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978-1-107-63596-8 - Architectural Building Construction: A Text Book for the Architectural and Building Student: Fourth Edition: Volume One

Walter R. Jaggard and Francis E. Drury

Excerpt

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CHAPTER ONE

BRICKWORK

TERMS EMPLOYED—BONDS

1. Bricklaying is the craft of laying and lapping comparatively small units of “brick,” for the purpose of producing a well united mass of any desired form, and such a mass of material efficiently united is known as brickwork.

Brick is an artificially prepared building material made by baking or burning prepared clay or shale, and is used as a substitute for other materials found in a natural state and more or less suitable for building purposes. It is easily and economically prepared by modern machinery and is in common use in most districts where natural stone is not obtainable cheaply and plentifully.

To facilitate the laying of bricks, each kind is made in some “regular size,” and proportioned to allow of some particular method of setting them.

The arrangement necessary to unite the pieces of brick by lapping one over another is called “bond.”

There are many ways of doing this, hence there are many “kinds of bond.” Some of these embody the good qualities of bonding to an almost perfect extent, while others, for convenience or economy, fall short of the ideal bond in varying degrees.

Thus variety of bond may arise from:

- (a) A desire to vary the surface appearance.
- (b) A demand for the greatest possible strength.
- (c) A desire to produce an economical structure sufficiently strong and durable for a required purpose.

Bonding is dependent on the relative dimensions of the bricks employed, hence we must first consider these.

2. Sizes of bricks. Although bricks vary in size with locality and custom, a standard size of ordinary building brick has become fairly established in this country, due to an arrangement between the Royal Institute of British Architects and brick manufacturers.

The dimensions adopted are: minimum, $8\frac{7}{8}'' \times 4\frac{5}{16}'' \times 2\frac{5}{8}''$, maximum $9'' \times 4\frac{3}{8}'' \times 2\frac{11}{16}''$, and to rise four courses to one foot. These

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dimensions are intended to ensure ease of handling, facility for bonding and satisfactory burning; see detail No. 1.

In common brickwork the mortar joints are usually $\frac{1}{4}$ " to $\frac{3}{8}$ " in thickness, which enlarges the dimensions of a brick of the minimum size above to, say, $9\frac{1}{8}" \times 4\frac{9}{16}" \times 2\frac{7}{8}"$, assuming the thinner joint and measuring centre to centre of joints. This gives an awkward set of dimensions for drawing.

When drawing bricks laid in position, it is necessary to adopt convenient dimensions for the purpose; these are generally $9" \times 4\frac{1}{2}" \times 3"$ and are a very close approximation to actual dimensions for many bricks, which are made $8\frac{3}{4}" \times 4\frac{1}{4}" \times 2\frac{3}{4}"$, a very convenient set of dimensions for $\frac{1}{4}"$ joints.

Observe that in the pictorial illustrations which follow in this chapter the joints are represented by double lines, in order to make clear and duly emphasise the detail of bonding.

The reason for the relation of length to breadth in the sizes adopted is, that in the crossing of bricks in the standard bonds two "brick widths" need to make a "brick length" on the face of the finished wall; hence "a brick length must be twice its width, plus the thickness of a mortar joint." This rule may always be adhered to; it cannot conveniently be varied.

The relation of thickness to other dimensions is not so important, and such variations as may be found in certain localities are chiefly in the "thickness." A standard thickness such as the one quoted above is useful in deciding the number of courses required for a given height.

In the north of England it is very common to find bricks rising four courses to 13", or even more in the case of cheap work. Their appearance leaves much to be desired, uniformly thin courses being preferable to the deeper ones, except in large buildings.

3. Bond. In proceeding to the detailed consideration of bond we need to make continual references to terms in common use, which may be defined as follows:

"Header"—a full brick, placed to show its "end" ($4\frac{1}{2}" \times 3"$) on the face of the wall, or, having its end "parallel" to the face.—Detail 2 B.

"Stretcher"—a full brick, placed to show its "side" ($9" \times 3"$) on the face of the wall, or, having its side "parallel" thereto.—Detail 2 B.

"Bat"—a broken (or cut) brick, being $4\frac{1}{2}" \times 3"$ by some fraction of the length; *e.g.* $\frac{1}{2}$ bat is half length ($4\frac{1}{2}"$), $\frac{3}{4}$ bat is three-quarters of the length ($6\frac{3}{4}"$).—Details 1 B and 1 C.

