Chimneys in old buildings

by
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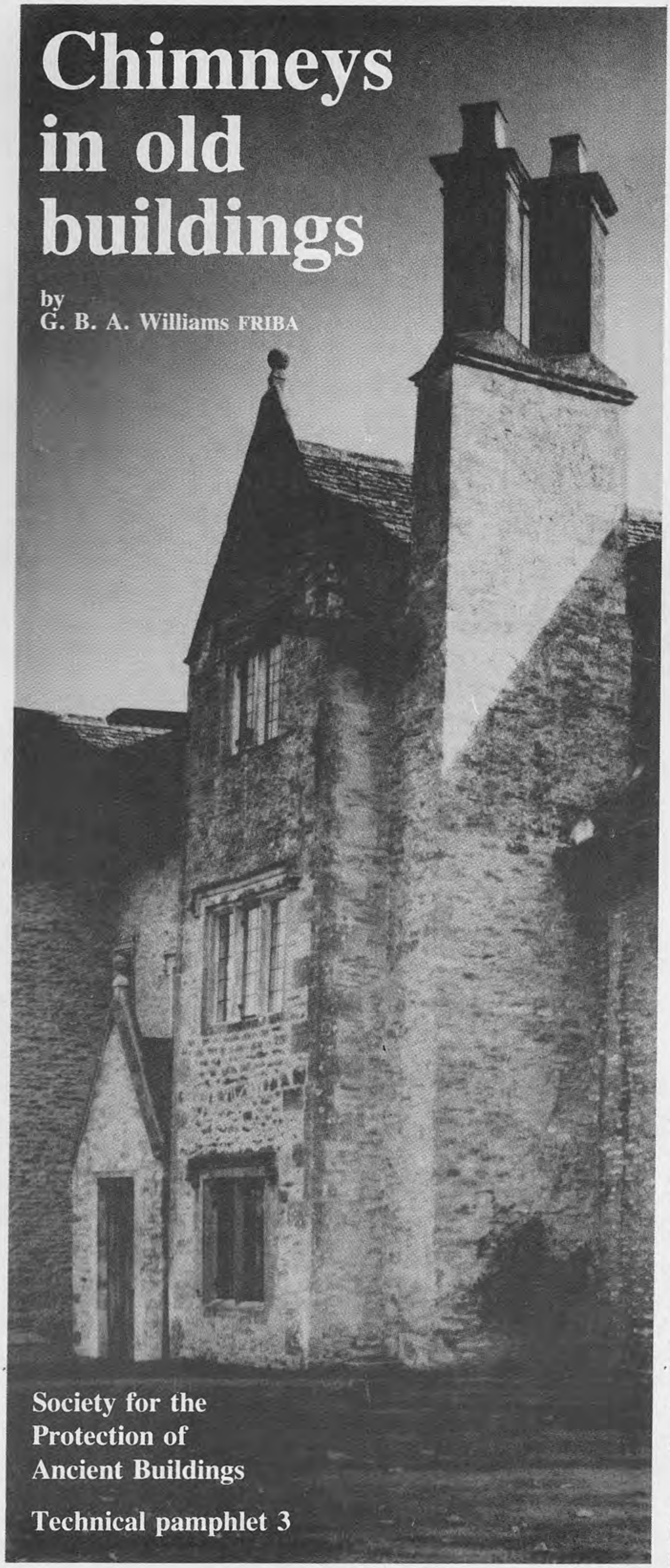


Society for the Protection of Ancient Buildings

Technical pamphlet 3

Chimneys in old buildings present different problems to those that arise in buildings constructed in the last 100 years. These are dealt with in the Coal Utilization Council's publication 'Curing Chimney Troubles'. The Society is frequently asked for advice on these different problems, and having made known its intention of preparing a pamphlet on the subject many members wrote with suggestions, information, and details of practical remedies. The author is most grateful for these letters, and has made use of their contents in writing this pamphlet.

John E. M. Macgregor, OBE, FSA, FRIBA, has contributed an introduction on the development of domestic internal heating.

In the pages following this introduction the most common problems associated with chimneys in old buildings are discussed.

Contents

Left: A 17th century chimney at Kelmscott Manor, Oxfordshire, since repair.

The development of domestic internal heating

The earliest form of domestic heating is, perhaps, the highly developed system of hot-air ducts devised and brought to this country by the Romans. The system can still be seen in the Roman baths that have been excavated in recent years. This heating system seems to have dropped out of use with the departure of the Romans, but it was used for greenhouses in the 17th and 18th centuries.

The indigenous form of heating that was used in Britain from Saxon times was, however, based on the open fire in the centre of the building, the flames and smoke being free to escape through a hole in the roof. This was the system adopted by most primitive races and is found in many parts of the world. The best example of this type of heating is the kiln of the Kentish oasthouse which usually consists of a circular building surmounted by a conical roof and terminating in an open-sided cone with a wind vane on the open side. The hops are placed on horsehair cloths over a slatted timber drying floor, and are dried by the rising hot air from the fire at the base.

By the 13th century this form of heating had culminated in the design of the 'hall' house, which was heated by a central fire on a circular hearth. The centre or 'hall' of this structure was open up to the roof, and two storeys were built at one or both ends under the same roof. The building was entered by doors on either side of the building, and the screen passage separated the one hall from the kitchens.

It is important to remember that in medieval times Britain was thickly covered with forests and woodlands, and it was possible to use massive timbers for the wall and floor structures. In the 13th century the vertical timbers were 9 to 10in wide, while the space between them was no greater. In the 14th and 15th centuries the size of the timbers was greatly reduced, and the space between them increased. In the 16th century these vertical timbers no longer reached full storey height, and an intermediate horizontal member was introduced which still further reduced the amount of timber used in the structure.

With such an abundance of timber in the early years, economy in the use of fuel was naturally not greatly studied, and so the use of the central open fire across which massive timbers could be laid was a natural expedient. This also meant that hard, slow-burning wood, such as oak, was used, which when thoroughly ignited gives off much heat without excessive smoke. When once such a fire was lit it would be kept burning practically all the time.

In the 'hall' house, therefore, there would be a continuous blaze, and a column of hot air and smoke, rising to the exit at the ridge of the roof, required a corresponding air intake at floor level. This inevitably created draughts that converged from all directions. Doors at either side of the building produced a great rush of air at these points, and screens were introduced to control the draughts.

The Normans brought with them their own technique of castle building which consisted of a multi-storied tower, keep, or bailey surrounded by a defensive enclosing wall which necessitated superimposed wall fireplaces and flues in the walls. The fireplaces were usually only partly sunk into the walls and above the fire opening the wall was carried on corbels and formed a funnel-shaped flue. On the Continent this projecting hood was used for several centuries, as can be seen in some of the Loire châteaux, but in England the fully recessed fireplace became more popular, as can be seen at Tattershall Castle.

No doubt, with the reduction in the amount of available timber, fuel was used more sparingly, and to reduce the updraught the central fire became enclosed on three sides in a stone or brick wall which produced inglinook fireplaces in which there was room to sit on either side. A beam was set across the front and a brick or stone funnel-shaped flue formed above it.

Many 13th century 'hall' houses were modernised in this way, and the roof timbers now enclosed still retain a thin covering of soot. With this enclosing of the central fire, a fireplace for cooking was added to the kitchen across the screens passage and a solar formed behind the central fire was similarly heated with its own separate wall fire.

The medieval kitchen fireplaces tended to be very wide, so that long logs could be laid on iron dogs. This in turn led to radial roasting, first in

Right: The original fireplace in the Great Hall, at Penshurst, Kent front of the fire on a long spit turned by hand and later by weights and pulleys or hot-air propellors in the flue above. In the really large houses of those times, the kitchen fire opening could be 10ft or so wide. In the small yeoman's house the main hall fireplace tended to be large enough to sit in, and if a really good fire was kept up, a sufficient amount of hot rising air was produced to remove the smoke efficiently.

