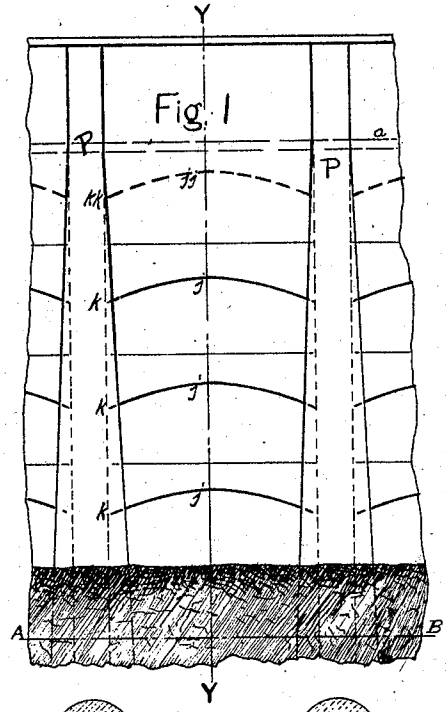
No. 800,313. PATENTED SEPT. 26, 1905.

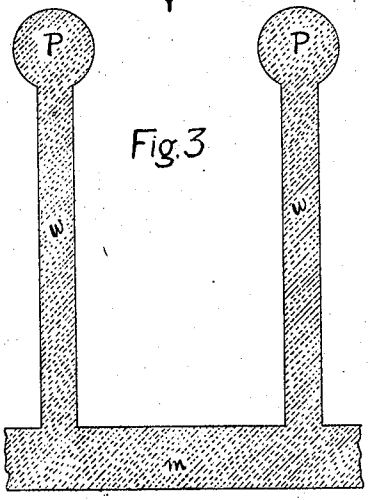
W. J. MEYERS.

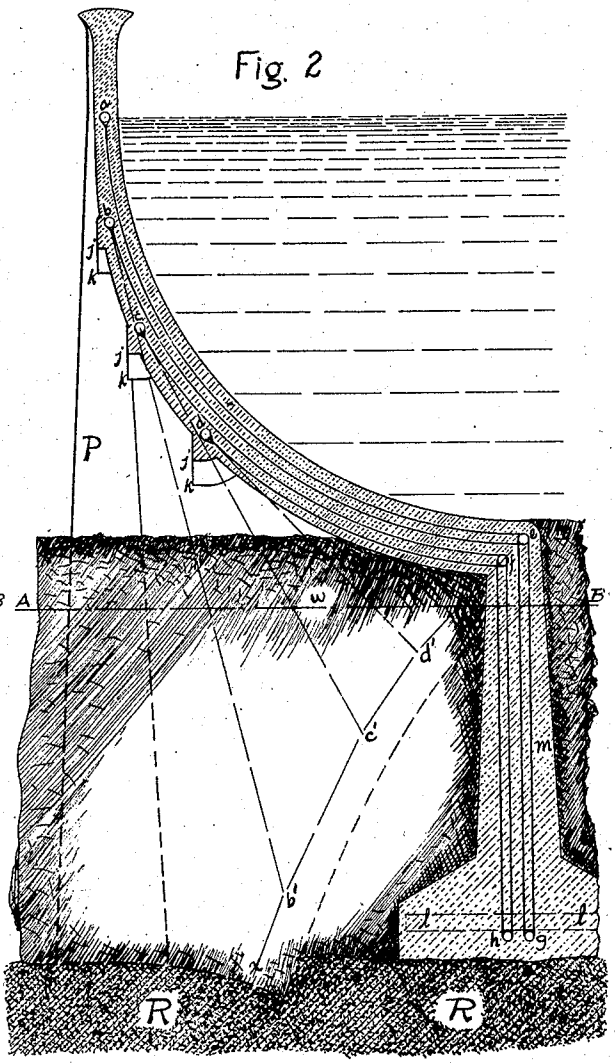
DAM.

APPLICATION FILED DEC. 19, 1904.

2 SHEETS—SHEET 1.







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2 SHEETS—SHEET 2.

