April 13, 1965 O. E. LIDDELL 3,177,667

SUBMERGED WOODEN PILE PROTECTING BARRIER SHEET AND SEAL

Filed March 29, 1962 2 Sheets-Sheet 1

FIG. 1

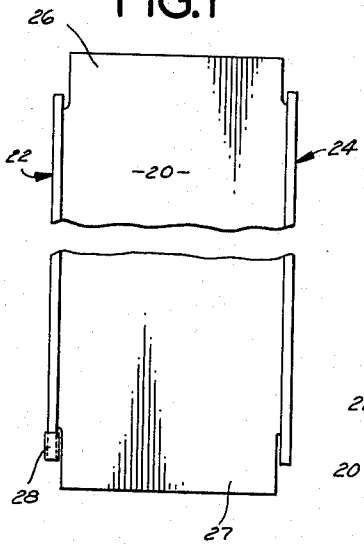


FIG. 2

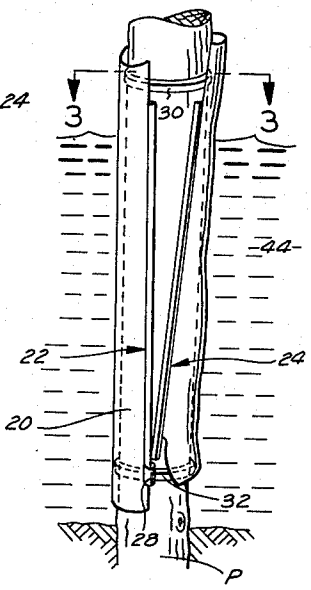
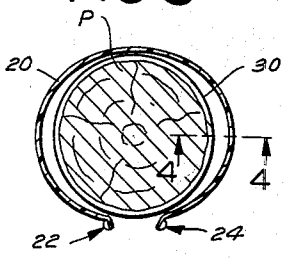


FIG. 3



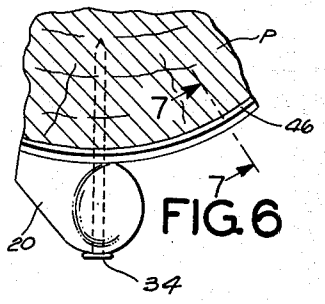


FIG. 6

FIG. 5

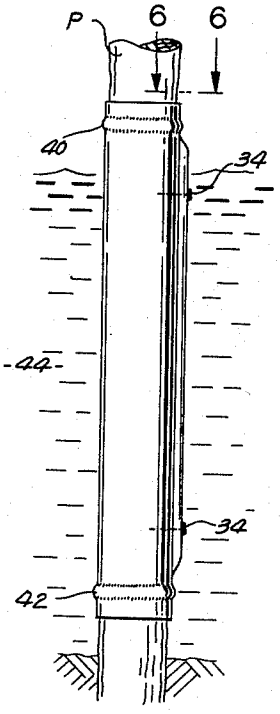


FIG. 4

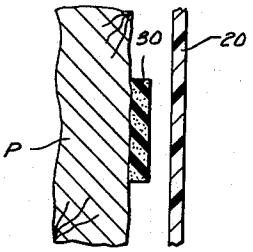


FIG. 8

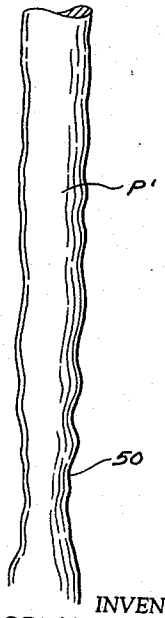
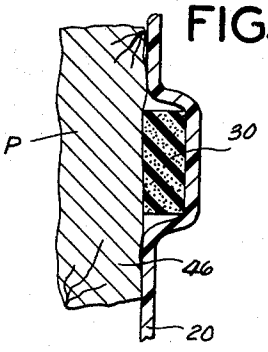


