F. J. HARDECKER.

CONCRETE WALL CONSTRUCTION.

APPLICATION FILED MAY 28, 1910.

1,006,478.

Patented Oct. 24, 1911.

2 SHEETS—SHEET 1.

FIG: 2,

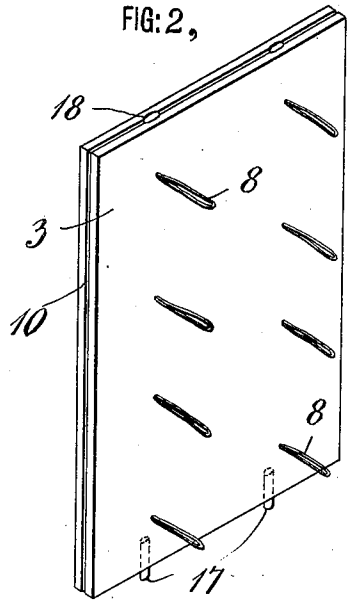


FIG: 3,

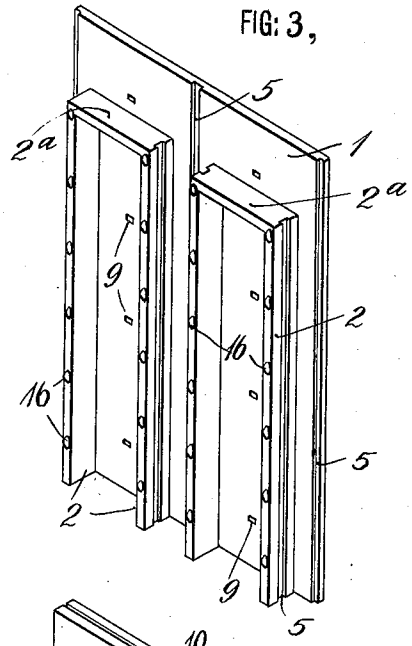
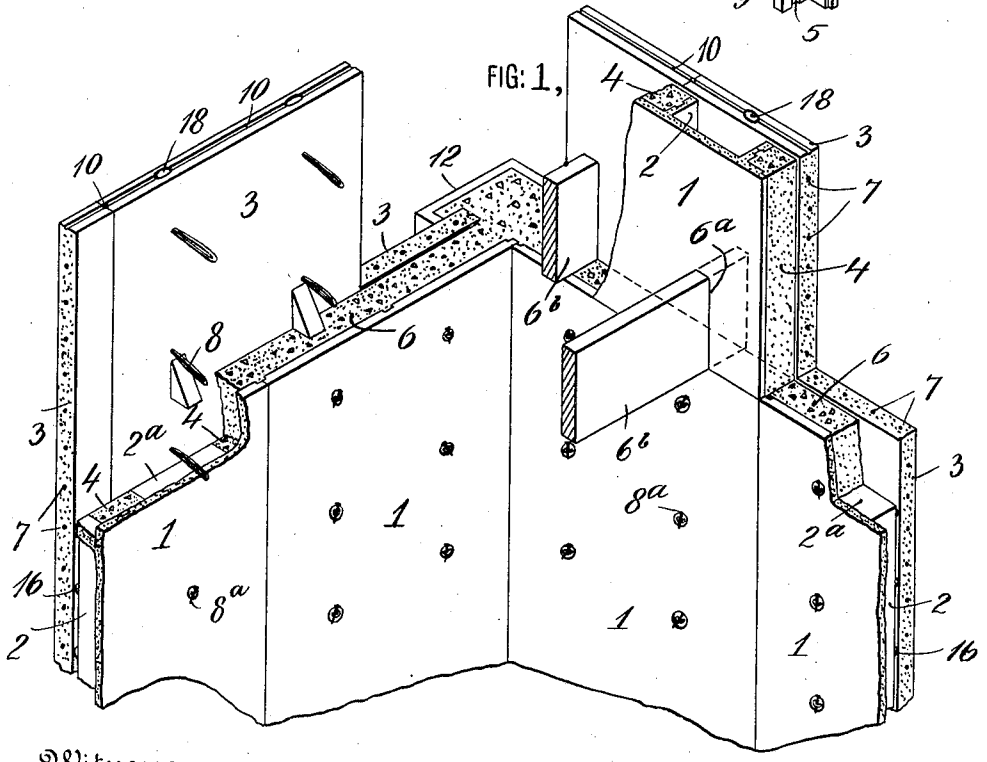


