To all whom it may concern:

Be it known that I, CORNELIUS G. HASTINGS, a citizen of the United States, and a resident of the city of Glendale, in the county of Los Angeles and State of California, have invented certain new and useful Improvements in Blocks and Interlocking Means Therefor; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, and to the numerals of reference marked thereon, which form a part of this specification.

This invention relates to a building block constructed preferably of reinforced concrete having associated therewith reinforcing members which protrude through the walls of the block in spaces provided therefor to receive interlocking means to engage similar blocks assembled with one another in a built up relation or practically all sides thereof.

It is an object therefore of this invention to construct a reinforced concrete building block with certain of the reinforcement members protruding through the surface of the block to register with similar members of other blocks permitting a number of blocks laid in built up relation to be securely interlocked with one another, and in a manner to permit a filling of concrete, cement or the like to be poured or blown into the spaces around the interlocking means of the blocks to afford substantially a unitary structure.

It is also an object of this invention to construct a reinforced concrete block provided with means projecting through the side walls and ends thereof for registration with similar means on other blocks laid in a built-up arrangement adjacent thereto to interlock the blocks one to another by the engagement of auxiliary means therewith.

It is furthermore an object of this invention to provide a building block particularly adapted for use in tunnel construction wherein a circular, elliptical or other shaped bore is to be lined by a retaining wall capable of withstanding great stresses, the blocks provided with devices for interlocking the same one to another at the ends and sides thereof for the purpose, to thereafter receive a filling of cement or concrete blown therearound and bonding thereto to form substantially a unitary or monolithic structure.

It is finally an object of this invention to provide a building block adapted for use particularly in tunnel constructions wherein reinforcement members molded within the block building blocks protrude through certain surfaces of the blocks for registration with similar members of other blocks built up adjacent thereto to receive locking means engaged therethrough to positively lock the respective blocks one to another.

The invention (in a preferred form) is illustrated in the drawings and hereinafter more fully described.

In the drawings:

Figure 1 is a conventional side elevation of one form of block embodying the principles of my invention.

Fig. 2 is a bottom plan view thereof.

Fig. 3 is a view of the end of the block.

Fig. 4 is a bottom plan view of the skeleton frame or reinforcement around which the concrete of which the block is formed, is molded.

Fig. 5 is a detail section taken on line 5—5 of Fig. 1, with parts omitted.

Fig. 6 is a side elevation of the skeleton frame.

Fig. 7 is a section taken on line 7—7 of Fig. 6.

Fig. 8 is a detail section with parts omitted, taken on line 8—8 of Fig. 6.

Fig. 9 is a fragmentary exterior plan view of a tunnel wall built of blocks constructed according to the principles of my invention.

Fig. 10 is a fragmentary end elevation thereof with parts shown in section and parts omitted.

Fig. 11 is a sectional view taken on line 11—11 of Fig. 9.

Fig. 12 is a longitudinal section taken through a modified form of device, showing parts in elevation.

Fig. 13 is a view of the end of a modified form of block.

Fig. 14 is a detail section on line 14—14 of Fig. 12, with parts in elevation.
Fig. 15 is a section through a number of assembled blocks of a tunnel wall, the section being similar to that shown in Fig. 14.

Fig. 16 is a fragmentary end elevation of a portion of a tunnel wall constructed of blocks of modified form.

Fig. 17 is a side elevation of the skeleton reinforcing frame of one of the blocks.

Fig. 18 is a detail section taken on line 18-18 of Fig. 16, with parts omitted and parts shown in section.

Fig. 19 is a fragmentary plan view at the junction of two blocks of the wall, with the joint shown in section.

As shown in the drawings:

Referring first to Figs. 1 to 11 inclusive, the block as a whole, and the material, such as concrete, cement or the like, of which it is composed, is denoted by the reference numeral 1, and has molded therewithin a metallic skeleton frame consisting of three flat arched bars. The side or outer bars are denoted by the reference numerals 2 and 3, and the intermediate or midbar by the reference numeral 3, the ends of said respective bars being bent downwardly or inwardly, substantially on a radius of the curvature of said bars. The pointed turned ends of said respective bars 2 and 3, are apertured, and extending through each thereof longitudinally of the bars, is a set of three arched rods, those of the outer bars 2, denoted by the reference numerals 4, 5, and 6, and those of the inner bar 3, denoted by the reference numerals 7.

As clearly shown in Fig. 6, the eyes formed on the ends of said respective rods 4 and 6, project through the ends of the blocks 1, into semicylindrical recesses provided in the ends of said blocks, so that when the blocks abut one another, a cylindrical recess is afforded.