FIG. 7



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FIG. 9

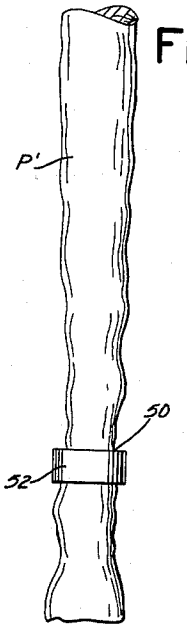


FIG. 10

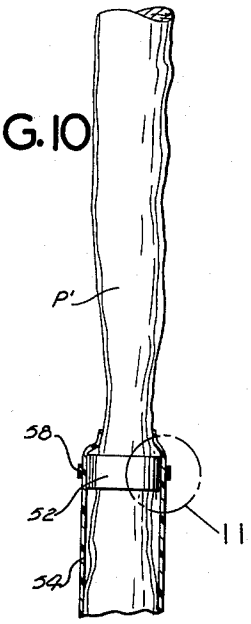


FIG. 11

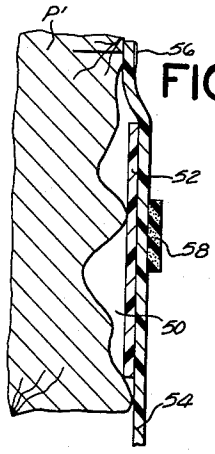


FIG. 12

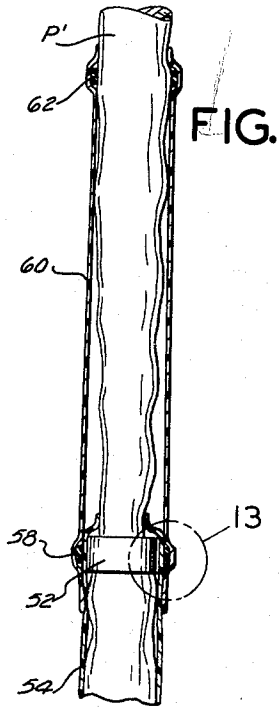


FIG. 14

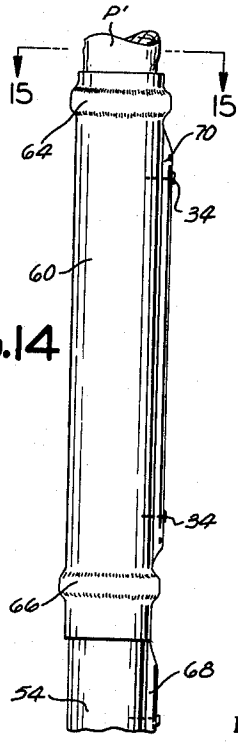


FIG. 13

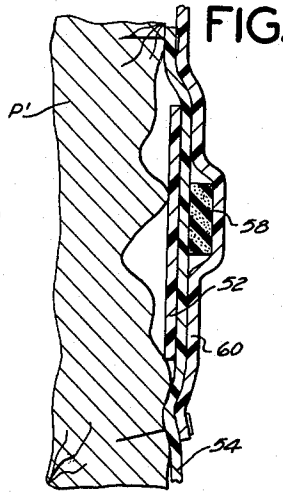
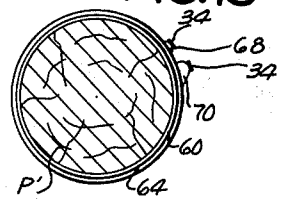


FIG. 15



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3,177,667

SUBMERGED WOODEN PILE PROTECTING BARRIER SHEET AND SEAL

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Filed Mar. 29, 1962, Ser. No. 183,603
8 Claims. (Cl. 61—54)

The present invention relates generally to the protection of submerged wooden structures against marine borer attack and specifically to a novel barrier sheet and seal construction for encompassing wooden piles to prevent such attack.

In my Patent No. 3,027,610, issued April 3, 1962 I have disclosed a novel method of arresting or preventing marine borer attack by creating and maintaining an environment of stagnant water around the pile to be protected. The stagnant water is created and maintained by means of a barrier sheet of waterproof material which is wrapped about the piling, with the space between the piling and the sheet being filled with the stagnant water.