In these days, however, it is not practical to be so lavish in the use of fuel, particularly when coal is used, to heat the full width of these old inglenooks. To overcome this difficulty two expedients were introduced. One was to extend the flue downwards towards the fire. The other was to raise the fire towards the chimney. The former method involved the lowering of the head of the fire opening itself or alternatively the extension of the flue by means of an internal cowl. The other method was to introduce a metal grate or basket, which in the kitchen was situated between the ovens. In the sitting room, the hob grate was introduced, and this became popular during the 17th century. Both types of grate were quite efficient for the burning of wood and crude coal but not for the dense smokeless types of fuel. These grates can, however, be adapted to burn it.

All the methods so far discussed are designed to draw smoke up and away from the fire. It is possible by intensifying the production of heat to consume it to a great extent. In Ireland inglenook fires have for many years been made to function more efficiently by the provision of centrifugal bellows, similar to a hair dryer, being set beside the fire to force air beneath the paving up through a grating in the hearth.

The most common method of house heating is to enclose the combustion chamber in a water-lined jacket, where both the air intake and extract can be accurately controlled, and to convey the water so heated in pipes throughout the building. By placing the boiler at the lowest point the water rises in the pipe to the highest point and is then allowed to flow back down to the boiler for reheating. Alternatively, the water is mechanically circulated around the house by electric pump.

Obviously, central heating in this manner is the most controllable, efficient and economic, but it is by nature invisible, and the visual appeal of a fire blazing in an open grate is something that most people miss, particularly when living in an historic house with its contemporary heat mechanism intact. The installation of central heating in old buildings itself produced other problems which will be covered in a later pamphlet.

Right: The 13th century chimney stack at Abingdon Abbey, Berkshire

Below: View of the north elevation of Kelmscott Manor, in Oxfordshire, showing the 17th century chimney stack in relation to the house

1 Structural stability

This can be threatened by:

A *Erosion of the brick or stone from which the chimney is built, by the action of wind, rain and frost.*

The effect is a general weakening of the whole chimney. If the chimney is reasonably plumb, and the erosion is not more than 25 per cent of the thickness of the chimney flue wall, it can be left for the time being. If more than 25 per cent, the individual brick or stone should be carefully cut out and replaced. 'Plastic repair' of the occasional eroded stone should also be considered as an alternative to replacement.

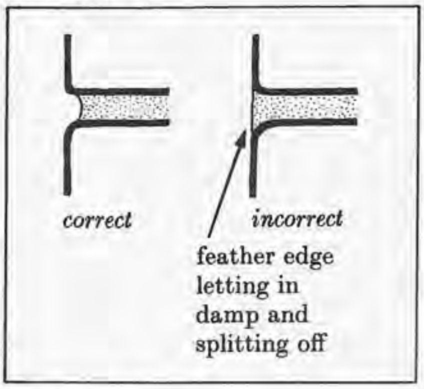
B *Erosion of the mortar by the action of wind, rain and frost.*

This will also lead to general weakening of the chimney. It can also lead to a gradually increasing 'lean' in the direction of the prevailing rain-laden south-westerly winds. Because of the increased weathering on that side the mortar erodes more quickly, leading to gradual settlement to the weather side. This effect is increased by a slower drying out on the lee side, causing expansion from the action of frost. Where the products of combustion from a gas- or oil-fired boiler are fed directly into the flue without a flue liner, the mortar is attacked by chemical action arising from acids condensing out of the flue gases on to the internal walls of the chimney. This will also lead to a general weakening of the chimney, and probably uneven settlement, causing 'lean'.

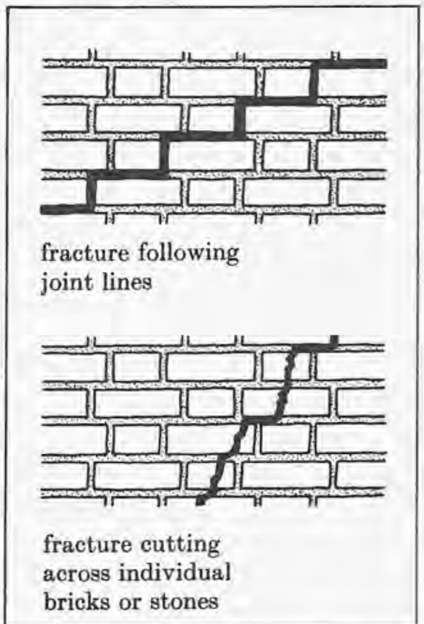
To remedy, carefully rake out to a depth of at least ¾in or twice the height of the joint, whichever is the greater, and re-point in a mix of 1:1:6 (cement, lime, sand) mortar, repeating the texture, colour and type of adjacent pointing. The mortar should be kept back slightly from the edge of the brick or stone, and not 'buttered' over (Fig. 1). The suface of the mortar should be brushed before setting to expose the coarser aggregate in the mortar.

C *Fracturing of the brick or stone caused by settlement, unequal loading, or frost.*

If these follow the lines of joints and are not extensive, re-pointing may be all that is necessary. If they cut across individual bricks or stones, and are not extensive, renewal of these bricks or stones will usually be sufficient (Fig. 2).



1 Pointing



2 Fractures

D *Extensive failure.*

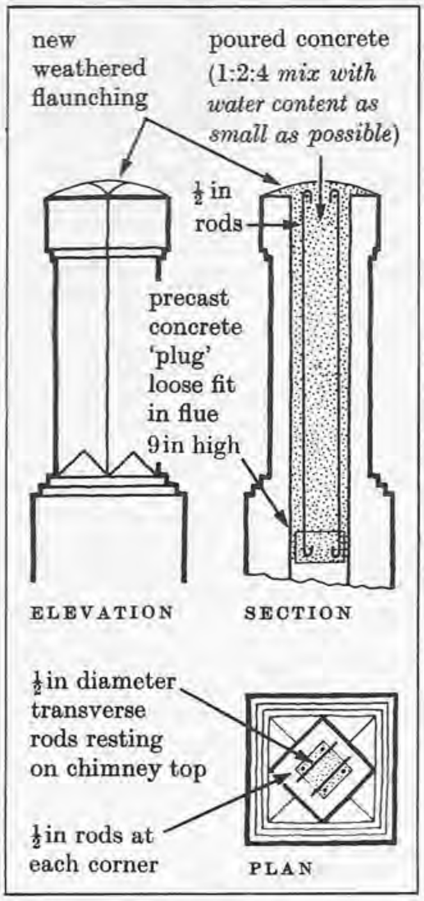
A chimney is sometimes in such poor condition, being out of plumb, extensively fractured, and with eroding mortar and masonry, that rebuilding may be the only solution. This, however, is a last resort as the chimney can still be stabilised by the following methods:

(i) *By stabilising in situ using the walls of the individual flues as permanent shuttering for a reinforced concrete core.* This is a method particularly suitable for an Elizabethan stack in which a number of individual shafts, usually highly decorative, emerge from a plain base at roof level. The base is generally in sound condition.

The method is first to cast a concrete plug of a size sufficient to slide down the individual flue to a point where the flue begins to bend or widen out. It is held at this point by a ½in reinforcing rod at each corner. The rods are long enough to reach the top of the flue, are hooked at the top and are held in position by transverse rods resting on the top of the chimneys. Spacers or cross ties should be used in the normal way to prevent the ½in rods from being displaced.

Concrete is then poured down the flue from the top. Lifts should be short and carefully tamped to avoid the risk of bursting the flue. If the flue is a tall one the stack should be temporarily strengthened by vertical scaffold boards bound to each face.

On completion the top of each flue should be capped, or the flaunching made good, and repairs to mortar and masonry carried out. Damp can no longer get down the flue, and so the process of erosion will be slowed and the appearance of the building maintained. This method, of course, can only be used when the flue itself is not being used and will not be used in the future (Fig. 3).