"Closer"—a portion of a brick cut and placed to obtain a correct start in setting the bond on the face of a wall.

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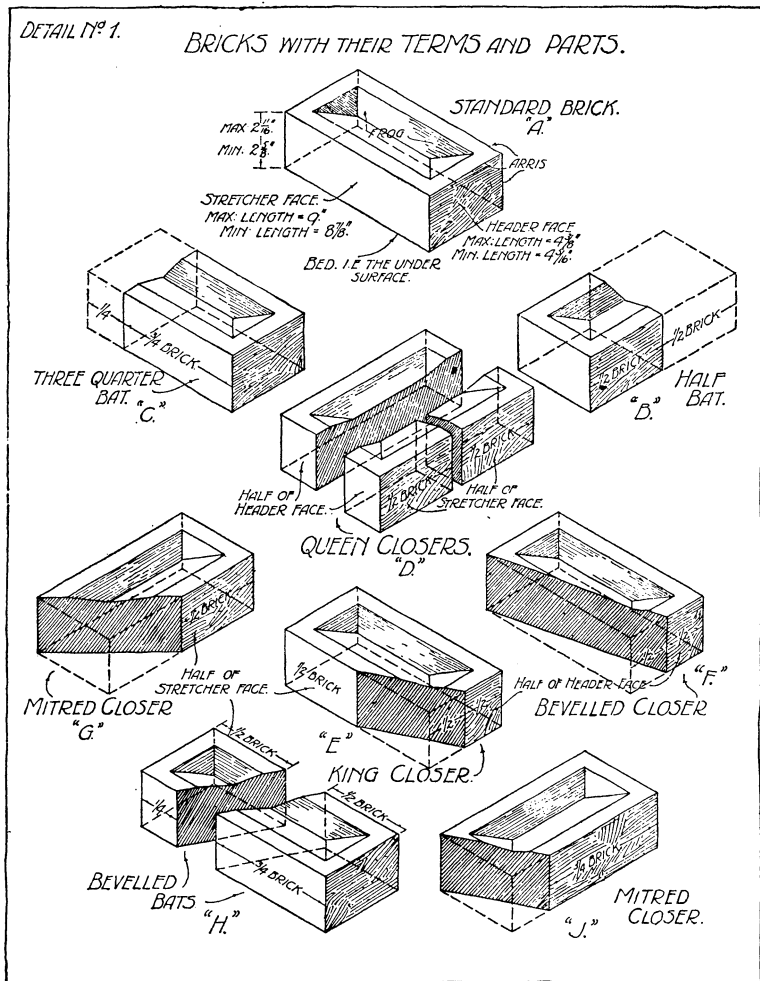
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“Queen closer”—half of a brick obtained by dividing the width; the “end” is $2\frac{1}{4}'' \times 3''$ and shows on the face of the wall, or is parallel to it.—Detail 1 D.



“King closer”—a brick reduced to a width of $2\frac{1}{4}''$ at one end by cutting off the triangular piece between the centre of one end and the centre of one side.—Detail 1 E.

This term is also employed in some parts of the country to include all “bevel cut bricks” of whatever shape.—Details 1 F to 1 J. We shall distinguish between these forms to prevent confusion.

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“Bevelled closer”—has one end reduced to $2\frac{1}{4}$ " wide by bevelling the whole length of the brick while maintaining the full width at the other.—Detail 1 F.

“Mitre bricks and mitred closers”—have their ends cut to mitre together. At a right angle the amount removed is $4\frac{1}{2}$ " each way from end and side, leaving a sharp edge, which is usually badly cut.—Details 1 G and 1 J.

“Bevelled bats”—bricks of less than their original length at every part, retaining their full width and cut across on the bevel.—Detail 1 H.

“Arris”—the sharp edge at the intersection of two faces, commonly termed the angle.—Detail 1 A.