As clearly shown in Fig. 6, the eyes formed on the ends of said respective rods 4 and 6, at one end of the block are slightly offset, so that the respective eyes on the ends of abutting blocks register with one another and may receive a connecting pin 8, therethrough. A plurality of clips 8 are provided, which, as clearly shown in Figs. 4, 6, and 7, consist of bars with the ends hooked or curved to engage the respective rods 4 and 6, and each with an inwardly struck hooked or curved central portion to engage and surround the respective rods 5, of said skeleton bars 2, insuring proper spacing of the same, and further acting to reinforce the concrete block 1, as a whole. Extending transversely across the block 1, as clearly shown in Fig. 7, beneath one of the rods 4, and beneath a rod 7, and offset to extend above the other of the rods 4, and likewise extended under the rods 6, and over another of the rods 7, are attaching straps or bars 10, the ends of which project through the side walls of the block into radially disposed semi-cylindrical recesses provided therein and are provided with apertures to register with the apertured ends of similar members of a block laid adjacent thereto to permit insertion of a locking pin or rod 11, therethrough. As clearly shown in Fig. 6, the central portion of each of the respective bars 2 and 3, is struck inwardly, and attached to each thereof is a radially directed bar 12, which is apertured to receive the respective rods 4, 5, 6, and 7, therethrough, assisting in spacing the same properly within the block, and acting further as a reinforcement member for the block. As shown in Fig. 2, a groove 18, is provided in the inner or under surface of the block 1, and this is to facilitate use of mechanisms utilized for placing the block in position.

In the modified form of device illustrated in Figs. 12 to 15 inclusive, I provide three arched bars 14, and 15, respectively, of which the bars 14, are disposed on either side of the bar 15. Extending through apertures provided in the inwardly turned radially directed ends of said bars 14 and 15, are curved rods 16, 17, 18, and 19, respectively, and the concrete or cement, denoted by the reference numeral 20, is molded about the turned ends of said bars, and the curved rods 17, 18, and two lowermost rods 19, of the middle bar 15, thus leaving the uppermost curved rods 16, of the side bars 14, and the topmost rod 19, of the intermediate bar 15, disposed above the outer curved surface of the concrete.

Spacing and reinforcing clips or straps are provided, the ends of which are curved to engage around the uppermost bars 16, and the lowermost bars 18, and the central portion of which is struck inwardly to engage around the intermediate rods 17, of said side bars 14, said straps or clips, of course, extending beyond the top surface of the block and having apertures therethrough to receive transverse connecting and reinforcing rods 22, therethrough, as shown in Figs. 13 and 14. As in the construction previously described, radially disposed bars 23, are provided, embedded in the concrete block and apertured to receive the curved rods 17, 18, and 19, therethrough with the upper end of said bars 23, projecting beyond the outer surface of the block and suitably connected to a indented portion of the bars 14 and 15, respectively. The ends of the bars 17 and 18, project through the end surfaces of the concrete block into semi-cylindrical grooves formed therein, and are bent around to form attaching eyes, with the eyes at one end of the block at a different height than those at the other end of the block, thus permitting the eyes of respective blocks to register when the blocks are laid in built up relation, and to receive locking pins or rods 24, therethrough.

As shown in the sectional detail illus.
In the modified form illustrated in Figs. 16 to 19 inclusive, Fig. 17 illustrates a metallic skeleton frame for one block embracing three arched bars 25 and 26, respectively, with the bar 26, interposed between the bars 25, and with each of the ends of said respective bars bent radially of the block as already described in the prior constructions.

20 Curved reinforcement rods 27, 28, 29, and 30 are provided extending through apertures in the turned ends of said respective bars 25 and 26, of which the ends of the bars 27 and 29, are extended and offset, and turned over to afford an eye through which horizontally directed rods 31, may engage, thus linking a series of rows of said blocks one to another.

The concrete molded around the skeleton frame to form a block is denoted by the reference numeral 32, and after the blocks have been laid in built up relation with the connecting rods 31, inserted in place, a filling of concrete 33, is provided around said rods 31, and projecting eyes of the rods 27 and 29, as clearly shown in Fig. 19. As clearly shown, the cross section of the block illustrated in the latter modification is slightly different from that of the preceding blocks, in that a right angled recess 34, is provided along one side and end of the block, and a projecting ledge or shoulder 35, is provided along the other side and end thereof, so that when the blocks are laid one against another said shoulder 35, of one block interfits the recess 34, of the block next adjacent. As in the prior construction described, bracing or retaining straps or clips 36, are provided, engaged upon the respective rods 27, 28, and 29, within the concrete forming the blocks, as well as spacing or retaining bars 37, mounted centrally of the block.

Transversely extending plates 38, are also provided, apertured at their ends and with their ends projecting into the side walls of the blocks into semi-cylindrical radially disposed recesses 39, provided therefor, whereby said apertured ends of adjacent blocks register and are adapted to receive a retaining rod or pin therethrough.

The operation is as follows:

Due to the peculiar manner in which this block is constructed, that is, whereby the same is provided with attaching eyes, both at its ends and at its sides, it is possible to interlock the respective blocks constituting a row one to another at the ends of the blocks, and as well connect the respective rows by means of rods or pins inserted through the attaching eyes provided for the purpose on the blocks. Therefore, after a quantity of concrete is blown inwardly around the outer surface of the tunnel between the same and the projected bore through the ground, completely covering and bonding around the projecting metallic portions and affording substantially a unitary structure.