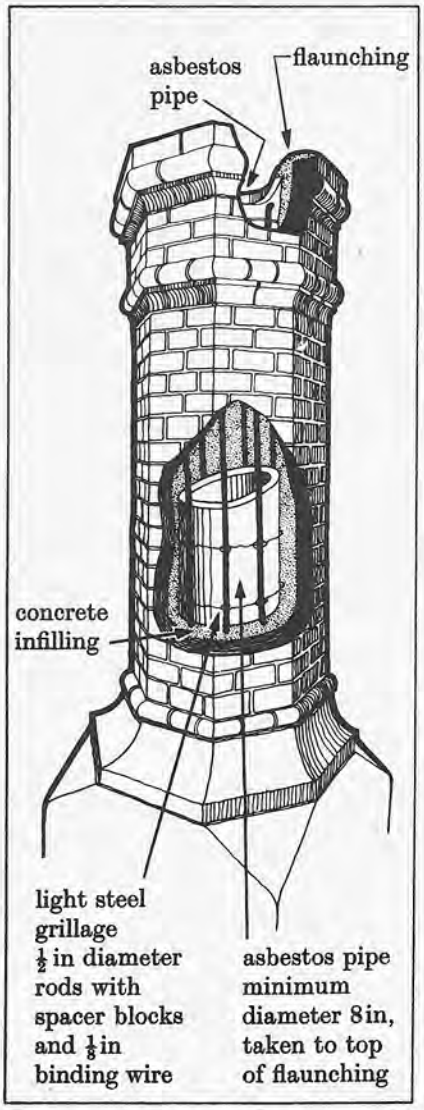


3 Method of stabilising a chimney stack with a solid core

(ii) *Where the flue has to remain in use* the flue can still be stabilised *in situ* provided its cross section is sufficiently large. This is usually the case, particularly in medieval buildings. The first method is to use a proprietary firm who insert a flexible inflated rubber liner, which is deflated and withdrawn when the concrete surrounding it is set.

The second method is to lower down the middle of the flue an asbestos pipe which is of such a diameter that a minimum of 4in is left between the outer face of the pipe and the inner face of the flue. The pipe should extend well down into the base of the stack, as should the concrete plug in the method previously described. At this point the base will have to be cut into, in order to seal the gap between the flue and pipe and form, in effect, an annular ring. Alternatively it may be possible to cast round the bottom of the pipe a concrete collar which will have the same sealing effect, as a close fit is not necessary. A light steel grillage should then be lowered into the space between flue and pipe.

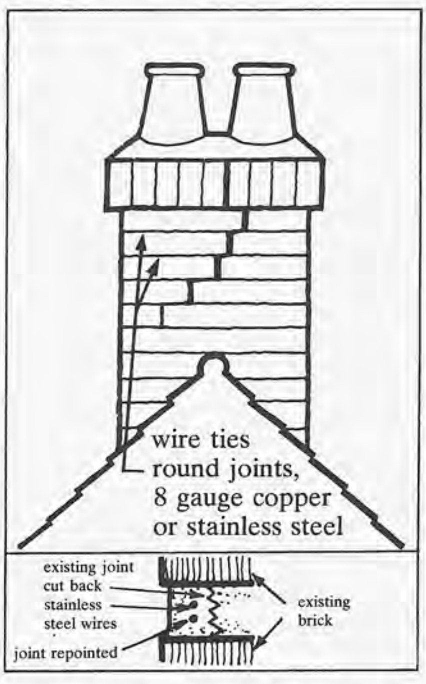
As the space for pouring the concrete is much more restricted than in method (i) the mix will have to be much more liquid and so it will be all the more necessary temporarily to strengthen the stack, as was described in method (i) of repair, before pouring begins. When the concrete is set the boards can be removed and the outside face of the stack repaired again as described with method (i) (Fig 4). Note that the internal pipe diameter must still be sufficient for the size of hearth the flue serves. This point is dealt with in detail later in this pamphlet, in the section on smoking chimneys.



4 Method of stabilising a chimney stack with a hollow core

As much of the charm of Tudor and Elizabethan chimney stacks lies in the character of their brickwork, its colour and texture, and the way it has mellowed and weathered over the centuries, every effort should be made to repair them by the methods described.

(iii) *In smaller chimney stacks, of the kind found on country cottages, it will commonly be only the top 2ft or so that is in poor condition, the failure frequently being the splitting outwards of the walls of the flue.* In such cases the brick or stone joints can be raked out and a wire tie inserted in each joint before repointing. The ties should be copper or stainless steel to avoid rusting and carefully tightened up to bear an equal strain (Fig 5). It is essential that the mortar bed against which the wire ties are tightened is sound, as otherwise the ties will merely slice through the mortar.

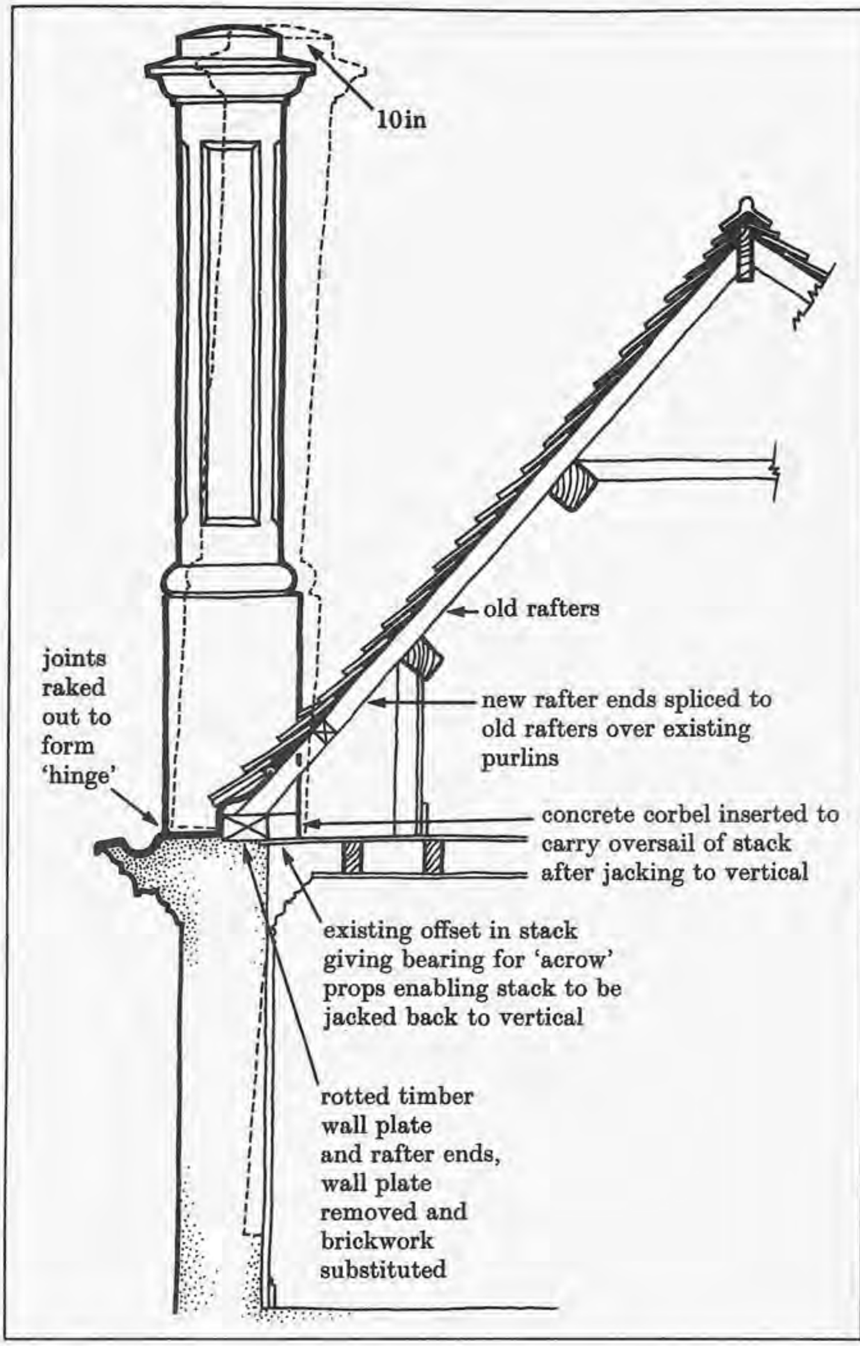


5 Strengthening the top of a small domestic chimney and section through mortar joint

(iv) *Decades of neglect have occasionally caused such a failure at the top of the chimney that the only alternative is to take down and rebuild the top 12in to 18in.* Wherever possible the bricks or stones should be reused. Great care should be taken to record the details before taking down so that the design of oversailing courses and so on can be repeated. With scaffolding erected it may then be worthwhile to consider capping the stack as mentioned later.

