W. H. ROOK, JR.

STRUCTURAL BLOCK.

APPLICATION FILED DEC. 17, 1914.

1,291,160.

Patented Jan. 14, 1919.

2 SHEETS—SHEET 1.

Fig. 1.

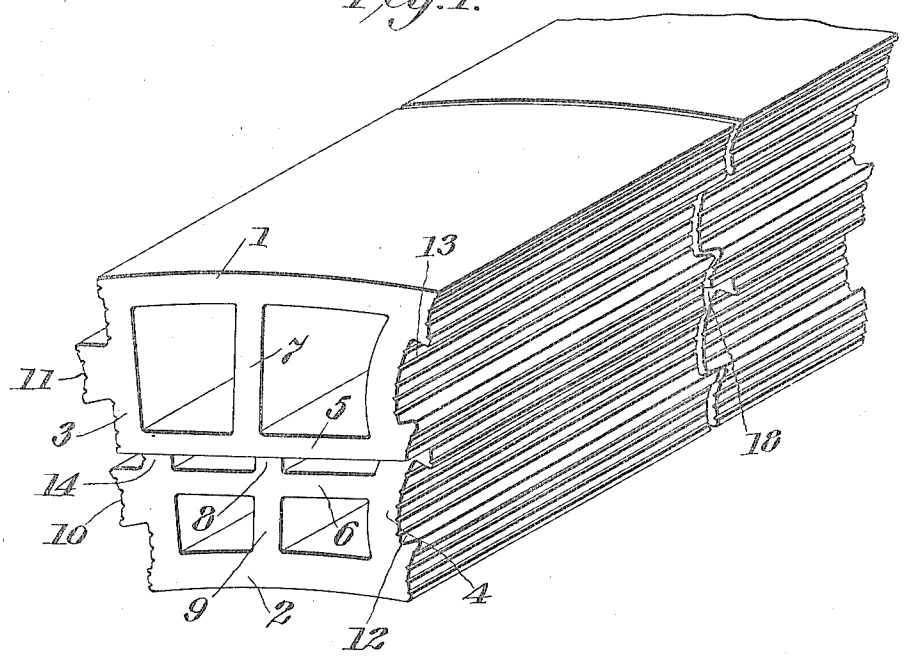
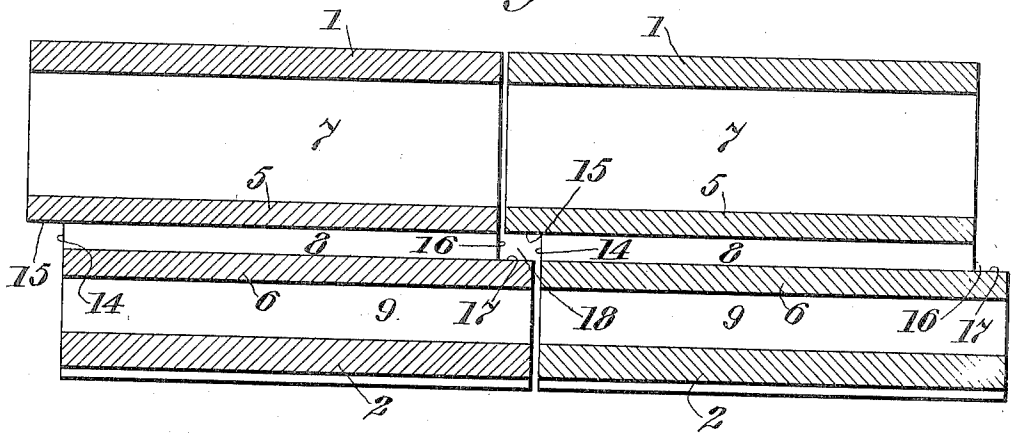


Fig. 2.



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2 SHEETS—SHEET 2.

Fig. 3.

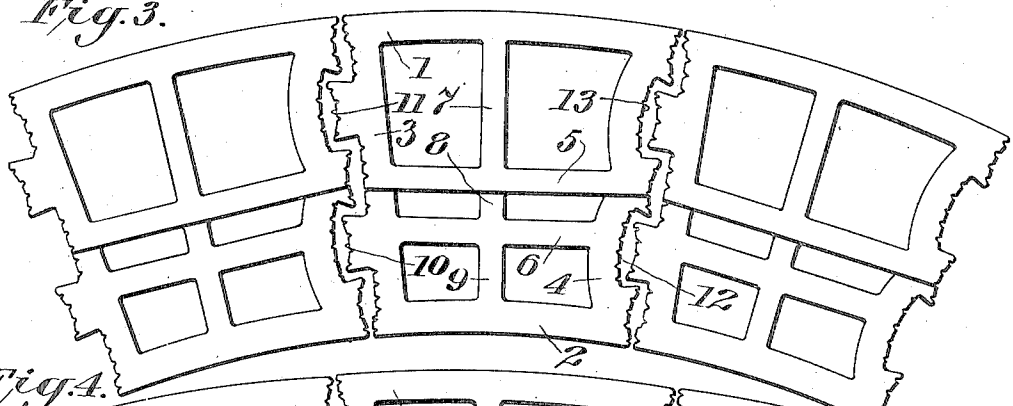


Fig. 4.

