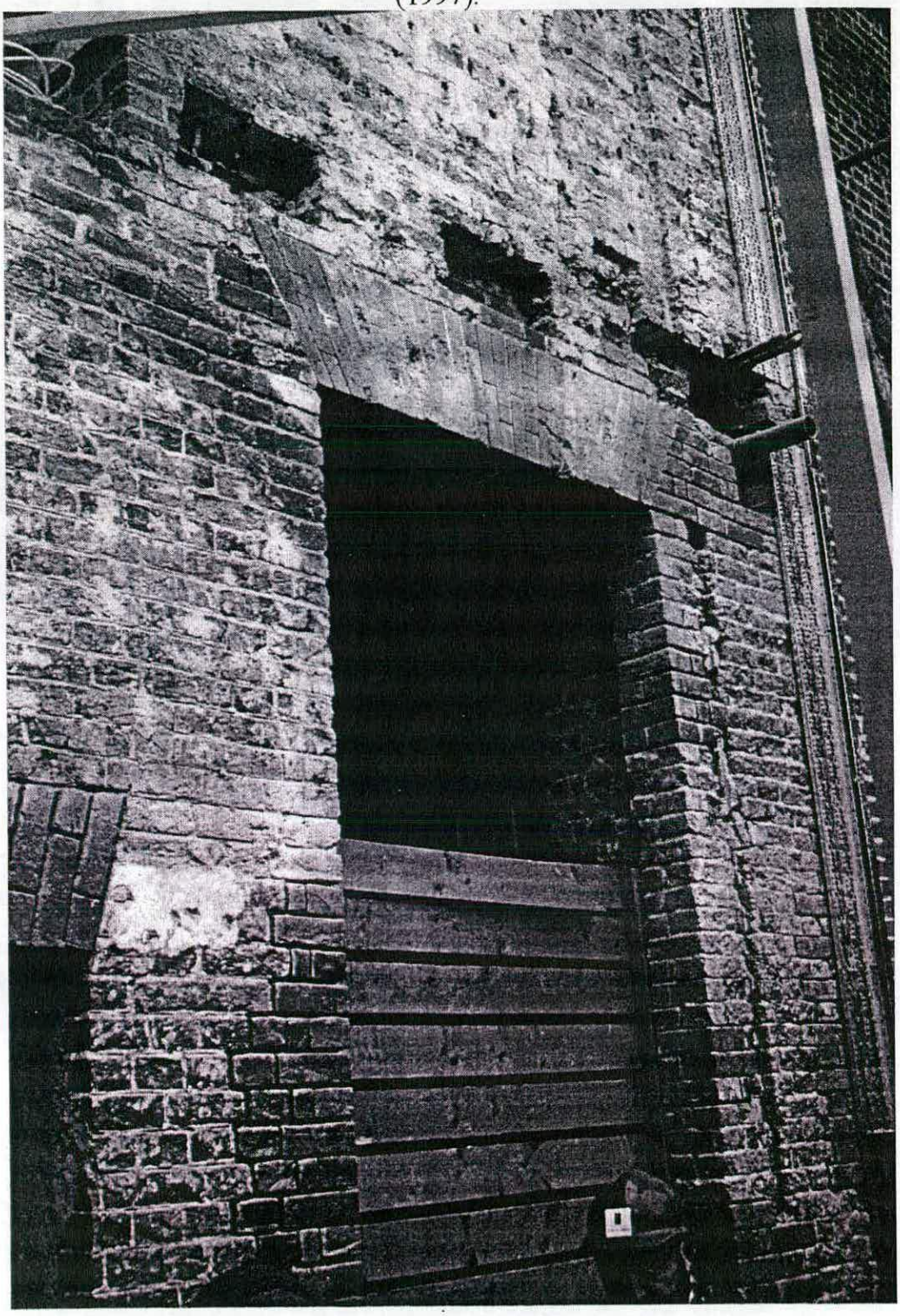


Fig.13

The brickwork of Samwell's original pavilion facade (much repaired) exposed during the restoration programme, showing the window opening together with the surviving section of the original stone cill. (1997).

