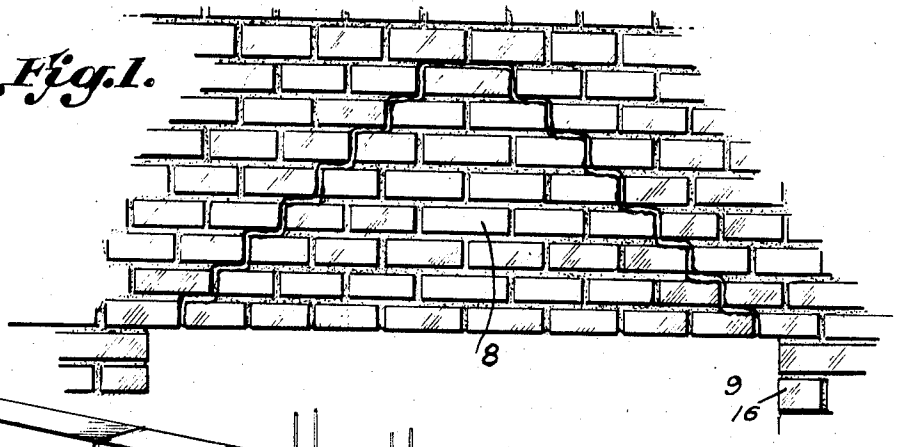
Aug. 3, 1943. J. J. KLABER 2,325,614

LINTEL

Filed Jan. 6, 1942

Fig. 1.



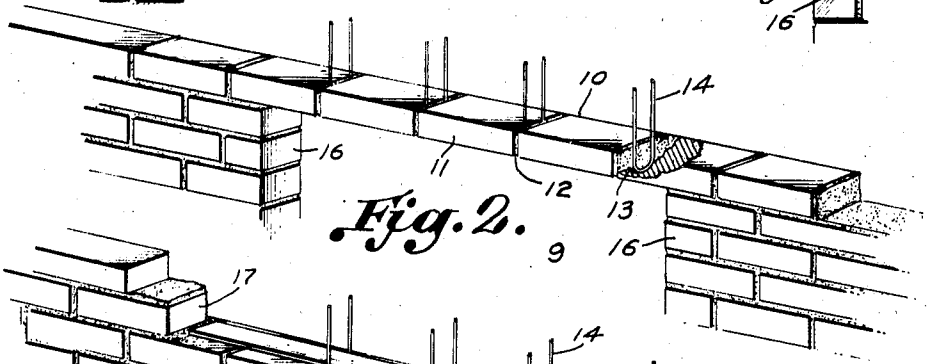


Fig. 2.

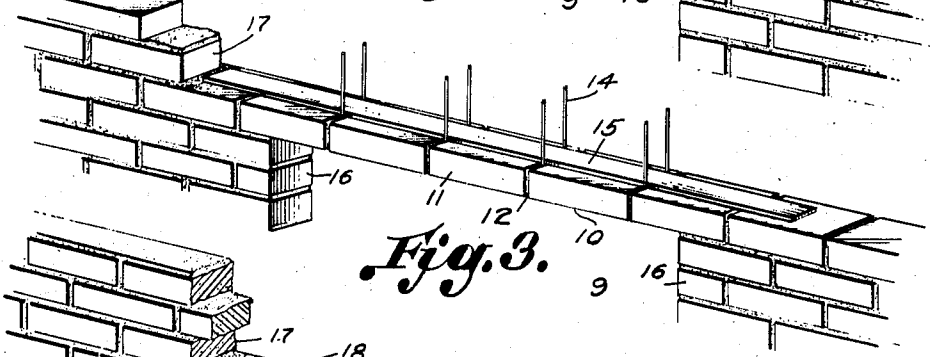


Fig. 3.

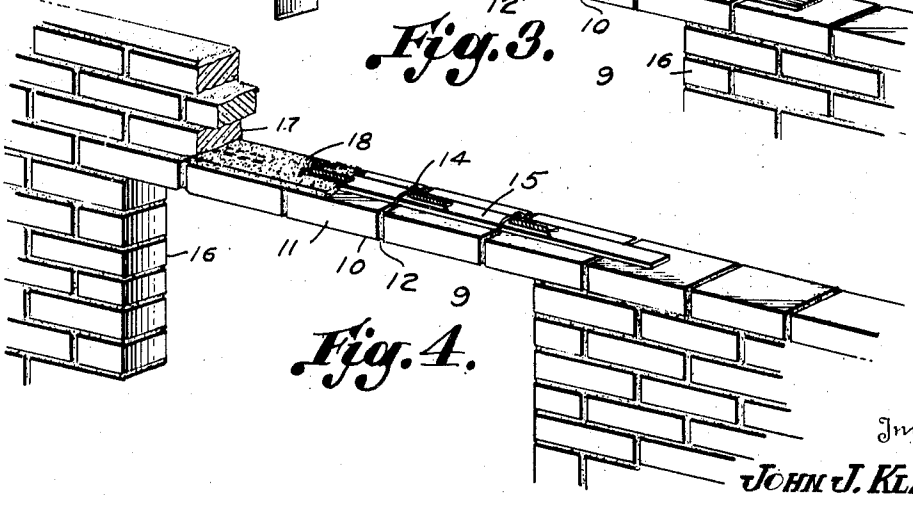


Fig. 4.

