Sept. 19, 1967 R. L. CROUCH ET AL 3,342,033

METHOD OF PROVIDING A SEALED JOINT EMPLOYING A FLEXIBLE BAG

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Fig. 1

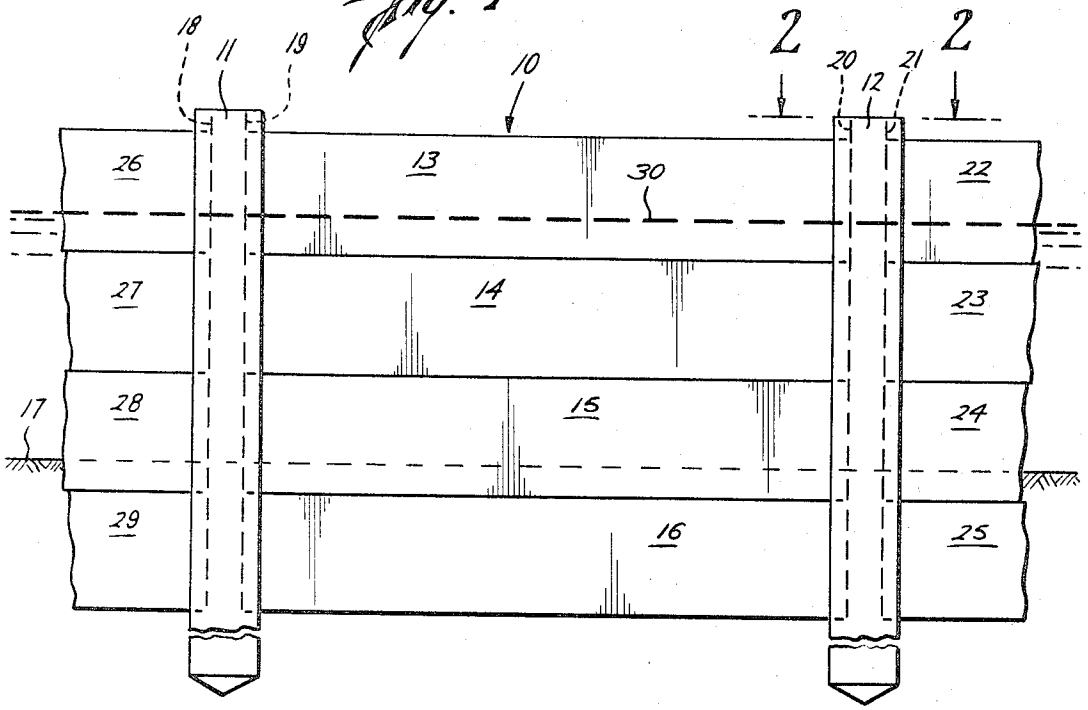
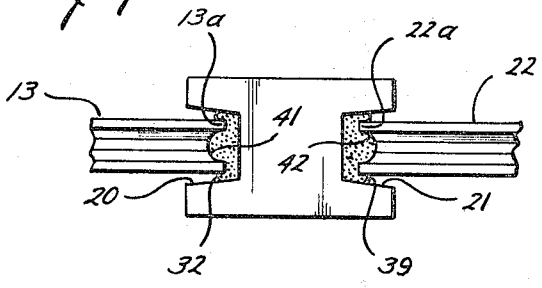


