Jan. 7, 1930. E. PROBST ET AL 1,742,369

DAM

Filed Nov. 12, 1928

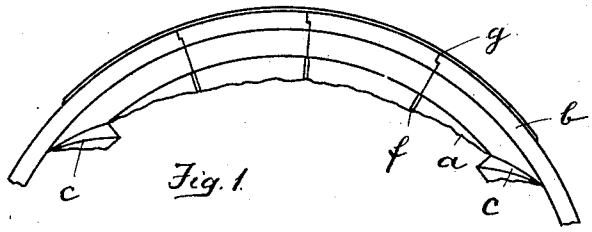
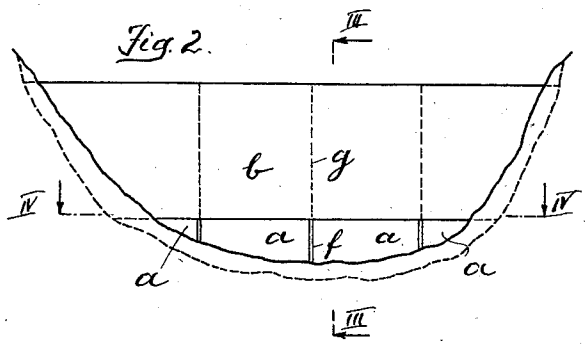


Fig. 1

Fig. 2.



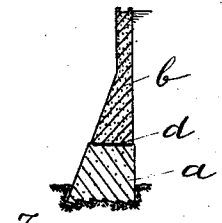


Fig. 3

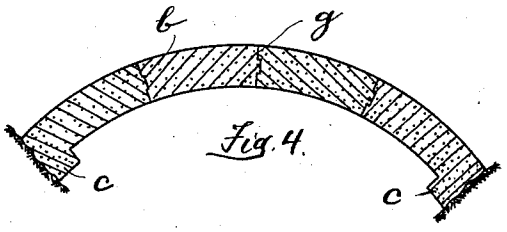


Fig. 4.

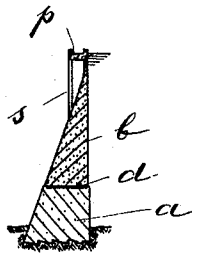


Fig. 6

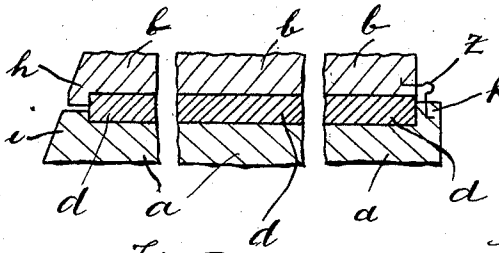


Fig. 5.

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UNITED STATES PATENT OFFICE

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DAM

Application filed November 12, 1928, Serial No. 318,691, and in Germany August 1, 1928.

Our invention relates to dams and has for its object the economical and statically safe construction of solid dams for small and medium-sized openings.

In the annexed drawing in which we have illustrated our invention, Fig. 1 is a top plan view of the dam, Fig. 2 a view from the tailwater side, Fig. 3 a transverse section along line III—III in Fig. 2, and Fig. 4 a section along line IV—IV in Fig. 2. Fig. 5 shows on a larger scale the intermediate layer between the lower and upper portions of the dam, while Fig. 6 is a similar view as Fig. 3 showing a modification.

The dam comprises a lower portion of the gravity type dam composed of a plurality of blocks *a* deeply built into the solid rock and separated by joints *f* of a width sufficiently great to present an arch effect in said lower dam portion, an upper portion *b* of the arched dam type, and a highly plastic intermediate portion, or layer *d*.

The lower portion composed of the blocks *a* has a horizontal top surface, provided with a smooth cement dressing. The shape of the surfaces on the air-side and on the water-side is determined by the static and structural requirements.

The joints *f*, which are perpendicular, are preferably offset as shown in Fig. 4, and for the purpose of preventing any water from seeping through, they are closed on the water-side, as for instance by a suitably shaped sheet metal strip of copper.

The intermediate layer consists of a highly plastic material so as to enable a slight perpendicular and horizontal relative displacement to occur between the upper dam portion *b* and the lower dam portion *a* without presenting any noticeable resistance.

