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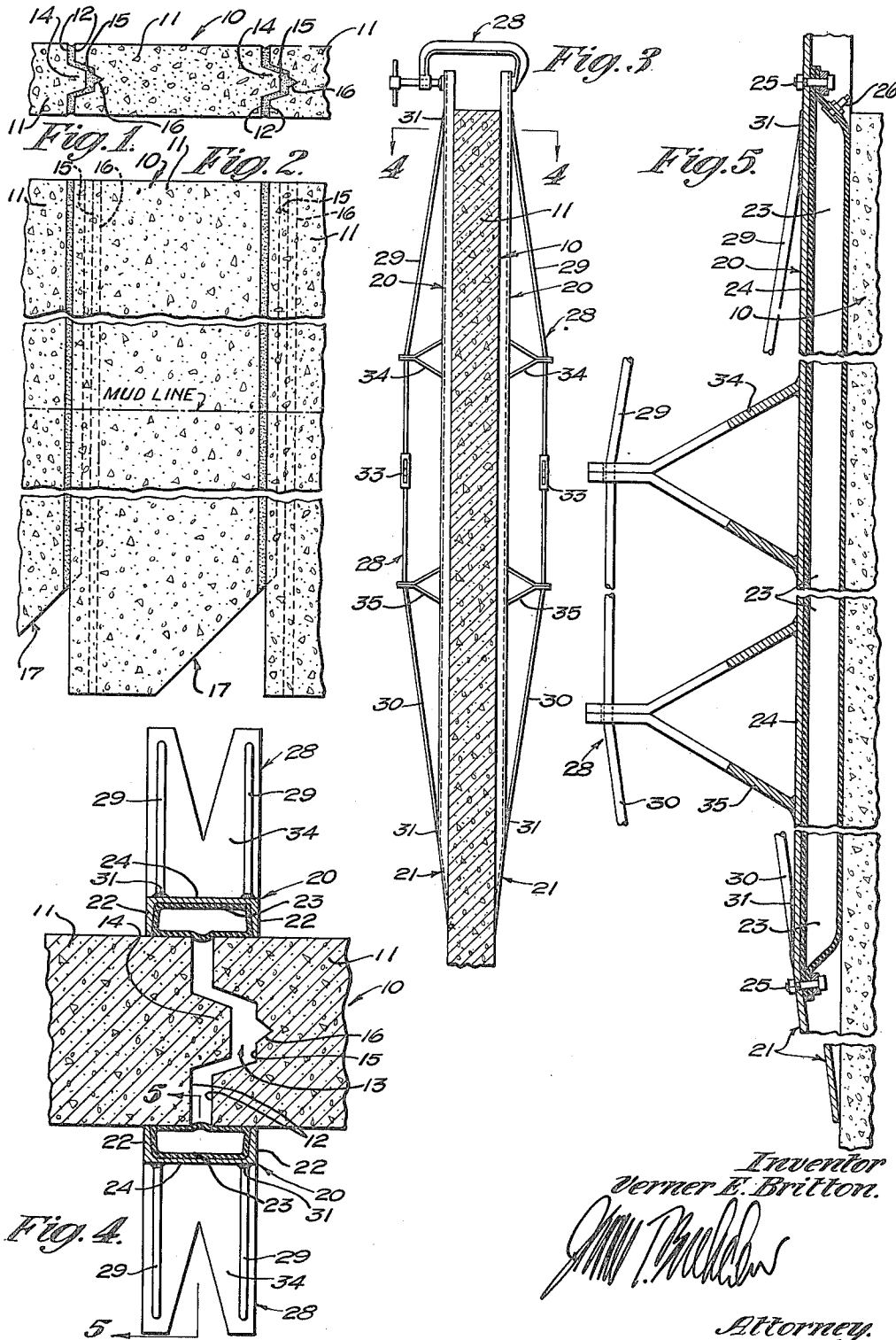
V. E. BRITTON