Fig. 2



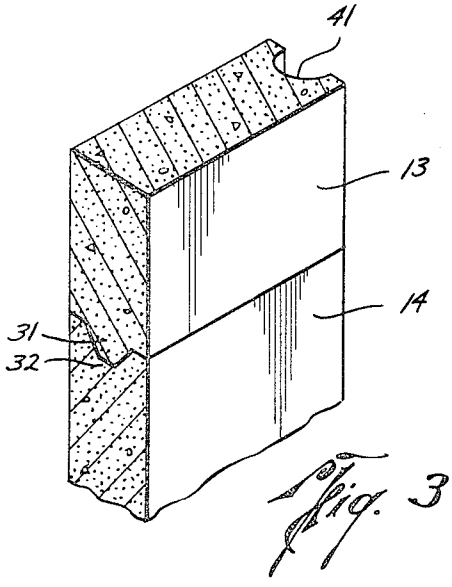


Fig. 3

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Fig. 4

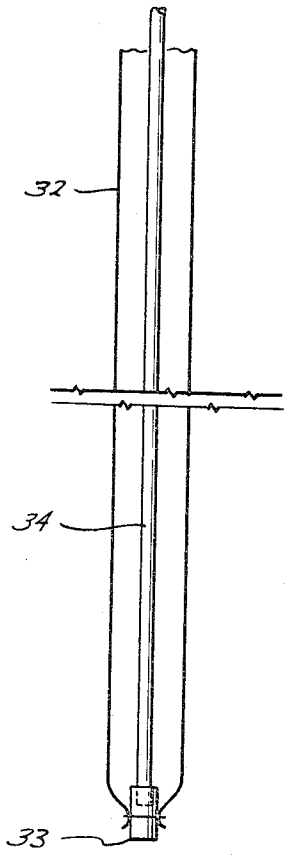


Fig. 5

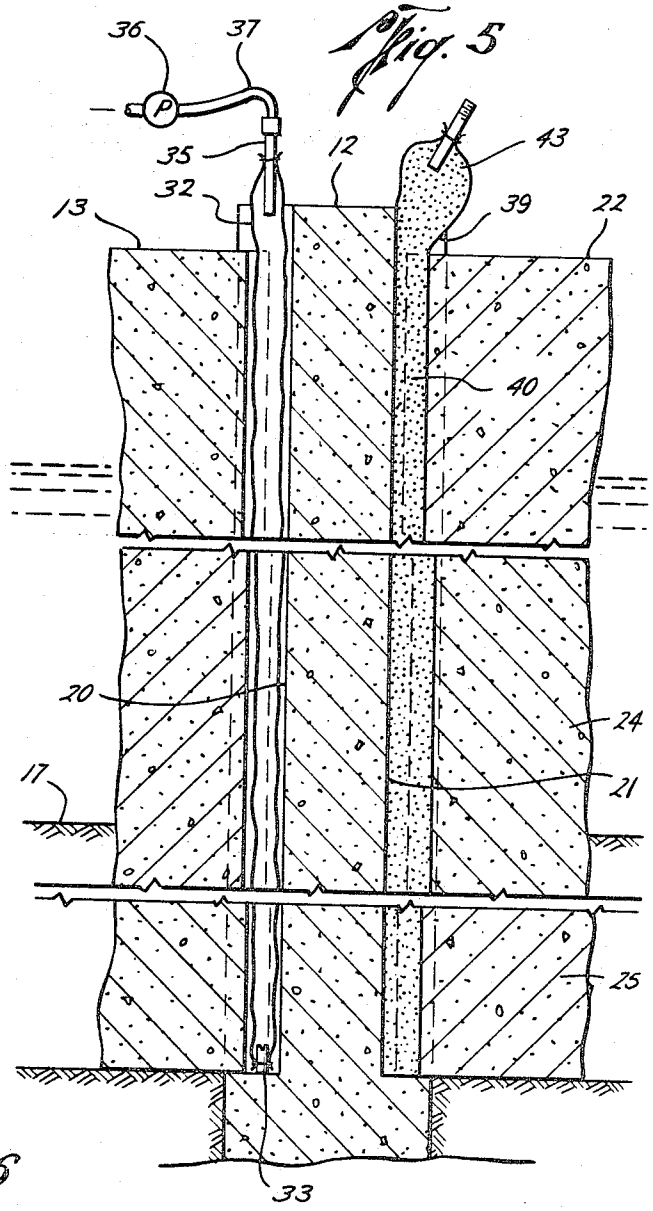
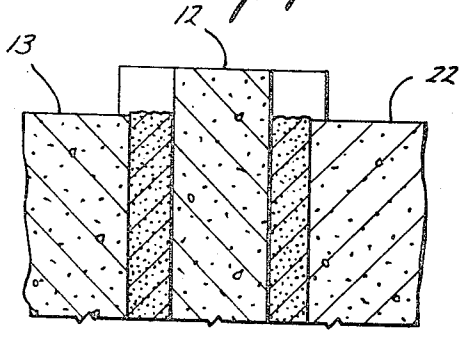


Fig. 6



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United States Patent Office 3,342,033 Patented Sept. 19, 1967

3,342,033

METHOD OF PROVIDING A SEALED JOINT EMPLOYING A FLEXIBLE BAG

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Filed Apr. 8, 1965, Ser. No. 446,533
4 Claims. (Cl. 61—30)

ABSTRACT OF THE DISCLOSURE

A method is disclosed for forming a sealed joint between two members, where one member has a groove into which the other extends. A flexible bag is located in the groove between the members. The bag has a porosity such that it will filter cement from a pumpable slurry of water and cement. Such a slurry is pumped into the bag, the excess water passes out of the bag leaving the cement. Slurry is pumped into the bag until the bag is filled with cement sufficiently to hold it in sealing engagement with members. Pressure is then held on the cement in the bag until the cement solidifies.