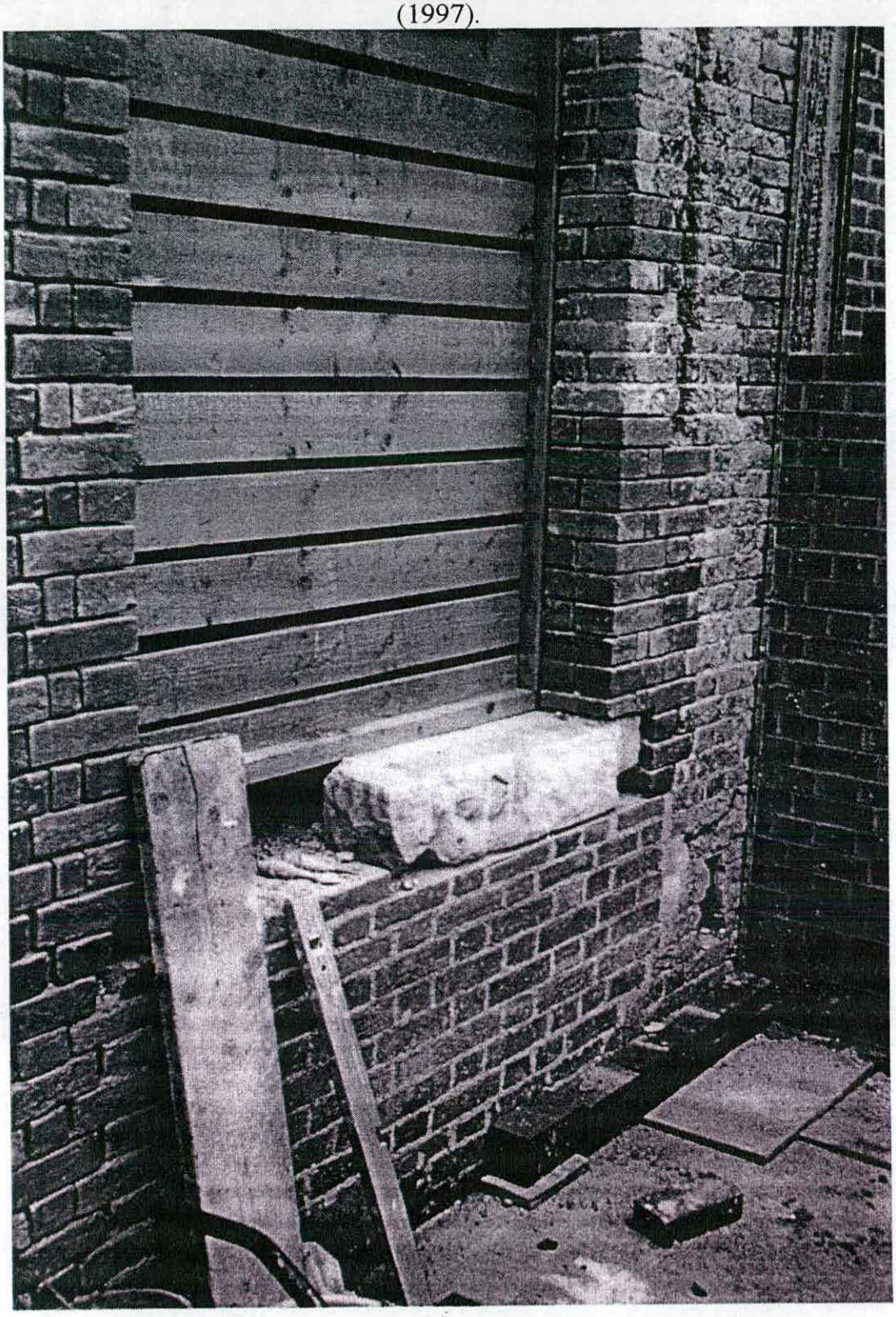


Fig.14

Two views of internal arrangement of window opening
indicating multi-phasing of brickwork
and later door opening to staircase.

