

F. A. BONE.
RETAINING WALL.
APPLICATION FILED DEC. 22, 1909.

975,381.

Patented Nov. 8, 1910.

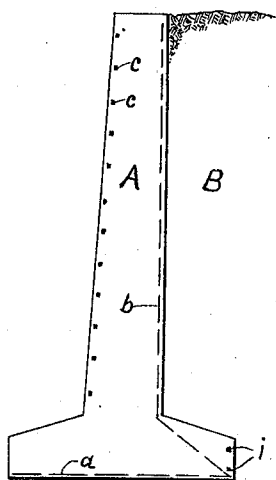
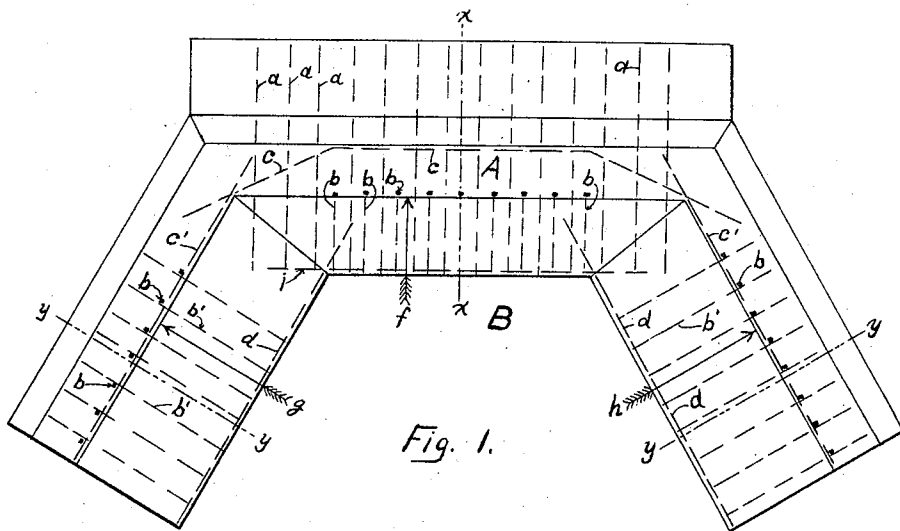


Fig. 2.

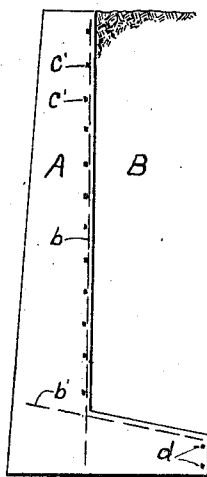


Fig. 3.

WITNESSES:

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FRANK A. BONE, OF CINCINNATI, OHIO.

RETAINING-WALL.

975,381.

Specification of Letters Patent.

Patented Nov. 8, 1910.

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To all whom it may concern:

Be it known that I, FRANK A. BONE, a citizen of the United States, residing at Cincinnati, in the county of Hamilton and State of Ohio, have invented new and useful Improvements in the Construction of Retaining-Walls, of which the following is a specification.

My invention relates to reinforced concrete retaining walls such as are used in abutments for a girder or truss bridge, in which said walls are required to support the ends of the bridge and also retain the earth for the roadway approach to the bridge.

The invention consists in making the wing walls at an angle with the face wall in connection with the introduction of metal rods or bars in a novel manner to reinforce the wall at the points where parts of the wall act in tension, to prevent said wall from overturning, bulging or sliding on its base, thus enabling me to construct wall of light section that will be stable in all points.

The construction is shown in the accompanying drawings, in which—

Figure 1 represents a plan of an abutment. Fig. 2 represents a section of abutment wall on the line *x, x*. Fig. 3 represents a section of the wing wall on the line *y, y*.

In the drawings similar letters refer to corresponding parts throughout the several views.

A is the body of the wall and B the retained material.

a a are bars to reinforce the cantaliver beams which constitute the heel and toe of the base against the reaction of the earth caused by the weight of the wall and retained earth.

b b are bars in the back part of the vertical portion of the wall continuing down into the heel and are to reinforce the vertical part of the wall against outward pressure of the earth and the heel against downward pressure of earth whenever the heel has a tendency to rise from any cause. Where the heel is long, as in Fig. 3 the bar *b'* is placed across *b* and continued into the heel answering the same purpose as if *b* were turned into the heel as mentioned above.

