June 9, 1931. J. S. MILLER 1,809,636

DAM

Filed July 3, 1929

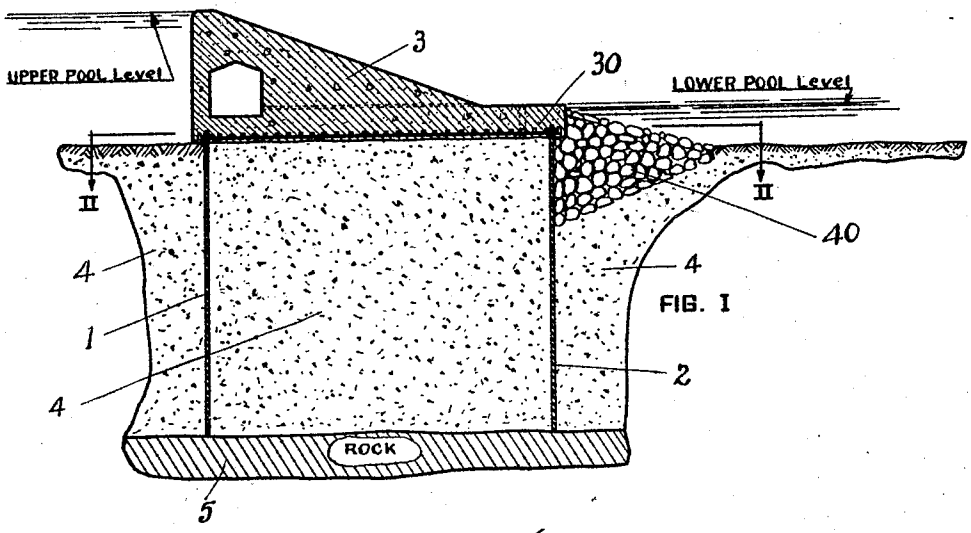


FIG. I

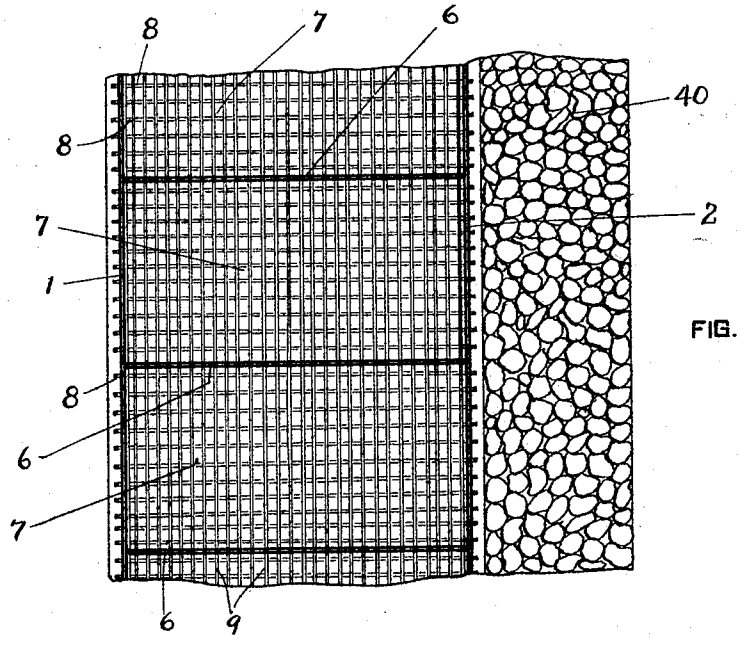


FIG. II

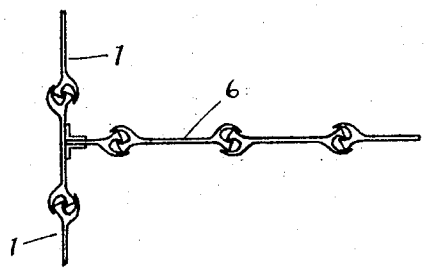


FIG. III

INVENTOR

James S. Miller

by Christy Christy and Wharton

his attorneys.

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UNITED STATES PATENT OFFICE

JAMES S. MILLER, OF PITTSBURGH, PENNSYLVANIA, ASSIGNOR TO DRAVO CONTRACTING COMPANY, A CORPORATION OF PENNSYLVANIA

DAM

Application filed July 3, 1929. Serial No. 375,662.

The invention relates to the structure of dams and is more particularly directed to the provision of a secure foundation which can be built at a minimum of expense and labor.

The bed of many rivers and streams is a more or less deep body or layer of soil or gravel, or both, overlying the bed rock, and it has been common practice to build the dam directly upon the river bed, the latter being reenforced to some depth by wooden piles and timbers positioned therein. Sometimes also there has been provided at or adjacent to the upstream edge of the dam a wall of steel sheet piling driven into the bed of the stream and extending transversely thereof. At the toe of the dam, or downstream side of the dam, it has been common to lay a depth of so-called riprap composed of heavy broken stone or boulders. In this common type of dam there is continual danger of the dam washing out. Erosion is likely to start under the toe of the dam, and unless carefully watched and protected by additional riprap, there is danger of the dam being eventually undermined and consequently collapsing. This has actually happened in at least one case within my experience.

