Dec. 1, 1931. O. V. HOUGH 1,834,060

RIVER BED PROTECTIVE CONSTRUCTION

Filed June 22, 1929 3 Sheets-Sheet 1

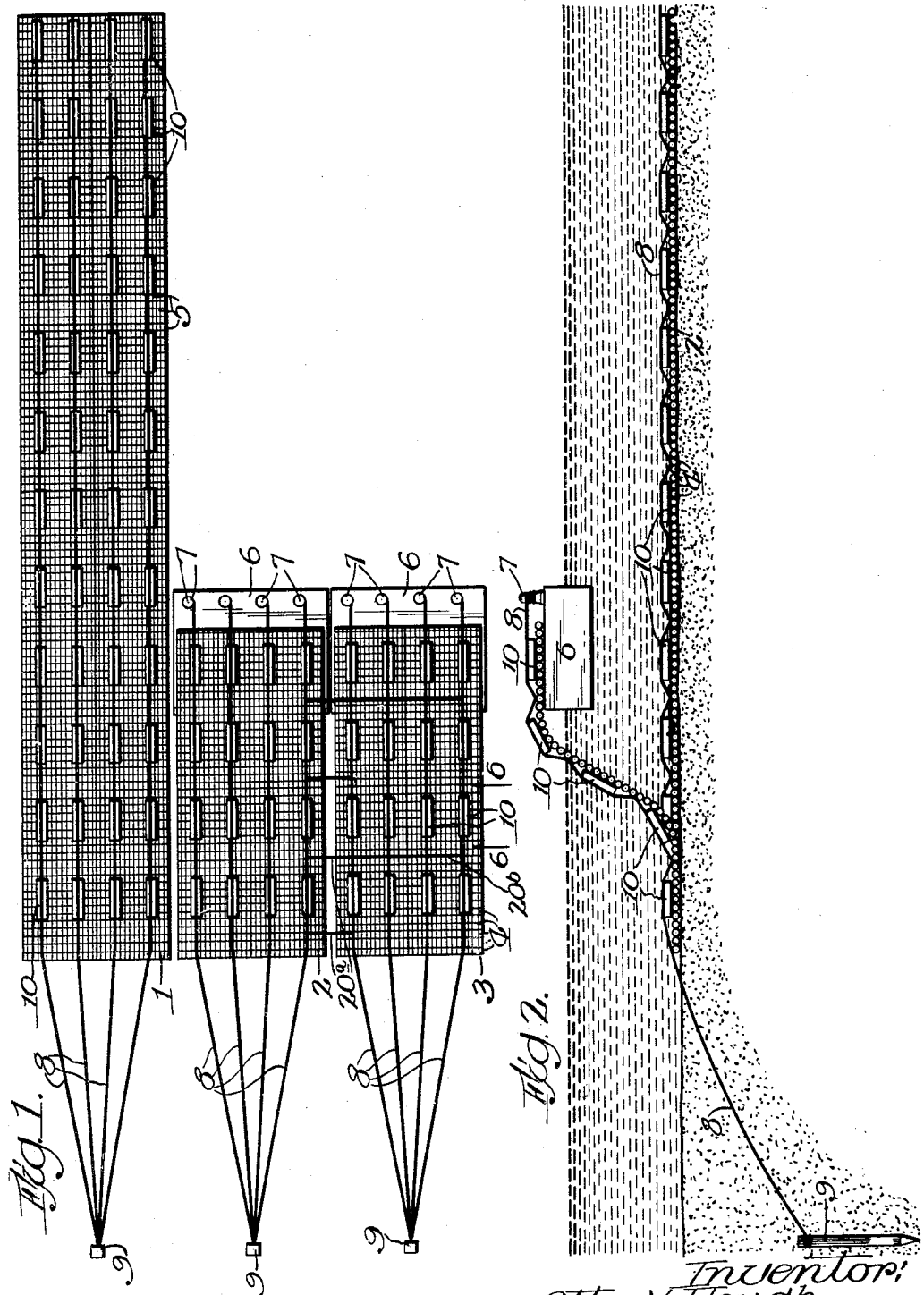


Fig. 1.

Fig. 2.