The arrangement of the intermediate layer *d* is illustrated in Fig. 5. On the air-side it abuts against shoulders *h* and *i* of the upper dam portion *b*, and the lower dam portion *a* which are preferably armored against lateral thrust. The gap separating the two shoulders is so dimensioned that irrespective of any load there is no contact. On the water side, the intermediate layer rests against a shoulder *k*, likewise preferably armored, of the lower dam portion *a*. And as to the size of the gap, the same applies as regards the gap on the air-side. For preventing any water to leak through on the water-side, the gap is closed by a yieldingly disposed sheet-metal strip *z* of copper, which, if desired can be covered. In the design of this construction, it was taken into consideration that a horizontal relative displacement can occur only in this way that the upper dam portion *b* is displaced relative to the lower dam portion *a* on the air-side, as is usually the case.

The upper dam portion *b* consists of a barrel vault of varying thickness and having enlargements on the imposts or piers *c*. Preferably, the axis of the barrel vault is perpendicular. The perpendicular radially extending joints *g* are serrated, as shown in Fig. 4. For preventing any leakage, they are covered on the water side by a sealing means, e. g., sheet-metal of copper. To make the vault entirely safe, the joints are cast after they have become hardened between the seal on the water-side and the outer edge on the air-side.

The width of the upper part of the upper dam portion *b* which part, as shown in Fig. 4 is of uniform thickness, is determined by the width of the top of the dam which usually also serves yet other purposes.

In order to prevent any undesirable static secondary effects, the modified construction shown in Fig. 6 is frequently preferred. The cross-section of the vault above the hydromechanical minimum strength is calculated according to purely static and structural view points. The solid or open structure top plate rests on the water-side on the barrel vault, while on the air-side it is supported by the dam by means of a plurality of urpights *s*. In order to avoid an undesired static strain of the top plate and the barrel vault, the plate *p* must loosely rest on the vault *b*.

For the dam as shown in the drawing, it is advisable to make the lower dam portion *a* about half the height of the upper dam portion *b*. For deep valleys of more V-shaped cross-section, the two dam portions are more or less of the same height, and in especial cases, it may be even economical, to make the

lower dam portion *a* higher than the upper dam portion *b*. The height of the upper dam portion *b* may be determined from the following point of view. For reasons of construction, the center angle of the barrel vault for the upper dam portion *b* is made as large as the profile of the valley will permit. Now, the smallest center angle, directly above the intermediate layer *d*, should not be substantially less than 100 degrees. How much one may deviate from this minimum angle, is a pure question of the shape of the valley and of economy.

The invention comprises dams both of masonry and of concrete, armored or unarmored. An armour will be advisable, where the static conditions involve higher tensional stresses than is permissible for concrete.

In order to afford a guide, one might say that the invention permits to economically construct dams of concrete only for a width of valley of about 400 ft. and a pressure head of about 130 ft. Only in excess of these dimensions, an armour will have to be considered, but, of course, only in the upper dam portion *b*, and iron members are required only near the piers or imposts on the waterside. They are preferably anchored in the enlarged portions *c*.

The particular object of the invention is to produce a dam wall, in which the transmission of forces can be readily and quickly recognized, aside from the fact that the dam wall is extremely economical, as the arch effect is eliminated where the gravity effect makes stability possible in the simplest manner. Moreover, the invention, because of the enlargements at *c*, involves a considerable reduction in the pressure at the piers or imposts.

We claim:

1. A dam comprising a lower portion of the gravity dam type, a top portion of the arched dam type, and means to prevent an arch effect in said lower dam portion, said top dam portion being mounted on said lower dam portion so as to be capable of displacement relative thereto.

2. A dam comprising a lower portion of the gravity dam type and a top portion of the arched dam type, said top dam portion being mounted on said lower dam portion so as to be capable of displacement relative thereto, said lower gravity type dam portion being composed of a plurality of separate blocks, and joints between said blocks of a width sufficiently great to prevent an arch effect in said lower dam portion.

3. A dam comprising a lower dam portion of the gravity dam type, a top portion of the arched dam type, means to prevent an arch effect in said lower dam portion, said top dam portion being mounted on said lower dam portion so as to be capable of displacement relative thereto, and a layer of plastic material between said dam portions.

In testimony whereof we affix our signatures.

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