This invention relates to walls and the method of forming same and refers more particularly to walls made up of prefabricated parts and the joints between such parts as well as the method of forming the wall and joints.

The present invention has application to walls of many types but is especially adaptable for use in the control of water and erosion along shorelines, bayous, etc., in the construction of tide-control dams, retaining walls, erosion barriers, and the like. Therefore, this invention will be described with particular reference to this use by way of illustration but not by way of limitation.

At the present time, in controlling the water level in bayous in low-land areas, walls are spaced across the bayous to form a sort of dam to prevent the salt water tides from backing up into the fresh water of the bayous. The structures used are made up of spaced piles with spanning panel members, usually all made of reinforced concrete. Adjacent panels extending between the piles may readily be sealed by the application of waterproof mastic or the like, but difficulty has been encountered in providing a sealed joint between the ends of the panels and the supporting piles. This invention provides a joint which may be readily sealed in such application, and the structures and method are such that the joint may be provided after the wall is in place even though substantial portions of the wall are submerged.

Therefore, it is one of the objects of this invention to provide a wall having sealed joints between adjacent wall members and a novel method of forming the wall and joints.

It is another object of this invention to provide a wall joint and method of forming same that will provide a seal between a support member and a plurality of panel members even though the ends of the panel members do not extend exactly to the same extent toward the centerline of a supporting pile.

It is another object of this invention to provide a wall and a method of forming same, having a sealed joint between each of two or more spaced support members such as reinforced concrete piles and the one or more panel members that extend between the piles to form a wall that can serve as a barrier in the control of water.

These and other objects of this invention are obtained by locating a flexible bag between two adjacent wall members and forcing the bag into sealing engagement therewith by filling the bag with material under sufficient pressure to obtain the desired seal. When forming a permanent joint, preferably the material used to fill the bag will solidify when in place allowing the pressure used to force the bag into sealing engagement to be released.

In the preferred embodiment of the invention having special adaptations for underwater work, the bag is porous and will pass liquids but not colloids and larger solids. This allows a watery slurry of Portland cement and water to be pumped into the bag with the excess water flowing out of the bag through the pores, while the cement is retained therein. After the bag is filled with cement under sufficient pressure to hold the bag in engagement with the two wall members with sufficient pressure to provide the desired seal, the cement is allowed to harden or solidify to form a permanent sealed joint between the two members. Since the bag is flexible, it will fill out along the course of least resistance. It is preferred to provide the members with cooperating means that form between the members a substantially enclosed space when viewed in transverse section. The space accommodates the bag because the bag is flexible; however, the space need not be uniform in cross-section at different positions along the length of the joint. Thus, the bag can form a sealed joint between a support member, such as a reinforced concrete pile, and a plurality of panel members that are stacked with their ends in a groove in the side of the pile even though the ends of the panel members do not extend to the same extent toward the centerline of the pile.

The invention will now be described in detail in connection with the attached drawings, wherein the preferred embodiment of the invention is shown for illustrative purposes. In the drawings:

FIGURE 1 is a side view in elevation of a section of the wall;

FIGURE 2 is a view along line 2—2 of FIGURE 1 in the direction of the arrows;

FIGURE 3 is a perspective view, partially in section, of a portion of two panel members connected together;

FIGURE 4 is a view of the bag assembled on a rod to be positioned in the space between the wall members;

FIGURE 5 is a vertical cross sectional view through one of the support members of FIGURE 1 with one joint formed and another in the process of being formed;

FIGURE 6 is a partial sectional view of the completed sealed joints of FIGURE 5.

Referring to the drawings, wall section **10**, shown in FIGURE 1, comprises support members **11** and **12** and panel members **13** through **16**. Support members **11** and **12** in this embodiment are reinforced concrete piles, which are driven at spaced points along the line of the wall. The piles are driven far enough beneath the bottom of the water, indicated by the dotted line **17** in FIGURE 1, to support themselves and the panel members, and to hold the panel members against the differential pressure expected to exist across the wall. The water level on the side of the wall shown in FIGURE 1 is indicated by the dotted line **30**.