2,239,989

SEALING MEANS FOR USE IN GROUTING VERTICAL SEAMS IN SEA WALLS OR THE LIKE

Filed May 27, 1939

2 Sheets-Sheet 1



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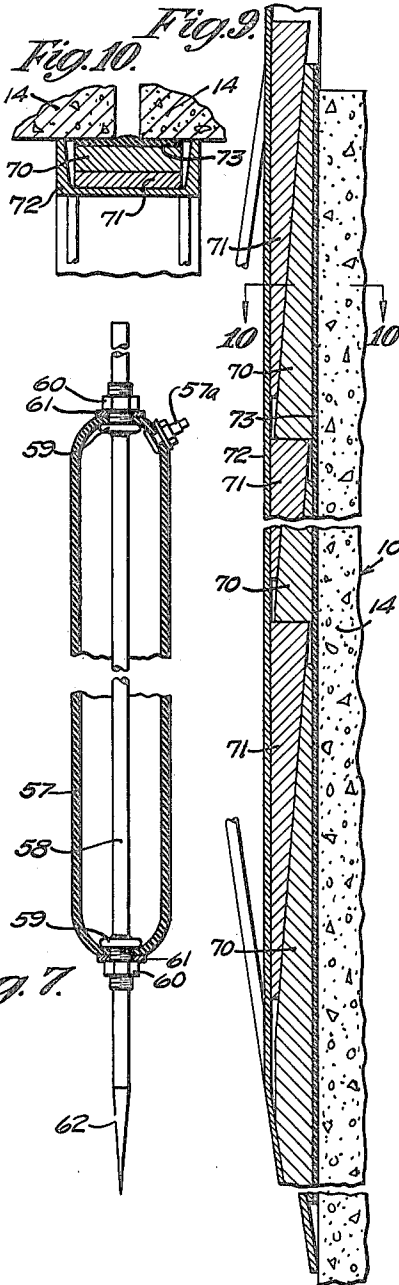
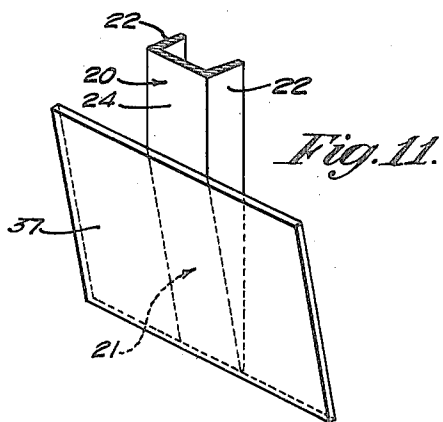
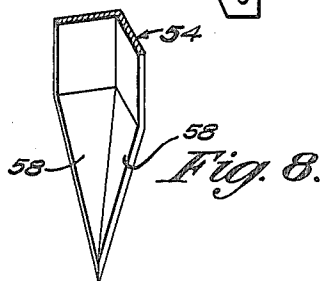
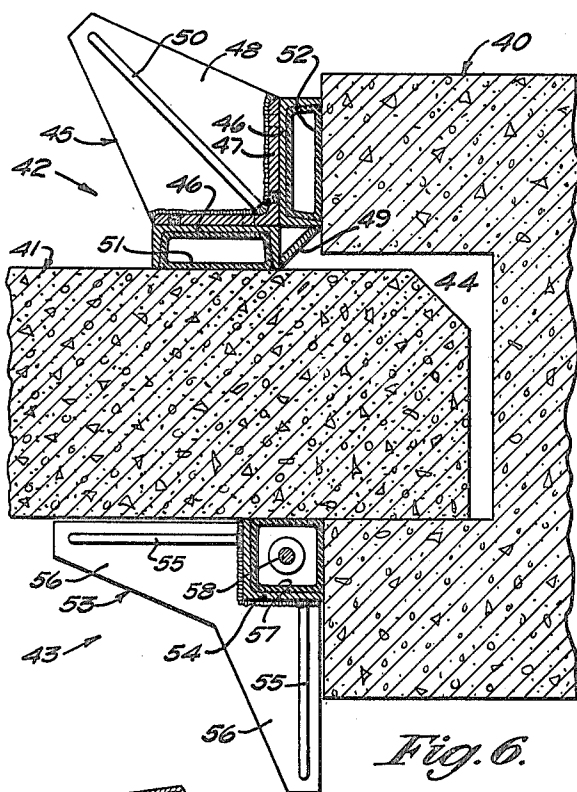
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2 Sheets-Sheet 2



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UNITED STATES PATENT OFFICE

2,239,989

SEALING MEANS FOR USE IN GROUTING
VERTICAL SEAMS IN SEA WALLS OR THE
LIKE

Verner E. Britton, Newport Beach, Calif.

Application May 27, 1939, Serial No. 276,175

8 Claims. (Cl. 25—118)

This invention has to do with the grouting of seams between the componental sections of such structures as submerged composite concrete structures, such as sea walls, breakwaters, dams, bridges, or the like, and relates particularly to means for sealing-off the grouting spaces between said sections for the purpose of cleaning those spaces prior to grouting, preventing the ingress of foreign matter, and confining the grout to said spaces during the introduction and setting periods.