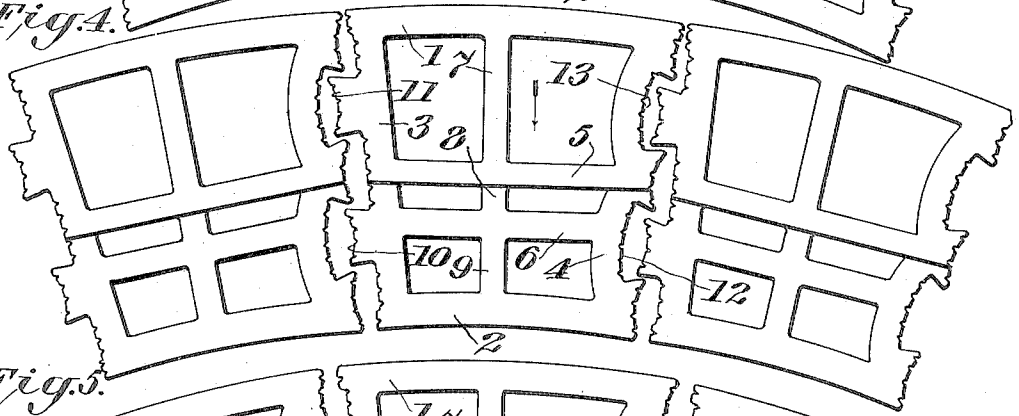


Fig. 5.

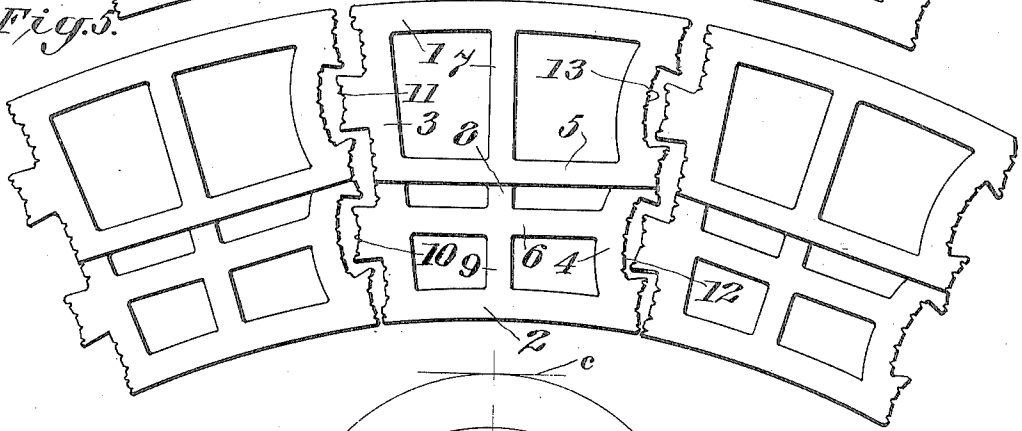
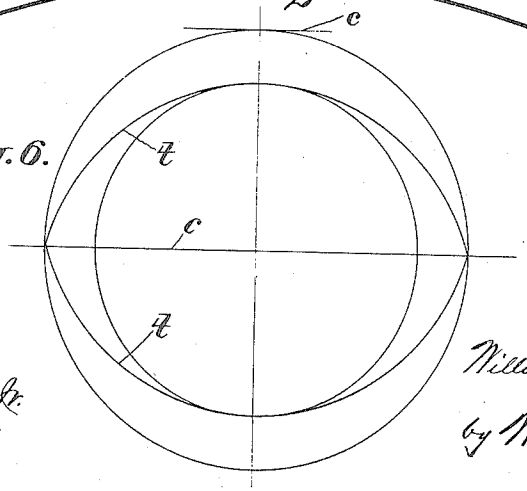


Fig. 6.



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UNITED STATES PATENT OFFICE.

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STRUCTURAL BLOCK.

1,291,160. Specification of Letters Patent. Patented Jan. 14, 1919.

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To all whom it may concern:

Be it known that I, WILLIAM H. ROOK, JR., a citizen of the United States, residing at Akron, in the county of Summit and State of Ohio, have invented a certain new and useful Improvement in Structural Blocks, of which the following is a full, clear, and exact description.