(v) *With old buildings special cases can always arise.* One such was a chimney stack, 15ft high and 45ft from the ground. It was leaning inwards 10in due to a built-in-wall-plate running lengthwise along the base of the stack which had crushed due to rot. The joints on the outside of the stack were thoroughly raked out at eaves level to form a 'hinge' the stack carefully jacked back to the vertical, the rotted wall plate removed, a concrete pad substituted, and the raked out joints repointed (Fig 6).

Above: General view of the central chimney stack at Kelmscott Manor. *Below:* Detail of the defective supporting timbers revealed on opening up (see Fig 6).



6 Jacking a leaning stack back into position

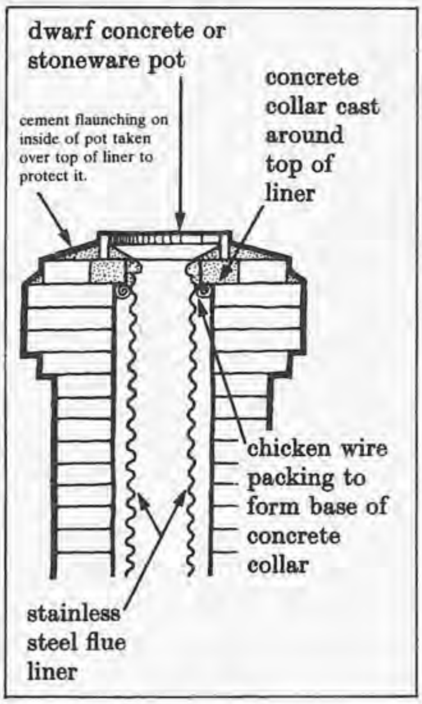
7 Sealing a flue liner at the top of stack

E *Flue liners.*

If a flue in an individual chimney serves an oil- or gas-fired boiler, it is essential to line the flue. The simplets method is to insert a flexible stainless steel flue liner. These can be obtained from a number of manufacturers in various lengths and diameters. Any of the previously mentioned methods of repair considered necessary can then be carried out. It is essential that the top of the stack should be properly sealed (Fig 7).

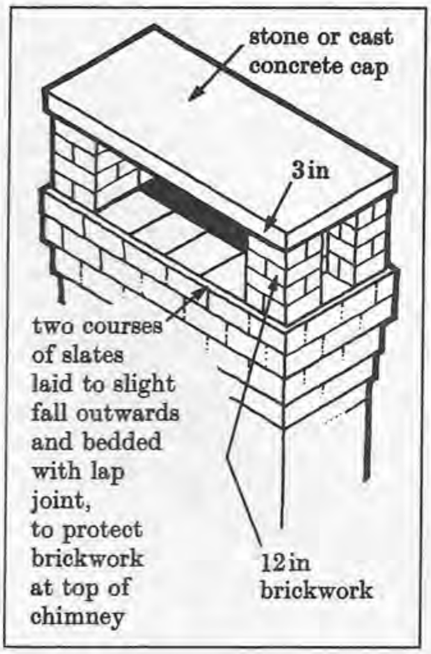
F *Tall chimney pots.*

On buildings built before the 17th century tall chimney pots are almost



7 Inserting a flue liner

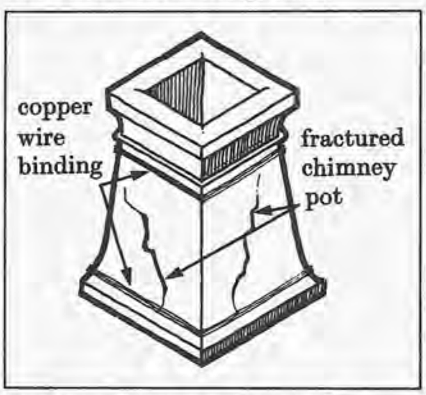
always later additions, generally added in an attempt to prevent down draught. They are frequently unstable and are best removed and a stone or cast concrete slab laid over the top of the chimney and supported by 12in high brick piers at the corners. This is also a traditional remedy against down draught. It also prevents rain from falling down the flue and helps to keep the top of the chimney dry (Fig 8).



8 Traditional alternative to chimney pots if appropriate to the character of the building

G *Decorative chimney pots.*

In the 17th century and onwards flues were often surmounted by decorative chimney pots moulded to a classical design, and these should always be retained. Replacement may not be possible, but they can sometimes be strengthened by binding with copper wire, carefully slurried over and painted with a stone paint (Fig 9). Otherwise it may be possible to 'cannibalise' them, replacing unsound pots in conspicuous positions with sound pots from elsewhere in the building which are not visible from the ground.



9 Strengthening a classical chimney pot

2 Ingress of damp

From the chimney itself and from the chimney into the building.

This can be caused by:

(a) Lack of a chimney capping.

(b) Disintegration of the flaunching at the top of the chimney.

(c) Inadequate thickness of the walls of the flue (4½in in the case of brick chimneys).

(d) Erosion of mortar.

(e) Disuse of the chimney itself, so that open fires and hot flue gases no longer help to keep it dry.

(f) Lack of a bend in the flue so that rain penetrates straight from the outlet on to an open hearth below.

(g) Secondary damp in the building caused by primary damp in the chimney itself. The most common example is the presence of deliquescent salts in the masonry and plaster, deposited after years of alternate drying and wetting of the flue walls. These salts absorb moisture from the air in conditions of high humidity, and show as damp patches on the chimney breast.

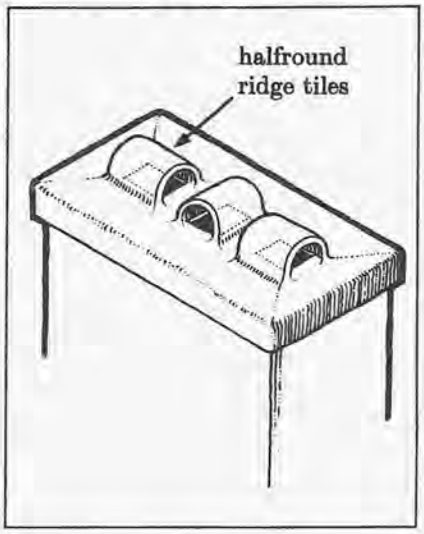
(h) Failure of the damp-proofing measures where the chimney penetrates the roof.

If a flue is no longer to be used, but does not have to be filled for structural reasons, a decision has to be made whether to close the flue. The arguments in favour are that the flue cannot be blocked by birds nesting; no rain can come down the flue; the fireplace can be filled in or removed, if it is of no historic or architectural importance. The arguments against closing the flue are that any damp penetrating the flue and percolating into the building has no chance of drying out; and that the ventilation value of the flue to the room which it serves is nullified.