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2,325,614

LINTEL

John J. Klaber, New York, N. Y.

Application January 6, 1942, Serial No. 425,721

4 Claims. (Cl. 72—59)

(Granted under the act of March 3, 1883, as amended April 30, 1928; 370 O. G. 757)

The invention described herein may be manufactured and used by or for the Government of the United States for governmental purposes without the payment to me of any royalty thereon in accordance with the provisions of the act of April 30, 1928 (Ch. 460, 45 Stat. L. 467).

This invention pertains to lintels for wall supports over doors, windows or other openings in structures formed or to be formed of bricks or other type of building blocks, and more particularly to their details of construction and formation.

A primary object of the present invention is to conserve steel by eliminating a considerable if not major portion of the usual angle or T-irons which have heretofore been considered necessary to withstand the load to which lintels are subjected because of the customary manner of calculating the stresses on the same in the structure.

According to my invention a considerable amount of lintel steel is conserved by basing the calculation on the discovery that the critical or governing stress is the shear to which the lintel is subjected, as distinguished from the customary assumption that the lintel stress must be figured in terms of tension.

Further objects of the invention are to reduce cost, add to durability of the structure, since the reinforcement is concealed and protected instead of being exposed to weather conditions, and to improve the appearance of the building, by avoiding staining of painted woodwork due to rusting of exposed metallic lintels.

The foregoing and other objects will become apparent from a reading of the following specification and appended claims.

An embodiment having the characteristics of my invention and by which the same may be practiced is illustrated in the accompanying drawing, in which,

Figure 1 is a section of a wall in elevation illustrating the triangular portion over the span of the opening which depends for support upon the lintel in the event of failure of the bonding mortar; and

Figures 2, 3 and 4 illustrate successive steps in the formation of the lintel incorporating the features of my invention.

For the purposes of my invention the load on the lintel over an opening in a brick wall may be considered as consisting of a triangular mass of bricks, the base being the span of the opening, or portion thereof, and the other sides inclined at an angle of approximately forty-five degrees, as is illustrated in Figure 1. Assuming a weight of 125 pounds per cubic foot, and a thickness of 4 inches, the weight of the mass would therefore be 125/12, or approximately ten times the square of the span, based on the formula:

$$\text{Load}=\frac{\text{Span}\times\frac{1}{2}\,\text{Span}}{2}\times\frac{1}{3}\times 125$$

According to my invention the weight of the triangular mass 8 over an opening 9 of a wall will be amply supported by a lintel comprising a course 10 of bricks or other building blocks 11 cemented together in end to end relationship, as shown in Figure 2, by a suitable thickness of mortar 12 in which tie wires 13 are partially embedded so as to allow free portions 14 to project upwardly, a metal reinforcing bar 15, extending from overlapping relationship with respect to the side walls or abutments 16 of the opening to be spanned, positioned upon the first course 10 of bricks, as shown in Figure 3, and that course secured to the reinforcing bar 15 by the projecting ends 14 of the ties 13 in a manner such as shown in Figure 4. The next course of bricks is then placed upon the reinforcing bar and cemented to the first course 10 at the sides of the bar. The bar is thereby encased by the two courses of brick and the mortar 18 therebetween.

In the ordinary type of construction, it is assumed that the steel member of a lintel must support the entire load of the triangular mass above the opening and by placing that member of the lintel as the first member across the opening it has heretofore been considered as subjected to all stresses. Upon this erroneous assumption it has been deemed necessary that the lintel be of considerable strength, particularly to withstand bending stresses. This is based on the assumption that the masonry is a dead load, with no strength in itself. Actually, however, the rigidity of the mass of bricks is sufficient so that for ordinary spans no bending stress occurs in the angle irons, and this is further assured in my invention by the bonding together of the bricks and the steel reinforcing bars, by means of the tie wires. The critical stress upon the steel member is the shear, as has been discovered, resulting from the pull of gravity on the mass of brickwork, and, too, the shear on each of the side walls of the opening would be one-half of the load.