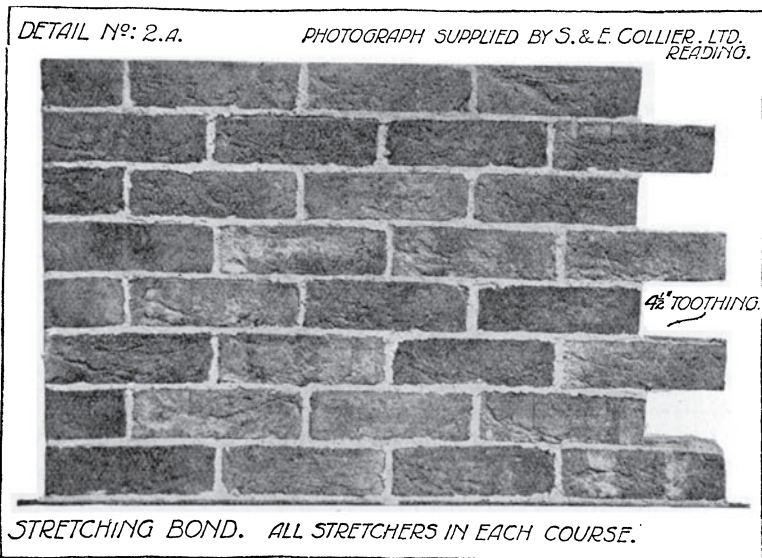
“Bed”—the surface of the brick on which it rests, or upon which another brick is supported. Usually the horizontal surface, $9" \times 4\frac{1}{2}"$.—Detail 1 A.

“Frog”—a depression in the bed whose purposes may be:

(a) To lighten the brick and economise material.

(b) To provide a recess for the mortar which, when set, helps to prevent displacement of any brick from the adjacent ones.

(c) To make it easier to bring the bed surfaces closer together. These surfaces become narrow bands and are not so liable to irregularities.—Detail 1 A.



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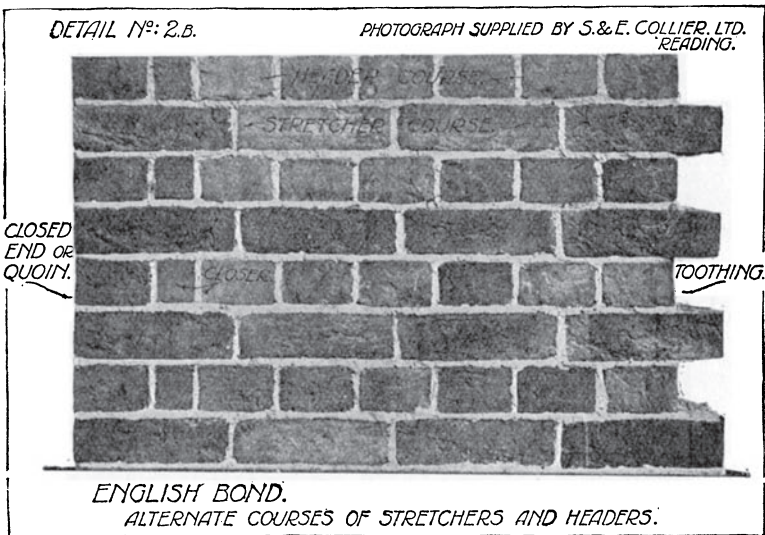
Wire cut bricks have “no” frog.

Hand made bricks have “one” frog.

Semi-dry machine made bricks have usually “two” frogs.

“Face”—any one of the vertical surfaces of an ordinary brick; a $9" \times 3"$ surface is called a “stretcher face” and a $4\frac{1}{2}" \times 3"$ surface a “header face.”—Detail 1 A.

“Course”—one continuous layer of bricks of the same thickness and laid on the same surface.—Detail 2 B.



“Perpend”—the line of vertical joint on the face of a wall. We are said to keep the “perpends” true, when the vertical joints in alternate courses form “parts of one vertical line”; they stand truly over each other.—Detail 2 C.

“Straight joint”—occurs when two consecutive vertical joints are in the same plane. Straight joints should never occur on the face of a wall; they *do* occur in short lengths within the wall in certain kinds of bond and occasionally near stopped ends and angles.

The fewer straight joints, the better the bond.

The bonds in common use are “stretching bond,” “English bond,” “Flemish bond” and “garden bonds.” In every case the varieties of bond are named and distinguished by the “face arrangement” of their courses.