FIG: 1,



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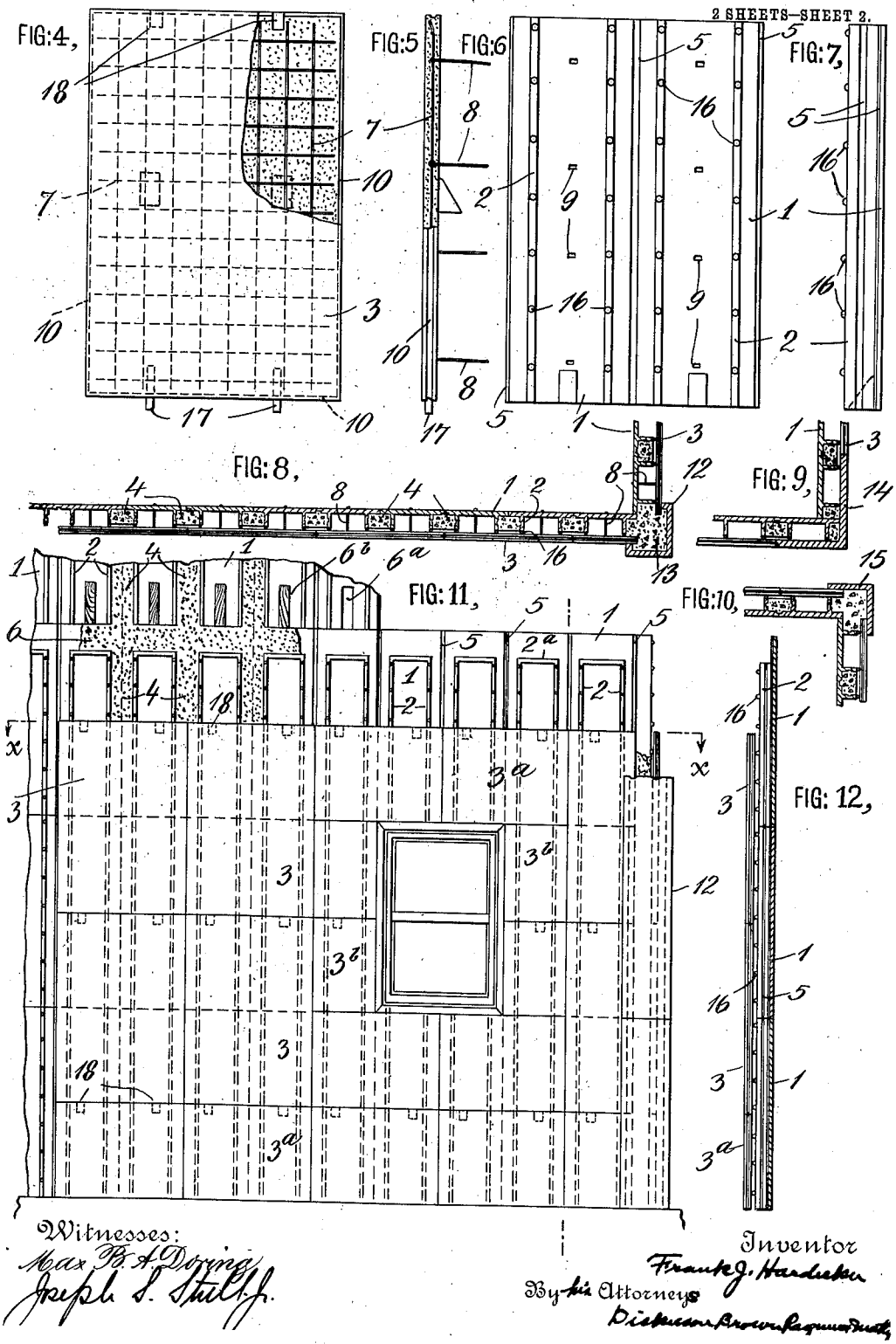

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UNITED STATES PATENT OFFICE.