In the modified form illustrated in Figs. 16 to 19 inclusive, a part of the interior reinforcement or metal work of the block is extended beyond the outer surface thereof, so that when the blocks are assembled in built up relation the concrete blown around the built up blocks between the outer surface thereof and the walls of the projected bore, bonds around the projecting metallic members, thus affording a reinforced substantially unitary shell serving to insure positive retention of the blocks in position, as well as maintaining a seal at the joints of the blocks.

In the form of block illustrated in Figs. 16 to 19 inclusive, in place of using radially disposed retaining pins or rods for locking the blocks one to another at their ends, I have constructed the blocks with the projecting eyes at the ends adapted to receive horizontally directed connecting rods, so that the blocks of a number of different rows may be thus connected one to another. Furthermore each of the blocks is provided with transverse apertures at its middle portion, so that the rods connecting the ends of one row of blocks may project through the interior of the blocks of the row next adjacent wherein the blocks of said second mentioned row are staggered with respect to the blocks of the first mentioned row.

I am aware that various details of construction may be varied through a wide range without departing from the principles of this invention, and I therefore do not purport limiting the patent granted otherwise than necessitated by the prior art.

I claim as my invention:

1. In a building block of the class described, reinforcement bars and rods connected together, a molding of concrete therearound with portions of said reinforcement rods projecting beyond the ends thereof, reinforcement bars offset for opposite ends engaging above and below said ends of said reinforcement members with the ends thereof projecting beyond the sides of said block, and connecting members adapted to interlock the block with similar blocks laid one against the other by engagement with said projecting portions of said rods and bars.

2. In a building block of the class described, reinforcement bars and rods connected together, a molding of concrete therearound with portions of said reinforcement rods projecting beyond the ends thereof, reinforcement bars offset for opposite ends engaging above and below said ends of said reinforcement members with the ends thereof projecting beyond the sides of said block, and connecting members adapted to interlock the block with similar blocks laid one against the other by engagement with said projecting portions of said rods and bars.
scribed, a reinforcement frame therein, certain members projecting beyond the ends of said block, eyes formed on the projecting ends of said members, and the respective ends of said members offset with respect to one another to permit registration with corresponding ends of similar blocks laid in built up relation, laterally disposed bars within said block, each bent downwardly near its center to permit the same to engage and below certain of said members with the respective ends of each of said bars projecting through the side walls of said block in offset relation to register with the corresponding ends of similar blocks, and interlocking means for engagement through said eyes and through the registering ends of said bars to lock said blocks in built up relation.

3. In a concrete building block, a reinforcement frame therein comprising arched bars, the ends thereof turned inwardly, curved rods engaged through the ends of said bars and disposed within the block with the ends of certain of said rods projecting beyond the ends of said blocks, eyes formed on the ends of said rods projecting through the ends of the blocks, and means for engagement through said eyes to lock a series of blocks one to another laid in built up relation.

4. A concrete block of the class described comprising a reinforcement frame molded therein, a plurality of rods forming a part of said frame, arched means bonded within said block through the ends of which said rods extend to maintain the same properly spaced in said block and to further reinforce said block, certain of said rods extending through the end surfaces of said block, eyes formed on the ends of said rods projecting through said block, hooked spacing members engaging said rods and acting to reinforce said block, and means for engagement through said eyes to attach the same to a block of similar construction laid in built up relation with said first mentioned block.

5. In a concrete building block of the class described, a reinforcement frame therein comprising bars, rods engaged through the ends of said bars, certain ones of said rods projecting through the ends of said block, eyes formed on the ends of said rods projecting through the ends of the block, means formed to engage said rods to space the same one from another, and also acting to reinforce said block, and members for engagement through said eyes to lock a series of blocks in built up relation.

6. In a concrete building block of the class described, a reinforcement frame therein comprising inwardly bent arched bars, rods engaged through said bars with the ends of certain of said rods projecting beyond the ends of said block, eyes formed on the ends of said projecting rods, clips within said block engaging said rods to hold the same in spaced relation, apertured straps extending transversely through said block and projecting beyond the side walls thereof, and means for engagement through said eyes and apertures to lock a number of blocks one to another laid in built up relation.

7. In a concrete block of the class described, a plurality of longitudinally disposed members therein, a plurality of transversely disposed means in said block, hooked members engaging certain of said longitudinal members to hold the same in spaced relation, and means for engagement said transversely disposed means and certain of said longitudinally disposed members to lock said block with a series of similar blocks laid in built up relation to one another.

8. In a concrete block of the class described, a plurality of members therein to form a reinforcing framework, offset reinforcing bars within said block extending above and below certain of said members, and clips provided with hooked ends and intermediate hooks for engaging certain of said members to hold the same in spaced relation and also acting to reinforce said block.

In testimony whereof I have hereunto subscribed my name in the presence of two subscribing witnesses.

CORNELIUS G. HASTINGS.

Witnesses:
CHARLES W. HILLS, JR.,
EARL M. HARDINE.