4. Stretching bond. Is used for $4\frac{1}{2}"$ walls only; all courses are stretchers lapping half their length over adjacent bricks upon which they rest.—Detail 2 A.

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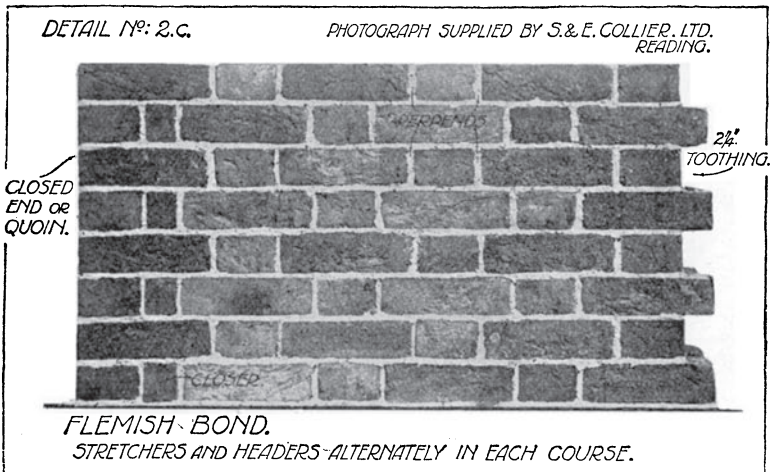
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These $4\frac{1}{2}$ " walls are also known as "half-brick" walls, and in the north of England as "single" brick walls.

5. **English bond** has the mass of the work laid in *alternate courses* of headers and stretchers on the face.—Detail 2 B. One header is centrally over the stretcher; its neighbour overlaps the stretcher joint equally on each side. The minimum lap is therefore $2\frac{1}{4}$ ".

6. **Flemish bond** has *alternate bricks* laid as header and stretcher in "every course."—Detail 2 C. Each header is centrally placed between the stretchers immediately above and below.

The term "double Flemish bond" means that both faces of a wall show the Flemish arrangement.



7. **Garden bond.** Accepting English and Flemish bonds as the principal ones in common use, we may define garden bond as an imperfect variation of either of these types. These variations are cheaper, less laborious to build when two fair faces are required, and most suitable for walls 9" thick, *e.g.* garden and boundary walls.

The two varieties of garden bond are:

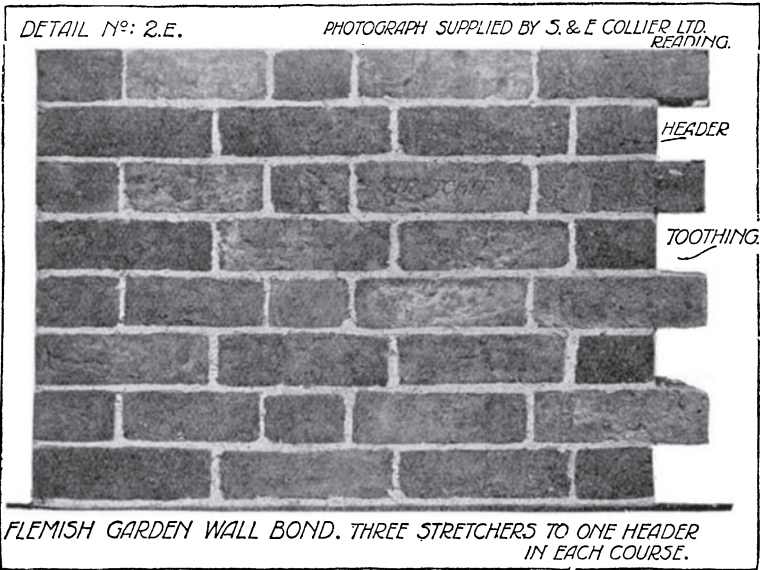
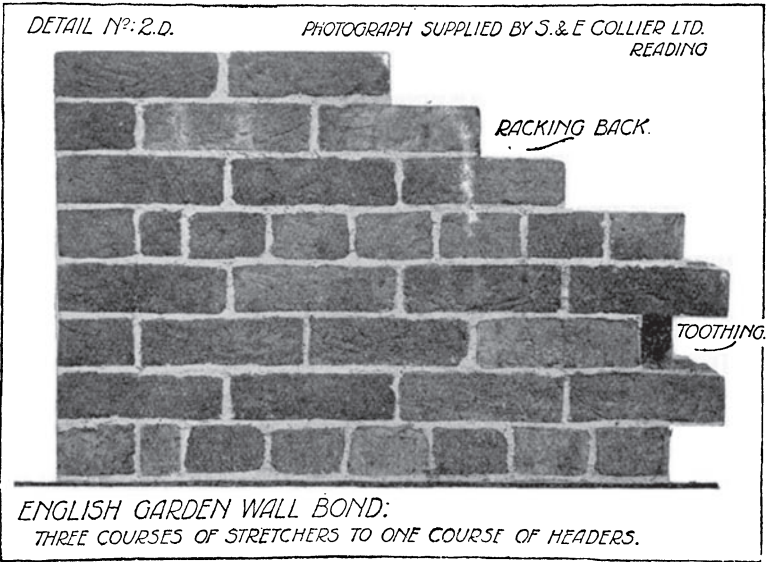
"English garden bond," which has the same "general arrangement" as English bond except that the heading courses are only inserted at every "fourth" or "sixth" course. Commonly we have *one* course of headers to *three* courses of stretchers. The stretching courses are bonded as in ordinary stretching bond and are quite detached from each other vertically between the heading courses.—Detail 2 D.