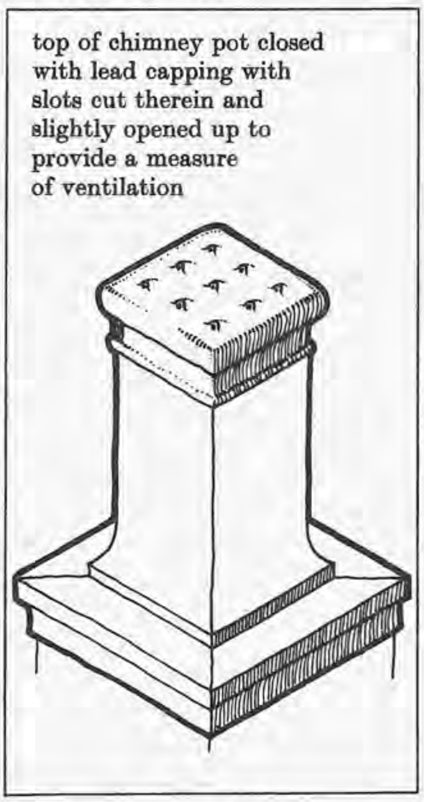
Particular circumstances will, of course, determine the correct course of action. In general, however, it is best to maintain ventilation in the flue, particularly in medieval buildings, and where the chimney is part of an external wall. This can be done by bedding, on top of the flue, a length of half round ridge tile, the open ends providing ventilation while the top of the tile protects the flue from rain penetration (Fig 10).

As an alternative, the chimney can be capped off as previously described (see Fig 8).

Where chimney pots are part of a classical chimney design, as was common in the 18th century, and it is considered advisable to seal off the flue, it is important that the design of the whole chimney stack is left unchanged. This can be achieved by a bedding of slate, cut to the cross section of the pot outlet, across the top of the pot. Alternatively, a lead capping can be used, dressed over the lip of each pot. A measure of ventilation can be given with this method by a series of incisions in the lead, which are opened up to form 'eyebrows' (Fig 11).



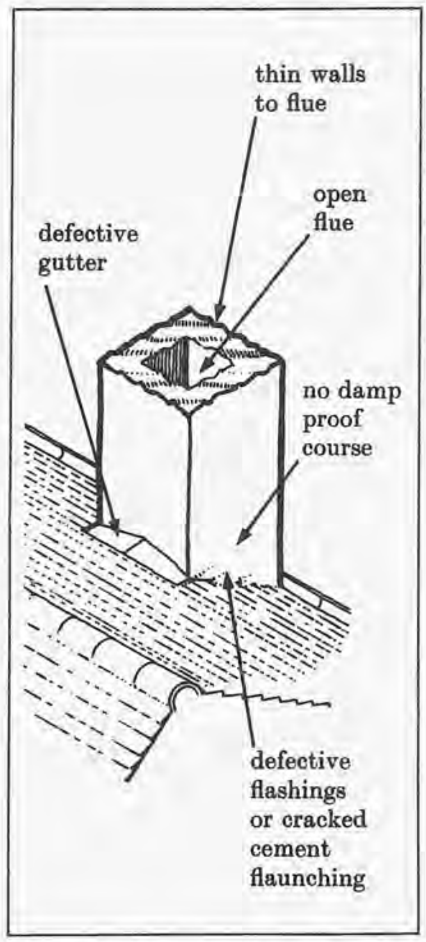
10 Maintaining ventilation in redundant flues



11 Similar action in a redundant chimney pot

Damp in a building which originates from a chimney most frequently occurs when the chimney is on an external wall, and partially or wholly penetrates the roof adjacent to the eaves. This is due to the difficulty of incorporating a damp-proof course, particularly if the roof is steeply pitched, and the increased difficulty of providing effective chimney flashings (Fig 12).

Unless the chimney has to be rebuilt, absence of a damp-proof course has generally to be accepted. Inspection and repair of defective flashings are normal building maintenance. Damp penetration is usually most obvious on the face of the chimney breast above the fireplace and is aggravated both by the presence of deliquescent salts and by moisture carrying sooty deposits from the inside of the flue through to the internal plaster work. If the plaster is hacked off and the breast allowed to dry out, replastering can be successful. Having gone this far, however, it is better, provided the design of the fireplace permits, to batten out the wall before replastering. Battens should be 'tanalised' or 'Newtonite' lathing should be used. Alternatively, a bitumen vertical membrane, such as 'RIW', can be applied to the wall before it is replastered.



12 Typical causes of damp in a chimney stack

3 Smoking chimneys

This can be the result of natural causes (that is, the proximity of trees or sharp rises in the ground causing down draught); artificial causes, that is, the proximity of other buildings, or portions of the same building, again causing down draught; by a partial blockage in the flue; or faulty design of the chimney itself.

Much has been written on this subject, some of it contradictory. The most frequently quoted authority is Count Rumford, that fascinating 18th century American, who was scientist, soldier and diplomat. The following are principles of design that he enunciated:

(a) The inside cross sectional area of a flue should be one-tenth of the area of the fireplace front opening, and it should be square in cross section.

(b) The fireplace front opening should have an equal height and width.

(c) The depth of the fireplace should be between one-third to one-half of the width of the front opening.

(d) The sides of the fireplace should be splayed to reflect the heat into the room.

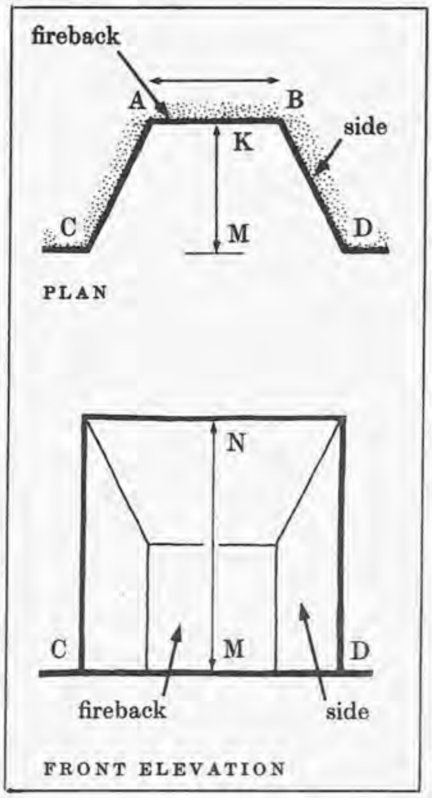
(e) The upper half or two-thirds of the fireback should be sloped outwards, also to reflect heat out into the room.

(f) Centrally above the fireplace should be a restricted throat, 4in from front to back, with its width determined by the splaying of the sides and back of the fireplace and the lintel over the fireplace opening.

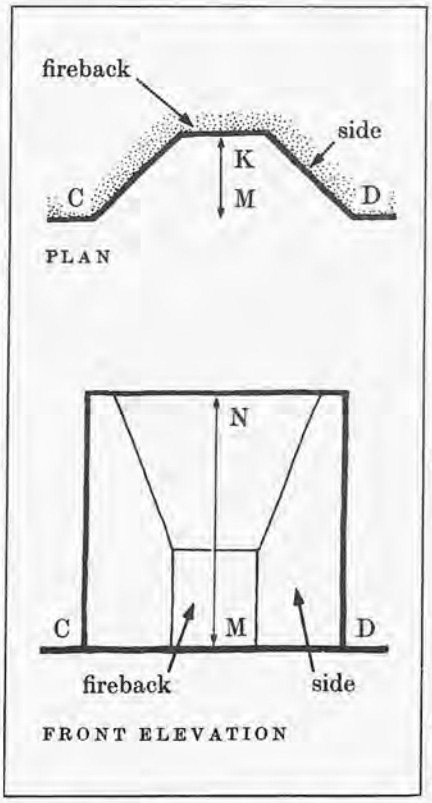
(g) Level with the restricted throat should be a smoke shelf. The purpose of this smoke shelf is twofold: to prevent soot and rain from falling into the fireplace, and, more importantly, to cause a two-way circulation of air in the flue. By this means Count Rumford claimed that the amount of air that had to be introduced into the room for the purposes of combustion was so small that no draughts would be caused, and the air supply needed for the flue itself would be provided by the two-way circulation of air.

(h) Immediately above the restricted throat there should be the smoke chamber, the same depth as the flue, and with its sides tapering inwards at an angle of 60 degrees until the flue is reached.