While in the following description my invention will be described in connection with the grouting of sea walls, it is to be understood that my invention is equally applicable to other related structures such as mentioned above.

An economical and practical form of sea wall is one formed of precast, steel reinforced concrete sections in the form of slabs or piles or both which are driven into place, one alongside another, and then grouted at their adjacent edges, thus bonding the sections to form a continuous impervious wall. In most instances, the grouting spaces are provided by recesses or grooves formed in the adjacent edges of the wall sections. The proper grouting of these spaces offers a serious problem, however, due to the seepage of mud or other foreign matter into them, which prevents, upon admixture with the grout, a proper bonding of the grout with the concrete wall sections. Another problem arises from the fact that it is practically impossible to drive the wall sections into exact predetermined positions relative to one another, the result being that some of the sections will be spaced apart. Under such circumstances, ordinary grouting methods may fail, or at least result in untidy seams.

My invention meets these problems by providing a means capable of sealing-off the grouting spaces under such circumstances as may occur in practice.

The main objects of my invention are to provide a simple and efficient means for sealing off the grouting spaces between such concrete sections in order that said spaces may be flushed to remove mud, silt or other foreign matter, for preventing further ingress of such foreign matter to said spaces, and for confining the grout to said spaces for the duration of the setting period. Water may also be removed and prevented from entering the grouting spaces, if desired.

Other objects of my invention are to provide a grouting space sealing means that may be easily operated, and may, with facility, be placed into

and removed from opposition to said grouting spaces.

My invention contemplates the use of an expansible and contractible sealing member used in conjunction with a rigid backing member adapted to back up the sealing member and urge it into fluid tight engagement with the structure sections at points adjacent the grouting space.

Other objects and features of the invention will be made apparent in the following detailed description, reference being had to the accompanying drawings, in which:

Figs. 1 and 2 show in plan and elevation, respectively, a form of sea wall structure to which my sealing device is applicable;

Fig. 3 is a vertical transverse section of the sea wall showing the grouting-space sealing device applied thereto;

Fig. 4 is an horizontal section taken on line 4—4 of Fig. 3;

Fig. 5 is a vertically contracted section taken on line 5—5 of Fig. 4;

Fig. 6 is an horizontal section of another form of sea wall and illustrates two other adaptations of the invention;

Fig. 7 is a detail vertical section of one of the expansible members shown in Fig. 6;

Fig. 8 is a fragmentary perspective of the lower portion of one of the backing members shown in Fig. 6;

Fig. 9 is a vertical section similar to Fig. 5, but showing a modified form of expansion means;

Fig. 10 is an horizontal section taken on line 10—10 of Fig. 9; and

Fig. 11 is a fragmentary perspective of the lower portion of an alternative form of backing member.

While the sea wall sections may be cast in any of a great number of shapes, I have shown as typical, in Figs. 1 and 2, a sectional wall 10 comprised of pre-cast, steel-reinforced, concrete slab piles 11 having edges 12 tongued and grooved as indicated at 14 and 15 so as to provide interengagement of the piles, one with another. The grooves 15 may be and are usually deeper than tongues 14 so that, when edges 12 are abutted, a grouting space will be formed at the base of the grooves. Grooves 15 may be further recessed as at 16 to enlarge the grouting space.

The piles are driven into the earth to a depth sufficient to prevent displacement or settling, and in many instances fluid mud will have to be penetrated to reach such a depth. The upper ends of the piles may be anchored against displacement in the usual manner (not shown). The

lower ends of the piles may be bevelled as at 17 so that each pile, as it is being driven, will be urged in the direction of the last driven pile. Edges 12 do not always meet, however, and very often they will be spaced as much or more than shown in Figs. 1 and 4, thus permitting free passage of fluid mud into the grouting space.

My sealing device is capable of sealing off such grouting spaces, as will appear in the following description, reference being had to Figs. 3 to 5. The backing member indicated generally at 20 is (in this instance) in the form of a channel, the lower end of which is beveled at 21. Between the flanges 22 of the channel, I provide an elongate expandable member in the form of an inflatable rubber tube 23 closed at both ends and fastened to the web 24 of the channel by any suitable means such as bolts 25. Near the upper end of the tube I provide a nipple 26 for inflating or deflating the tube. With the tubes deflated, two such sealing devices are driven down along opposite sides of the wall, directly opposite the space that is to be grouted, the lower beveled ends 21 of the channels serving as entering wedges and forcing the channels into engagement with the faces of the wall at opposite sides of the vertically extending opening between adjacent slabs. The channels are driven through the fluid mud and to a lower depth sufficient to anchor their lower ends against horizontal displacement and to place the lower ends of the tubes at or below the bottom of the fluid mud zone. The upper ends of the channels are then forced against the wall in any suitable manner, as by clamping as indicated at 28. Air is then pumped into the tubes, through nipples 26, to inflate them and force them into fluid tight engagement with the faces of the wall sections adjacent the grouting spaces, the required air pressure depending upon the fluid head near the lower ends of the tubes. The rubber tubes are sufficiently flexible to make, under reasonable internal pressure, fluid-sealing engagement with the wall sections in spite of any irregularities in the wall surfaces or intervening particles that might otherwise prevent such engagement. At the same time the rubber is heavy enough that it will not be extended unduly into the opening that the tube seals.

