To all whom it may concern:

Be it known that we, BERTRAM H. M. Hewett, a subject of the King of Great Britain, and a resident of the city of New York, Eltingville, borough of Richmond, in the county of Richmond and State of New York, and SIGVALD JOHANNESSEN, a subject of the King of Denmark, and a resident of Upper Montclair, in the county of Essex and State of New Jersey, have invented a new and Improved Tunnel and Shaft Lining, of which the following is a full, clear, and exact description.

This invention relates to new and useful improvements in tunnel and shaft construction, and it pertains more particularly to a new and improved tunnel and shaft lining.

The primary object of the invention is to provide a tunnel or shaft lining which is capable of use in connection with tunnels or shafts of various cross-sectional shapes and dimensions.

A further object of the invention is to provide a tunnel or shaft lining in which the several joints or seams are rendered water-tight without the caulking usually employed.

A still further object of the invention is to provide a lining for tunnels or shafts which is formed from a plurality of metallic sections so constructed that a larger portion of erection work may be carried out exteriorly of the tunnel than is possible in the type of shield-driven lining at present employed.

A still further object of the invention is so to construct a tunnel lining that its exterior surface may be water-proofed, which operation is impossible in the present form of shield-driven tunnel linings.

A still further object of the invention is to construct a tunnel or shaft lining in which the skin may be brought to a position such that it is in direct line of the axis of the rams used for forcing the tunnel shield ahead so that danger of damage to the rams and the lining due to the usual eccentric location is obviated.

A still further object of the invention is to distribute the material used for a tunnel or shaft lining that a minimum weight is used for any given set of conditions thus producing an economical design.

A still further object of the invention is to provide a type of tunnel or shaft lining in which the work of erection within the tunnel or shaft is reduced.

With the above and other objects in view, which will appear as the nature of the invention is better understood, reference is had to the accompanying drawings, in which:

Figure 1 is a transverse sectional view of a tunnel or shaft constructed in accordance with the present invention;

Fig. 2 is a detail longitudinal sectional view;

Fig. 3 is a longitudinal sectional view showing the relation between the tunnel lining and the driving rams and shield;

Fig. 4 is a longitudinal sectional view of a modified form of the invention in which the several elements of the tunnel lining are welded together.

Referring more specifically to the drawings, A represents the earth through which the tunnel or shaft is driven, this tunnel or shaft being formed in any ordinary manner including that by a shield which is moved forwardly from the lined portion by means of jacks. The lining comprises a plurality of ribs B, which are shaped to conform to the shape of the excavation. While in the present instance this excavation is shown as circular in cross sectional form, it is to be understood that the same may be of any shape desired. These ribs B are made up of a plurality of sections of steel plates which are indicated by the reference character C.

The ribs B are made up as follows: There is a steel plate web C, the inner edge of which is provided with angle irons D, which are curved or shaped longitudinally to conform to the shape of said ribs. The sides of the angle irons D, which engage the side faces of the webs C, may be secured to the webs by welding. When in position the inner angle irons form a continuous flange designated by the reference character E. Spaced from the outer edges of the sections C and attached on opposite sides thereof are angle irons F. These angle irons F may likewise be welded to the sections C. By welding the angle irons E and F to the members C, a seepage of water is prevented and the process of caulking eliminated. The sections of the ribs are connected together by welding or other suitable means.

While the several rib sections B are being placed in position in spaced relation to each
other as indicated in Fig. 2 of the drawing, or after the rib sections have been so placed if the latter prove more convenient, the skin or lining H is placed in position, this skin or lining being supported on and attached to the outer set of angle irons F. In the present instance, the skin or lining H is shown as consisting of concrete. It is to be understood, however, that the lining may be formed of wood or metal, or any other material considered suitable. If metal is used for the skin, it will be understood that the same may be welded in order to prevent the seepage of water into the tunnel or shaft, to the members C of the ribs and to the angle irons F, and that adjacent sections of the skin may be welded together.

As shown in Fig. 2, the extreme outer edge of each of the members C projects outside of the skin H, as designated by the reference character K.

It will be apparent that perforations may be made in the skin H at desired points in order that concrete or other suitable material may be forced therethrough for the purpose of filling voids on the exterior of the skin.

In Fig. 3 the manner of forming the tunnel and the relation of the rams to the tunnel lining and the driving shield is shown. In this figure, the rams 10 are positioned against one of the rib members σ in such a manner that the thrust of the rams will be in direct longitudinal alignment with the skin H. The opposite end of each of the rams 10 is adapted for engagement with the rear end of the driving shield 12.

From the foregoing, it will be seen that the present invention provides a tunnel or shaft structure in which advantages are had over the types and constructions as at present used, and that, at the same time, the operation of erecting the lining is facilitated.

Having thus described the invention, what is claimed as new is:

In a structure of the character described, a plurality of ribs comprising sections of steel plates, inner and outer angle irons attached to said sections, and skin plates attached to said ribs and to the outer angle irons, said ribs, inner and outer angle irons, and skin plates being welded to each other to prevent water from entering the structure.

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