A retaining wall with a cross section in shape of an inverted T or an L and reinforced as described with the bars *b b* and *b' b'* may be perfectly safe as to overturning and bulging and yet be liable to slide for-

ward on its base because the weight of the wall and earth on the heel may not be enough to cause sufficient friction on the foundation.

This invention is largely to provide against the tendency of the wall as a whole to slide forward, although it also affords means to prevent overturning and bulging and is accomplished as follows. The wing walls are made to run back from the face at an angle with said face and a series of longitudinal reinforcing metal bars are placed in the wall being located near the front surface of the face wall in the central part of said face and passing to the back corners so as to follow the line of tensile stress in said wall as near as practical. This series of rods *c c* is either bent to continue along the back surface of the wings or another series of rods *c' c'* is placed as is shown in the drawing to continue the reinforcing in the tension area of the wing and answer the same purpose as if the rods *c c* were bent at the angle and passed into the wings as continuous rods.

The rods *d d* placed in the rear of the heel act to anchor said heel and wing to the face and also to reinforce the wing as a cantaliver where the metal does the greatest possible good.

The rods *i i* tie the two wings together through the heel of the face wall. This arrangement of rods in an abutment of this shaped plan prevents the face wall from sliding forward as it is anchored to the wings which have but slight tendency to slide in the same direction as the face of the wall. It also prevents the wings from sliding forward at right angles to their respective faces as each is anchored to the face wall and one wing has a tendency to slide in one direction while the other tends in another, they therefore operate to counteract each other in this matter to a large degree.

For internal stresses the face wall is considered a continuous beam fixed at both ends with the load acting in the direction of the arrow *f*, while the wings may be considered as cantaliver beams with the loads acting in the direction of the arrows *g* and *h*.

It is obvious that the rods *c, c'* and *d* not only act to anchor the face wall to the wings but also act to reinforce the beam action of the parts in which they are located at the points where most efficient.

The rods *b b* usually need only to be used near the center of the face wall and near the

outer ends of the wings and in a short face or wing may in some cases be dispensed with altogether. That is the longitudinal rods are sufficient for a limited distance from the
 5 angles in the wall for resisting all the internal stress in the wall that it may be subjected to from the outward pressure of the retained material.

It will be noted that the weight of the
 10 earth resting on the heel presses it against the earth below and thus creates friction thereon. This friction is transmitted from the heel to the wall by the rods *a* and the lower ends of the rods *b* and *b'* and from the
 15 wings to the face by the longitudinal rods *c'* and *d* or from the face to the wings as the case may be.

Having thus described my invention what I claim as new and wish to secure by Letters Patent, is—

1. In an abutment having wing walls at an angle to the face wall a series of longitudinal metal bars embedded within said walls being located near the front surface of
 25 the face wall, in its central portion and passing to near the rear surface of the wing walls thereby anchoring said walls together and at the same time reinforcing them at the points where tension occurs from the beam action
 30 required to support the retained material.

2. The combination with an abutment having wing walls at an angle with the face wall, a series of longitudinal metal bars located near the front surface of the face wall
 35 in its central portion and passing to near the rear surface of the wing walls and acting to prevent the outward force of the retained material from overturning, or sliding said abutment on its base.

40 3. In an abutment having wing walls at

an angle with the face wall the combination of a series of longitudinal metal bars near the front of the face wall and passing to the rear of the wing walls, with a series of vertical metal bars located in the back part of
 45 the walls and continuing down and back into the heel, all acting together to maintain the abutment in a vertical and stable position, substantially as described.

4. An abutment having wing walls at an
 50 angle with the face wall in combination with the longitudinal bars *c c'*, the vertical bars *b* and the transverse bars *a* all embedded within said abutment substantially as shown and for the purposes set forth.

5. In a wing wall for retaining material a series of longitudinal reinforcing bars located in the back part of said wing wall and extending well into the abutment or main
 60 wall and thus acting both to anchor said wing to the abutment and also to reinforce the cantaliver beam action of the wing in supporting the retained material.

6. In an abutment having wing walls at an angle with the face wall and having a
 65 heel extending to the rear upon which the retained material rests, a series of transverse bars embedded in said heel and extending into the wall in combination with a series of longitudinal bars embedded in the face of
 70 the abutment and continuing into the wings all working together to maintain a stable abutment.

Signed by me at Cincinnati, Ohio, this 18th day of December 1909.

FRANK A. BONE.

Witnesses:

W. H. RUCKER,
 DORA MAY REED.