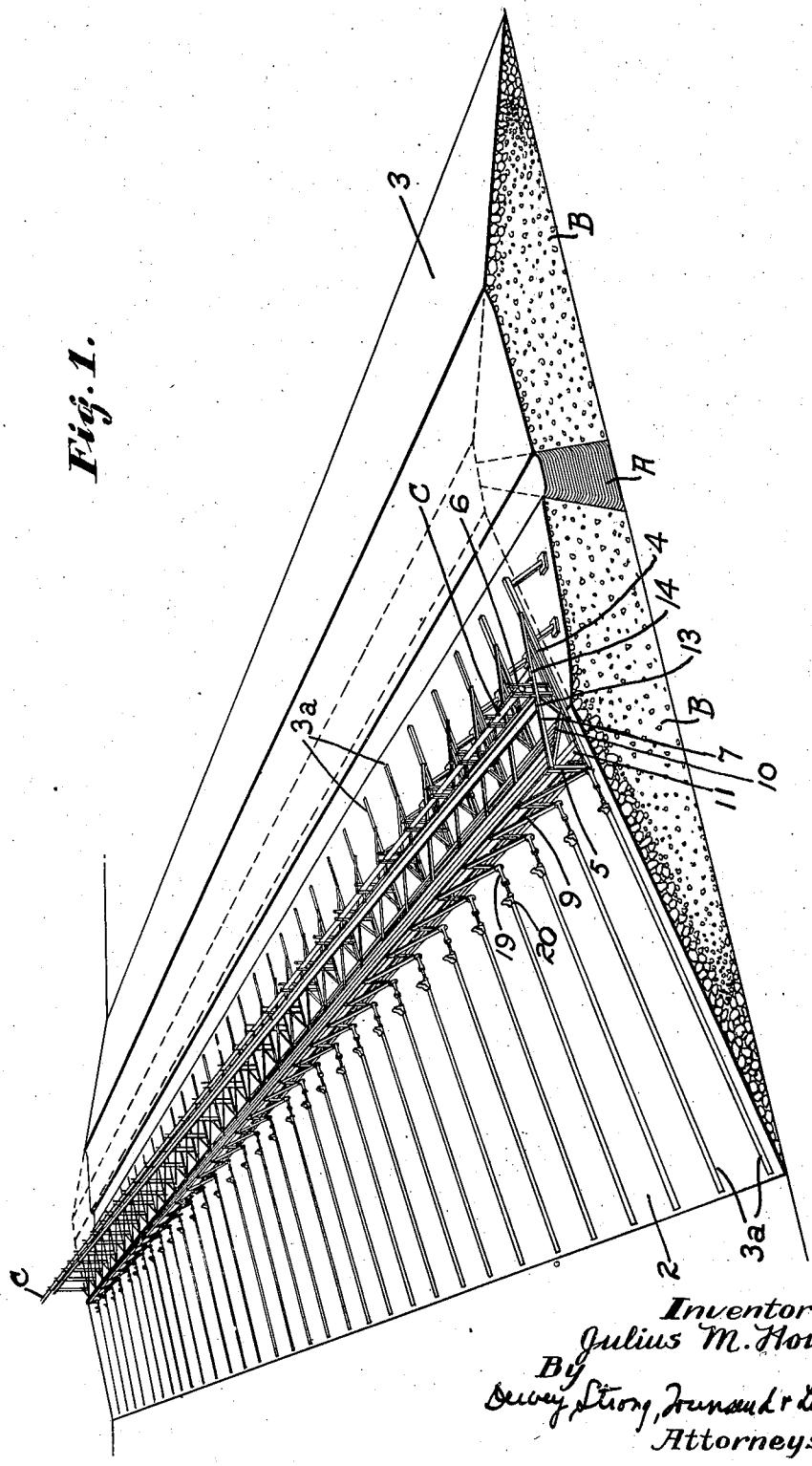
Feb. 2, 1926. 1,571,446

J. M. HOWELLS

HYDRAULIC FILL DAM BUILDING MACHINE

Filed July 28, 1924 3 Sheets-Sheet 1

Fig. 1.