In order to avoid this danger, in some cases a succession of piers have been built by the pneumatic caisson method which extend down to the bed rock, and the spaces between the piers have been filled in with concrete, thus providing a continuous concrete foundation for the dam, which extends down and is anchored to the bed rock. This of course overcomes any danger of the dam being undermined, but such construction is very expensive.

It is the object of the present invention to provide a foundation which will be practically continuous and impervious to erosion or undermining, while at the same time the cost will be much less than the concrete foundation last above mentioned.

In order to accomplish this result, generally speaking, I sink into the bed of the stream adjacent, respectively, to the upstream edge and to the downstream edge of the dam a wall of interlocking steel sheet piling, of which a number of forms are well known in the art, these walls being preferably connected at intervals by cross-bars connecting their upper ends. Then at intervals I provide cross walls of the same sheet piling secured to and connecting the two longitudinal walls, and thus forming in effect a series of compartments or coffers extending transversely of the stream underneath the dam. These compartments or coffers may, if desired or convenient, be filled with gravel, or they may contain mainly the original material of the bed of the stream into which the sheet piling is driven. In addition to the bars connecting the longitudinal walls at their tops, I may provide longitudinal bars of similar form connecting the cross walls of the sheet piling. Where it is possible the sheet piling should of course be driven down to bed rock. But where that is not possible, a secure foundation will in any event be obtained.

In the accompanying drawings Figure 1 is a view of a construction of dam embodying the present invention, shown in vertical cross-section on a plane extending in the line of the flow of the water in the stream. Figure 2 is a plan view taken on the line II—II of Figure 1 and shows a longitudinal segment of the foundation of the dam structure. Figure 3 shows in plan the top edges of interlocking sheet piling of a well known form which may be conveniently employed, it being understood that there are several types of interlocking sheet piling which are well known at the present time and which may be used to obtain the same result.

Referring to the drawings, the reference numeral 1 indicates a wall of interlocking steel sheet piling driven into the bed of the stream and extending down to bed rock at or near the upstream edge of the dam, and 2 denotes a like wall driven in like manner at or near the downstream edge or toe of the dam. These two walls extend in parallelism across the stream bed or that portion of it in which it is desirable to form the base or foundation of the dam body 3. As shown in Figure 2 there are provided also transverse walls of sheet piling, the ends of which are se-

cured to and which firmly interconnect the walls 1 and 2 at predetermined points throughout their length. One of the points of connection between the wall 1 and one of the cross walls 6 is shown in Figure 3. This frame work of steel piling forms a succession of compartments or coffers 7 arranged immediately adjacent to each other and extending across the stream. As above stated, these coffers may be packed with gravel, or they may contain mainly the original bed material 4, and after the body 3 has been built, as will be described presently, the steel piling and packed material make up a foundation of a very strong and permanent character. Preferably the walls 1 and 2 are connected as above stated by cross-bars 8, advantageously formed of stock which is about one inch square in section. Likewise extending longitudinally parallel with the walls 1 and 2, and connecting the cross walls 6 above the bars 8, are a similar series of longitudinal bars or rods 9. Also preferably, as shown in Figure 1, the upper edges of the steel piling and the space bars 8 and 9 are actually contained within the lower portion of the concrete which forms the dam body 3. In such construction the upper edges of the piling and the bars are rigidly retained in the concrete and make of the whole a substantial, integral structure.

The usual riprap 40 may be placed adjacent to and immediately beneath the toe 30 of the dam, simply to serve as an additional precaution against the deleterious action of the water. However in the construction described it will be obvious that erosion and undermining of the foundation of the dam is effectively prevented.

It is obvious that the structure above described may be varied in many ways, and it is even possible that where economy is an object the mere provision of the wall 2 of sheet piling underneath the toe of the dam will effectively prevent dangerous undermining. However, the construction hereinabove particularly described is an embodiment of the invention in the best form now known to me.

I claim as my invention:

1. A monolithic dam structure including a block of concrete having embedded in its base a horizontally extending metallic reinforcement resting upon two parallel lines of sheet-piling, upon which piling the said reinforcement immediately rests and upon the upper rim of which piling the concrete is shaped and hardened.

2. A monolithic dam structure including a block of concrete having embedded in its base a horizontally extending metallic reinforcement, a wall of sheet-piling extending beneath the toe of the dam structure, upon which wall of piling the said reinforcement immediately rests and over the upper rim of which wall the concrete is shaped and hardened.

3. A monolithic dam structure including two parallel walls of sheet-piling which are driven into the bed material of the body of water to be constrained, the upper rims of said walls projecting upwardly from said bed material, and a block of concrete cast immediately upon the surface of such bed material and having embedded in its base a horizontally extending metallic reinforcement, upon which walls of piling the said reinforcement immediately rests and over the upper rims of which walls the concrete is shaped and hardened.

4. A monolithic dam structure including two parallel walls of sheet-piling which are driven into the bed material of the body of water to be constrained and a plurality of partition walls of sheet-piling which is driven into such bed material for transversely interconnecting and latterly supporting said parallel walls at various points throughout their extent, the upper rims of said walls of sheet-piling projecting upwardly from said bed material, and a block of concrete cast immediately upon the surface of said bed material and having embedded in its base a horizontally extending metallic reinforcement, upon which walls of piling the said reinforcement immediately rests and over the upper rims of which walls the concrete is shaped and hardened.

In testimony whereof I have hereunto set my hand.

JAMES S. MILLER.