Cooperating means carried by the members between which the joint is to be formed are provided to form a substantially enclosed space, when viewed in transverse cross section, to receive the bag used to form the joint. Preferably, these cooperating means are also interlocking, although they may be only abutting. In the embodiment shown, each pile is provided with longitudinally extending grooves on the opposite side surfaces thereof, such as grooves **18** and **19** in pile **11**, and **20** and **21** in pile **12** (FIGURE 2). The piles are driven with each grooved side surface facing toward the grooved side surface of the adjacent piles. The panel members then are positioned between adjacent piles with their opposite ends extending into the grooves to form a type of tongue-and-groove interlocking joint between the piles and the panels. For example, panel members **13** through **16** are positioned

between piles **11** and **12** with their ends extending into grooves **19** and **20** to form section **10** of the dam. Groove **18** on the opposite side of pile **11** from groove **19**, and groove **21** on the opposite side of pile **12** from groove **20**, receive the ends of panels **26–29** and **22–25**, respectively, of the adjacent wall sections.

Such a tongue-and-groove type of joint will provide a substantially enclosed space between the members, as viewed in transverse section, as long as the end surface of the panel member does not contact the bottom of the groove. Therefore, to insure that space is always available for the bag, the end surfaces of the panels are preferably grooved. Thus, as shown in FIGURES 2, even if panel members **13** and **22** are positioned with their end surfaces **13***a* and **22***a* in engagement with the bottom of grooves **20** and **21**, grooves **41** and **42** in their end surfaces will provide ample space for a flexible bag to be positioned between the panels and the piles.

The grooves may extend the entire length thereof or only part way as shown. The latter construction is preferred for the bottom of the groove helps confine the lower end of the expanded bag and also provides support for the panels. Where the wall is to act as a dam, usually the lower panel members **16**, **25** and **29** are positioned at least partially below the bottom of the water. They should extend below the bottom of the water far enough to at least minimize the water from seeping beneath the wall from one side to the other when the maximum differential exists thereacross. If the bottom consists of soft or unconsolidated material, the panels, usually, will sink by their own weight into position against the bottom of the grooves. If not, other well-known methods can be used to locate the panels below the bottom, such as hydraulic jetting.

After the lower panels are in place the remaining panels are stacked on them to the desired height above water line **30**. In this embodiment, the panel members are provided with a tongue-and-groove type joint between their abutting edges. For example, as shown in FIGURE 3, panel **13** is provided with a protruding tongle **31** that fits into groove **32** in the abutting side of panel **14**. To seal this joint to keep water from leaking between the panels, the mating surfaces are coated with a mastic that is insoluble in water, such as pitch or tar. Thus, with the panels in place between the piles and in sealing engagement with each other the only joint remaining to be sealed to complete the wall or dam are the ones between the piles and the ends of the panels.

To seal these joints in accordance with this invention, flexible bags are positioned between the support members or piles and the ends of the panel members are filled with sufficient material to force the bags into sealing engagement with the members. The material employed to fill the bag, the differential pressure that will exist across the seal, etc., will determine the type of bag that is used, i.e., whether it is perforate or imperforate, how much pressure it will hold, etc.

In the embodiment shown, a Portland cement is employed to fill the bag and expand it into sealing engagement. Preferably, with this type of cement, a perforate bag is used having a porosity such that water will pass through the bag but the cement will not. Such a bag may be purchased from the National Filter Company of Salt Lake City, Utah. It consists of nylon fibers woven in such a way that water will readily pass through the pores of the bag in between the fibers, yet the bag will filter out colloids and other solids suspended in the water. With such a bag, a slurry of cement having any desired amount of excess water can be used. This facilitates the pumping of the slurry into the bag. Further, by filling the bag in this manner, it readily conforms to the irregular surfaces of the members it engages. Also, the excess water flowing out of the pores of the bag tends to wash and clean the surfaces against which the bag is forced by the pressure of the slurry, which improves the seal obtained between

the bag and the surfaces of the members it engages. Further, where the bag extends below the bottom of the water, such as in the embodiment shown in the drawings, the excess water flowing out of the bag will help wash away any bottom material that may ooze into the groove between the panel members and the pile.

To form a sealed joint between pile **12** and panels **13–16** the lower end of open-ended, porous bag **32** is closed by solid plug **33**. The bag is long enough to extend above top panel **13** with the plug in engagement with the bottom of groove **20**. Rod **34** is inserted into the bag into engagement with plug **33**, as shown in FIGURE 4, to push the bag to the bottom of groove **20** in the space provided between the pile and the ends of the panel members by groove **20** and the grooves in the end surfaces of the panels. After positioning the bag, the rod may be removed.