FRANK J. HARDECKER, OF BROOKLYN, NEW YORK.

CONCRETE-WALL CONSTRUCTION.

1,006,478. Specification of Letters Patent. Patented Oct. 24, 1911.

Application filed May 28, 1910. Serial No. 563,874.

To all whom it may concern:

Be it known that I, FRANK J. HARDECKER, a citizen of the United States, and a resident of Brooklyn, county of Kings, and State of New York, have invented certain new and useful Improvements in Concrete-Wall Construction, of which the following is a specification.

My invention relates to the construction of double or hollow walls of slabs formed of concrete or other suitable material, and comprises an improved construction whereby hollow walls may be built up from stock sizes of relatively thin slabs of large area, the load to be carried by the wall being carried by piers formed in the wall at suitable intervals; the wall itself carrying merely its own weight.

The objects of my invention are to provide an improved construction for hollow walls, buildings and the like, such that walls may be erected rapidly from stock sizes of slabs and by unskilled labor; to provide adequate air circulation through the wall and so to avoid dampness; to provide for the carrying of load by means other than the wall itself; to permit the erection in whole or part of the inner layer of the double wall, to any extent desired, and the application of the outer layer of such wall subsequently, as desired; to guard against the destructive action of frost on the wall; to tie together adequately the inner and outer layers of the wall; to reduce to a minimum the conduction of heat through the wall; and to facilitate the application of various ornamental finishes to the wall.

I will now proceed to describe my invention with reference to the accompanying drawings illustrating one construction of wall embodying my invention, and will then point out the novel features in claims.

In said drawings: Figure 1 shows a perspective elevation and section of a portion of a wall embodying my invention; Fig. 2 is a perspective elevation of one of the outer slabs of such a wall; Fig. 3 is a perspective elevation of one of the inner slabs of such a wall; Fig. 4 is a side elevation and partial section of one of the outer slabs; and Fig. 5 is an end elevation and partial section of such slab; Fig. 6 is a front elevation of one of the inner slabs of the wall; Fig. 7 is an end elevation of such inner slab; Fig. 8 shows a horizontal section of the wall on the line x—x of Fig. 11, and illustrates one of various alternative corner constructions; Fig. 9 is a similar horizontal section illustrating another corner construction; and Fig. 10 is a further horizontal section illustrating a further alternative corner construction; Fig. 11 shows a side elevation of a wall in course of construction; and Fig. 12 a vertical section of such wall.

The improved wall herein described, is made up of inner and outer slabs of considerable size but which, as compared with ordinary brick and concrete block constructions, are relatively thin, such slabs being made preferably of concrete. These slabs are intended in themselves to carry merely their own weight and the weight of the corresponding slabs above them, and at intervals piers of concrete or other suitable material are provided in the interior space of the wall, which not only stiffen the wall itself, but serve to carry floor loads and the like such as building walls are ordinarily intended to carry. The construction of the inner slabs, *i. e.*, the slabs which form the inner layer of the wall, is such that they may be erected completely, if so desired, and thus the building entirely inclosed before the outer slabs are put on. These outer slabs may then be put on as convenience may dictate. In order that the inner slabs may have the stiffness necessary in order that they may be erected independently of the outer slabs, and in order that the wall as a whole when erected may in itself have great stiffness, the inner slabs are provided with outwardly projecting ribs or webs which, in the completed wall, extend to, or nearly to, the outer slabs. Suitable spacing means are provided between the inner and outer slabs whereby circulation throughout the interior of the wall may occur, such spacing means being, customarily, bosses formed on the edges of the said webs of the inner slabs. The said webs or ribs of the inner slabs so stiffen these slabs, that, ordinarily, other reinforcing of such slabs, (as by metal reinforcing included in the slabs) is unnecessary; but the outer slabs which, customarily, are not provided with webs, are customarily stiffened and strengthened by wire fabric or other suitable metallic reinforcing, included in these outer slabs and which, at the ends of

the slabs, preferably extends close to the outer edges, so reinforcing these slabs at the point where cracking, crumbling, or splitting, is otherwise most likely to occur. The inner and outer slabs are tied together by suitable metallic ties secured at their outer ends to the metallic reinforcing of the outer slabs, and which are passed through apertures formed in the inner slabs and are fastened on the inner sides of such inner slabs.

