(No Model.) 2 Sheets—Sheet 1.

W. O'BRIEN.

ARCH.

No. 519,340. Patented May 8, 1894.

FIG. 1.

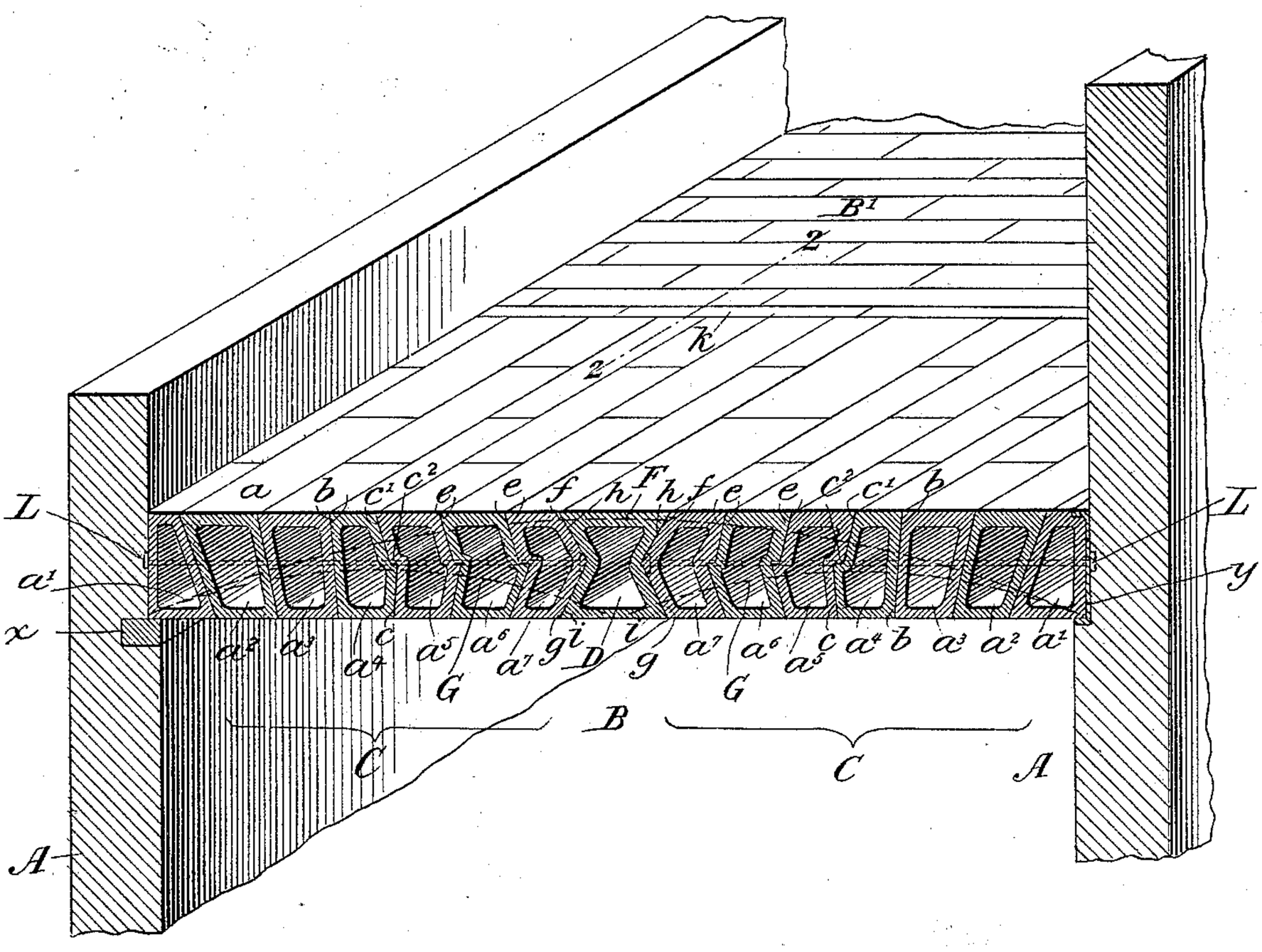


FIG. 2.