It is a major object of the present invention to provide a novel seal for the upper and lower ends of a barrier sheet of the nature shown in my aforementioned Patent No. 3,027,610, such sheet and seal controlling the circulation of water between the stagnant water and the ambient water wherein the pile is submerged.

It is another object of the present invention to provide a barrier sheet and seal of the aforedescribed nature which may be readily and quickly installed.

A further object of the present invention is to provide a barrier sheet and seal of the aforedescribed nature which will provide a long and trouble-free service life.

An additional object of the present invention is to provide a barrier sheet and seal of the aforedescribed nature which finds particular use where the pile to be protected has been eaten away by previous marine borer attack.

It is a particular object of the present invention to provide a barrier sheet and seal of the aforedescribed nature wherein the seal is first installed around a pile while in a compressed condition, with the barrier sheet being then applied in encompassing relationship with the piling and the seal thereafter expanding underneath the barrier sheet into sealing relationship relative to the pile and the barrier sheet.

Other objects and advantages of the present invention will become apparent from the following detailed description, when taken in conjunction with the appended drawings wherein:

FIGURE 1 is a side elevational view showing a barrier sheet which may be utilized in the practice of the present invention;

FIGURE 2 is a perspective view showing the barrier sheet of FIGURE 1 being installed around a pile in accordance with the present invention;

FIGURE 3 is a horizontal sectional view taken in enlarged scale along line 3—3 of FIGURE 2;

FIGURE 4 is a vertical sectional view taken in enlarged scale along line 4—4 of FIGURE 3;

FIGURE 5 is a side elevational view showing the barrier sheet and seal of FIGURE 2 installed upon a pile;

FIGURE 6 is a fragmentary horizontal sectional view taken in enlarged scale along line 6—6 of FIGURE 5;

FIGURE 7 is a fragmentary vertical sectional view similar to FIGURE 6, but showing said seal after it has expanded to its operative position;

FIGURE 8 is a side elevational view showing a wooden piling which has had large surface areas eaten away by marine borers so that it no longer has a uniform taper;

FIGURE 9 is a view similar to FIGURE 8 but showing a first step in installing a second form of barrier sheet and seal embodying the present invention on the damaged pile of FIGURE 8;

FIGURE 10 is a side elevational view similar to FIGURES 8 and 9 showing a second step in installing said barrier sheet and seal on the pile of FIGURES 8 and 9;

FIGURE 11 is a central vertical sectional view in enlarged scale of the encircled area 11 of FIGURE 10;

FIGURE 12 is a side elevational view similar to FIGURE 10 showing a third step in installing said barrier sheet and seal;

FIGURE 13 is a central vertical sectional view in enlarged scale of the encircled area 13 of FIGURE 12;

FIGURE 14 is a view similar to FIGURE 12 but showing said barrier sheet and seal after the seal has expanded to its operative position; and

FIGURE 15 is a horizontal sectional view taken in enlarged scale along line 15—15 of FIGURE 14.

Referring to the drawings and particularly FIGURES 1 through 7 thereof, there is shown a barrier sheet 20 utilized in carrying out the present invention encompassing a wooden pile P. The sheet 20 is substantially rectangular and is of pliable, preferably waterproof material. Several synthetic plastics have proven satisfactory, as for example polyvinyl chloride. Alternately, the sheet 20 may be formed of rubber, neoprene or a woven fabric. The sheet 20 should be "substantially waterproof" in the sense that while it may be porous, the ratio of the volume of pores of interestices to the volume of mass restricts the circulation of sea water around the encased pile P to such an extent that the rate of circulation is less than that required to sustain marine borer life. When the salt, oxygen and organic matter which the borers extract from the sea to sustain themselves are not supplied at a sufficiently high rate, the borers die as a consequence. The extent for which the rate of circulation must be restricted will vary according to the type of borer, the salt, oxygen and organic matter content of the sea water and other local conditions and is therefore subject to many variables.