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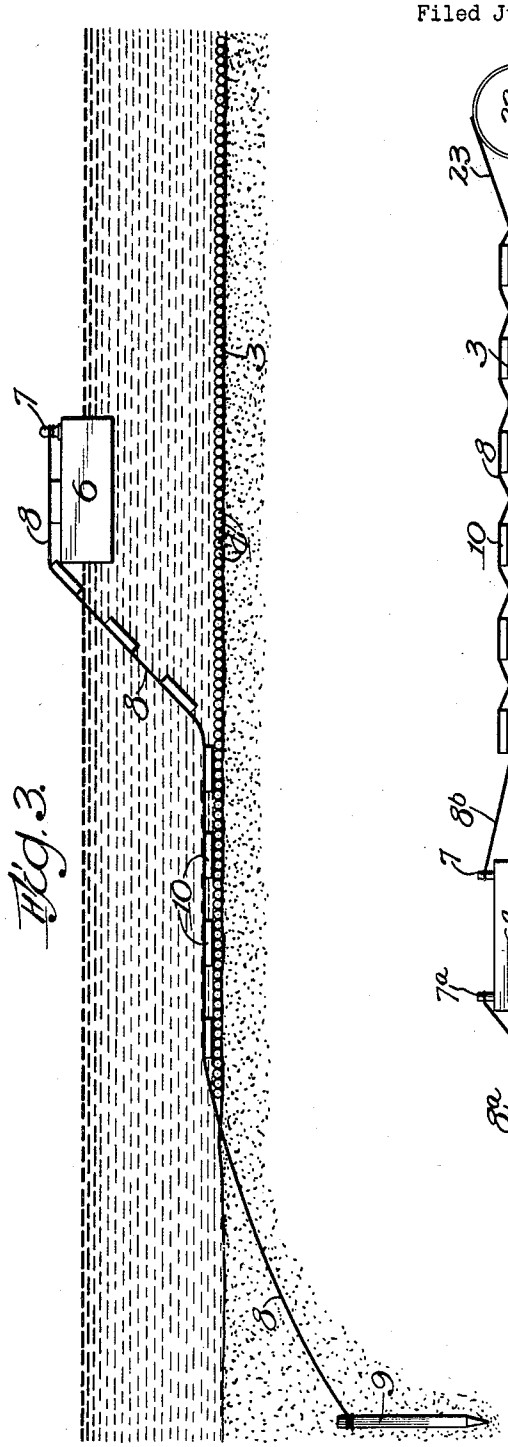


Fig. 3.