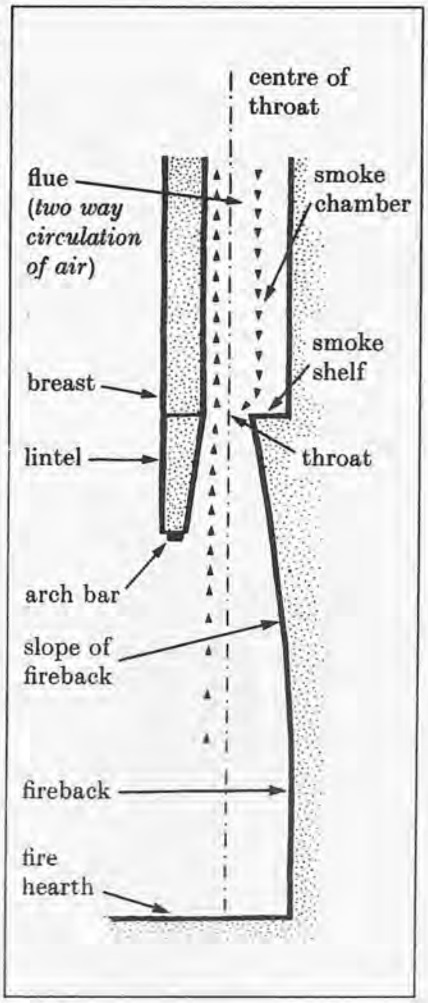
Count Rumford's principles are illustrated diagramatically in Figures 13, 14, 15 and 16.



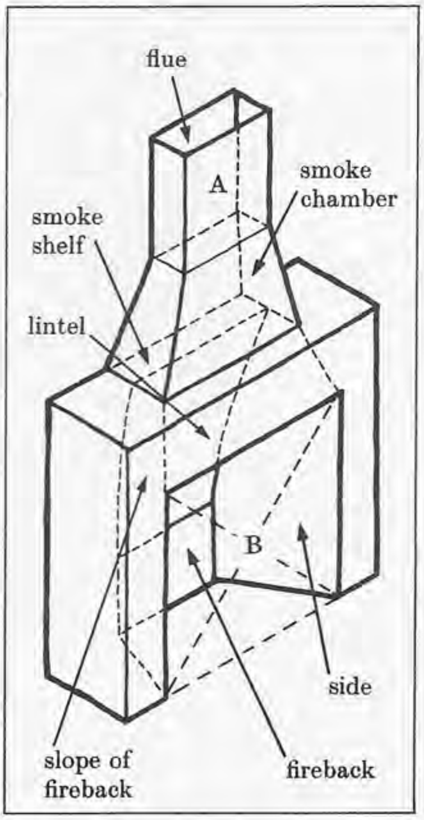
13 Correct proportions for fireplace opening. Dimensions C–D and M–N to be twice the depth of M–K



14 Alternative proportions. Opening C–D to be three times the depth M–K



15 Circulation of air above smoke shelf



16 Diagrammatic illustration of a Count Rumford fireplace. The inside area of the flue A should be one-tenth of the area of the fireplace front opening B

It is obvious from the proportional ratios involved that these principles can only be conveniently applied to fireplaces dating from the late 17th century. The area of the fireplace which results is such that the burning of large logs, unless the whole fire surround is very large, is impractical. These principles are therefore difficult to apply to a typical medieval fireplace of the inglenook type, unless its appearance is to be radically changed by remodelling the interior.

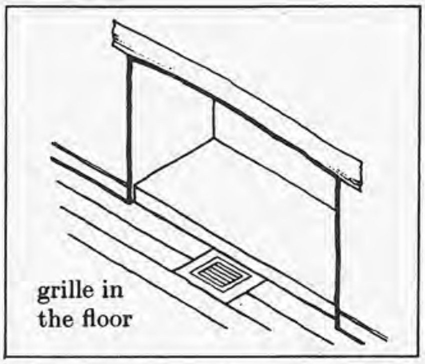
With medieval fireplaces, therefore, other methods have to be used. These include:

(a) A stone cap above the chimney frequently helps to counter down draught, whether from natural or artificial causes. Any other type of termination to the flue is either likely to be unsuccessful or aesthetically undesirable.

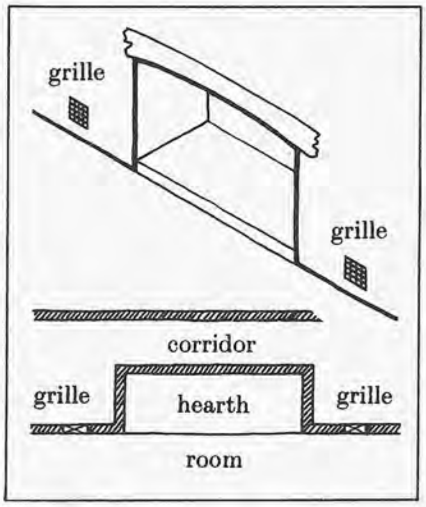
(b) In an old building it is necessary also to encourage a strong updraught. Flues in an old building are often over-large and so need a greater air supply to prevent smoking, but all too often the supply has been reduced due to weather stripping of external doors and windows. The effectiveness of the air flow can easily be tested by opening a window and seeing if the chimney still smokes. If it does not the permanent remedy is greatly to increase the air supply from a source other than doors or windows. With a suspended floor, a grille through the floor can be provided immediately in front of the hearth (Fig 17).

If the floor is solid and the fireplace is on an internal wall it may be impossible to obtain an adequate air supply, unless an entrance hall or corridor is back to back to the fireplace. In such cases a grille can be formed in the wall on each side of the fireplace with an opening to the hall or corridor behind (Fig 18).

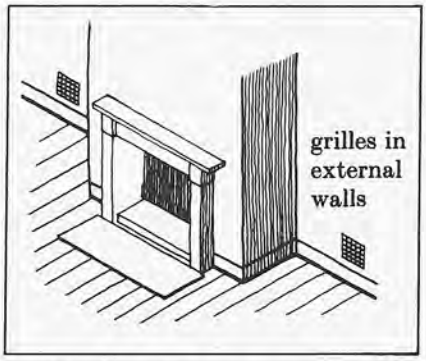
If the fireplace is on an outside wall an adequate air supply can usually be obtained by inserting air brick with grilles on each side of the fireplace (Fig 19). If the chimney breast projects externally air bricks can be provided in the cheeks (Fig 20).
The combined unobstructed cross-sectional area of the inlets should not be less than the cross-sectional area of the flue.