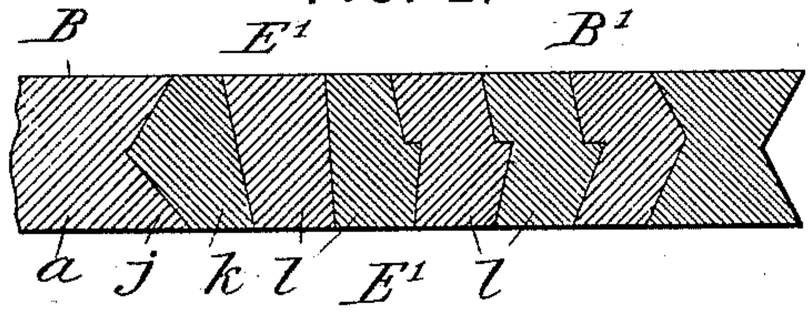
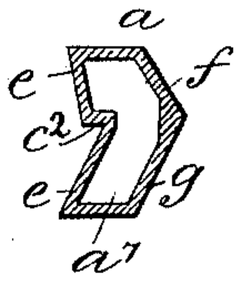


FIG. 3.



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(No Model.) 2 Sheets—Sheet 2.

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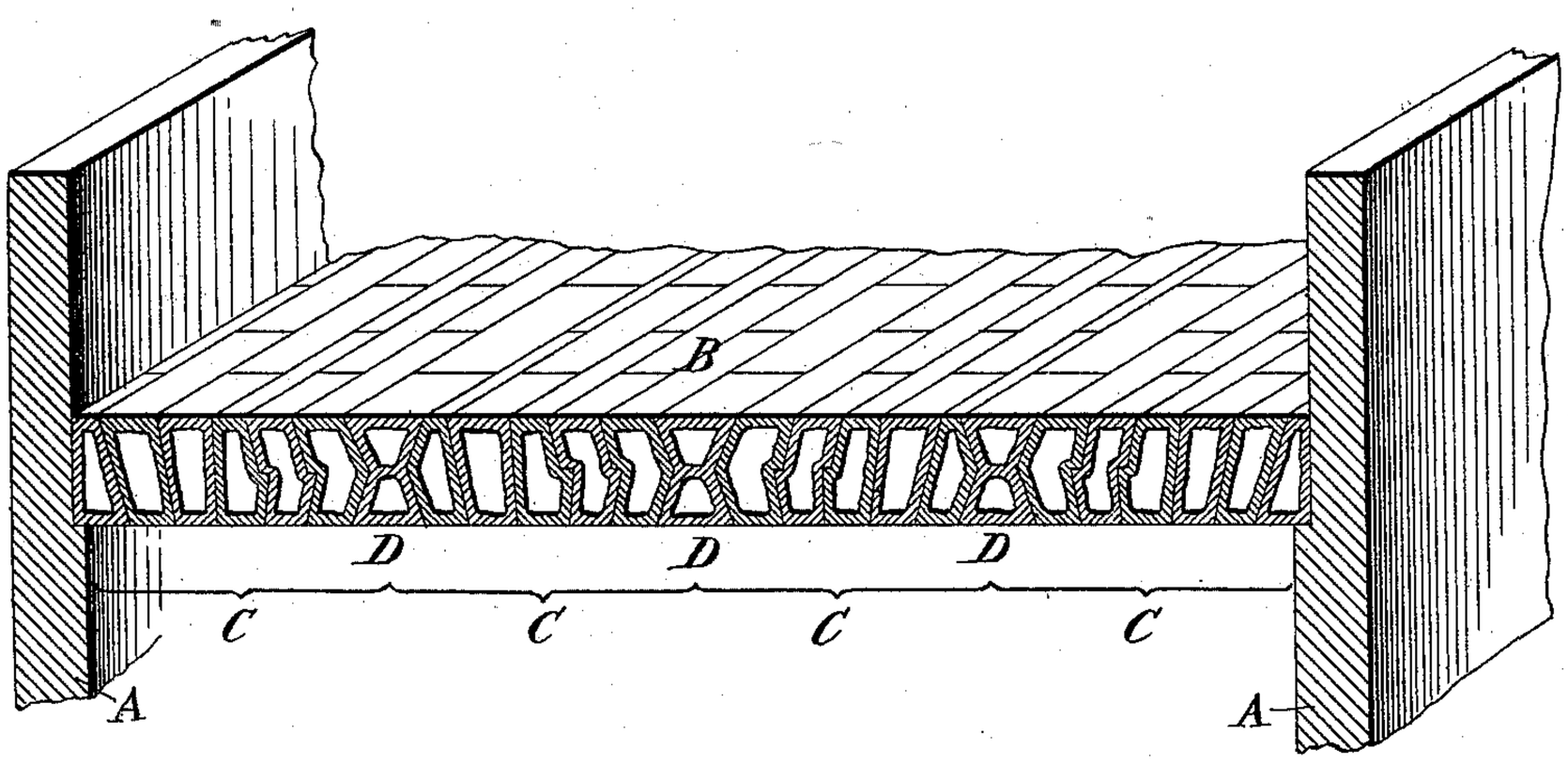
FIG. 4.