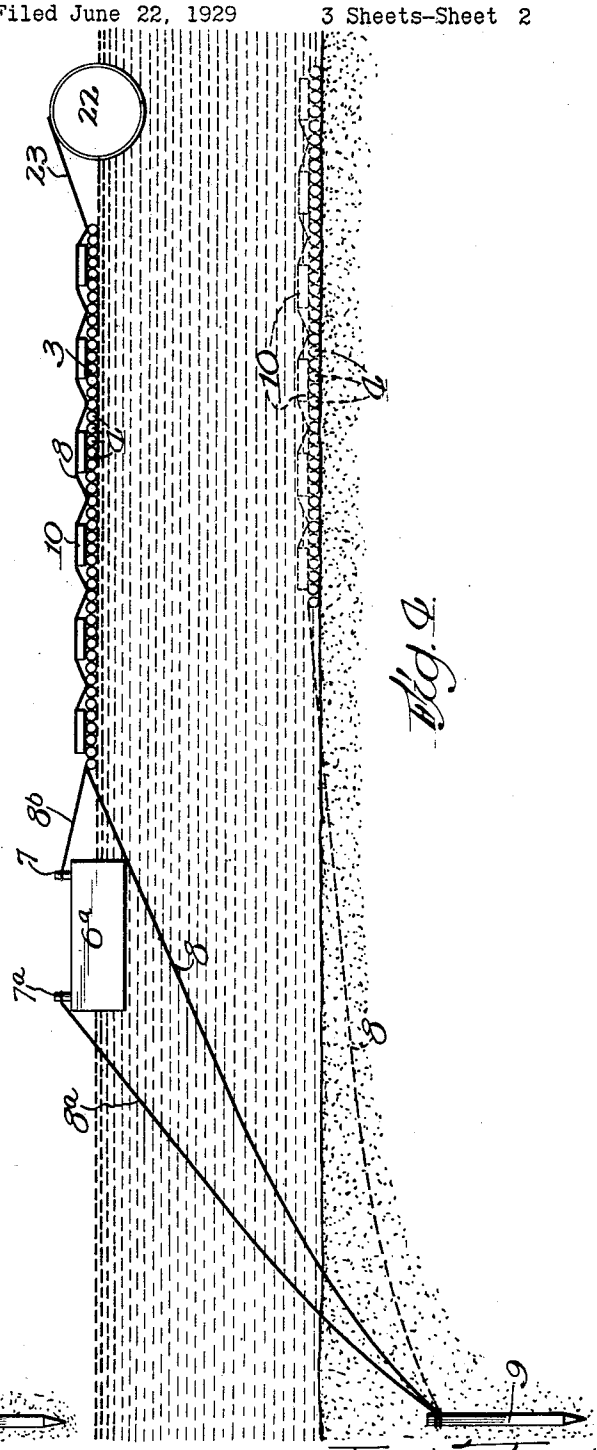


Fig. 4.

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Fig. 5.

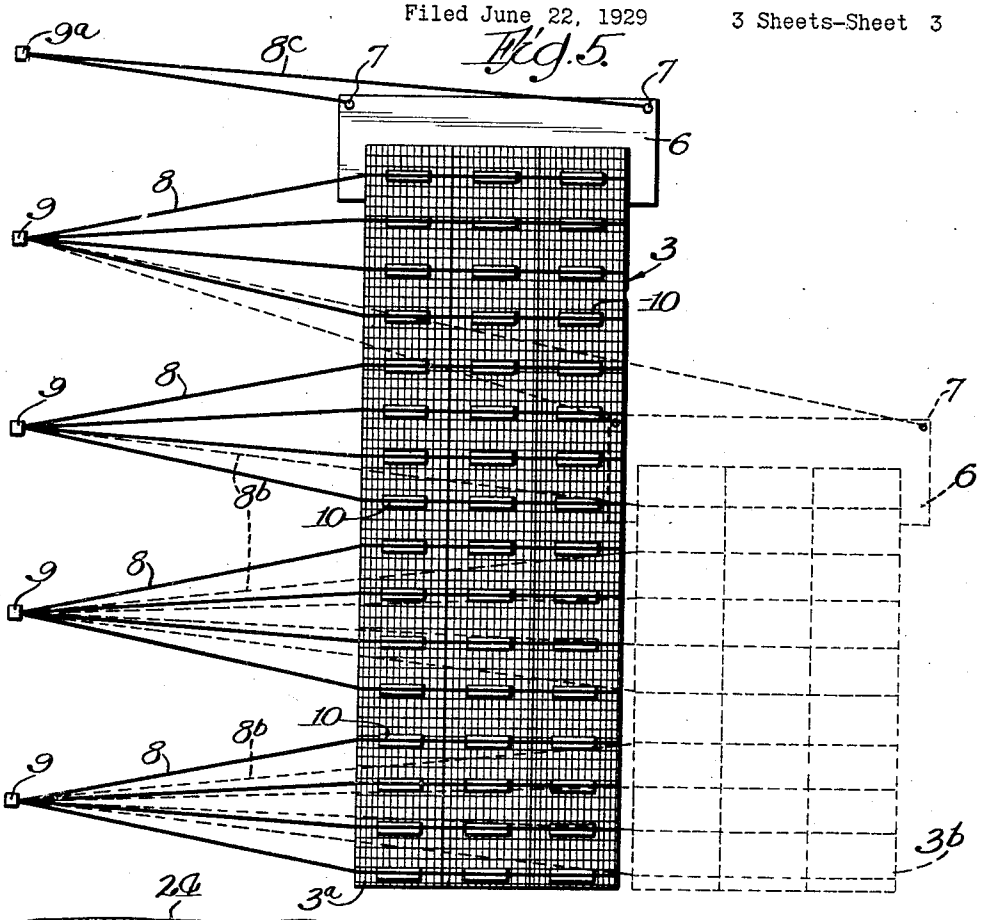
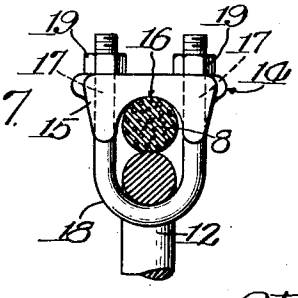


Fig. 6.