This invention relates to segmental, hollow blocks for use in the construction of sewers and other circular, curved or tubular structures; and the object of the invention is to provide a block so constructed as better to resist the tension and compression strains due to external and internal loads or pressures to which the structure is subjected or exposed, and which may be manufactured successfully and economically in accordance with present standards for producing clay products by expressing or exuding presses.

Blocks for building circular or tubular and other curved structures have been produced with interlocking or dovetail side joints, and while these are generally efficient, it is a demonstrated fact that they are not universally so under all conditions.

In the present invention the block is hollow, and preferably divided interiorly by transverse webs and perpendicular partitions into six cells to care for drainage, proper mortar distribution, and strength, and its sides are inclined on radial lines and the opposite sides provided with longitudinally extending pairs of tongues and complementary grooves alined with the tongues, so that the tongues of one block will enter the grooves of the next adjacent block to be engaged therewith by the interposed motar; the tongues and their complemental grooves being located near the inner and outer sides of the block at points where the tension and compression stresses occur. By disposing the two tongues and their complementary grooves upon opposite sides of the transverse center of the block, tension and compression resistance is most effectively obtained, and collapse or distortion by either external or internal pressure most effectively resisted, as I will proceed now to explain and finally claim.

While the block of this invention is capable of use in the erection of different sizes or diameters of structures, it is more especially useful in building large sewers, and similar tubular or curved structures, irrespective of depth of underground placement thereof.

In the accompanying drawings illustrating the invention, in the several figures of which like parts are similarly designated, Figure 1 is a perspective view of one of the blocks complete and a portion of another arranged end for end to illustrate the shiplap joint at the abutting ends of the blocks. Fig. 2 is a longitudinal section of two end-jointed blocks. Fig. 3 is an end elevation of part of an arch showing three blocks assembled side by side and in normal condition. Fig. 4 is an end elevation illustrating an arch deformed by external vertical pressure or load. Fig. 5 is an end elevation illustrating the effect of external vertical pressure on the blocks at the spring of the arch. Fig. 6 is a diagram illustrating the stress lines of compression and tension when the sewer is subjected to load.

The blocks may be produced efficiently and economically by standard machinery of the expressing press type now in common use, and their structural characteristics have been developed with this possibility in mind.

Without, however, limiting the invention to the illustrated form, I will proceed now to explain the invention by means of such form.

The parallel outer wall 1 and inner wall 2 are made upon concentric arcs; the side walls 3 and 4 which connect the outer and inner walls are in radial planes, and they are connected by a transverse web 5 arranged about midway between the outer and inner walls and a second and parallel transverse web 6 arranged between web 5 and the inner wall. The space between the web 5 and the outer wall is divided by a perpendicular partition 7, and this partition is extended at 8 and 9 between the two transverse webs 5 and 6 and the inner wall, so that the hollow block is divided into a number of cells, thus retaining the strength of the tube or hollow column with its relative lightness in weight, and reinforced in strength by a lattice effect of the intersecting webs and partitions; the cells themselves serving to take care of seepage and also affording distribution and locking cavities for the mortar used in the end joints.

One of the radial side walls of the block is

provided with the two parallel dovetail tongues 10 and 11, extending lengthwise of the block, the tongue 10 being arranged about opposite the end of the web 6 and the tongue 11 being arranged about midway between the tongue 10 and the outer wall. The opposite radial side wall is provided with complementary grooves 12 and 13 appropriately located to receive the tongues 10 and 11 of a similar block laid upon it side by side.

The side walls may be roughened by scoring or otherwise, as shown, in order to afford a firmer hold for the mortar used between the joints. These side walls also may be varied in contour on opposite sides, and as shown, the side walls 3 may be substantially straight while the side walls 4 may be curved at the bases of the grooves 12 and 13.

As will be understood, when laying the blocks in courses, mortar is spread along the grooved sides, and the tongues of the superposed block are entered into the mortar in the grooves and pressed home to a seat, sufficiently far at least to insure that the flaring edges of the tongues enter the grooves in such way that the tongues and grooves of adjacent blocks will be effectually interlocked.

One end of the block is cut away transversely from the inner wall 2 up to the bottom or under face of the web 5, while the opposite end is similarly cut away transversely from the outer wall 1 to the top or upper face of the web 6, so that one end of each block is undercut at 14, and provided with an overhanging projection 15, and its other end is uppercut at 16 and provided with a bottom projection 17, with the result that when the unlike ends of adjacent blocks are alined, a ship-lap joint, so-called, is formed, as shown in Figs. 1 and 2, and a transverse space 18 is left between the projections 15 and 17 of adjacent blocks in which the mortar is supported and displaced into the cells between the webs 5 and 6, thereby forming a locking joint between the blocks.