Inventor.
Julius M. Howells.
By
Dewey Story, Townsend & Lofting
Attorneys.

Feb. 2, 1926. 1,571,446

J. M. HOWELLS

HYDRAULIC FILL DAM BUILDING MACHINE

Filed July 28, 1924 3 Sheets-Sheet 2

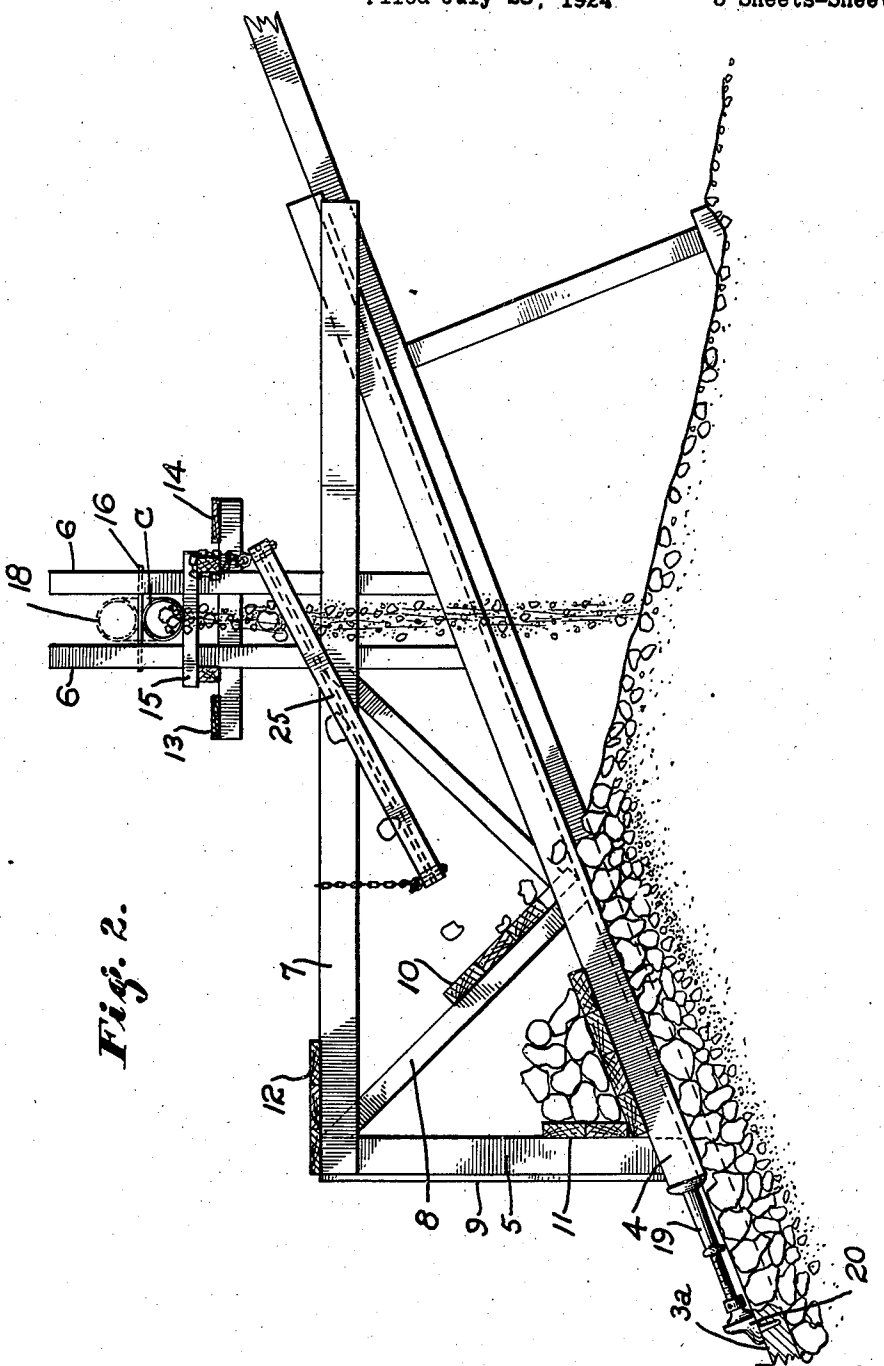


Fig. 2.