Fig. 7.



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UNITED STATES PATENT OFFICE

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RIVER BED PROTECTIVE CONSTRUCTION

Application filed June 22, 1929. Serial No. 372,932.

The present invention relates to river bed protective constructions and the method of laying the same.

Among the objects of the invention is to provide a novel method of constructing and placing a river bed protective covering on the bed of a river. Heretofore, in the construction of protective coverings for the bed of streams, such as mattresses, the mattress, during construction, was anchored and held in place by cables fastened to some form of anchor resting on the bed of the stream, or connected to "dead men" buried in the banks of the stream, or to piling driven into the bed of the stream. The driving of such piling could not be successfully carried out in deep water, nor was it possible to make the anchors resting on the bed of the stream hold, especially where the current was swift and the bed of the stream somewhat smooth. Again, if the stream in which a protective covering was to be placed were wide, it was not feasible to use "dead men" on the banks of the stream to which cables holding the mattress were fastened.

It is an object therefore of the invention to eliminate these difficulties as met with in the present practice of laying a protective covering on the bed of a stream and to provide a method of constructing and laying a mattress or the like, whether the stream be deep or shallow, wide or narrow.

A further object of the invention is to provide means for and a method of ballasting the mattress or protective covering on the bed of a stream, wherein the ballast is positively positioned on the mattress. In the construction of such protective devices, heretofore, the mattress was ballasted with loose rock, commonly called "one man stone," such rock being dropped into place after the mattress had taken a position on the bed of the stream. By dropping ballast onto the mattress or protective covering in this manner, there was no assurance that the ballast would be evenly distributed over the mattress, nor was it possible to accurately lay the ballast adjacent to the upstream edges of the mattress. Where there was a deep, swift current in the stream, failure to ballast the upstream edge of the mattress permitted the current to lift and roll such edge of the mattress and to undermine the entire structure. This current and pressure against the rolled edge of the mattress or protective covering would cause a working of the loosely positioned ballast rock toward the downstream edge of the mattress, causing a further rolling of the mattress and likewise a greater surface exposure to the current in the stream with a consequential further and greater tendency for the rolling or working of the ballast rock toward the downstream side, until the mattress has been partially or wholly dispaced.

It is an object of this invention to provide a novel means for and method of ballasting a protective covering and anchoring such ballast so that any rolling and flapping of the upstream edge of the mat will not cause a displacement of the ballast toward the downstream side of the mattress with a consequential rolling of the mat and its displacement from its position on the bed of the stream.

The invention comprehends the idea of providing a means for and method of, whether with or without ballast, anchoring a mattress or protective covering on the bed of a stream in such a way that the up-stream edge of the mattress will not roll and flap in the current of the stream to present a surface against which the current will act to cause a displacement of the mattress.

The invention further comprehends the means for and method of utilizing the cable used for mooring the pontoon or barge upon which the mattress is constructed and continuously payed out therefrom, for the anchoring of the mattress or the ballasting material or both.

A further object of the invention is to provide a novel method of constructing ballasting means for a protective covering or mattress in the bed of a stream and a novel method of securing this ballasting means to a cable. In the embodiment selected to illustrate the invention, a pre-cast concrete block is provided with a reinforcing rod having a loop portion extending beyond the end of the

block and a bent portion of the rod at the other end of the block. A cable clamp or clip securely holds the loop end of the rod to the cable, while a wire tie, slidable on the cable and one end of which catches the bent portion of the rod at the other end of the rod, holds the block in position temporarily until the ballasting means and protective covering is in its final resting place on the bed of the river.

Other objects, advantages, capabilities and features are comprehended by the invention as will later appear, and as are inherently possessed thereby.

Referring to the drawings:

Fig. 1 is a top plan view of one of the embodiments selected to illustrate the invention, and showing the method of laying and anchoring a river bed protective covering.

Fig. 2 is a side view in elevation of the embodiment disclosed in Fig. 1.

Fig. 3 is a side view in elevation disclosing the method of laying ballast to anchor a river bed protective covering which has already been positioned on the bed of the river.

Fig. 4 is a side view in elevation of a mattress or river bed protective covering constructed in accordance with the invention, the finished mattress being floated by buoys or the like until completed when it is cut loose and assumes the position shown in dotted lines.