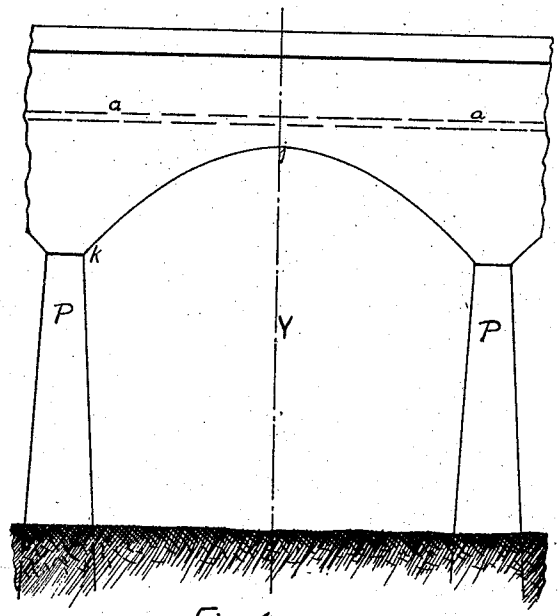


Fig. 4

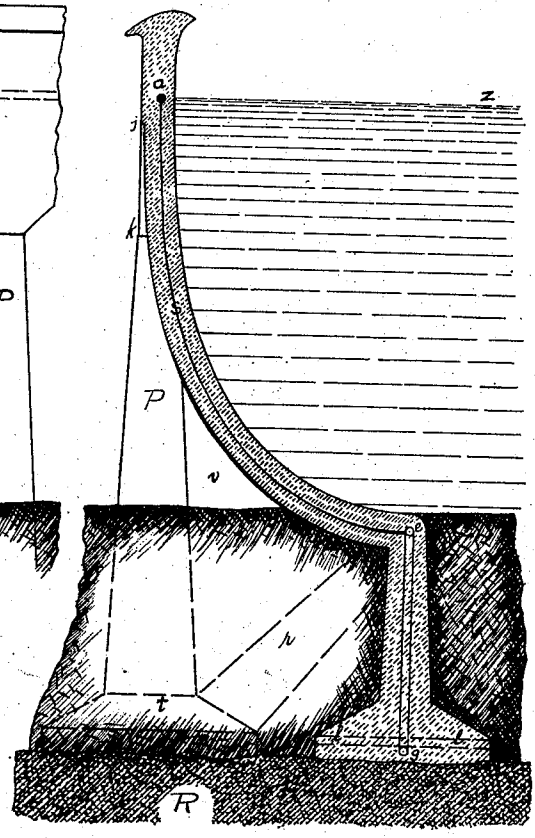


Fig. 5

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DAM.

No. 800,313. Specification of Letters Patent. Patented Sept. 26, 1905.

Application filed December 19, 1904. Serial No. 237,426.

To all whom it may concern:

Be it known that I, WILLIAM J. MEYERS, a citizen of the United States, residing at Fort Collins, in the county of Larimer and State of Colorado, have invented new and useful Improvements in Dams, of which the following is a specification.

In this specification I use the term "sheet" or the phrase "sheet of the dam" to denote that portion of the dam which is composed of substantially impervious material and against which the water above and upstream from the dam directly presses. I use the term "cut-off wall" to denote that portion of the substructure whose purpose it is to prevent or impede the underground escape of the waters of the reservoir or basin.

My invention briefly described consists in so shaping the sheet of the dam that every section of the water-face of said sheet normal to the crest of the dam shall throughout the extent of said section be concave to the water of the reservoir, thus subjecting the said sheet along said section to tensile stresses dependent upon the degree of curvature of the water-face of said section and the depth of water lying thereon, which tensile stresses are resisted by suitably-disposed material of great tensile strength. Such material is at the base of the sheet suitably anchored and attached to the cut-off wall, and at the upper parts of the sheet the said material is suitably attached to beams substantially parallel to the crest of the dam, which beams, either alone or with the aid of arches lying in the plane of the load, transmit the load to posts suitably placed, by which posts the load is transmitted to the foundation of the structure. Where the base of the sheet and the plane of the anchorage are not tangent, as they ordinarily will not be, the resultant stress is carried to the foundation by suitably-disposed posts and arches, if such be needed.

To make the foregoing specification clearer, reference may be made to the drawings accompanying this specification, said drawings being composed of five figures numbered 1, 2, 3, 4, and 5, respectively, placed upon two sheets, of which figures numbered 1, 2, and 3 are upon Sheet I and figures numbered 4 and 5 are upon Sheet II. Figure 1 represents the downstream face of a portion of a dam constructed in the manner above briefly described. Fig. 2 shows a sectional view of such dam, the line YY in Fig. 1 being the trace of the cutting-plane. Fig. 3 shows another section, the line AB in Figs. 1 and 2 being the trace of the cutting-plane and the section being looked at from beneath. In Fig. 2 the concave outline of the water-face of the section is circular. Under some circumstances it will be advisable to make such outline that of the hydrostatic arch instead of a circular arc. Figs. 4 and 5 show the appearance of the dam in such case, Fig. 4 showing the downstream-face of a portion of a dam so constructed, and Fig. 5 showing a sectional view, the trace of the cutting-plane being the line Y in Fig. 4.