Inventor:
Julius M. Howells
By
Dewey, Stong, Tournend & Lyttle.
Attorneys.

Feb. 2, 1926. 1,571,446

J. M. HOWELLS

HYDRAULIC FILL DAM BUILDING MACHINE

Filed July 28, 1924 3 Sheets-Sheet 3

Fig. 3.

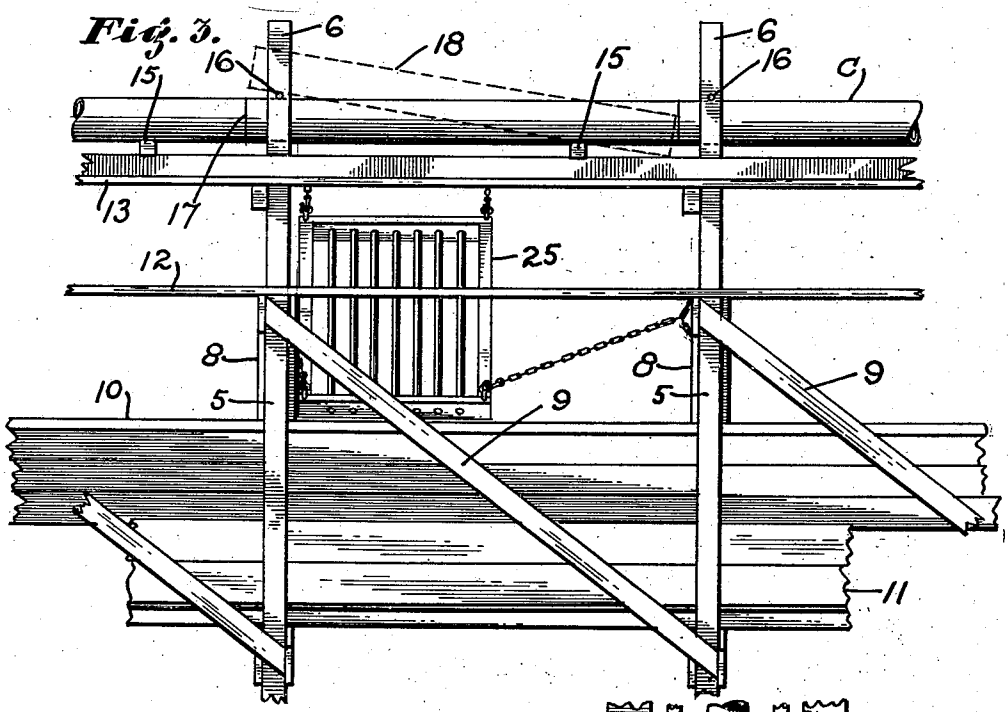
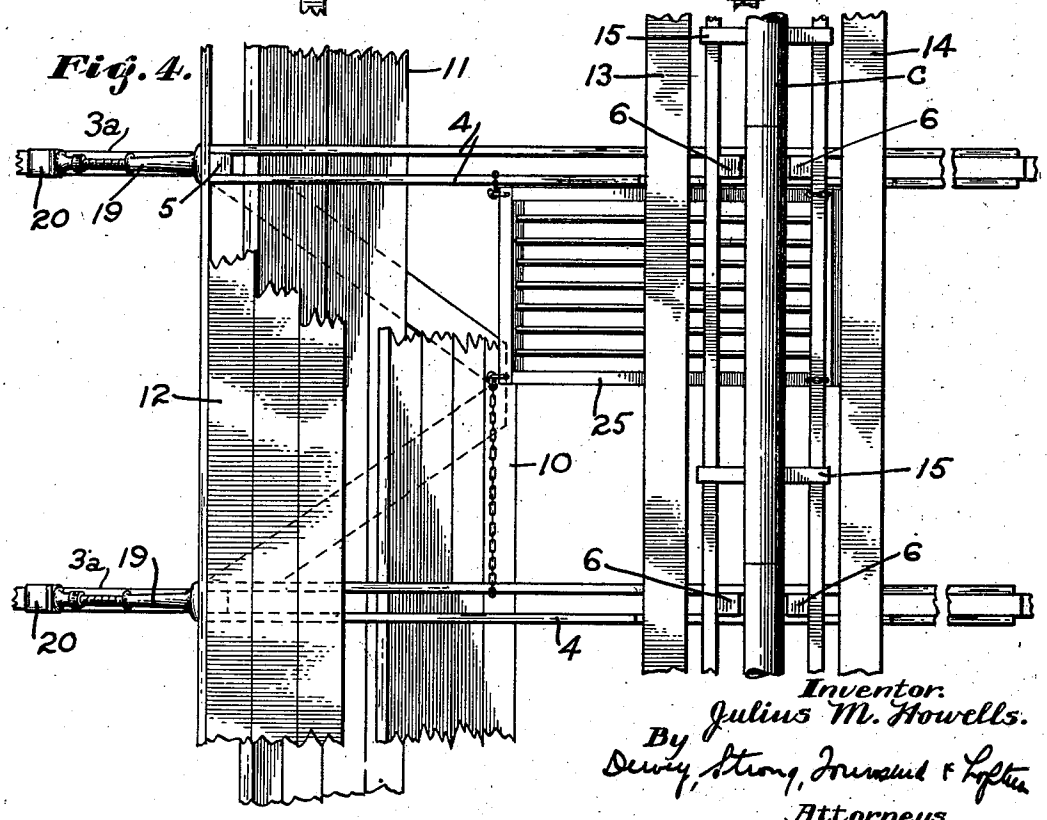