The length of the sheet 20 is sufficient to cover the height of the pile P subject to marine borer attack. The sheet 20 has a width throughout its length exceeding the corresponding circumference of the pile. The vertical edges of the sheet 20 are stiffened or rigidly reinforced against bending by a pair of vertically extending pole pieces, designated 22 and 24. Both of the pole pieces 22 and 24 are semicylindrical and are formed of wood, metal, synthetic plastic or the like. The flat side 25 of each pole piece is rigidly affixed as by cement to its respective edge of the sheet 20. The pole pieces do not extend the full length of the sheet 20 and the upper and lower portion of the latter define skirts 26 and 27.

The pole pieces 22 and 24 permit the sheet to be readily manipulated for placement around the pile P in the manner shown in FIGURE 2. With the sheet 20 wrapped around the pile P in the manner shown in FIGURE 2, the lower ends of the pole pieces 22 and 24 are releasably joined by means of a semicylindrical socket 28 on the lower end of the pole piece 22 that loosely receives the exposed lower end of the other pole piece 24 in a non-rotational manner. Thereafter, the two pole pieces 22 and 24 are brought together to define a substantially cylindrical unit, as indicated in FIGURE 6.

Prior to the positioning of the barrier sheet 20 around the pile P, seal strips 30 and 32 will be wrapped about the pile P at points corresponding to the upper and lower edge portions of the barrier sheet when the latter has been installed upon the pile P. These seal strips 30 and 32 are formed of a material having physical characteristics such that it may be compressed to a fraction of its unconfined volume and thereafter within hours it will

automatically return to such unconfined volume. A suitable material is sold under the trade name Compriband by Pacific Sealants (affiliate of Northrup Corporation), 1491 Daisy Avenue, Long Beach, California. This material comprises a polyurethane foam impregnated with asphalt and is the subject of United States Letters Patent No. 2,964,424. Other materials having similar characteristics may be employed, such as a foamed, synthetic plastic impregnated with a suitable temporary binder other than asphalt.

With particular reference to FIGURES 2 and 3, seal strips **30** and **32** are wrapped about the pile P while in a compressed, flattened condition and thereafter secured to the pile P by suitable means such as nails, cords or adhesive. The strips **30** and **32** may be passed between a pair of rollers to effect such flattening. After the seal strips are secured to the pile, the sheet **20** is arranged in the position indicated at FIGURE 2 and the pole piece **24** inserted within the socket **28** as indicated hereabove. The pole pieces **22** and **24** are then rotated in unison so as to contract the sheet **20** into close proximity with the pile P. In order to aid in holding the sheet **20** in place, but primarily to hold the pair of pole pieces **22** and **24** against counter-rotation in a direction such as would permit loosening of the sheet, nails **34** are driven through the pole pieces and into the pile P as indicated in FIGURES 5 and 6. It should be noted that the pole pieces serve to bridge gaps formed along piles which have previously been partially eaten away by marine borers.

At this time, the seal strips **30** and **32** will still be in their flattened condition of FIGURE 4. Thereafter, however, in a matter of hours the material of these seal strips will expand to their original size, as indicated in FIGURE 7. The barrier sheet **20** will then have the appearance indicated in FIGURE 5. Referring to the latter figure, the seal strips **30** and **32** will have bulged the upper and lower edges of the sheet **20** outwardly, as indicated at **40** and **42** in FIGURE 5. In this manner an effective seal is provided between the pile P and the barrier sheet suitable to control the flow of water between the ambient, freely circulating water **44** surrounding the pile P and the water contained within the generally circumferential space **46** separating the pile P and the sheet **20**. Generally, it is not essential that this seal be absolutely water-tight. It should, however, be sufficiently water-tight to restrict the flow of ambient water to a rate insufficient for supporting marine borer life within the space **46**. The use of the seal bands **30** and **32** eliminates the necessity of carrying the top edge of the sheet **20** above the high tide level of the water **44** surrounding the pile P. In this manner there may generally be effected an important economy in the cost of the barrier structure.