In the drawings, numerals 1 designate the said inner slabs and numerals 2 the outwardly projecting ribs or webs thereof; and numerals 3 designate the outer slabs. The spaces included between the said webs 2, are available for the reception of supporting piers of concrete or the like, and in the drawings I have indicated such piers 4 as at suitable intervals. It is not necessary, ordinarily, nor is it desirable, that all of the spaces between these webs be filled with concrete, as if such were the case the wall would be practically a solid concrete wall and would have much greater strength than is ordinarily required, and much greater weight than is ordinarily desired; consequently such piers are, customarily, provided at intervals only; for example, in alternate spaces between webs. The said webs give to the inner slabs 1 such stiffness and such breadth of base that the said slabs may be erected one upon another until a complete wall is formed, if desired, the outer slabs being applied subsequently when convenient. This permits an extremely rapid erection of walls to an extent sufficient to completely inclose a building and to permit the laying of the floors and other interior work to go on while the outer slabs are being erected; and it also avoids possible injury to the outer slabs while the heavy work in the erection of the building is going on, since these outer slabs may be applied at any time prior to the plastering of the walls inside. It is not intended that the inner slabs or the outer slabs should carry weight other than that of the similar slabs above them. Other weight, such as that of the floors and the load these floors carry, is carried by the concrete piers 4, such load being distributed to the piers 4 by means of horizontal beams 6, preferably of concrete, connecting the piers 4 just below the floor level; apertures 6^a being provided at intervals in those inner slabs 1 which are immediately above the beams 6, for the extension of the floor joists, 6^b, over these horizontal beams 6.

The inner slabs 1 and their webs 2, form adequate molds for the concrete piers 4, except for the outer sides of these piers, and in forming these piers, the pier spaces may be inclosed on the outer sides by a temporary closure, such as boards or the like, which can be removed after the pier has set. In order that these piers may be interlocked with the inner slabs, said inner slabs are provided with suitable grooves 5 which the concrete of the piers will fill, so interlocking the piers and inner layer of the wall together.

As shown particularly in Figs. 3 and 11, those inner tiles 1 which are opposite the horizontal beams 6, are provided with horizontal ribs 2^a forming, with the faces of such inner slabs, forms for the molding and supporting during molding and setting of these horizontal beams 6. These horizontal beams are therefore molded at substantially the same time, and in substantially the same way, as the piers 4, and since these horizontal beams 6 extend around the entire structure, the piers 4 and the horizontal beams 6 form in fact a substantially monolithic frame for the entire building, of great strength and stiffness. These horizontal beams furthermore add to the strength and stiffness of the concrete piers 4, since they reduce the unsupported vertical length of these piers and thereby reduce flexure stresses in such piers. Similar horizontal beams may be provided for spanning large window and door openings.

It will be understood in the art that, without invention, metallic or other reinforcement may be employed in the vertical columns 4, and horizontal beams 6.

Those slabs 1 which are provided with the horizontal ribs 2^a, are special in so far as they are provided with such webs; and the slabs 1 above them which are provided with the openings for the passage of the joists, are also special in a sense. However, these special slabs are readily molded in the ordinary molds and by means well known to those skilled in the art.