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WALTER O'BRIEN, OF BROOKLYN, NEW YORK.

ARCH.

SPECIFICATION forming part of Letters Patent No. 519,340, dated May 8, 1894.

Application filed July 15, 1893. Serial No. 480,592. (No model.)

To all whom it may concern:

Be it known that I, WALTER O'BRIEN, a citizen of the United States, residing in Brooklyn, in the county of Kings and State of New York, have invented certain new and useful Improvements in Arches, of which the following is a specification.

This invention relates more particularly to flat or substantially flat arches of the character used in constructing floors, and which can be utilized for long spans, with the intention of omitting iron or other beams when possible, and making such floors entirely fireproof.

In the accompanying drawings which illustrate certain adaptations of my invention:—Figure 1 is a perspective view of my improved arch in its preferred form shown as employed for the floor of a building, the building and floor being in vertical cross-section. Fig. 2 is a fragmentary cross-section of the arch shown in Fig. 1, cut on the line 2—2 in said figure. Fig. 3 is a cross section of one of the voussoirs, and Fig. 4 is a view similar to Fig. 1 showing a greater number of the arches than shown in Fig. 1.

Referring to the drawings let A A indicate the walls of the building.

B indicates my improved arch as a whole, which is made up of smaller arches C C C which are kept from falling by an improved self supporting voussoir or keystone D of an hour-glass shape inserted between the arches C C C. The arch is supported at one abutment by the customary wall plate *x*, while at the other side another customary means of abutment support as the channel beam *y* is shown.

Heretofore flat arches of this character have consisted of a plurality of wedge-shaped voussoirs, the middle one constituting the keystone, the end ones the abutment stones, and the intermediate voussoirs the corresponding wedge-shaped pieces, which in some constructions have been constructed with indented joints. The voussoirs of such arches have been constructed of various materials, hollow brick being generally employed. Such arches have consisted of one arc, the voussiors being extended at top and bottom to form flat extrados and intrados, the arch being given a slight rise in construction to compensate for settling.

According to my invention I employ an arch consisting of two or more small arches, each having its respective arc and voussoirs, and each small arch constituting a part of one large arch having an arc of greater radius than that of the small arches. I shall hereinafter term the large arch, or the arch as a whole, the "major arch," and the small arches forming part of the large arch the "minor arches." Each voussoir serves both as a voussoir for its minor arch and for the major arch, and the keystone of the major arch serves as an abutment for the adjacent abutment voussoirs of the minor arches.

Referring now to the drawings, I will describe in detail the construction preferably employed in carrying out my invention as shown in Fig. 1.

B represents the major arch, *a a* the voussoirs thereof, and the dotted line F the arc thereof.

C C represent two minor arches, and the dotted lines G G the arcs thereof. The voussoirs a' a' are of ordinary construction, and constitute the abutment voussoirs at the outer ends for both the major arch and the two minor arches. The voussoirs a^2 a^3 are of ordinary construction and constitute intermediate voussoirs for both the major and the minor arches. The voussoirs a^4 a^4 are according to my invention of improved construction, and constitute respectively keystones for the minor arches and intermediate voussoirs for the major arch. On their outer faces *b b* they are smooth and inclined, to correspond to the adjacent voussoirs a^3 a^3, but on their other sides they are constructed with two faces extending in different planes, and preferably also an intermediate indented joint. The lower of these faces, lettered *c*, is inclined oppositely to the face *b*, and constitutes the other face of the keystone of the minor arch in each instance. The upper face c' is inclined relatively to the face *c*, and constitutes one of the voussoir faces for the major arch. Between the faces *c* and c' is an indented shoulder c^2, which is preferably a horizontal shoulder projecting beyond the face c', and terminating at its intersection with the face *c*. The next

