G. MACCAFERRI.

DEFENSE FOR THE BANKS AND THE BED OF WATER COURSES.

APPLICATION FILED OCT. 20, 1913.

1,162,499. Patented Nov. 30, 1915.

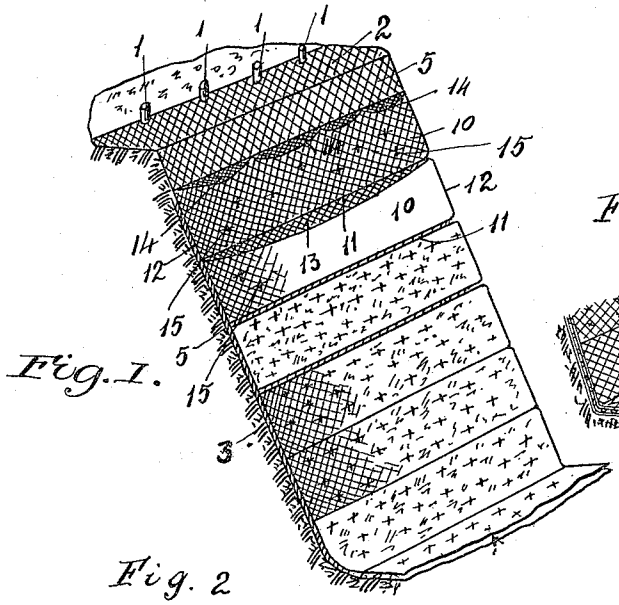


Fig. 1.

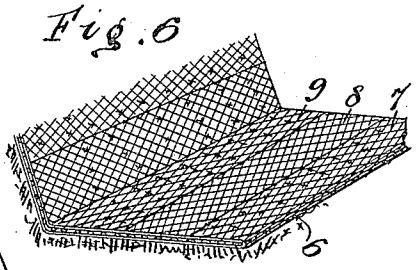


Fig. 6

Fig. 2

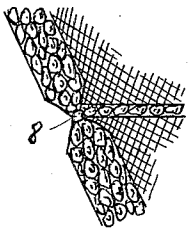


Fig. 3

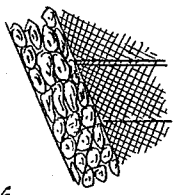
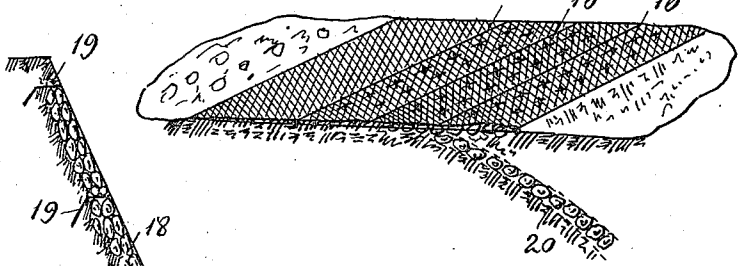


Fig. 4



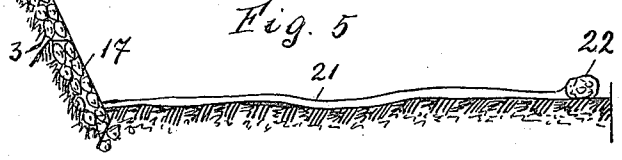


Fig. 5

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GAETANO MACCAFERRI, OF ZOLA PREDOSA, NEAR BOLOGNA, ITALY.

DEFENSE FOR THE BANKS AND THE BED OF WATERCOURSES.

1,162,499. Specification of Letters Patent. Patented Nov. 30, 1915.

Application filed October 20, 1913. Serial No. 796,333.

To all whom it may concern:

Be it known that I, GAETANO MACCAFERRI, a subject of the King of Italy, and residing at Zola Predosa, near Bologna, in the Kingdom of Italy, have invented certain new and useful Improvements in Defenses for the Banks and the Bed of Watercourses, of which the following is a specification, reference being had therein to the accompanying drawing.

The invention relates to improvements in defense works for the banks and beds of water courses and the like.

Another object of the present improvement is to devise a defense work which will easily repair a slip or scour.

The invention consists in constructing a revetment of the banks and the bed of water courses by aid of two sheets of wire netting or the like, having filled in between them stone or cement matter.

The two sheets of wire netting, which may also be one single properly bent piece of such netting, are arranged so as to form pockets with one or more openings for throwing in the stone or cement matter and which are then closed by any suitable lacing, or so as to form a species of quilted mattress or cushion which is stuffed with stone or cement matter and then closed by means of wire lacings or the like. It will be found advisable, when forming each pocket or cushion, to connect the two sheets of wire netting by sewing them together, so as to construct a complete quilted cover.

In order that the invention be readily understood, it will here be described, by way of example, with regard to several constructional forms of the defense according to the invention, reference being had to the accompanying drawing.

Figure 1 is a perspective view showing my improved bank protector in place. Fig. 2 is a detail section through the device. Fig. 3 is a detail section through the device. Fig. 4 is a perspective view of a modified form of installation. Fig. 5 is a transverse section through a bank and bed showing the device in position. Fig. 6 is a detail perspective view of a modification.