The outer slabs 3 referred to are thin slabs grooved on the sides and provided with molded-in metallic reinforcing 7 as indicated particularly in Figs. 4 and 5. As shown particularly in Fig. 5, the metallic reinforcing is carried close to the outer edges of these slabs so as to reinforce them at the point where they are the most subject to action tending to cause them to crack or crumble. They are provided with ties 8 by which they are secured to the inner slabs 1; these ties being, customarily, wires molded into the concrete of the slab at one end and wrapped around the metallic reinforcing of the slab at that end, the other end projecting and being adapted to be passed through openings 9 formed in the inner slab, and otherwise secured on the inner sides of these inner slabs, by pins 8^a passed through loops in threads of the ties, or otherwise, so firmly securing the inner and outer slabs together. The reinforcements 7 of these outer slabs give to said slabs strength and stability such that they may be handled readily in erection, and such as

will prevent opening of joints or development of cracks due to temperature changes, and also facilitate the attachment of the ties 8. In erecting these outer slabs, the grooves 10 in their sides are filled with grout or other suitable cement, and when this cement hardens the various outer slabs are all united so as to form substantially a single covering which excludes moisture and so protects the structure from the destructive action of frost. Preferably, the outer slabs 3 are given a suitable waterproofing coating, on the inner side, or outer side, or both, before erection. Such coating may be applied by painting or dipping. If the outer side only is water proofed, the coating may be applied after erection.

As shown particularly in Fig. 11 the inner and outer slabs are preferably so set relatively, that when practicable the joints between the outer slabs are broken with respect to the joints between the inner slabs. This may be accomplished readily by using in erection half size and quarter size slabs, in addition to full size slabs. The use of half size and quarter size slabs will also in most cases permit construction around door and window openings without resort to slabs of other special sizes. In Fig. 11 I have indicated full size slabs 3 as used in the construction of the main portion of the wall, half size slabs 3^a being used in the lower course, so that the horizontal joints between the outer slabs may be broken with respect to the horizontal joints between the inner slabs, and I have indicated quarter size slabs 3^b at the sides of a window opening 11.

It will be noted that the forms of the inner and outer slabs are such that they may be molded in simple molds of ordinary construction, and it will be understood by those skilled in the art that half size and quarter size slabs, also odd sizes, may be molded in the same molds used to form the full size slabs, by providing suitable dividers or separators in these molds.

It will also be understood by those skilled in the art, that the outer slabs, being molded flat, may have ornamental finishes applied to their outer surfaces, during molding or afterward, with much greater facility than is possible when the finish is to be applied to a wall already erected. It requires considerable skill to produce the so called "pebble dash" effect on a vertical wall, whereas such effect may be produced very easily and by an artisan of ordinary skill, working on a horizontal surface.

Various corner constructions are practicable. In Figs. 1 and 8 I have indicated one such corner construction, comprising an offset angle tile 12 embracing the gap between the outer end slabs of the wall, the space within this angle tile being filled with concrete 13. In Fig. 9 I have illustrated an alternative construction wherein an angle tile 14 is used which is set in line with the slabs 3. In Fig. 10 I have illustrated a construction similar to that of Fig. 8 except that the corner tile 15 herein used is not provided with end offsets so as to produce a prominent relief effect at the corners.

To insure free circulation of air through the interior of the wall, and also to reduce to a minimum contact between the inner and outer slabs, and so to reduce conduction of heat through the wall, the edges of the webs 2 of the inner slabs are provided with rounded bosses 16 against which only the outer slabs 3 rest. This provides a minimum contact surface between the slabs, and also provides free space for air circulation throughout the wall and even past the piers 4 and horizontal beams 6 thereof.

To insure adequate connection of the thin outer slabs 3 to one another, vertically, I provide these slabs with dowels 17 on one side, preferably the lower side, and provide dowel holes 18, on the opposite side, customarily the upper side, these dowel holes being of a size adapted to receive the dowel pins, and, preferably, being somewhat larger so as to provide latitude in connecting the slabs. These dowel holes will be filled with grout, around the pins, when the slabs are erected, thus binding the slabs closely together. The dowels may be, conveniently, short metal rods or pipes inserted when molding the slabs.

Owing to the provision made for free air circulation through the interior space of the wall, and to the water proofing of the outer slabs, the inner slabs will be dry, and so plaster may be directly applied to their inner surfaces, such inner surfaces being formed somewhat rough so that the plaster will cling thereto.