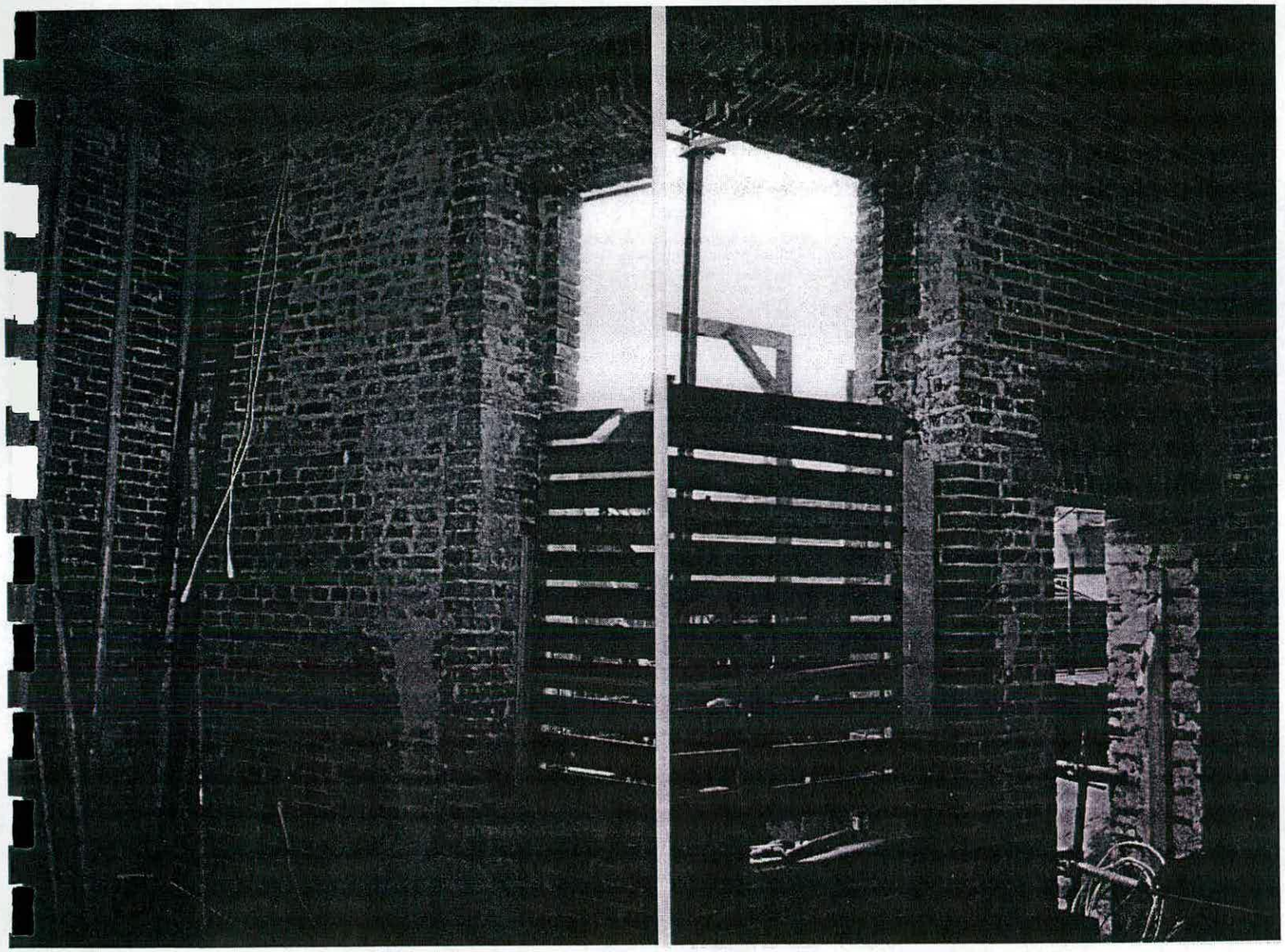


Fig.15

Upper part of internal brick reveal showing brick nib
behind which the frame was accommodated and
original plasterwork exposed during the restoration programme.
(1997).