Fig. 4.



Inventor:
Julius M. Howells.
By
Dewey, Strong, Jaenicke & Lyttle
Attorneys.

Patented Feb. 2, 1926. 1,571,446

UNITED STATES PATENT OFFICE.

JULIUS M. HOWELLS, OF OAKLAND, CALIFORNIA.

HYDRAULIC-FILL-DAM-BUILDING MACHINE.

Application filed July 28, 1924. Serial No. 728,629.

To all whom it may concern:

Be it known that I, JULIUS M. HOWELLS, a citizen of the United States, residing at Oakland, county of Alameda, and State of California, have invented new and useful Improvements in Hydraulic-Fill-Dam-Building Machines, of which the following is a specification.

This invention relates to a machine for building hydraulic-fill dams.

Dams in general are classified according to the materials of which they are built. They are further classified by the process employed in their building, or by their outstanding structural features. Thus, there are; brush dams, timber dams, earth and rock dams, masonry dams, and steel dams.

Just as there are various types of masonry dams, there is a variety of earth and rock dams. The more important of these are the rock-crib, the rock-fill, the earth-fill, and the hydraulic-fill.

The method of handling material in the hydraulic-fill dam may be traced to the early mining days on the Pacific coast, where new and quite spectacular methods of mining auriferous gravels on a large scale were evolved by the bold inventive genius of the American miners.

The hydraulic-fill process soon came to be recognized as the most economical method of moving earth, sand, and loose rock on a large scale, as well as the most positive and satisfactory means of compacting it in a solid immovable mass.

By the skillful direction of the water by which the material is conveyed, the disintegrated materials are assorted, rearranged, and deposited where needed to perform the required functions of stability and water-tightness in the dam, thus reversing the destructive process of mining by saving, instead of wasting the débris, and converting the same into great serviceable structures.

The first hydraulic-fill dams did not exceed 100 feet in height. The principles involved when utilizing water of varying velocities for loosening, conveying, assorting, distributing, depositing, and consolidating the materials have been more carefully studied and scientifically employed in the design and construction of higher and more important dams. These principles are adaptable to the building of dams of almost any desirable height, provided suitable materials are available and the conditions permit of economical construction.

As confusion had arisen as to what constituted a hydraulic-fill dam, at a recent meeting of the San Francisco section of the American Society of Civil Engineers, a committee was appointed to formulate and present to the section a definition of the term "Hydraulic-Fill Dam". The report of that committee follows:

Definition of a hydraulic-fill dam.

