

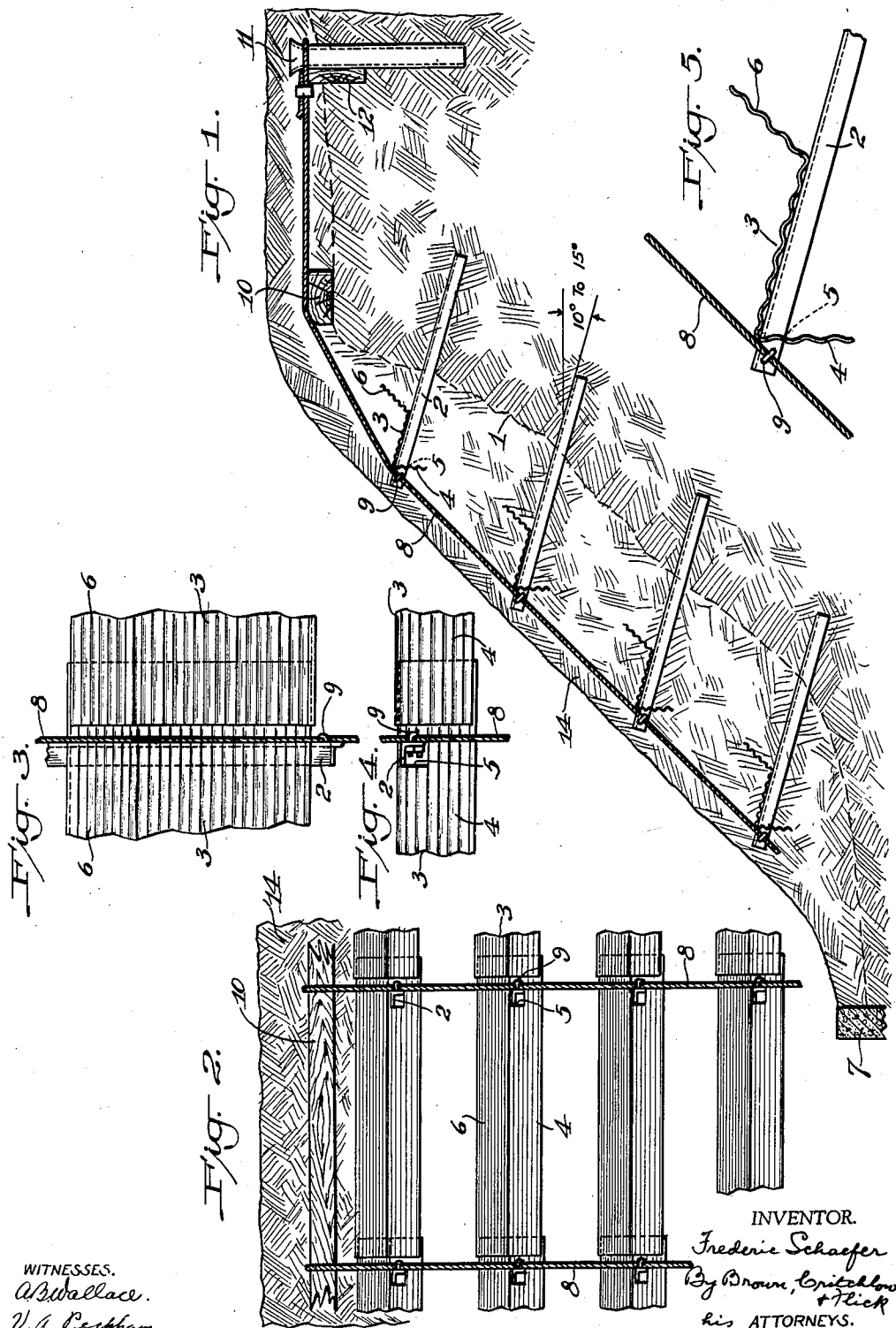
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EMBANKMENT RETAINER

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EMBANKMENT RETAINER

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7 Claims. (Cl. 61—35)

This invention relates to structures for retaining in place earthen embankments that are exposed to severe erosion or washing away, such as embankments bordering on rivers, lakes and oceans.