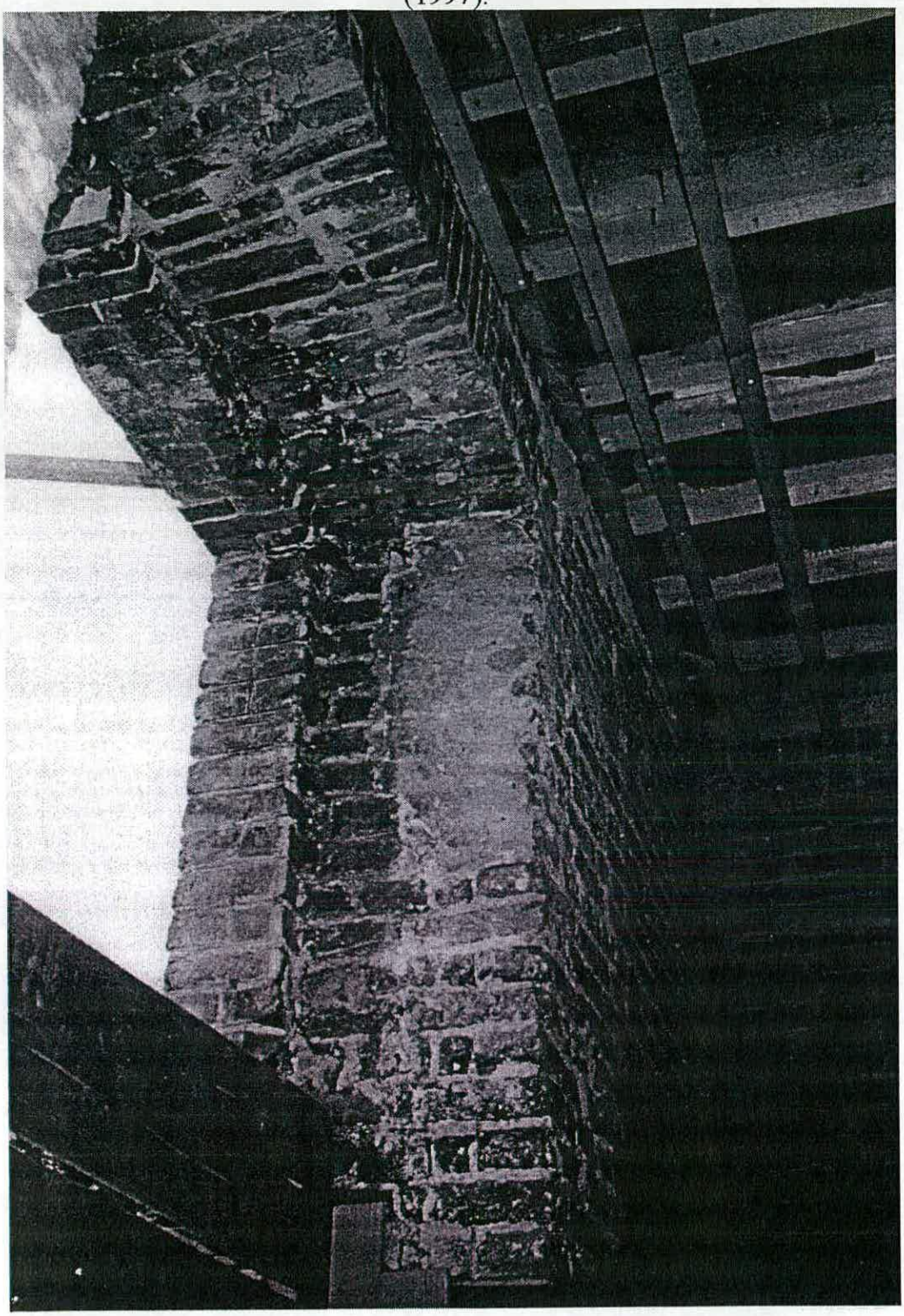


Fig.16

Lower section of sash frame showing sash lifts.
(1997).