voussoirs a^5 a^5, a^6 a^6, are constructed with interengaging reciprocal faces *e e* corresponding to the faces *c c'* and the shoulder c^2, those at bottom being wedge-shaped to an increasing extent, and forming the intermediate voussoirs of the minor arch, and those at top being inclined relatively to those at bottom and forming the intermediate voussoirs of the major arch. The voussoirs a^7 a^7 are constructed at one side with reciprocal faces *e* in like manner unto the voussoirs a^5 and a^6, and engaging with the like faces thereof, and at their other sides the voussoirs a^7 are constructed with oppositely inclined faces *f* at top and *g* at bottom, the top faces *f* serving for engagement with the keystone of the major arch, and the bottom faces *g* for engagement with the abutment for the minor arch in each instance. The mid voussoir D according to my invention comprises a keystone for the major arch and an abutment for the two minor arches. As a keystone it is supported by its major arch, and thereby is maintained in position as an abutment for the minor arches. It is constructed to accomplish this by being provided with oppositely wedge-shaped faces *h* at top engaging the faces *f* of the voussoirs a^7, and with opposite inverted wedge-shaped faces *i* at bottom engaging the faces *g* of the adjacent voussoirs a^7, and serving as abutment faces for these voussoirs.

Preferably when a floor is constructed, a number of the arches B are use in the form of groin arches, as shown in Figs. 1 and 2, in which the part lettered B' is an arch corresponding in construction to the arch B but running at right angles thereto. The arch B in this construction has a grooved face *j* in the end of each of its voussoirs *a*, and the arch B' has its voussoirs E' disposed at right angles to those in the arch B, the outer or abutment voussoir lettered *k* fitting on its outer face into the grooved end *j* of the voussoir *a*, and the intermediate voussoirs lettered *l l* are constructed as described with reference to the arch B.

I prefer to pass tie-bars L L, as shown in dotted lines in Fig. 1, through the voussoirs of the arches to insure their retention in the proper position under any circumstances, but this is not essential.

In use, the strains transmitted to the arch are taken up by the major arch, or by it and one or both of the minor arches. In construction the various voussoirs are successively located until the voussoirs a^7 a^7 are in position, and then the keystone voussoir D is passed in between the last named voussoirs, thus completing the arch as a whole. The indented joints c^2 interlock the voussoirs a^4 a^5 a^6 and a^7 and prevent their relative displacement, while the opposed wedge-shaped faces *h* and *i* of the voussoir D prevent its displacement relatively to the adjacent voussoirs.

It will be understood that my invention is not limited to the exact construction and arrangement described and shown, as it may be availed of according to such modifications as circumstances will dictate, without departing from the essential features of the invention.

I claim as my invention the following-defined novel features, substantially as hereinbefore specified, namely:

1. In an arch, two arches, and a voussoir supported by said arch and between and supporting said arches.

2. In arches, a major arch composed of two minor arches having arcs of less radius than that of the major arch, the keystone of the major arch constituting the abutment for the minor arches, and the voussoirs of each arch serving as voussoirs for both the major and minor arches.

3. In a flat arch, an arch B having voussoirs constructed with grooved ends *j*, and an arch B' disposed at right angles to said arch B and having an abutment voussoir *k* fitting the grooved ends of the voussoirs of said arch B and supported thereby.

4. In a flat arch, a plurality of voussoirs, abutment voussoirs at the flanks and an intermediate keystone, in combination with tie-bars traversing said abutment voussoirs and the remaining voussoirs of the arch at one side of the keystone, and locking said voussoirs in position.

5. In an arch, a voussoir having at bottom inclined wedge-shaped faces forming a voussoir for an arch of short radius, and at top inclined wedge-shaped faces differing in direction from those at bottom and forming a voussoir of an arch of different radius than that to which said bottom faces are adapted.

6. In an arch, a voussoir having at top inclined faces *e f*, and at bottom reversed inclined faces *e g*, and having intermediate of said faces shoulders c^2, substantially as and for the purpose set forth.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

WALTER O'BRIEN.

Witnesses:
GEORGE H. FRASER,
THOMAS F. WALLACE.