The internal pressure in the tubes of course tends to force the channels away from the wall, and the load thus put on the channels may in some instances be quite large. For the purpose of opposing deflection of the channels resultant from such forces, I provide the channels with trusswork 28 comprising tension rods 29 and 30 secured as by welding at 31 to the channels, and coupled by turnbuckles 33; and compression struts 34 and 35 interposed between the tension rods and webs 24 of the channels. This trusswork may vary in design with different lengths of backing members, its purpose and effect being to stiffen the channels against bending.

In case a hard formation is encountered beneath a layer of earth or mud of insufficient depth to firmly anchor the lower ends of the channels of the backing member, the back surfaces of the channels may be increased by welding thereto a backing plate 37 as shown in Fig. 11. (For the purpose of illustration, the expansion tube has been omitted in this view.) This backing plate provides sufficient area contacting with the earth to hold the lower end of the channel against the wall.

After the grouting space 13 has been sealed in the above described manner, it is then possible to

thoroughly flush mud or other foreign matter from the grouting space and then to fill the space with grout and thus make a dependable bond between the wall sections. Flushing of the grouting space may be accomplished by inserting a jet pipe from above and forcing water through it into the lower end of the space. Also, the grouting space may be grouted by forcing grout through a pipe extending to the bottom of said space and then withdrawing the pipe as the grout column rises, displacing the water above it. Or, if desired, the water may be pumped out of the grouting space before the grouting operation, so that the grouting would then be done in a dry space. The sealing devices are removed, after the grout has set, by first deflating the tubes and then loosening and removing the channel structure. The resulting seams are smooth and neat.

The form of wall shown in Fig. 6 includes columns of H-section (one half of one of which is shown), driven at spaced intervals. Intervening slabs are dropped within the opposed recesses of two columns and driven into the earth. There may be more than one such slab, one on top of the other; and in such an arrangement the lower slab will be driven into the earth at its lower edge, and its upper edge may preferably be above the water line. The column 40 and slab 41 (both fragmentarily shown) form between them re-entrant corners 42 and 43 and grouting space 44; it being desired to seal the grouting space at said corners.

I have shown at 45 (associated with corner 42) one adaptation of my invention for sealing such corners comprising two channel backing members 46 which are disposed at right angles and joined by angle member 47 and filler strip 49 welded or riveted thereto. Struts 48 and tension rod 50 comprise the trusswork, similar to that shown in Fig. 3. The expansion tubes are indicated at 51 and 52. The lower ends of channels 46 may be beveled like the channel shown in Fig. 3. A more detailed description of this form of sealing device is deemed unnecessary since it is substantially no more than a binary duplication of the form shown in Figs. 3 to 5 except for the singular feature that filler strip 49 (which may be flat as shown, angular or curved) bounds the grouting space in a manner to form a grout fillet of any desired configuration in its associated corner.

At 53 I have shown in association with re-entrant corner 43 another adaptation of my invention for sealing such corners comprising a single angle backing member 54, trussed by tension rods 55 and struts 56, and containing expansion tube 57. The lower end of angle 54 may be beveled as indicated at 58 (Fig. 8) to assist the driving of it into said corner. The tube 57 may be secured to one leg of angle 54, or it may be a separate unit as shown in Fig. 7. The expansion tube 57 there shown is mounted on rod 58 and is hermetically sealed at its ends by being clamped against shoulders 59 by nuts 60 and washer 61, the usual valve nipple being provided at 57a. The ends of rod 58 extend beyond the ends of the tube and the lower end is pointed at 62 so that it may (with tube deflated) be driven down within the space defined by angle 54 and the wall sections to the required depth. The advantage of having the expansion tube as a separate unit, in this manner, lies in its placeability relative to its backing member irrespective of the depth to which said backing member is driven.