Fig. 5 is a top plan view of an embodiment constructed in accordance with the invention, the laying of the protective coverings being transversely of the thread of the stream, and showing in dotted lines the positioning of a successive covering or mattress to be constructed and laid on the bottom of the stream or river.

Fig. 6 is a view in side elevation taken in a plane represented by line 6—6 in Fig. 1 of the drawings, and showing in detail the means and method of securing the ballast to the mooring cable and the mooring cable to the protective covering or mattress.

Fig. 7 is a cross-sectional view taken in the plane represented by the line 7—7 of Fig. 6.

Referring now more in particular to the drawings, one of the embodiments selected to illustrate the invention, comprises a protective covering or mattress of which section 1 has been constructed and laid in accordance with the invention, while sections 2 and 3 are in the process of being constructed and laid. The mattress 1, and likewise 2 and 3 are constructed of boards or saplings 4 or the like, the boards or saplings being interwoven with each other and are held together by tie wire 5 or other means, being interwoven around the boards or saplings to form a flexible mattress. This mattress is built or constructed upon a barge or pontoon 6 having at one side thereof capstans 7 around which is secured cables 8 having an end connected to a pile 9 which is driven into the bed of the stream and below a point which would be subject to the eroding action of the current of the stream.

The mattress is woven and continuously payed out over the edges of the barge or pontoon, and is provided at intervals with ballast comprising a precast concrete block 10, as clearly shown in Fig. 6, the block 10 having a reinforcing rod 11 with a looped end 12 projecting from one end and a bent portion 13 extending from the other end. As the mattress or protective covering is constructed and is payed off over the edge of the barge or pontoon, the same is ballasted by the ballast blocks 10 which are placed at intervals along the cables 8 and are secured to the cables at their upstream end by a cable clamp or clip 14, a detail of which is clearly shown in Fig. 7 of the drawings. This cable clamp or clip 14 is provided with a body portion 15 having a circular bearing portion 16 adapted to engage the cable 8 and is also provided with holes 17 at each end adapted to receive the ends of a U-bolt 18 engaging the looped end of the rod 12 in the block 10 to hold the rod in a fixed position against the cable 8 when the bolts 19 are drawn tight on the threaded ends of the U-bolt and against the body portion 15.

Wire ties 20 looped around the cable 8 are provided, the ends of which engage the bent end 13 of the rod 11 to position the downstream end of the precast block 10. The mattress or protective covering 3 is secured to the cable 8 by cable clamps 21 similar to those shown as 14, these clamps 21 holding the wires 5 of the mattress 3 and cable 8 together on the upstream and downstream sides of the ballast blocks 10. It will be seen that the ballast blocks 10 are firmly secured to the cable 8 which in turn is secured to the wires 5 of the mattress 3. It will also be apparent that the cable 8 is not only used to hold the barge or pontoon during the construction of the mattress, but is used to hold the mat in position during its construction and becomes part of and anchors the permanent protective covering when the cable is cut loose to free the barge and to let the mattress down into its final position.

The width of the mattress being constructed on the barge or pontoon may vary to suit the conditions present at the point in the bed to be protected. In a wide stream, sections of mattress can be constructed and laid in position after which another section can be built and laid in place alongside of the first one constructed. It may also be desired to have one or more barges or pontoons transversely across the stream, each contructing a section of a mattress. These sections, if constructed simultaneously, may be connected by cross ties 20^a looped with and secured to the cables 8, or wires 5, at the adjacent margins of the

mattresses. Likewise any number of cables may be anchored to the piles 9, and the blocks may be spaced consistent with the proper construction and ballasting of the mattress to fit the conditions present at the points in the bed of the river being protected.

Fig. 3 discloses an embodiment illustrating the invention where the mattress or protective covering 3 as shown in Figs. 1 and 2 has been constructed and laid in place on the bed of the stream. The ballast blocks 10 are then secured at intervals to the cable 8 as described and are payed off over the side of the barge to assume their final position on the mattress or protective covering which has previously been laid on the bed of the stream. The cable securely holds the ballast blocks in place and bears against the upstream edge of the mattress to prevent the rolling of the edge and displacement which would result if the edge rolled or flapped in the current of the stream.