It is among the objects of this invention to provide an embankment-retaining structure which is relatively easy to construct, which is made from material that is inexpensive and readily obtainable, which can be erected quickly and with a minimum of labor, and which is concealed from view but holds an embankment in place while planting is taking root.

In accordance with this invention a plurality of stakes are driven into the side of an embankment in vertically spaced rows with their outer ends protruding therefrom and rigidly connected together by cables that extend up the bank and over its top where they are anchored in fixed position behind the upper row of stakes. The stakes are thus securely held in place. A line of metal plates is then placed on the projecting portions of each row of stakes for supporting fill material that is deposited upon them and that is used to fill the spaces between the horizontal rows of stakes and plates so that they are entirely covered. Preferably, the front edges of the plates are turned down to form flanges in which there are openings through which the supporting stakes extend, and the rear edges of the plates are turned upwardly to provide stiffening flanges. The original bank is protected by the overlying layer of fill material, while the fill is prevented by the metal plates from being washed down out of place.

The preferred embodiment of the invention is illustrated in the accompanying drawing, in which Fig. 1 is a vertical section through an embankment showing one end of my retaining structure; Fig. 2 is a fragmentary front view of the retaining structure before the fill has been deposited; and Figs. 3, 4 and 5 are enlarged fragmentary plan, front and end views, respectively, of the retaining structure, especially the plates.

Referring to Fig. 1 of the drawing, the side or inclined face of the embankment that it is desired to build up and hold in place may, of course, be of any configuration, such, for example, as that indicated by the broken line 1. The first step in protecting the embankment is to drive a plurality of stakes 2 into its side, preferably downwardly at a small angle to the horizontal. A strong and inexpensive type of stake is one formed from an angle iron driven into the bank in such a manner that one flange is on top. If

the irregularity of the side of the bank requires it, the stakes may be of different lengths so that after they have been driven the desired distance into the bank their outer ends will all lie in substantially the same inclined plane which should correspond to the inclination desired for the repaired bank. In any event the stakes are long enough to permit them to be driven into the bank far enough to assure firm anchorage therein and yet to leave a considerable length of stake protruding from the bank. The stakes are arranged in horizontal and vertical rows for a purpose now to be described.

The projecting outer ends of the stakes serve as supports for a plurality of metal plates 3 which rest thereon and which therefore likewise are disposed in vertically spaced horizontal rows as shown in Fig. 2. One end of each plate rests on the upper flange of one of the stakes, but the opposite end of the plate preferably overlaps and is supported by the end of the next plate which projects beyond its supporting stake. The stakes are desirably driven into the bank at an angle between ten and fifteen degrees to the horizontal so that the plates will not tend to slide backwardly along the stakes. This obviates the necessity for fastening means for connecting the plates to the stakes. Nevertheless, to anchor the plates to the stakes so that they can not move lengthwise out of position, the outer edge portion of each plate is preferably turned down to form a substantially vertical flange 4 having near one end an opening 5 (Fig. 4) through which the underlying stake extends. The stake may be inserted in this opening before it is driven into the bank so that each plate can be used as a gauge for setting its associated stake the correct distance from the preceding stake on the same level, or the stakes may be driven into the embankment first and the plates then mounted on them by slipping openings 5 over the ends of the stakes. This downturned flange 4 also strengthens the plate which preferably is corrugated lengthwise for that purpose. Also, the rear edge portion of each plate may be turned upwardly to form a similar strengthening flange 6.

After the stakes and plates have been put in place the outer ends of the stakes are secured to cables that are anchored in fixed position above and behind the stakes. For this purpose a plurality of horizontally spaced cables 8 extend down the embankment where they lie in substantially parallel relation across the plates and beside the ends of the stakes projecting therefrom. These cables are rigidly connected to the stakes by any

suitable means, such as by U-shaped clamps 9 bolted to the side flanges of the stakes. The upper ends of the cables pass rearwardly over a timber 10 or other support resting on top of the original embankment and are secured to suitable anchoring members. Each anchoring member may consist of a pipe 11 or the like driven down into the top of the embankment behind the upper row of stakes and prevented by a plank 12 against its front side from being pulled forward.