It is to be understood that the separate expansion tube unit just described is not limited to

this specific adaptation but may be utilized to advantage in any of the other forms of sealing device herein described.

Figs. 9 and 10 show a modified form of sealing means wherein the expansion means comprises wedges 70 and 71 confined within a channel 72 which is similar to channels 20 in Figs. 3-5. After the channel 72 is driven and secured in place against the wall, a strip of resilient material 73 is placed against and overlapping the wall sections, and wedges 70 and 71 are then forced down between the channel and strip 73 thus urging the strip into fluid tight engagement with said wall sections. If desired, the wedges may be removed by tongs or other suitable means (not shown) prior to removal of the channel. In place of a separate resilient strip 73, the wedges 70 may be provided with resilient faces, as will be understood without further illustration; that is, the resilient or yielding strip may either be a separate piece or may be secured to the wedges. In Fig. 9 I have shown several sets of said wedges 70 and 71, the number of such sets depending on the practicable length of each wedge set and the total length of the opening which is to be sealed.

I claim:

1. In a system for grouting the seams intervening componental sections of a sea wall or the like, a rigid backing member adapted to be secured against the wall in opposing relation to a seam, and a hollow sealing member expansible by applied internal pressure between the backing member and the wall and adapted by expansion to seal the seam at the wall face.

2. In a system for grouting the seams intervening componental sections of a sea wall or the like, an elongate rigid backing member having lateral flanges adapted to be secured in contact with the wall face at opposite sides of a seam, and an expansible sealing member within the flanged backing member and adapted by expansion to engage the wall face at opposite sides of the seam and seal the seam.

3. In a system for grouting the seams intervening componental sections of a sea wall or the like, an elongate rigid backing member having lateral flanges adapted to be secured in contact with the wall face at opposite sides of a seam, and an inflatable flexible walled tube within the flanged backing member and adapted by inflation to sealingly engage the wall face at opposite sides of the seam.

4. In a system for grouting vertically extending seams intervening componental sections of a sea wall or the like, a rigid backing member adapted at its lower end to be driven into the earth at the foot of and against the wall, means for holding the upper end of the backing member against the wall, and a hollow sealing member expansible by

applied internal pressure between the backing member and the wall and adapted by expansion to seal a seam at the wall face.

5. In a system for grouting vertically extending seams intervening componental sections of a sea wall or the like, a rigid backing member adapted at its lower end to be driven into the earth at the foot of and against the wall, said lower end having a beveled surface at its side opposite the wall, said beveled surface acting by reason of earth pressure to force and hold said lower end against the wall, means for holding the upper end of the backing member against the wall, and an expansible sealing member between the backing member and the wall and adapted by expansion to seal a seam at the wall face.

6. In a system for grouting vertically extending seams intervening componental sections of a sea wall or the like, a vertically elongate and rigid backing member having lateral longitudinally extending flanges which are adapted to contact the wall face at their edges, the lower end of the backing member having a beveled surface at the side opposite the wall, said beveled surface acting by reason of earth pressure to force and hold the lower end of said member in contact with the wall face when the lower end is driven into the earth at the foot of the wall, means for holding the upper end of the backing member against the wall, and an expansible sealing member between the backing member and the wall and adapted by expansion to seal a seam at the wall face.

7. In a system for grouting vertically extending seams intervening componental sections of a sea wall or the like, a vertically elongate and rigid backing member having lateral longitudinally extending flanges which are adapted to contact the wall face at their edges, the lower end of the backing member having a beveled surface at the side opposite the wall, said beveled surface acting by reason of earth pressure to force and hold the lower end of said member in contact with the wall face when the lower end is driven into the earth at the foot of the wall, means for holding the upper end of the backing member against the wall, and an inflatable flexible walled tube within the flanged backing member and adapted by inflation to sealingly engage the wall face at opposite sides of a seam.

8. In a system for grouting the seams intervening componental sections of a sea wall or the like, in combination with a flanged backing member, a sealing member insertible within the backing member and between it and the wall, said sealing member comprising a longitudinal rod and an inflatable flexible walled tube surrounding the rod and attached at its ends to the rod.

VERNER E. BRITTON.

CERTIFICATE OF CORRECTION.

April 29, 1941.

Patent No. 2,239,989.

VERNER E. BRITTON.

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction as follows: Page 3, first column, line 46, claim 3, for "beacking" read --backing--; and that the said Letters Patent should be read with this correction therein that the same may conform to the record of the case in the Patent Office.

Signed and sealed this 8th day of July, A. D. 1941.

Henry Van Arsdale,
Acting Commissioner of Patents.

(Seal)