If desired, cross ties 20^b may be connected at intervals between cables 8 and at points between blocks 10.

Fig. 4 is still a further embodiment selected to illustrate the invention. In this illustrative embodiment of the invention, the barge or pontoon 6^a is securely anchored to the piles 9 by cables 8^a connected to a binding post or capstan 7^a, mooring or positioning the barge 6^a upstream from the particular region or area of the bed of the stream to be protected by a mattress or protective covering. The mattress 3 is constructed on a barge such as shown in Figs. 1, 2 and 3, and the ballasting blocks are secured in place as described, and as the mattress with the ballast thereon is payed off over the sides of the barge, buoys 22 with cables 23 are connected at intervals around the edges of the mattress, as also upon the surface of same, to keep the mattress or protective covering, together with the ballast, afloat until the section of mattress is completed, at which time it is fastened to the mooring barge 6^a by the slip line 8^b. When the mattress is in the position desired, the slip line 8^b is cut loose of the mooring barge and the cables 23 are cut loose of the buoys 22 when the mattress or protective covering will sink or settle into position with the anchoring cable 8 attached as clearly shown in dotted lines. This insures accurate placing of the mattress in the location desired.

Fig. 5 is illustrative of the invention as disclosed and described in the previous figures embodying the invention. This embodiment, however, discloses the construction and laying of a mattress such as 3^a transversely of the thread of the stream. In this embodiment piles 9 are driven into the bed of a stream, each one of them having a plurality of cables such as 8 and 8^b secured to the upper ends of the piles by any suitable means. To one of the piles as 9^a, a barge such as 6 is moored or anchored by cables 8^c and connected to the barge or capstans 7. The mattress such as 3 is constructed on the barge 6, operations starting or beginning at the shore line or bank 24 and proceeding towards the center of the stream and thence to the opposite bank. As the mattress or protective covering 3 is payed off over the edge of the barge 6, precast ballast blocks 10 connected as previously described to the cables 8, are positioned on the mattress 3, the cables 8 being connected as described to the mattress 3 by cable clamps or clips 21. The mattress 3 is payed off over the edge of the barge 6 and will settle or sink to the bed of the stream and is securely anchored in position by the cables 8 connected to the piles 9. If it be desired to lay a similar section of mattress such as 3^b shown in dotted line, alongside of the section of mattress 3, the barge 6 is brought back to the bank 24 and another section as 3^b is constructed, the cables 8^b being used to anchor the mattress section 3^b and to hold the ballast block in place on the mattress. As many of these sections may be laid as desired and may be held in place by cables similar to 8 and 8^b anchored to the piles 9.

While I have herein described and upon the drawings shown illustrative embodiments of the invention, it is to be understood that the latter is not limited thereto but may comprehend other constructions, details, arrangements of parts, features and process steps without departing from the spirit thereof.

Having thus disclosed the invention, I claim:

1. A stream bed protective covering comprising a mattress resting upon the surface of the stream bed, cables each anchored at one end below said bed at positions adjacent to said mattress, said cables each having a portion extended over the top of said mattress, and weighted members resting upon the top of said mattress so as to ballast the same, said weighted members being connected with the respective cables.

2. A stream bed protective covering comprising a mattress resting upon the surface of the stream bed, cables each anchored at one end below the bed of the stream at positions adjacent to one edge of said mattress, said cables each having a continuous portion extended over the top of said mattress, weighted members resting upon the top of said mattress so as to ballast the same, said weighted members being connected with the respective cables in spaced relation longitudinally thereof, and means connecting each cable to the mattress at positions between the weighted members.

3. A stream bed protective covering comprising a mattress resting upon the bed of the stream, a plurality of cables each anchored at one end below the bed of the stream and

having portions extended over the top of the mattress, a plurality of spaced apart weights resting upon the top of said mattress, each of said weighted members having its up-stream end securely connected to its cable, means for loosely connecting the other end of each weighted member to its cable so as to facilitate positioning of said members during the construction of the protective covering, and to also prevent lateral displacement of said weighted members with respect to the mattress.

4. A stream bed protective covering comprising a mattress resting upon the bed of the stream, a plurality of cables each anchored at one end below the bed of the stream and having portions extended over the top of the mattress, a plurality of spaced apart weights resting upon the top of said mattress, each of said weighted members having its up-stream end securely connected to its cable, means for loosely connecting the other end of each weighted member to its cable so as to facilitate positioning of said members during the construction of the protective covering and to also prevent lateral displacement of said weighted members with respect to the mattress, and means for securing the overlying portions of said cables to said mattress at positions between said weighted members.