I am aware that various concrete block constructions have been proposed heretofore comprising inner and outer blocks provided with stiffening ribs or webs, air spaces being left between such blocks. There is a considerable practical difference, however, between such block constructions and the slab construction herein described, in that the blocks are customarily made with very much thicker walls than contemplated by many for these slabs, and are of very much less area. Without restricting myself to any definite dimensions for the slabs, I will say that one contemplated size is 5′ x 3′ with a thickness of about 1″ to 1½″ for the inner slabs and a thickness of about 1″ to 2″ for the outer slabs. Such slabs, made of ordinary concrete, will not be too heavy to be handled and set by two workmen of ordinary strength, without the use of derricks, and slabs as large as contemplated as above stated, will have very much less length of

joints, for any given wall area, than would a concrete block construction made up of blocks of ordinary sizes.

The slab construction above described, also lends itself well to the construction of other walls; for example, retaining walls, bridge piers, abutments, etc. One great advantage of this construction is that no special wooden forms are required in the field, the concrete slabs forming the facings for the wall, pier, abutment, etc., being molded in stock sizes, cured, dried, waterproofed if dried, and shipped to the point of use, erected at the designated spot (this may usually be done without false work) and the interspace filled with such filling as may be preferred. Since the slabs are prepared in advance, the perfect drying necessary for proper waterproofing, is insured.

It will of course be understood that, in some cases (as for example in industrial buildings, where appearance is no object) the outer sheathing formed by the slabs 3 may be omitted altogether. Or, other sheathing may be substituted for the slabs 3.

What I claim is:—

1. A wall construction comprising inner and outer walls, spaced apart, and each of sectional construction, there being an air space between the inner and outer walls, the sections of the inner wall comprising integrally formed stiffening webs projecting toward the outer wall and provided with spacing projections abutting against the inner surface of the outer wall, there being spaces between such spacing projections forming air circulation channels.

2. A wall construction comprising inner and outer walls, spaced apart, and each of sectional construction, there being an air space between the inner and outer walls, the sections of the inner wall comprising integrally formed stiffening webs projecting toward the outer wall and supporting piers located in the spaces between certain of said ribs and interlocked with the webs between which such piers are located.

3. A wall construction comprising in combination sections provided with vertical integrally formed stiffening ribs, the ribs of certain of said sections extending the full length of the sections, the ribs of other of said sections extending through less than the length of such sections, the section provided with such shorter ribs being provided also with horizontal ribs, piers in the spaces between certain of said vertical ribs, and horizontal beams in the spaces above such horizontal ribs and uniting said piers and forming therewith a skeleton frame.

4. A wall construction comprising in combination sections provided with vertical integrally formed stiffening ribs, the ribs of certain of said sections extending the full length of the sections, the ribs of other of said sections extending through less than the length of such sections, the section provided with such shorter ribs being provided also with horizontal ribs, piers in the spaces between certain of said vertical ribs, and horizontal beams in the spaces above such horizontal ribs and uniting said piers and forming therewith a skeleton frame, and floor beams supported on the ends of said horizontal beams.

5. A wall construction comprising in combination substantially parallel inner and outer walls, spaced apart, and both of sectional construction, the sections of one of said walls comprising on the side nearest the other wall integrally formed vertical stiffening ribs with spaces therebetween, certain of said sections also comprising horizontal ribs forming supports for horizontal beams, piers in certain of the spaces between said vertical ribs, and horizontal beams connecting said piers and resting upon the said horizontal webs.

6. A wall slab for use in building construction comprising a slab of concrete or like material, provided on one side with vertical integrally formed stiffening ribs, of a length less than that of said slab, and with horizontal integrally formed ribs connecting certain of said stiffening ribs.

7. A wall slab for outer building construction comprising a slab of concrete or like material, provided on one side with integrally formed stiffening ribs which are provided on their longitudinal edges with projecting bosses.

In testimony whereof I have signed this specification in the presence of two subscribing witnesses.

FRANK J. HARDECKER.

Witnesses:

H. M. MARBLE,

E. S. ROSS.