Next the upper end of bag **32** is connected to short nipple **35**, which is connected to pump **36** through hose **37** (FIG. 5), and a watery, low viscosity slurry of cement and water is pumped into the bag by pump **36**. As the slurry is pumped into the bag, the excess water will pass out of the bag and the cement will fill the bag forcing it outwardly into engagement with the adjacent wall members as shown in FIGURE 2. After the bag is filled with sufficient cement to hold the bag in sealing engagement with the wall members with the desired pressure, pumping is stopped and the cement allowed to harden, after which the pressure can be released and the joint is complete. Such a joint is shown in groove **21** on the right-hand side of pile **12** in FIGURE 5, where bag **39** has been filled with solidified cement **40**, in the manner described above, to provide a sealed joint between pile **12** and the ends of panel members **22–25**.

Since bag **32** is flexible, it can conform to irregularities in the spacing between the ends of the panels and the bottom of the groove in which they are located in the manner shown in FIGURE 5. Therefore, with the joint of this invention the ends of the panels do not have to be aligned as they are stacked between the piles, i.e., the ends of the panels do not have to extend into the groove of the pile to the same extent.

Since the upper portion of the bag extends above the space provided between the two members and is unconfined, the maximum pressure that can be applied to the bag is its bursting pressure. With the preferred bag identified above, the cement slurry may be pumped in at pressures of several hundred p.s.i.

After the cement has solidified, the upper portion of the bag and cement along with the fill nipple, such as portion **43** of bag **39**, can be knocked off with a sledge hammer leaving the top of the completed joints as shown in FIG. 6.

From the foregoing it will be seen that this invention is one well adapted to attain all of the ends and objects hereinabove set forth, together with other advantages which are obvious and which are inherent to the structure and method.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.

The invention having been described, what is claimed is:

1. A method of providing a water seal between two adjacent wall members of impermeable material with one member extending into a groove in the other, comprising the steps of locating a flexible bag in the groove between the members having a porosity such that it will filter cement from a pumpable slurry of water and cement

pumped into the bag by passing the excess water out of the bag while retaining the cement, pumping a water cement slurry into the bag under sufficient pressure to force the excess water in the slurry out of the bag, continuing to pump the slurry into the bag until the bag is filled sufficiently with cement to force it into sealing engagement with the adjacent members, and holding pressure on the cement in the bag to hold the bag in contact with the members until the cement therein solidifies.

2. A method of constructing a wall comprising the steps of locating a plurality of spaced support members of impermeable material along the line of the wall, positioning a panel member of impermeable material between each support member with one of the members extending into a groove in the other member to interlock the support members and the panel members, locating a flexible bag in each groove between the members that has a porosity such that it will filter cement from a pumpable slurry of water and cement pumped into the bag by passing the excess water out of the bag while retaining the cement, pumping a slurry of water and cement into each bag under pressure thereby forcing the excess water in the slurry out of the slurry through the bag until the bag is filled with cement sufficiently to hold the bag in sealing engagement with the members, and holding the pressure on the bags until the cement hardens.

3. A method of building a wall of grooved spaced support members with spanning panel members comprising, positioning the support members the desired distance apart, with their grooves in facing relationship, stacking the panel members between the support members with their ends extending into the grooves, locating flexible porous bags in the grooves between the ends of the panels and the bottom of the grooves to be partially confined by the ends of the panels and the groove in the support members, the bags having a porosity such that they will pass water but not colloids, pumping a watery cement slurry into each bag under sufficient pressure to force excess water in the slurry through the bag leaving the cement in the bag, continuing to pump the slurry into the bag until there is a sufficient amount of cement in the bag to hold it in sealing engagement with both members, and holding pressure on the bag until the cement solidifies.

4. A method of constructing a wall to form a dam across a body of water comprising the steps of driving piles that are longitudinally grooved on opposite sides into the bottom of the body of water at spaced points along the line of the dam with the grooves in the piles in facing relationship with the grooves of the adjacent piles, stacking a plurality of panel members between each two adjacent piles with the ends of the panel members extending into the facing grooves of the adjacent piles that support them and with the abutting longitudinal edges of each panel coated with a water insoluble material for providing a seal between each two abutting panel members, locating a flexible bag having a porosity such that it will pass water but not cement in each groove in the piles between the ends of the panel members and the piles and extending from above the expected water level of the water to be dammed to below the level of the bottom of the water, pumping a slurry of water and cement into each bag under pressure thereby forcing the excess water in the slurry out of the slurry through the bag until the bag is filled with cement sufficiently to hold the bag in sealing engagement with the panels and the pile, and holding the pressure on the bag until the cement hardens.

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