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“Flemish garden bond” has the same nature of variation, viz., the quantity of stretchers is increased and *three* stretchers are laid to *one* header in each course, the latter being always laid in the centre of the middle stretcher of the series.—Detail 2 E.

Note. English garden bond is in very common use; Flemish not so common, in some districts quite unknown.

8. Comparative value of “English,” “Flemish,” and “garden” bonds. If a wall be more than $4\frac{1}{2}$ ” thick we have the choice of these three bonds for ordinary continuous walling.

Garden bond is suitable for one brick (9”) walls only, is quickly laid to obtain two fair faces, but is deficient in strength “cross-wise” and liable to bulge at the stretching courses, if loaded too heavily.

It is used because other bonds are more difficult to lay for one brick walls if two fair faces are required, owing to the bricks varying in length. If comparatively few headers are needed they may be conveniently selected from the supply to obtain uniform length. The thickness of a wall is then determined by these selected headers and the stretching courses made flush with the header faces.

English bond is, all things considered, the strongest bond obtainable. It ties the wall efficiently lengthwise and crosswise and has no serious deficiency except in thick walls; there are no straight joints in the mass of the walling. Its appearance is also very good.

Deficiencies in thick walls are referred to in Vol. II.

Flemish bond is defective in strength as compared with English, yet sufficiently well bonded for all general purposes. It contains numerous straight joints $2\frac{1}{4}$ ” long which somewhat detract from its strength. See detail No. 3 B. Its chief asset is popularly said to be its “face appearance,” though this is a debatable point and a matter of personal preference.

Examine details Nos. 2 B and 2 C and observe practical examples of these two bonds; you may then decide for yourself which “pattern” you prefer.

As our chosen structures contain examples of stretching, English, Flemish and garden wall bonds we shall speak of them in detail as they arise, but as a preliminary to the consideration of the applied details, it is wise to become thoroughly acquainted with the simpler arrangements and further practical terms.

Refer to the illustrations on details Nos. 2 B and 2 C.

The elevations of walls in English and Flemish bonds are shown together here to allow comparison. They are to be employed respectively in the workshop and cottage. Each has a “square stopped end” which necessitates a study of the means employed to obtain

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a start for the bonding. Observe that in every “stretching” course of the English bond the bricks are laid as stretchers throughout, but in the heading course, in order to ensure the correct position of the headers in the mass of the work, viz. each central over the stretcher below, a “queen closer,” $2\frac{1}{4}$ ” wide, is placed immediately after the first header.

In English bond, it throws the succeeding header $2\frac{1}{4}$ ” over each stretcher below it, and the next header centrally over the stretcher.

In Flemish bond the “stretching course” is the one *commencing* with a stretcher and contains header and stretcher alternately throughout. The “heading course” commences with a header, and is immediately followed by a closer which throws the succeeding stretcher forward to overlap the header below equally at each end.

When commencing a heading course at a stopped end, we may therefore establish the following rule: *place a closer immediately after the first or quoin header in the course*. Stretching courses contain no closers at the stopped end on the *faces* of the wall.