A first form of construction of this defensive work is as follows.—After having properly prepared the bank and leveled the bed of the water course to which the revetment is to be applied, a zone 2 of wire netting is secured, for example, by means of piles 1, to the top of the bank (Fig. 1) and is then freely spread out in a fold 5 down the bank 3 and upon the bed 4 of the water course, until this fold reaches the lower border 6 forming the limit of the revetment. A layer of stone matter is then arranged on the last part of the wire netting thus put in place, so as to form a cushion 7 which will be covered with the residual wire netting bent on the edge 6, or with another piece of wire netting sewed along this edge 6 to the fold 5, and a seam is made along the line 8. Another layer of stone matter is then arranged on the adjacent part of the fold 5 of wire netting so as to form a second cushion which is covered with another part of the residual wire netting, and a second seam is made along the line 9. These operations are continued until the top of the revetment has been reached, where the edge of the residual wire netting is sewed to the zone 2.

When the revetment is made in the way above described, the seams as 8, 9, etc. of the cushions are in the shape shown in Fig. 2, where the revetment is narrowed along these seams and is therefore not uniform. In several cases this may prove to be an inconvenience.

When it is desired to construct a revetment having a uniform thickness or connections between its various elements similar to those shown in Fig. 3, a wrapper with pockets is made (Fig. 1) consisting of the inner fold of wire netting 5, as described, and of a plurality of outer folds 10, which are sewed to, or interwoven with, the inner fold along the lower edges 11 and along the sides 12, so as to form a plurality of pockets having a large upper opening 13 or several smaller upper openings 14 obtained through stitches dividing the large opening. The folds 10 may be held in place by securing them to the fold 5 by means of stitches 15. These pockets are filled with stone matter which divides itself evenly within them, and the openings are then closed by securing the free edge of each pocket to the lower edge 11 of the pocket immediately above. If the seams along the lines 11 and 12 and the stitches 15 are well made, that is to say, if they have all the required length, the revetment thus obtained will have a constant and uniform thickness, or its thickness may be uniformly varied, as desired, without it being prevented from fully adapting itself to the irregular forms of the ground.

The continuity of the structure in longi-

tudinal direction may in each case be obtained by overlapping the neighboring apparatus for a few inches in the direction of the current, or by connecting the apparatus, when arranged one beside another, by stitches or seams, or, preferably, by prolonging in longitudinal direction both the lower fold and the upper fold or folds of wire netting through adding new netting and connecting it to the preceding netting by interweaving and interlacing their meshes.

Instead of using a plurality of apparatus consisting of separate pockets or cushions, it may in some cases be found convenient to construct the revetment by prolonging without interruptions in both directions both the lower and the upper folds of wire netting, adding new netting to the netting already put in place by interweaving and interlacing their meshes. In this way, one single element for the whole bank and bed to be protected will be obtained. The upper sheet of wire netting will then be secured to the lower sheet through stitches, such as 15, or in any other similar way. This large quilted cushion or mattress may also be filled from one single upper opening, when the weight of the stone matter will secure a complete filling of this mattress or cushion.

Fig. 4 shows another example of this defense work. The protection of the bed of the watercourse is here obtained, in a manner similar to the one above described, with a suitable number of cushion elements 16 or, if desired, with one large element, or with one or a few cushions connected to a large zone of simple wire netting or attached to any known defensive work, whose strength will thereby be greatly increased.

It is evident that the method for constructing this defense may be altered in many other ways, according to circumstances and to requirements, without departing from the spirit of the invention. In some cases it will be found necessary to fix the revetment in its place, and this may be done, for example, by means of stakes or piles of wood, similar to the piles 1, driven through the revetment at suitable points thereof, or with other means, or by making some of the elements of the revetment thicker than their brother elements. If the bank to be protected is sufficiently solid, the revetment may consist of one single upper sheet of wire netting, covering a layer of stone or cement matter. A revetment constructed in this way is shown in Fig. 5, where it consists of one single sheet of wire netting 17 covering the stone matter 18 filled in behind it. Such a revetment is employed, as has been said, when the bank 3 is sufficiently solid. The metallic fabric 17 may be fixed to the river bed by means of hooks 19 of metal or wood.

It will easily be seen that a revetment according to the invention has the further advantage, provided of couse a suitable filling material is used, that it will follow the ground where the same gives way and take up the successive positions thereof, for example, the position 20 shown in dotted lines in Figs. 1 and 4, thus preventing excavations following on scours.

When the condition of the bed or the bank of the river permits it, a useful defense work may be constructed, without departing from the spirit of the invention, by spreading out directly upon the bottom and upon the bank a zone of wire netting 21 which may be kept in place through wooden stakes or any other suitable means. At the end of this zone of wire netting, there is formed a swelling 22 of tubular or any other suitable shape, which is filled with stone matter. This swelling spontaneously buries itself in the ground and prevents scours.

What I claim is:

1. A protector for the banks and beds of water courses comprising a sheet of wire netting and a plurality of smaller sheets of wire netting having their lower ends and sides fastened to the first-mentioned sheet and their upper ends open, said smaller sheets arranged one above the other, whereby a plurality of pockets are formed extending in a horizontal position and arranged one above the other, cement or other material placed in the space between the smaller sheets and the main sheet, and means for closing the open ends of the said sheets.

2. A protector for the banks and beds of water courses, comprising a sheet of wire netting, and a plurality of smaller sheets of wire netting having their lower ends and sides fastened to the first-mentioned sheet and their upper ends open, the open upper edge of the smaller sheets attached to the main sheet at a plurality of points and thereby forming a plurality of small pockets arranged side by side in horizontal relation to each other, said smaller sheets arranged one above the other, whereby a plurality of series of horizontally arranged pockets are formed one series above the other, cement or other material placed in the space between the smaller sheets and the main sheet of wire netting.

In testimony whereof I have signed my name in the presence of two subscribing witnesses the 4th day of October 1913.

GAETANO MACCAFERRI.

Witnesses:

GIOVANNI VALATELLI,

CORELLO FARIBANI.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."