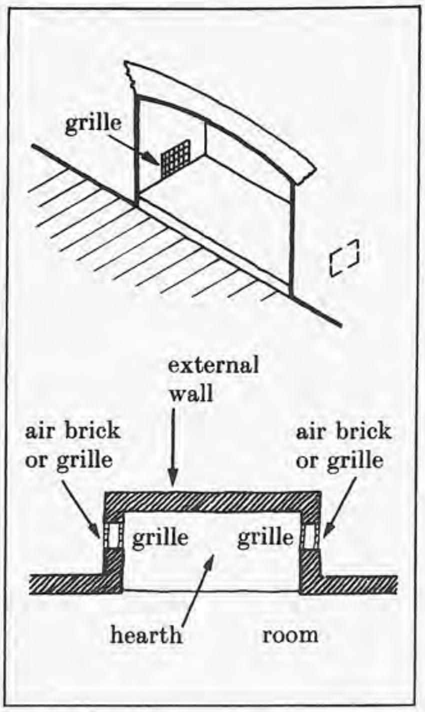
17 Floor grille to improve draught



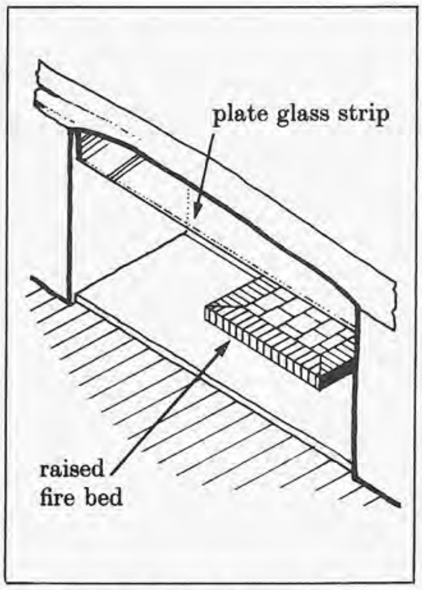
18 Wall grilles for the same purpose



19 Similar grilles on an external wall



20 Air inlets direct to walls of hearth



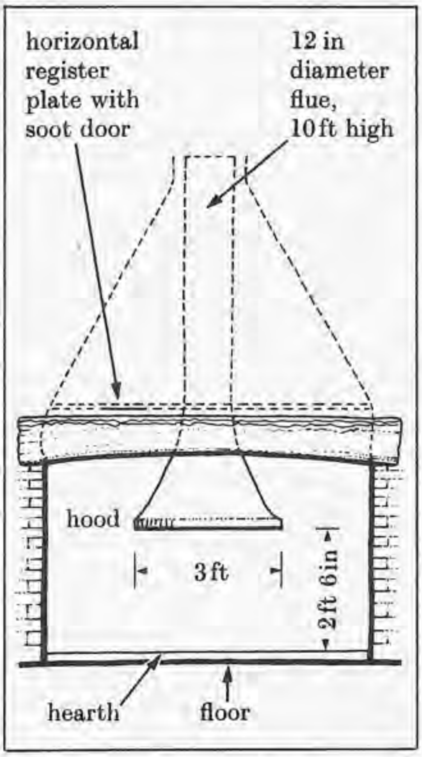
21 Methods of reducing the height of the hearth

Right: Improvements to a medieval fireplace at Woodsell, near Faversham, Kent. This illustrates the use of a raised hearth with air inlet and a hood and flue liner above

Even when those recommended measures have been carried out the fireplace may still smoke, although only intermittently. This can often occur when an inglenook has been revealed in a medieval building leaving an excessively wide and high fireplace opening. Raising the fireplace may help, as may also lowering the height of the fireplace opening by a copper, iron or glass panel (Fig 21). An empirical rule governing the relationship of the flue to the fireplace is that the total volume of the flue should not be less than the total volume of the fireplace. Another empirical rule is that the area of the front fireplace opening should never exceed 8 times the cross-sectional area of the flue.

If none of these measures is successful the only traditional remedy is to close off the whole of the soffit of the opening with an iron register plate. In this there should be a hole not less than 12in in diameter, connected to an iron flue of the same diameter projecting upwards into the flue above as far as possible, but certainly not less than 10ft. Below the hole is fixed an iron or copper hood finishing about 2ft 6in above the fire bed and measuring about 3ft wide and 2ft deep at its opening. The exact dimensions will be governed by the size and proportions of the fireplace opening (Fig 22).

A possible non-traditional remedy, particularly with a short length of flue, is to install a proprietary extract fan within the chimney capping.



22 Insertion of hood and flue liner

4 Fire risk

These can be the result of:

A *Timber bonders, bressummers, ennds of joists and beams being buried in the flue walls or even exposed on the internal face of the flue.*

The fire risk arising from hidden timbers or grounds exposed directly or indirectly to the heat of a flue is difficult or near impossible to detect. It can be minimised by ensuring that the chimney does not 'catch fire'. Of course, it is not the chimney which catches fire but the soot on the walls of the flue. For example, burning paper or Christmas decorations in the hearth can make enough additional heat to cause the soot to catch fire and the resulting heat and updraught of air fan the flames. Under these conditions the walls of the flue will become over-heated and timber buried in or closely adjacent to the flue can begin to smoulder. This in turn can ignite the shavings and other dry debris lying between the floor joints, and the fire takes hold before its presence is discovered.

Old flues should always be swept regularly, and if a sweep's brush cannot be inserted the full height of the flue due to abrupt or too many bends, there is probably a latent fire risk due to the resultant accumulated pockets of soot.

B *Several flues in one stack joining together.*

C *Bends in the flue preventing sweeping, thus allowing soot to accumulate.*

D *Defective pargetting and/or jointing.*

The pargetting or mortar rendering to the walls of the flue deteriorates with age. Many flues are not pargetted in old buildings; or the mortar in the brickwork of the flue can crumble away. These factors can cause smoke and sparks more readily to reach timber near or in contact with the flue.

It is possible to apply a smoke test to flues, as is done in the smoke-testing of drains, and it is a wise precaution to do so, if there is any doubt about the condition of the flue. If serious leaks are found, it may be possible for a specialist firm to 'core' the flue in a similar way to the 'coring' of leaking drains.

If this not possible the following alternatives are available: first, if the building is centrally heated the flue can be left unused; second, if the flue is straight, an asbestos liner can be inserted in short lengths. This second suggestion is a very expensive operation and only likely to be justified if the whole building is in such a condition that a great deal of money will be needed for repairs in any case.

Stainless steel flue liners are not recommended for use with open fires due to the greater heat in the flue and the difficulty of sweeping and hence of dislodging the soot adhering to the corrugated surface of the liner.

E *Insufficient separation between floor timbers and the hearth.*

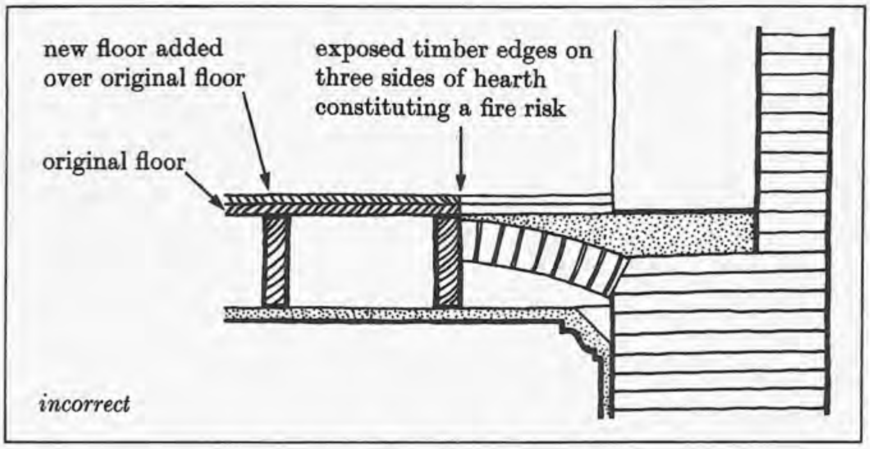
In old buildings, it is frequently found that the top surface of the hearth is at the level of the top of the floor joists. In addition, in many old buildings, a new set of floor boards overlays the original boards, or parquet has been added. The hearth is therefore sunk, surrounded on three sides by the exposed edge of the timber floor. It is thus exposed to the heat of the fire and to the risk of contact with hot ash. The remedy is to build up the hearth flush with, or higher than, the floor (Figs 23, 24).