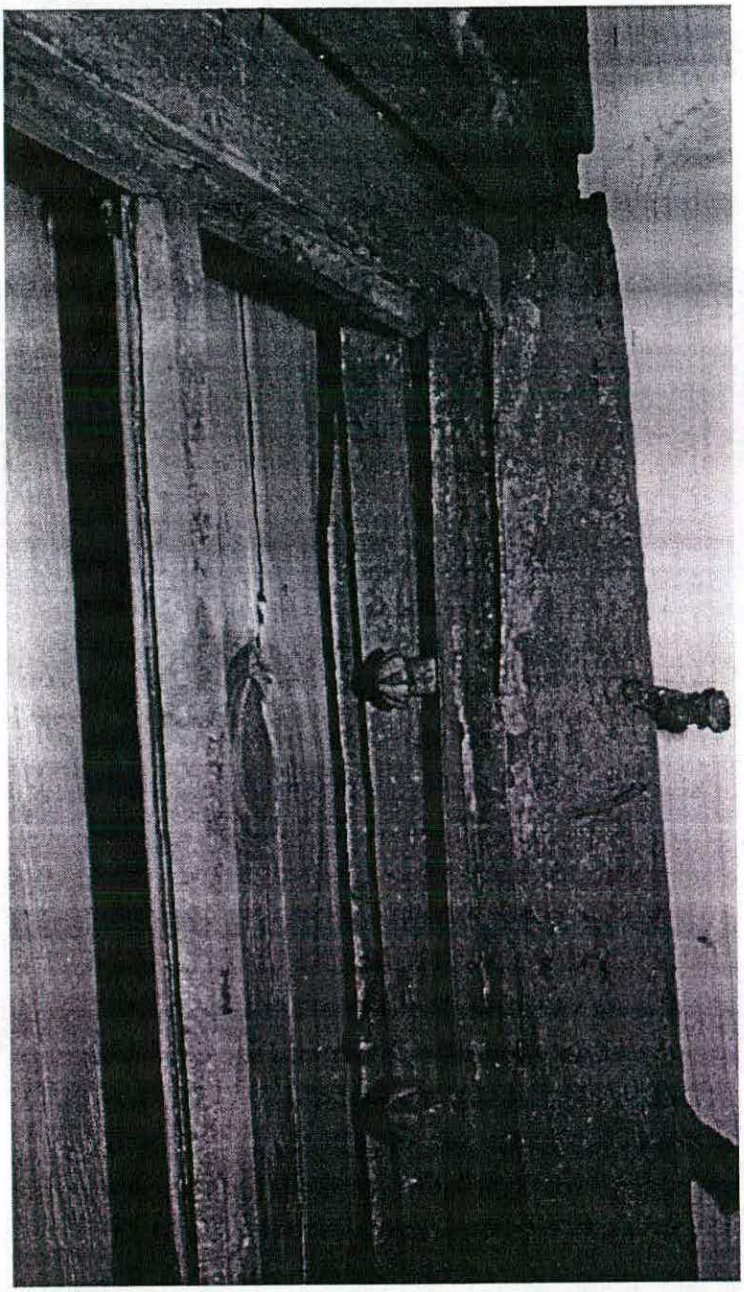


Fig.17

Upper section of sash frame showing pulley pocket together with surviving brass wheel and sash line. (1997).

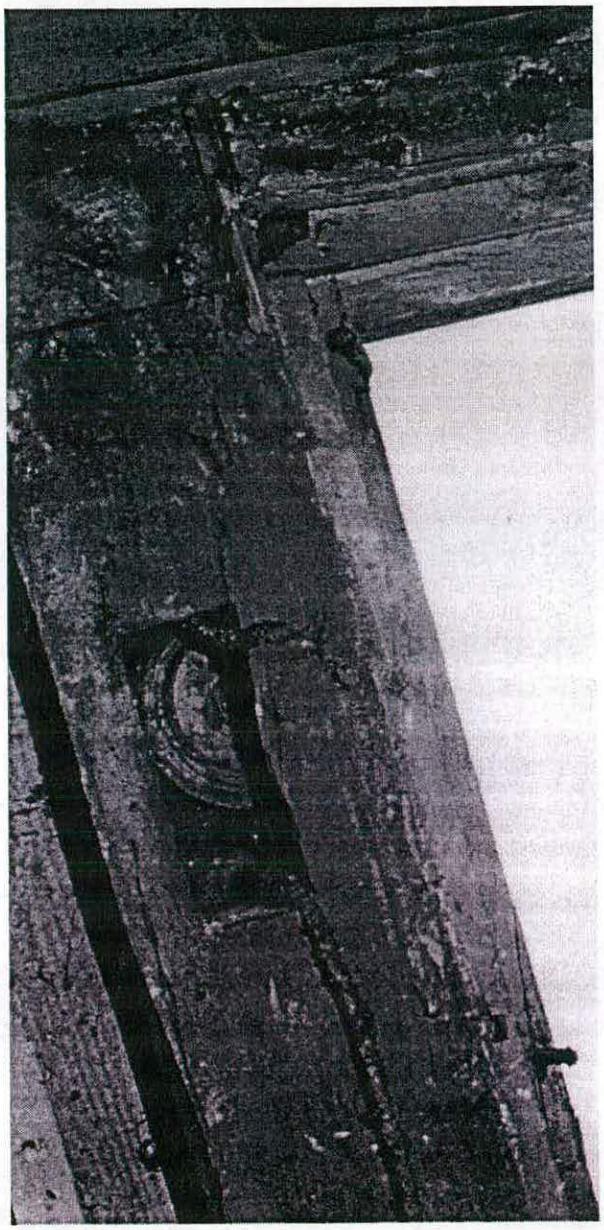


Fig.18

Lower section of sash frame showing iron assembly/glazing angles.
(1997).