"The hydraulic-fill method of constructing earth dams implies a conveyance of material to its place in the structure by flowing water, but the material may be brought to the structure by mechanical means, providing it is properly washed and segregated while it is in the process of being deposited.

"Any dam constructed throughout by this method is a hydraulic-fill dam.

"The method further implies more or less separation of the material into two distinct classes, each deposited in definite locations within the cross-section of the dam— the coarsest, most gritty, and porous conveyed and deposited by running water and constituting the outer portions of the dam, to secure stability; and the finest and most water-tight material deposited under standing water and constituting the central portion, insuring water-tightness.

"Whenever an appreciable part of a dam is built by the dry-fill method and a part by the hydraulic method, the structure is no longer to be classed as a hydraulic-fill dam, but is a combination structure—a loose rock dam with hydraulic-fill core, a dry-fill earth dam with hydraulic-fill core, etc., as the case may be."

The first hydraulic-fill dam was built in Tyler, Texas, in 1894, and the second in San Diego County, California, in 1895. These earlier and smaller hydraulic-fill dams were built far cheaper than any types of earth dams. In view of the increasing size, responsibility, and cost of such dams, the need for a device, sufficiently applicable to common local conditions as well as those involved in up-to-date hydraulic-fill practice was appreciated by the inventor and led to the development of the hydraulic-fill dam building machine. What is believed to be accomplished by this design, is a practical elimination of those uncertain labor factors

which are responsible for the unnecessarily high cost of placing the material composing almost the total body of the structure.

The uncertain labor items which are standardized by this device are four in number and will be here discussed.

First, the shifting or moving of the material-carrying flumes, pipes or other sluiceways with the gain in elevation of the dam. At present, these sluice-ways are carried on many trestle bents of dangerous heights made necessary by the demands of sluice grades. It is uncommon to make one trestle location suffice for the full height of dam. As many as twenty trestles have been built on one dam during the progress of its erection. Not only is there unnecessary cost by this frequent trestle building, but chutes must be resorted to in order to properly distribute the material from a fixed trestle location to the constantly moving top of dam.

In the hydraulic-fill dam building machine, the sluice pipe is carried on a sliding trestle, advanced by the necessities of other functions of the machine at a rate to deposit the material at the most desirable point on the interior slopes of the dam. Only the building of one trestle is required for each slope of the dam and this trestle is a low, well braced structure, safe from destruction by winds or snows which often have destroyed high sluice-way trestles.

Second, the maintenance of levees at the top of the side slopes is an item of no small cost. At present, these levees are raised by shovelling by hand, or by teams and scrapers or in a few cases by mechanical means.

The hydraulic-fill dam building machine provides a sort of moving shear board against which the material is properly directed and automatically, the peak of the dump forms the levee.

Third, the alignment and grading of the dam face is now accomplished by hand grading with the use of templates necessitating frequent checking by the engineers.

The hydraulic-fill dam building machine automatically aligns and grades as it is advanced. The form of the dam is accurately established by the proper laying of its skid-ways or tracks which the engineer aligns but once.

Fourth, the riprapping of the dam's face with boulders is now done in a most laborious fashion. Quarries are often opened to yield necessary rock when usually within the hydraulic-fill itself suitable rock is available.

The hydraulic-fill dam building machine ripraps both faces of the dam, automatically thus saving about three-fourths of the cost of such riprapping.

Fig. 1 is a perspective view of a hydraulic-fill dam showing the machine in position while the work is in progress.

Fig. 2 is an enlarged cross-section of one slope of the dam showing the dam building machine in position.

Fig. 3 is a side elevation of a portion of the dam building machine.

Fig. 4 is a plan of a portion of the dam building machine.

By referring to Fig. 1, it will be noted that a hydraulic-fill dam consists of a central core portion A and two outer stability sections such as indicated at B—B. The stability sections are composed of boulders, gravel, sand or other similar material, while the core or central portion is composed of fine sand and clay or similar materials which are practically impervious to water. The coarsest material, such as large boulders, rocks, etc., is deposited towards the outer faces or slopes 2 and 3 of the dam, while the smaller rock, boulders, gravel, sand, etc., are deposited by the flow action of the water towards the center portion, and the "fines" or core material are finally deposited in quiet water or pool maintained in the center of the dam. The fill material is usually delivered to a flume or pipe line such as indicated at C in any suitable manner; the material being carried through the flume or pipe line by means of water which, therefore, acts as a conveying medium and also to segregate the material which is deposited in the dam structure proper.