When a structure, say a sewer, is built of hollow structural blocks of the character hereinabove described, the usual procedure is followed, beginning with the invert at the flow line of the sewer, and then building up course by course to complete the invert and arch in such way that the blocks break joint longitudinally.

Referring now to Figs. 3, 4, 5 and 6, it is to be noted that Fig. 3 shows a portion of the arch of a sewer normally laid and in normal condition; but it sometimes happens through accident or faulty construction, or excessive load or other conditions, that the arch of the structure drops or collapses in a vertical line, and in so doing obviously the sewer is sprung or bulged at the spring line, due to the strains of compression and tension exerted throughout the several blocks. If there is nothing to retard the collapsing of the arch, then the structure is apt to be completely destroyed. By the use of the two tongues and complemental grooves as a connecting medium for the several blocks constituting the sewer, it will be observed, upon reference to Fig. 4, that when excess pressure or load is applied in the direction of the arrow, the tendency is for the joints to separate at the inside, and this separation may extend so far that the innermost tongues would entirely withdraw from their grooves. If, now, there were only one tongue and groove to resist the strain of the load and be dislodged thereby, it is obvious that the keystone block might readily be displaced and thus permit the utter collapse of the structure, but by the use of two tongues, the separation of the lower one would be resisted and compensated for by the upper one, the upper one serving as an additional lock at or near the fulcral point of the blocks where the leverage is decreased and practically locking the blocks against separation and thus avoiding collapse of the sewer. Upon a deflection of the arch as indicated in Fig. 4, and pust described, of course the effect is transmitted to the spring line, and this effect is indicated in Fig. 5, if it be supposed that Fig. 5 represents the spring or skew-back sections instead of the arch. The collapsing of the arch as above described would effect an opening of the skew-back sections or spring blocks from the exterior, and in the same way the innermost tongues and grooves would effectively resist the displacement of the outermost tongues and grooves and serve as an additional lock at or near the fulcral point between the adjacent blocks should the outermost tongues and grooves be dislodged and thus prevent the utter collapse of the structure.

As already indicated, the block is designed for circular or curved work, and the addition of the extra tongue and groove is designed to place the tongues and grooves at points where the greatest tension and compression stresses are applied. In circular or curved work the load is imposed from above, and of course this load is increased in proportion to the depth underground of the sewer or other work. The pressure, therefore, on top of a sewer is in most cases very severe. It is equal, however, over the surface or top of the arch, but the maximum must be carried by the sections of the wall at the spring line; that is to say, a line drawn horizontally through the center of the sewer. Inasmuch as the support for the arch is on each side of the sewer, and the load is on the arch and some distance from this support, any tendency to collapse

or sink begins at the keystone or center of the arch. But before there can be any collapse it is necessary to open the arch as already described, using the outside thereof as a fulcrum. The point where the arch is opened on the inside is subjected to a tension stress and this stress may be represented by the lines *t* with the lines *c* as the compression lines. When the tension stress reaches the spring line, the tension in the sewer, when loaded, is transferred from the inside to the outside, as indicated by the line *t*. By the placing of the tongue and groove on each side of the center of the section or block, I in effect add a tension resisting appliance, which automatically resists distortion by reason of its location and conformation.

What I claim is:—

1. A tubular structure, composed of a series of hollow segmental blocks, each of said blocks having radially disposed longitudinal sides, a pair of dovetail tongues projecting from one radial side and a complemental pair of dovetail grooves in its opposite radial side, the said tongues and grooves being arranged upon opposite sides of the transverse center of the block so as to obtain effectively tension and compression resistance, the grooves being adapted to receive and engage with the tongues of a similar block laid alongside it so that upon completion of the tubular structure any externally or internally applied forces tending to open the joints between the radial sides of the blocks would tend to transfer the resistance from one to the other of the tongues and grooves and thereby prevent the collapse of the structure.

2. The combination of a series of segmental structural blocks, arranged side by side to form a sewer or other tube, each of the blocks having its ends adapted to interlap with the ends of adjacent similar blocks and having opposite longitudinal radial sides, one of its radial sides provided with a pair of parallel laterally projecting dovetail tongues and its other radial side provided with a pair of complemental dovetail grooves adapted to receive the dovetail tongues on an adjacent block, the joints between the blocks being closed by mortar or equivalent cementitious matter, and the tongues and grooves arranged on opposite sides of the transverse centers of the blocks, so that when the sewer or other tubular structure is subjected to externally or internally applied forces tending to open the joints between the radial sides of the blocks the strain will be transferred from the inner to the outer pairs of tongues and grooves or vice versa, respectively, without detrimentally opening the joints.

In testimony whereof I have hereunto set my hand this 15th day of December, A. D. 1914.

WILLIAM H. ROOK, Jr.

Witnesses:
A. S. McComber,
H. E. Haas.