The embankment and retaining structure are now covered with a layer of suitable fill material 14 (Fig. 1), such as earth and stones, which fills in between the rows of plates 3 and permits the bank to be given the desired smooth grade. Enough fill can be placed over the retaining structure to permit planting to be done on the embankment to help retain the earth in place.

If the embankment starts to be washed out from between any two rows of plates, the erosion is confined to that location because the upper of the two rows keeps the dirt above from sliding down into the washed out area which can be again filled in with much less labor and material than if the whole bank were affected. Likewise, the planting on the undisturbed area of the embankment is thus prevented from being torn out and is given a chance to take firm root. The very bottom of the embankment may be protected by a low retaining wall 7 of any suitable material.

It will also be seen that inexpensive and readily available commercial products such as angle irons, corrugated plates, cables and clamps make up my retaining structure, and that it can be constructed in a relatively short time without much work.

According to the provisions of the patent statutes I have explained the principle and construction of my invention and have illustrated and described what I now consider to represent its best embodiment. However, I desire to have it understood that, within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:

1. An embankment-retaining structure comprising a plurality of horizontally and vertically spaced stakes driven laterally into the side of an embankment, cables extending down the embankment and rigidly connected to the outer ends of the stakes, means anchoring the upper ends of the cables, and metal plates resting substantially flat on and supported by the upper sides of said stakes.

2. An embankment-retaining structure comprising a plurality of vertically spaced rows of stakes driven laterally into the side of an embankment, cables extending down the embankment, means rigidly connecting the cables to the outer ends of the stakes, means anchoring the upper ends of the cables in the embankment behind the upper row of stakes, and a plurality of rigid metal plates resting on and supported by each

row of stakes with the body portions of the plates disposed substantially flat against the stakes and with one end of each plate overlapping the adjoining end of the next plate.

3. An embankment-retaining structure comprising a plurality of horizontally and vertically spaced stakes driven laterally into the side of an embankment, cables extending down the embankment and rigidly connected to the outer ends of the stakes, means anchoring the upper ends of the cables in fixed position, and rigid metal plates resting on and supported by the upper sides of said stakes, each of said plates having a down-turned flange along its outer edge, and said flange being provided with an opening in which the outer end portion of the supporting stake is disposed.

4. An embankment-retaining structure comprising a plurality of horizontally and vertically spaced stakes driven laterally into the side of an embankment, cables extending down the embankment and rigidly connected to the outer ends of the stakes, means anchoring the upper ends of the cables, and rigid metal plates resting on and supported by the upper sides of said stakes, each of said plates having a down-turned flange along its outer edge with an opening therein in which the outer end portion of the supporting stake is disposed, and each of said plates also having an up-turned flange along its inner edge.

5. An embankment-retaining structure comprising a plurality of horizontally and vertically spaced stakes driven laterally into the side of an embankment, cables extending down the embankment and rigidly connected to the outer ends of the stakes, means anchoring the upper ends of the cables, and rigid corrugated metal plates resting substantially flat on and supported by the upper sides of said stakes.

6. An embankment-retaining structure comprising a plurality of horizontally and vertically spaced stakes driven laterally into the side of an embankment at an angle with the horizontal of between approximately ten and fifteen degrees, cables extending down the embankment and rigidly connected to the outer ends of the stakes, means anchoring the upper ends of the cables, and metal plates resting substantially flat on and supported by the upper sides of said stakes.

7. An embankment-retaining structure comprising a plurality of horizontally and vertically spaced stakes driven laterally into the side of an embankment, each of said stakes being in the form of an angle iron having one flange substantially vertical and the other flange extending along the upper side of the stake, cables extending down the embankment, clamps rigidly connecting said cables to said vertical flanges at the outer ends of the stakes, means for anchoring the upper ends of the cables, and metal plates resting on and supported by the upper flanges of said stakes.

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