The machine proper is supported on a series of base or track timbers such as indicated at 3^a. These are set to conform with the intended slope or grade of the dam when the structure is started and the machine as a whole is movable upwardly on the support thus provided, as the elevation of the dam increases.

The machine extends substantially from end to end of the dam and while it may be constructed in sections of suitable length, it is here illustrated as one integral structure. The machine is nothing more or less than a frame constructed of timber or like material throughout. The frame is triangular in cross-section and consists of a series of sill or base plates 4 which are supported and slidably mounted on the base timbers 3. The frame-work furthermore consists of a series of upright vertically disposed timbers 5 and 6, a series of horizontal timbers 7, and laterally and longitudinally disposed bracing timbers 8 and 9. The frame of the machine is thus braced both laterally and longitudinally and a rigid structure is in this manner secured throughout. A shear plate extending from end to end of the machine is formed by securing a series of planks 10 to the brace timbers 8. A ballast-carrying platform 11 is formed by securing planks to the sill members 4 and the uprights 5. A

plank walk 12 is obtained by securing planks to the horizontal timbers 7 and walks on each side of the pipe line C are also provided by placing planks 13 and 14 on each side of the stringers. The pipe line is supported on cross-timbers secured in the uprights 6, and means are employed for extending or shortening the pipe line as desired. This is best illustrated in Fig. 3. The pipe line is, of course, constructed of sections which may be readily coupled in any convenient manner. The pipe lengths not in use are supported at one end by the cross-timbers 15 and the opposite end of each pipe length is held in a raised position by lock-pins 16 extending through perforations formed in the uprights 6.

If the end of the pipe line from which the material is discharging reaches the point indicated at 17, and it is desired to extend the pipe line by one length, it is only necessary to remove the pin 16 so that the elevated end of the pipe shown in dotted lines at 18 may be lowered to align with the end of the pipe 17. This is readily accomplished and when pipe 18 is lowered by removing the pin 16, it is a simple matter to couple the pipe sections 17 and 18 as desired. The pipe line may thus be extended or shortened as desired without interruption to the material which is being delivered.

The frame or machine supporting the pipe line, the shear plate, the plank walks, the ballast-carrying platforms, etc., is moved gradually upwardly on the slope as the work advances. The sill plates are therefore slidably mounted on the base timbers 3 and means must accordingly be provided for securing the frame as a whole and for shifting the frame upwardly on the slope and this is accomplished as follows:

By referring to Figs. 1 and 2, it will be noted that screw-jacks 19 are employed. These jacks align with the sill plates 4 and they are interposed between the lower ends of the sill plates and spikes or like devices such as shown at 20. The screw-jacks secure the main frame in position and by gradually turning each screw-jack, the frame as a whole may be advanced or shifted upwardly on the slope.

For the purpose of clearly illustrating the operation of the machine, it will be supposed that the dam during its construction has reached the elevation shown in Fig. 1 and that the boulders, rock, gravel, sand, mud, etc., are being deposited from the end of the pipe line C. If this is the case, segregation of the material is obtained by the wash action of the water, and an inner slope is maintained on the crest of the dam to permit the finer materials to be carried to the center or core portion, where they are deposited in still water. The coarser materials settle out of the flowing water and are thus deposited near the outer edge or slope of the dam, while the finer materials travel inwardly with the flowing water. The larger rocks and pebbles are deposited towards the outer face, while the still larger boulders and rocks are deposited on the very face by means of a grizzly such as shown at 25. A number of these grizzlies may be employed or a single grizzly may be advanced along the frame as the point of pipe line discharge is advanced, the grizzly being hung by means of chains or the like so that it may be swung from side to side to uniformly deposit the boulders. The grizzly discharges the boulders against the shear face or head and the boulders thus roll down the shear face so that they will be deposited on the very slope or face of the dam. The shear face or edge at the time smooths off the face of the dam when the frame as a whole is shifted upwardly on the slope, and it can thus be seen that a uniform surface equal to the riprap surface is obtained without the use of templates and constant checking on the part of the engineers.