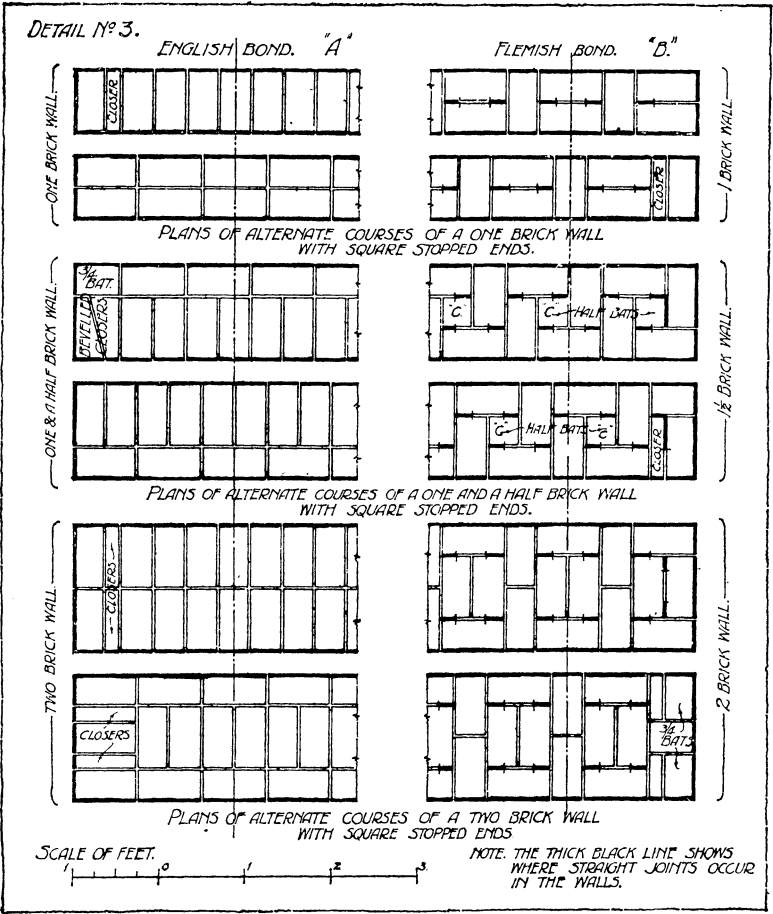
Whatever the thickness of a wall the elevation for one kind of bond is practically constant. The change in thickness does, however, alter the plan arrangement of the courses for, as the thickness increases, difficulties of bonding arise due to maintaining the features of the bond at the “face of the stop,” and to odd half bricks in the thickness.

9. English bond plans. Detail No. 3 A shows the method of bonding walls up to 18” thick in English bond. The 9” wall should need no explanation. Our only remark concerning it is, that the queen closer shown $9" \times 2\frac{1}{4}"$ would, with common bricks, be in two pieces $4\frac{1}{2}" \times 2\frac{1}{4}"$ because it is difficult to cut a brick lengthwise without snapping it across. A short vertical joint might therefore occur at the centre.—See sketch at detail No. 1 D.

In the $13\frac{1}{2}"$ (one and a half brick) wall the courses have stretchers on one face and headers on the other, which is the only economical arrangement resulting in a strong wall. It is always adopted in walls whose thickness is in odd half bricks, but it is essential that two headers should coincide in width with one stretcher. The stopped end is formed by one $\frac{3}{4}$ bat and two bevelled closers in one course and by the usual unit in the other: alternative methods are available which you should endeavour to discover.

The 18” (two brick) wall demonstrates the general principle of setting the bricks in a thick wall with a stopped end. Stretching courses are invariably laid with stretchers on the faces of the wall and the centre filled with headers in order to keep the “cross-tie”

adequate for the work of concentrated loading. (This principle causes deficiencies in very thick walls—see Vol. II.)
A stopped end in a wall 18" thick or more is treated in bonding as a separate narrow wall. Its "face headers" become "stretchers"



on the end and similarly "face stretchers" become "headers," the intervening space between them being filled with headers and the requisite "spacing closers."

10. Flemish bond plans. Detail No. 3, on the right, demonstrates the difference between English and true Flemish bonds.