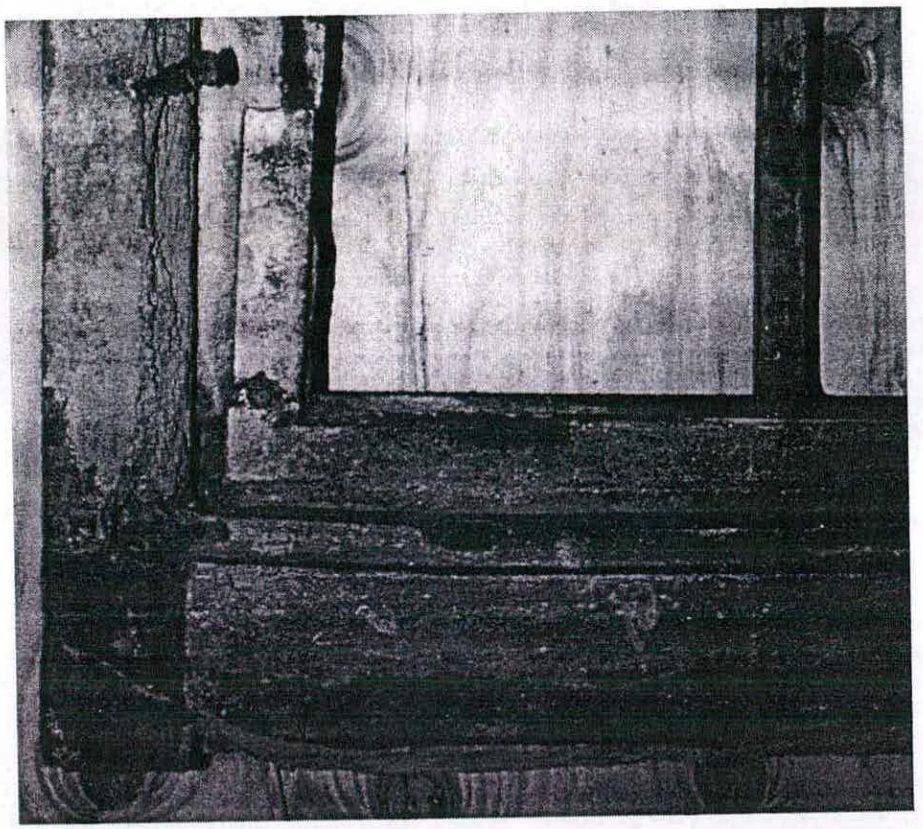


Fig.19

Ham House, Surrey c.1670
Drawing attributed to Gentlemen architect William Samwell.