Referring now to FIGURE 8, there is shown a wooden piling P' which has had large surface areas eaten away by marine borers. This piling, however, still retains sufficient structural strength to carry out its function. A cavity **50** is shown at the intermediate portion of the piling P'. In view of the irregularity of this cavity **50** it would be understandably difficult for an effective seal to be provided if the seal strips **30** and **32** described hereinbefore were utilized. It is an important advantage of the present invention that an effective seal may be provided even where such cavities exist.

Referring to FIGURE 9, the first step in installing a barrier sheet and seal unit embodying the present invention on the piling P' is to wrap the piling with a back-up band **52**. This band **52** is formed of a material having high tensile strength affording it a tendency to remain flat after being wrapped around the pile P'. The material from which the back-up band **52** is formed should be immune to the deteriorating effects of sea water and also immune to marine borer attack. It has been determined that a glass fiber reinforced synthetic plastic strip is a very desirable material for this purpose. It will be understood, however, that other materials having similar characteristics would be satisfactory.

The back-up band **52** is suitably secured to the pile P' in encompassing relationship with the cavity **50**, as by means of cord, nails or a suitable adhesive (not shown). Thereafter, referring to FIGURE 10, a lower barrier sheet **54** is wrapped around the piling P' in a manner which may be similar to that described hereinabove with respect to the barrier sheet **20**. The upper edge of the barrier sheet **54** extends above the back-up band **52**, while the lower end of this sheet extends downwardly along the pile P' a desired distance below the area of active marine borer attack. The upper edge of sheet **54** is suitably affixed to the piling P', as by nails **56**.

Referring now to FIGURE 12, a seal strip **58** similar to seal strips **30** and **32** described hereinbefore is wrapped around the lower barrier sheet **54** in horizontal alignment with the approximate mid-portion of the back-up band **52**. When so installed, the seal strip **58** is in a compressed, flattened condition. The seal strip **58** will be suitably secured in place upon the outer surface of back-up band **52**. Next, an upper barrier sheet **60** is wrapped around the portion of the piling P' above the cavity **50**. This upper barrier sheet **60** is similar to the lower barrier sheet **54** and may be applied to the pile P' by pole pieces in the same manner as the barrier sheet **20** of FIGURE 1–7. Preferably, the upper end of the upper barrier sheet **60** will be provided with a seal strip **62** similar to the seal strips **30** and **32** shown and described hereinbefore in conjunction with FIGURES 1–7.

Referring now to FIGURE 13, the lower seal strip **58** will in a matter of hours expand radially outwardly to its original unconfined configuration. In this manner, an effective seal will be provided between the upper edge of the lower barrier sheet **54** and the lower edge of the upper barrier sheet **60**. Referring to FIGURES 14 and 15, there is shown the completed barrier sheet and seal unit of this form of the invention. It will be noted that the seal strips **58** and **62** in expanding to their unconfined condition will budge the barrier sheets **60** outwardly as indicated at **64** and **66**. The barrier sheets **54** and **60** are shown provided with pole piece assemblies **68** and **70** in FIGURES 14 and 15. These pole piece assemblies **68** and **70** may be similar to those described hereinbefore in conjunction with FIGURES 1–7. It should be particularly observed that it is within the scope of the present invention to provide solely the upper or the lower edge of the barrier sheets with seal strips. In particular, the lower edge of the barrier sheet may extend below the mud line so as to provide a seal at this point.

Various other modifications and changes may be made with respect to the foregoing detailed description without departing from the spirit of the present invention or the scope of the following claims.

I claim:

1. Apparatus for protectively encasing a submerged wooden pile against marine borer attack, said pile being formed with a cavity, comprising: a back-up band secured about said piling in encompassing relationship with said cavity; a lower sheet disposed about said pile in encompassing relationship with its upper end extending over and above said back-up band and its lower end extending below the area of active marine borer attack on said pile; an upper sheet disposed about said pile in encompassing relationship with its lower end extending below the upper end of said lower sheet as well as said back-up band and its upper end extending above the area of active marine borer attack on said pile; seal means aligned with said back-up band and interposed between the upper end of said lower sheet and the lower end of said upper sheet and additional seal means between said upper and lower sheets and said pile, with said sheets, seal means and additional seal means limiting the flow of sea water to the generally circumferential water-filled spaces between

said pile and said sheets to a rate insufficient for supporting marine borer life.