The pipe sections are connected as the work advances and until material to a considerable height has been distributed along the entire face of the dam. The entire machine is then shifted upwardly a predetermined distance and the pipe sections are disconnected one by one as the material is again being deposited. In other words the material is first deposited at one end of the dam and the pipe line is so connected that its length gradually increases until it reaches the opposite end. The frame is then shifted upwardly and the operation is reversed as the pipe sections are disconnected one by one. The work is in this manner continued until the opposite end of the dam is reached, when the frame is again advanced, this operation being continued until the desired height or crest is reached. In the operation of the machine, instead of definite steps of advancement upwardly on the slope of the dam, as described above, it may be constantly and gradually advanced at an average rate, consistent with the progress of the dam structure.

The drawings merely illustrate one machine, but it is obvious that two machines will be employed, one on each face of the dam.

A machine constructed and operated as here shown should prove a great labor-saving device, as it reduces the work on the part of the engineers; it insures a uniform level and slope without using templates, etc.; it does away with the necessity of building and tearing down numerous trestle bents for carrying the flumes or pipe lines; it permits shortening or lengthening of the pipe line with a minimum amount of labor; it

does away with the extra operation of riprapping the faces of the dam; it insures proper segregation and deposition of material; it insures uniform work, and it similarly reduces time and structural cost to a minimum.

While certain features of the present invention are more or less specifically illustrated, I wish it understood that various changes in form and proportion may be resorted to within the scope of the appended claims. I similarly wish it understood that the materials and finish of the several parts employed may be such as the experience and judgment of the manufacturer may dictate or various uses may demand.

Having thus described my invention, what I claim and desire to secure by Letters Patent is—

1. A machine for building hydraulic-fill dams comprising a grade-establishing support disposed transversely of the dam and parallel with one slope face thereof, a superstructure mounted thereon and movable transversely of the dam, means carried by said structure for delivering material for the construction of the dam, and means carried by said structure for segregating and depositing the material at points longitudinally of the dam.

2. A machine for building hydraulic-fill dams comprising a grade-establishing support disposed transversely of the dam and parallel with one slope face thereof, a superstructure mounted thereon and movable transversely of the dam, means carried by said structure for delivering material for the construction of the dam, means carried by said structure for segregating and depositing the material at points longitudinally of the dam, and a shear plate carried by said structure to smooth the face of the dam.

3. A machine for building hydraulic-fill dams, comprising a grade-establishing support disposed transversely of the dam and parallel with one slope face thereof, a superstructure mounted thereon, means carried by said structure for delivering material for the construction of the dam, a shear plate carried by the super-structure to smooth the face of the dam, and means for imparting movement to the structure upwardly on the grade support.

4. A machine for building hydraulic-fill dams, comprising a grade-establishing support, a super-frame mounted thereon, a pipe line carried by the said frame adapted to deliver material for construction of the dam, and a grizzly carried by the super-structure for segregating and depositing material discharging from the pipe line.

5. A machine for building hydraulic-fill dams, comprising a grade-establishing support, a super-frame mounted thereon, a pipe line carried by the said frame adapted to deliver material for construction of the dam, a grizzly carried by the super-structure for segregating and depositing material discharging from the pipe line, and a shear plate on the frame against which the grizzly discharges, said shear plate extending longitudinally of the frame and the dam.

6. A machine for building hydraulic-fill dams, comprising a grade-establishing support, a super-frame mounted thereon, a pipe line carried by the said frame adapted to deliver material for construction of the dam, a grizzly carried by the super-structure for segregating and depositing material discharging from the pipe line, a shear plate on the frame against which the grizzly discharges, said shear plate extending longitudinally of the frame and the dam, a series of stop members secured to the grade-establishing support, and screw-jacks interposed between said stop members and the frame whereby movement may be imparted to the frame in an upward direction on the grade-establishing support.

JULIUS M. HOWELLS.