Assuming that reinforcing steel may safely stand a stress of 10,000 pounds per square inch, the following formula results:

$$\text{Area of steel (in sq. ins.)}=\frac{10\times\text{square of span (in feet)}}{2\times 10{,}000}$$

$$=\frac{\text{square of span}}{2{,}000}$$

The following table may therefore be established:

Span (feet)	3	4	5	6	7	8	9
Steel (sq. in.)	.0045	.008	.0125	.018	.0245	.032	.0405

Since it is desirable to use reinforcement that will not interfere with regular brick coursing, and since the usual joint is ½ inch thick, the reinforcement may consist of a flat bar ⅛ inch thick, or any other cross-sectionally shaped bar not exceeding ½ inch in thickness, which may be laid in the joints without increasing their thickness. The following table may then be resorted to to insure adequate strength in lintels:

Span (feet)	3	4	5	6	7	8	9
Width of bar (inches)	.036	.064	.100	.144	.196	.256	.324

From the foregoing table it will be seen that for any opening up to 9 feet, a steel bar capable of safely standing a stress of 10,000 pounds per square inch will be ample reinforcement if only ⅛ of an inch by $^{324}/_{1000}$ of an inch, provided of course that the rigidity of the masonry can be assumed. From experience it is known that failures are due primarily to settlements rather than to load stresses. However, to insure against imperfect workmanship, which must always be assumed as a possibility, the steel should be increased to include an amount sufficient for a reasonable safety factor. The loads of floors and roofs, bearing on the wall, also add to the stresses which are liable to occur. Even by the inclusion of additional steel to insure adequate strength in the event of unusual, but possible, stresses and loads, the size of the metal reinforcing bar incorporated in my invention is radically less than the amount of steel heretofore considered necessary for angle and T-iron lintels.

In brick lintels there is a possibility of course that the bricks of the first course across the opening may drop out due to imperfect bonding. This according to my invention is guarded against by anchoring the bricks to the metal reinforcing bar by the tie loops 14 inserted in the vertical joints between that course of the bricks.

My invention therefore comprises the combination with brick lintels of a reinforcing metal bar interposed between courses or within a horizontal joint of the building blocks or bricks above the opening to be spanned and extending into the side walls of the opening sufficiently to secure adequate bond and form a rigid structure. The combination also includes ties securing the first brick course of the lintel to the reinforcing bar, the cross-sectional area of the metal bar being at least as great as that calculated by the following generic formula:

$$(1)\ \text{Load} = \frac{(\text{Span})^2 \times \text{Thickness (in feet)} \times \text{Weight per cu. ft.}}{4}$$

$$(2)\ \text{Cross-sectional area of steel} = \frac{\text{Load} \times (\text{Span})^2}{2 \times \text{safe shearing stress (lbs. per sq. in.)}}$$

$$(3)\ \text{Cross-sectional area of steel} = \frac{(\text{Span})^4 \times \text{Thickness of wall (in feet)} \times \text{Weight per cu. ft.}}{8 \times \text{safe shearing stress (lbs. per sq. in.)}}$$

From the foregoing it will be seen that the reinforcing bar and the tie wires may be placed in position by a brick-layer in the ordinary course of construction without requiring special skill or equipment, other than a light centering frame for the first courses until the cement hardens, and that when constructed, in accordance with the foregoing, will subject the steel portions of the lintel to shearing stress only.

Having described my invention and the method of constructing the same, what I claim is:

1. A lintel for openings of a building formed of spaced superimposed layers of preformed building blocks, including a course of building blocks spaced in end to end relation spanning the side walls of said opening, and bonding material between and securing said blocks together, said lintel comprising a metallic reinforcing member superimposed upon said course spanningly of said opening and having over all cross sectional dimensions less than those of the normal space between said layers, and ties formed in endless loops supported by said metallic reinforcing member for securing said spanning course of blocks to said reinforcing member.

2. A lintel for door or window openings of a building formed of spaced superimposed layers of preformed building blocks, said lintel comprising the combination of a course of building blocks spaced in end to end relation spanning the side walls of said opening, bonding material between and securing said blocks together, a metallic reinforcing member superimposed upon said course and having over all cross sectional dimensions less than those of the normal space between said layers, and ties formed in endless loops around said reinforcing member embedded in said bonding material securing said spanning course of blocks to said reinforcing member.

3. A lintel for door or window openings of a building formed of spaced superimposed layers of preformed building blocks, said lintel comprising the combination of a course of building blocks spaced in end to end relation spanning the side walls of said opening, bonding material between and securing said blocks together, ties formed in endless loops embedded within and partially extending from said bonding material, a substantially flat reinforcing member superimposed upon said course and spanning said openings surrounded by a plurality of said ties, said course of blocks being secured to said member by the extending portion of the ties embedded therein.

4. A lintel for door or window openings of a building formed of spaced superimposed layers of preformed building blocks, said lintel comprising the combination of two courses of building blocks superimposed one upon the other and spanning an opening in the building, bonding material between and securing the blocks of each course in end to end relationship, a metallic reinforcing member between said courses encased within the side walls of said courses by bonding material, and a plurality of ties formed in endless loops surrounding said metallic reinforcing member securing the lowermost course of blocks of said lintel to said reinforcing member.

JOHN J. KLABER.