2. Apparatus as set forth in claim 1 wherein said seal means is a foamed synthetic plastic impregnated with a temporary binder.

3. Apparatus for protectively encasing a submerged wooden pile against marine borer attack, said pile being formed with a cavity, comprising: a back-up band secured about said piling in encompassing relationship with said cavity; a lower sheet disposed about said pile in encompassing relationship with its upper end extending over and above said back-up band and its lower end extending below the area of active marine borer attack on said pile; an upper sheet disposed about said pile in encompassing relationship with its lower end extending below the upper end of said lower sheet as well as said back-up band and its upper end extending above the area of active marine borer attack on said pile; a seal strip aligned with said back-up band and interposed between the upper end of said lower sheet and additional seal means supporting said sheet upon said pile;
and the lower end of said upper sheet, with said sheets seal strip and said additional means limiting the flow of sea water to the generally circumferential water-filled spaces between said pile and said sheets to a rate insufficient for supporting marine borer life.

4. Apparatus as set forth in claim 3 wherein said seal strip is a foamed synthetic plastic impregnated with a temporary binder.

5. Apparatus for protectively encasing a submerged wooden pile against marine borer attack, comprising:

a sheet of substantially waterproof material disposed around said pile to define a generally circumferential water-filled space;

means supporting said sheet upon said pile;

and seal strip means wrapped circumferentially about said pile adjacent the ends of said sheet, the material of said seal strip means being water-tight and having the physical characteristic of returning to its original volume after having been compressed with each said seal strip being compressed before said sheet is wrapped about said pile, each said strip thereafter expanding to its original volume so that said sheet and seal strip means limit the flow of sea water to said space to a rate insufficient for supporting marine borer life.

6. Apparatus as set forth in claim 5 wherein each said seal strip is a foamed synthetic plastic impregnated with a temporary binder.

7. Apparatus for protectively encasing a portion of the length of a pile that is submerged in sea water against marine borer attack, one end of said pile remaining out of direct contact with the sea water, comprising:

a sheet of substantially waterproof material disposed around said pile to define a generally circumferential water-filled space, one end of said sheet extending vertically toward said one end of said pile so as to remain out of direct contact with said sea water, the opposite end of said sheet remaining submerged in said sea water;

elongated vertically extending stiffening means attached to the vertical edges of said sheet, said stiffening means being secured to said pile to support said sheet thereon;

and seal means formed of a water-tight material having the physical characteristic of returning to its original unconfined volume after being compressed to a fraction of its unconfined volume, said seal means being arranged around said pile underneath said sheet and adjacent said opposite end of said sheet, with said sheet and said seal means limiting the flow of sea water to said space to a rate insufficient for supporting marine borer life.

8. Apparatus as set forth in claim 7 wherein said seal means is a foamed synthetic plastic impregnated with a temporary binder.

References Cited by the Examiner

UNITED STATES PATENTS

2,181,526	11/39	Upton	61—54
2,928,411	3/60	Johnson	61—54 X
2,964,424	12/60	Mast	117—98

JACOB L. NACKENOFF, *Primary Examiner.*

JACOB SHAPIRO, *Examiner.*

UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 3,177,667 April 13, 1965

Orval E. Liddell

It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, lines 20 to 22, for "the upper end of said lower sheet and additional seal means supporting said sheet upon said pile; and the lower end of said upper sheet, with said sheets" read -- the upper end of said lower sheet and the lower end of said upper sheet and additional seal means between said upper and lower sheets and said pile, with said sheets, --.

Signed and sealed this 28th day of September 1965.

(SEAL)
Attest:

ERNEST W. SWIDER
Attesting Officer

EDWARD J. BRENNER
Commissioner of Patents