In Fig. 2 the strands of the tensilely-stressed material embedded in and supporting the sheet are shown extending from *a* and *b* to *e* and from *c* and *d* to *f*—*a*, *b*, *c*, and *d* denoting sections of the beams to which the upper ends of said strands are attached and *e* and *f* the beams to which the lower ends of said strands and the upper ends of the strands *ef* and *gh* of the anchorage (lying in the cut-off wall) are attached. The arch supporting the beam *a* and transmitting its load to the posts P is a blind or concealed arch, being contained entirely within the sheet, and is denoted by the broken-lined curve extending from *kk* through *jj* in Fig. 1. The arches supporting the beams *b*, *c*, and *d* are partially exposed and have their soffits shown at *j* and their springing-points at *k* in Fig. 1. The loads on these arches when the reservoir above the dam is filled have the directions shown approximately in Fig. 2 by the lines *dd'*, *cc'*, *bb'* and a vertical line extending downward from *a*. These loads are transmitted to the foundation through the posts P and the walls *w*, Figs. 1, 2, and 3. The pull of the anchorage-strands *eg* and *fh* and that of the sheet-supporting strands *ea*, *eb*, *fc*, and *fd* will have a resultant whose direction is represented approximately in Fig. 2 by the line *fd'*. If the soil adjacent to the cut-off wall *m*, Fig. 2, does not furnish sufficient reaction to neutralize this resultant, it must be provided for in the design of the wall *w*, arches being used in the plane of the resultant, if necessary, for concentrating this load upon the walls *w*. The underlying stratum forming the foundation or support for the entire structure (including the substructure) must be suitably shaped to avoid any dangerous tendency to slide the structure downstream.

In Figs. 1, 2, and 3 the curve of the upstream face of the sheet is, as is above said, circular. This makes the tensile stress devel-

oped in the sheet and the supporting-strands *ae*, *be*, *cf*, and *df* proportional to the depth below the free surface of the fluid in the reservoir, thus requiring a greater number of such strands in the lower part of the sheet and a series of arches, one above the other at intervals from the bottom to the top, supporting the beams *d c b*, &c., for transmitting tangentially the loads to the supporting-posts P and walls *w*, thence to the foundation. Under some circumstances it will be more satisfactory to have all tensile strands supporting the sheet carried to the top of the structure. In order that a tensile curve supporting hydrostatic pressure may be uniformly stressed throughout, its radius of curvature at any point must be inversely proportional to the distance of that point below the free surface of the fluid. In other words, the curve must be that known to engineers as the "hydrostatic arch."

In Figs. 4 and 5 I have shown a dam in which the water-face of the sheet is based upon the principle of the hydrostatic arch. In Fig. 5 the tensilely-stressed strand supporting the sheet is denoted by *s*. *a* denotes the beam to which the upper end of *s* is fastened, which beam is supported by an arch whose soffit is at *j*, Figs. 4 and 5, and whose springing-point is at *k*, Figs. 4 and 5. The support or fastening of the lower end of the tensile strand *s* is substantially the same as is that in Fig. 2. *r* in Fig. 5 denotes a post inserted (if necessary under the circumstances of the case) to transmit to the foundation the resultant of the stresses acting at *e*, Fig. 5. Where necessary, an arch in the plane of the said resultant may be used for concentrating the resultant upon the posts *r*. In this design the trilinear space denoted by *v* in Fig. 5 is empty.

For the tensilely-stressed strands supporting the sheet steel wire will in most cases be used and for the sheet concrete; but I do not limit myself to the use of any particular kind of matter nor to any particular variety of curve; save that the curve be always in tension. Where necessary for the prevention of deleterious contortion of the sheet when the reservoir is empty or only partially filled, I shall use auxiliary cables or stiffening-trusses of any standard form, lying in planes normal to the crest of the dam. Sheet metal may also be used to resist tension.

What I claim as my invention, and desire to secure by Letters Patent of the United States, is—

An improvement in dams for resisting fluid-pressure, which said improvement consists of a substantially or sufficiently impervious sheet whose section in a plane normal to the crest of the dam is substantially everywhere concave to the impounded fluid, the said sheet being supported by tensilely-stressed material the tensile stresses wherein are substantially in planes normal to the crest of the dam, the load caused by the said tensile stresses being transmitted through the medium of beams or of arches or of beams and arches combined to posts or walls or posts and walls combined, by or through which the said load is transmitted to the foundation of the structure, substantially as described in the foregoing specification, but without restriction of the class of curve to the circle, the hydrostatic arch or any other particular curve, save that the curve be substantially everywhere concave to the impounded fluid.

In testimony whereof I have hereto attached my signature in the presence of two subscribing witnesses.

WM. J. MEYERS.

Witnesses:
B. H. MEYER,
EDWIN W. KERR, JR.