5. A stream bed protective covering comprising a mattress resting upon the surface of the stream bed, cables each securely anchored at one end in said bed, continuous portions of said cables extending over the top of said mattress and bearing against the up-stream edge thereof so as to prevent curling of the mattress, and ballast members connected to said cables and resting upon the top of said mattress, said ballast members being arranged in spaced relation longitudinally of the respective cables.

6. A stream bed protective covering comprising a mattress resting upon the bed of the stream, a plurality of cables each anchored at one end below the bed of the stream and having a portion extended over the top of the mattress, said last mentioned portions being connected to the mattress at spaced apart intervals, and ballast members resting upon said mattress and each lying between a pair of the connections between the cable and the mattress and beneath the portion of the cable extending between said connections.

7. A stream bed protective covering comprising a mattress resting upon the bed of the stream, a plurality of cables each anchored at one end below the bed of the stream and having a portion extended over the top of the mattress, said last mentioned portions being connected to the mattress at spaced apart intervals, ballast members resting upon said mattress and each lying between a pair of the connections between the cable and the mattress and beneath the portion of the cable extending between said connections, and means connecting the ends of each ballast member to that portion of the cable which overlie the same.

8. In a method of anchoring a mattress to the bed of a stream, the steps of placing a mattress upon said bed, ballasting said mattress by anchoring one end of a cable below the stream bed adjacent one edge of said mattress, connecting ballast to a continuous portion of said cable at spaced apart locations and extending said continuous portion of the cable over said mattress, and allowing said cable and the attached ballast to sink into the stream until the ballast rests upon said mattress.

9. A method of constructing a protective covering for the bed of a stream comprising the steps of anchoring one end of a cable to the bed of a stream and attaching a barge to said cable, constructing a mattress upon said barge, connecting ballast to a continuous portion of said cable, paying out the mattress from said barge and simultaneously paying out the ballast laden cable over the top of said mattress, and allowing the mattress and the ballast laden cable to sink into the stream until they rest upon the bed thereof with the ballast on top of the mattress, so that when the barge is released from said cable the overlying ballast laden cable will hold the mattress on the bed of the stream.

10. A method of constructing a protective covering for the bed of a stream comprising the steps of anchoring one end of a cable to the bed of a stream and attaching a barge to said cable, constructing a mattress upon said barge, connecting ballast to a continuous portion of said cable, connecting said ballast laden cable to the top of said mattress so that the cable overlies the mattress, and paying out the mattress and ballast laden cable from the barge and allowing them to sink into the stream until the mattress rests upon the stream bed with the ballast resting upon the mattress and the cable overlying said mattress, and finally releasing the barge from said cable.

11. In a method of securing a mattress to the bed of a stream, the step of placing a mattress on said bed, anchoring one end of a cable below the bed of the stream at a position up-stream from an edge of said mattress, buoyantly supporting the main portion of the cable, securing ballast to said cable, and paying out the cable and attached ballast by a down stream movement with respect to the anchored end of the cable and sinking the ballast laden cable until the ballast rests upon the mattress and the cable overlies the same.

12. In a method of constructing a protective covering for the bed of a stream, the

steps of securing each of a plurality of cables at one end below the bed of a stream, forming a ballast mattress upon a barge moored to certain of said cables, securing continuous portions of other of said cables to the top of said mattress and attaching ballast members to said cable portions, buoyantly supporting the ends of said mattress with the superposed cable portions and ballast members, and finally depriving the mattress and the superposed cable portions and ballast members of their buoyant support and allowing them to sink to the bed of the stream.

13. In a method of constructing a protective covering for the bed of a stream, the steps of securing one end of each of a plurality of cables below the bed of a stream, buoyantly supporting a mattress and extending portions of said cables over the top of the mattress and securing them thereto, providing the mattress with weighted members, and finally releasing the mattress from its buoyant support and allowing it to sink to the bed of the stream with the weighted members and cables on the top thereof.

In witness whereof, I hereunto subscribe my name to this specification.

OTTO VERE HOUGH.