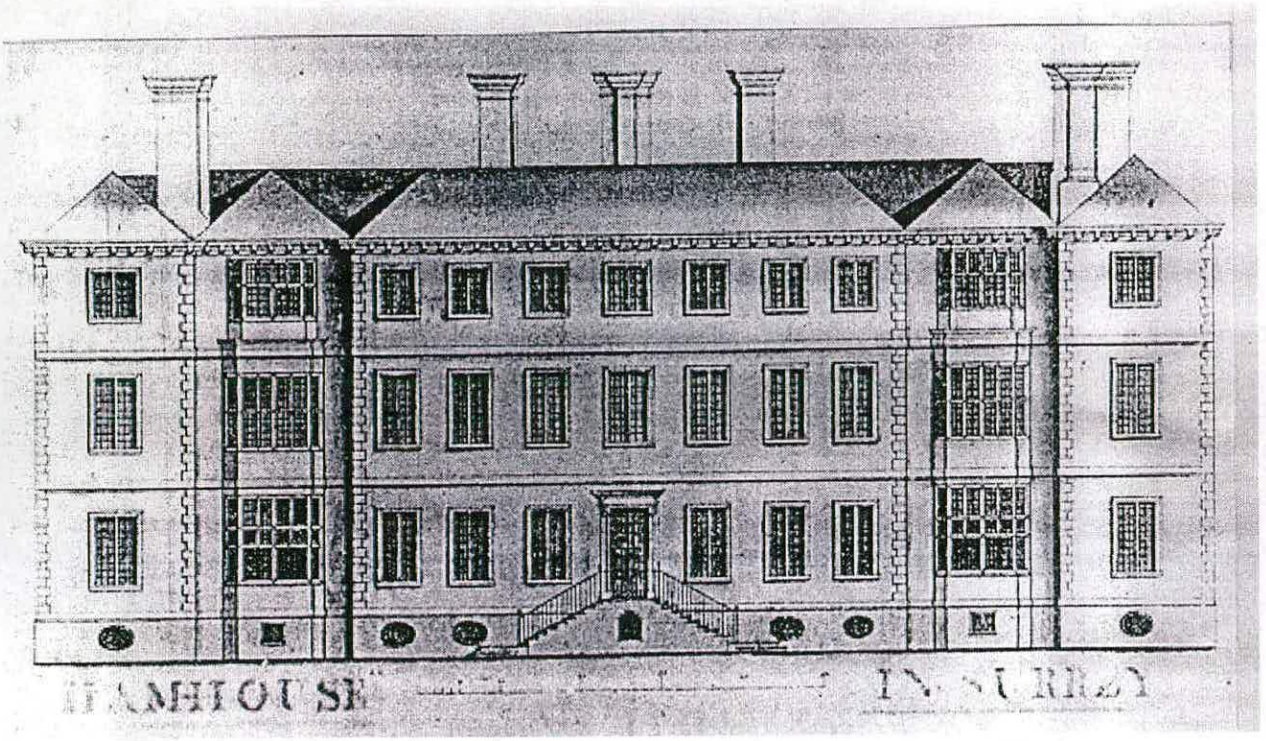


Fig.20

Illustration from John Evelyn's *Sylva* (2nd edn., 1670)
showing a power assisted machine for boring elm tree pipes
for distribution of urban water supplies. In this case power is
provided by an undershot waterwheel, which drives the spoon-shaped
boring tool or auger by means of wooden gearing
(*Industry and Technology*. W H Chaloner & A E Musson).