F *Extensive use of timber framed partitions and floors in old buildings which adds to the fire risk.*

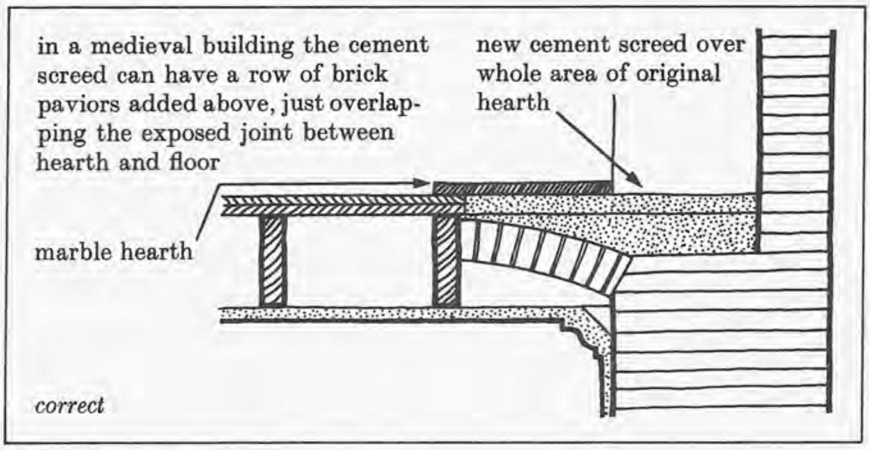
Stone hearths are frequently found in old buildings with the projecting portion supported on the outer edges by the timber floor, with timber grounds beneath carrying through the line of the ceiling below. Any cracks in such a hearth are potentially dangerous, as hot ash can work through the crack to timber grounds beneath. The simple remedy is to lay a new stone hearth over the original one (Figs 25, 26).

Flues in chimneys situated inside a building, as was usual from the 17th century onwards, present a potentially greater fire hazard than those placed on external walls where the flues will be exposed to cooling air and where the presence of buried timbers adjacent to the flue is less likely.

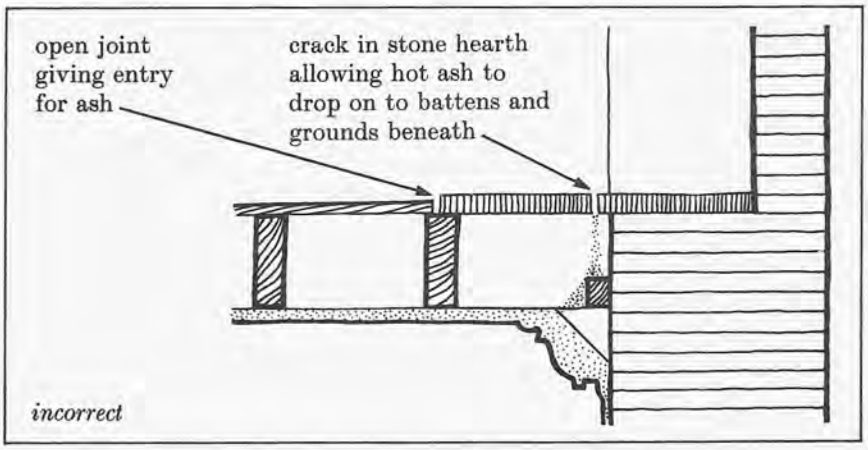
Due to the greater fire risk in old buildings, fire extinguishers should always be available in suitable positions.



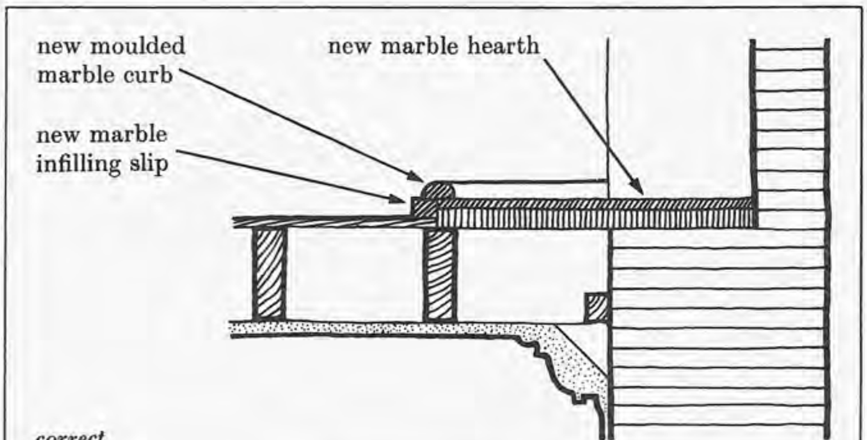
23 Floor timbers exposed to fire risk from hearth



24 Floor timbers suitably protected



25 Floor timbers and ceiling below at risk



26 The timbers and ceiling protected

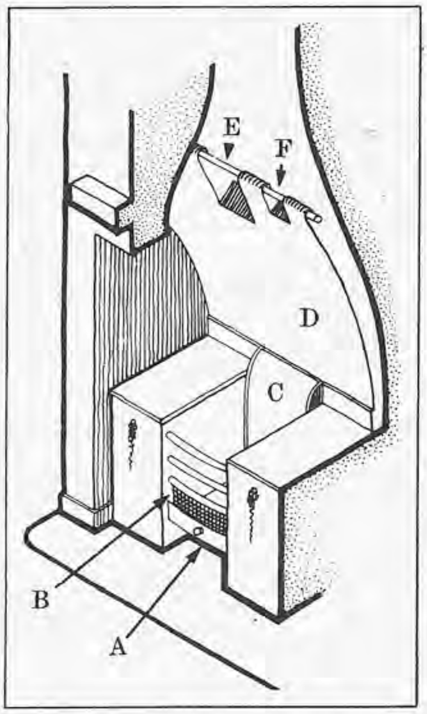
5 Choice of remedies

Almost invariably in an old building, the chimneys are an essential component in the general character and appearance of the building. Therefore, even if the chimney is no longer used, it is no remedy to demolish it. Only as a last resort should the chimney be pulled down and rebuilt. This is particularly important in buildings of the Tudor and Elizabethan periods, when chimneys were extremely elaborate and made extensive use of moulded bricks. The problem then is to remedy the defects in as inconspicuous a way as possible.

The choice between the various methods outlined will be governed by the type of defect and how serious it is; the position of the defect and how serious the possible consequences of delay in dealing with it might be; the accessibility of the chimney; the importance of the chimney in relation to the building; and the overall programme of repair. It would be foolish, for instance, to scaffold a chimney only, when by deferring repair for one year the whole wall would be scaffolded and the chimney could then be repaired from the wall scaffolding. There is no general rule; every case has to be considered individually.

Above: A typical hob grate at 94 The Mount, York, North Yorkshire, the fireplace is on the first floor

6 Adaptation of hob grates to burn smokeless fuel



27 Converting a hob grate to burn smokeless fuel

The advent of smokeless fuel presents a serious threat to the hob grate which has been widely used during the last couple of centuries. A great many have already disappeared and represent a serious loss of an often charming architectural detail.

Conversion can be done inexpensively by the following method (Fig 27). Smokeless fuel needs a very small controlled air flow both to and from the fire. The traditional hob grate provides an almost unlimited flow of air from beneath. This can be controlled by fixing a sliding drawer (A) on the underside of the grate which prohibits upflow when closed but can allow a desired amount by slightly pulling the drawer forward.

In order to produce a combustion chamber a metal plate (B) is fixed between the sliding drawer and the first bar above. The chamber can also be reduced for economy's sake by bedding an additional fire brick back (C).

A hob grate dictates an excessively large chimn[illegible]mouth, which draws out too muc[illegible] bustion and so lowers [illegible] ture in the room. Thes[illegible] n be readily overcome by [illegible] n iron sheet (D) across the opening, curving up from the back of the grate to the inside of the fireplace lintel. The centre part (E) is cut and bent back to provide a limited access opening to the flue above. The sheet of iron becomes warm and conducts the smoke up to the opening.

It may be found that smoke tends to hang at either end of the lintel in which case two small exits (F) can be provided in a similar manner. A strip of iron should be rivetted along the top of the sheet to hold its parts in proper position, and the whole sheet fixed so as to be readily removed to allow the flue to be swept.

Dimensions

When this pamphlet was in draft metric dimensions had not become official policy. In any case, when dealing with old buildings, it has to be remembered that they were originally set out and the materials cut and moulded in feet and inches. To quote metric dimensions, for example 12mm instead of ½in implies a degree of accuracy which could be midleading. It has therefore been decided that the measurements in this pamphlet should remain in imperial units. To transpose these measurements into metric units it is sufficiently precise to assume: 25mm = 1in and 300mm = 1ft.

Acknowledgements

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Rupert Gunnis Bequest

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