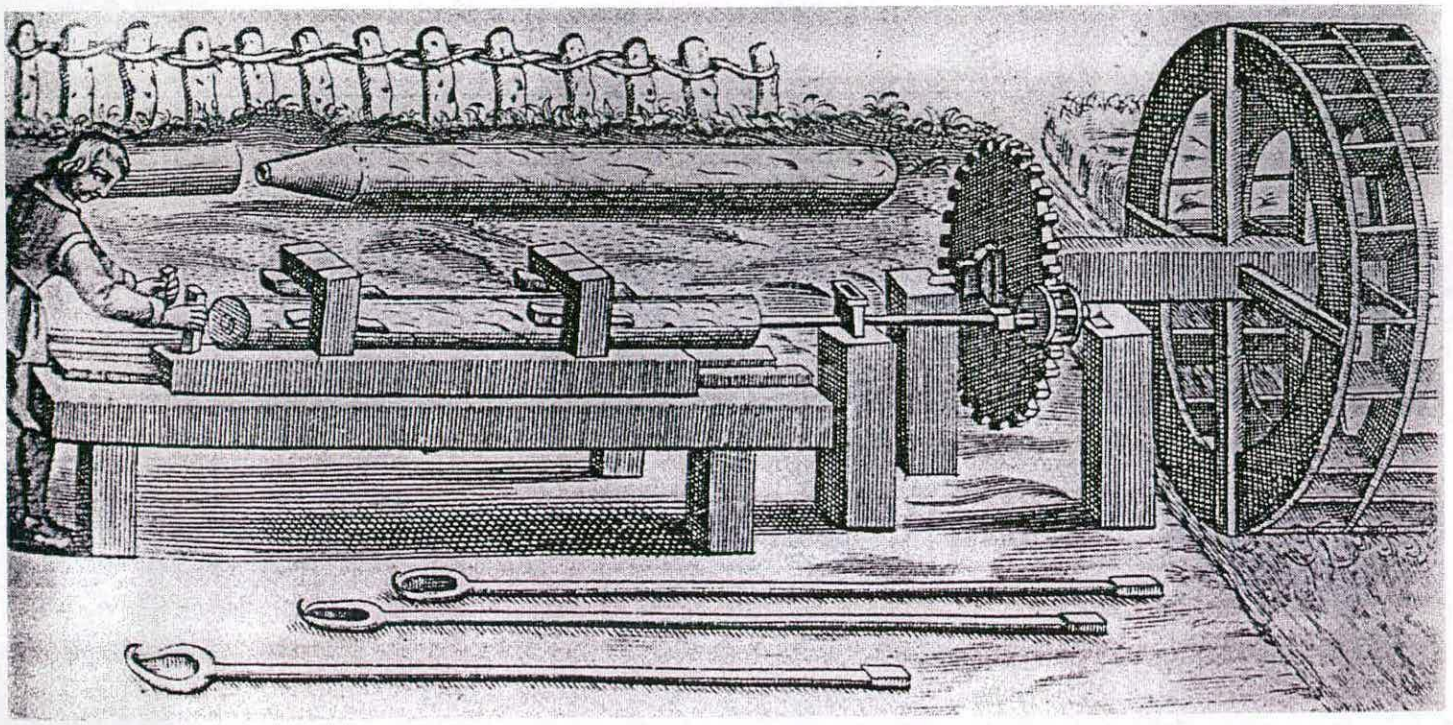


Fig.21

Illustration showing tree-trunks being hollowed out
for water supplies using spoon-shaped hand auger c.1556
(*A History of Technology*. Charles Singer et al. 1957).

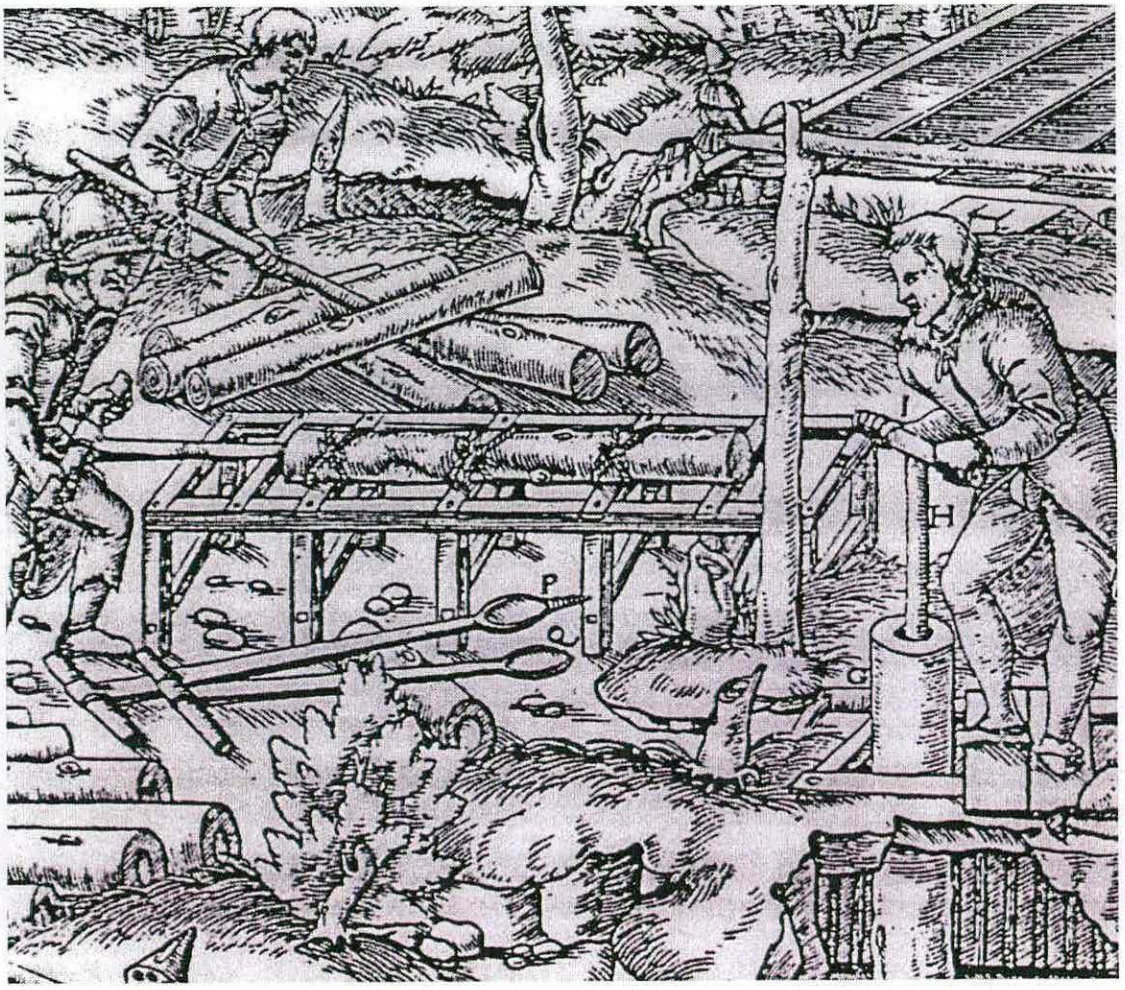


Fig.22