Dec. 16, 1930. R. V. PROCTOR 1,785,096

TUNNEL

Filed July 14. 1928 2 Sheets-Sheet. 1

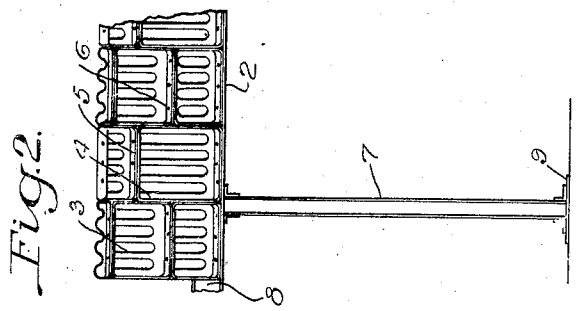


Fig. 2.

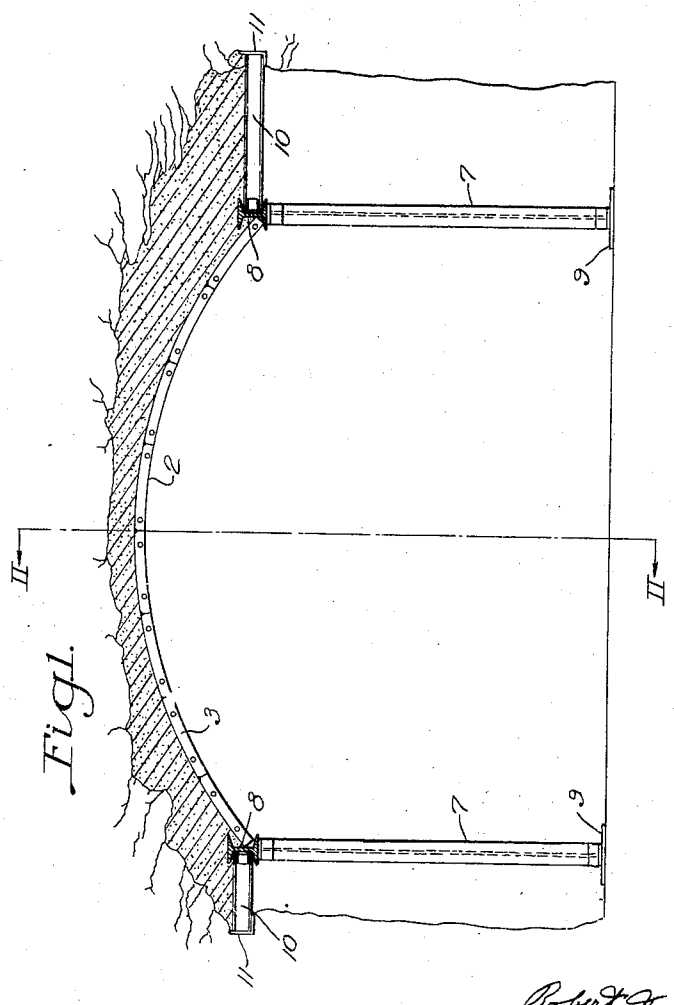


Fig. 1.

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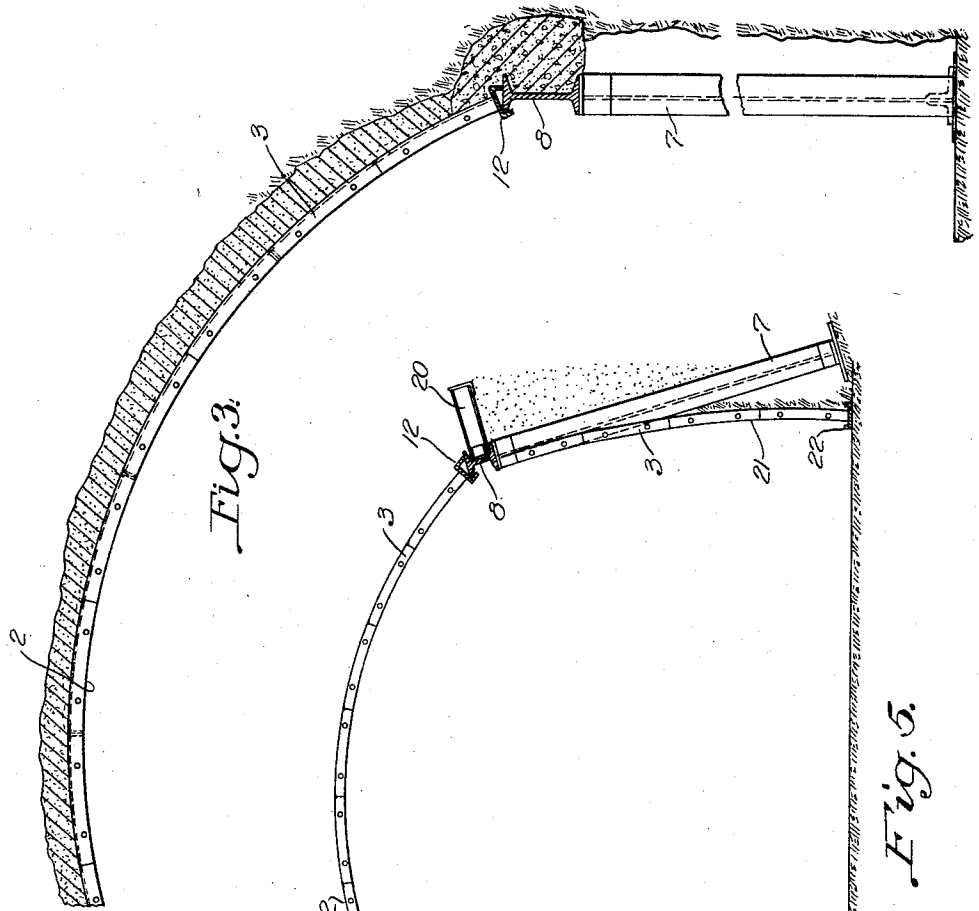


Fig. 3.

Fig. 5.

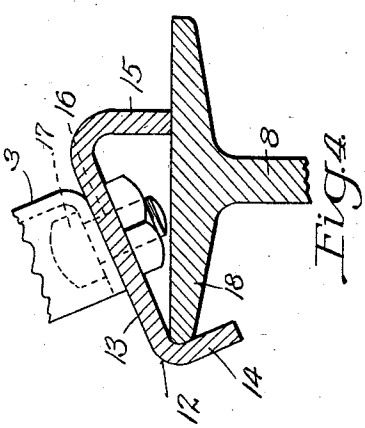


Fig. 4.

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UNITED STATES PATENT OFFICE

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TUNNEL

Application filed July 14, 1928. Serial No. 292,874.

This invention relates generally to tunnels and more particularly to means for either temporarily or permanently supporting the roof or the roof and sides of a coal mine.

In present systems of coal mining there are certain underground workings, such as loading stations, where it is necessary to provide a roof of a more or less permanent nature in order to protect workmen from being injured by pieces of rock and shale which occasionally drop off the roof of the working.

Heretofore the general method of protecting workmen from such falling fragments has been to provide a roof of timber, brick work, or concrete. In the event of an explosion, when either timber, brick work or concrete are employed in forming such a roof, these materials fall down into the working and form a great deal of débris in the room or entry which closes the passages in the mine and prevents ventilation of the working, as well as forming a barrier against the escape or rescue of the miners. In order to put in a concrete or brick roof in a mine working, it is necessary to excavate additional material in order to form a space sufficient to include the concrete or brick work forming the roof or wall of the working and in order to give the necessary head room required in the operation of the working.

This entails the delivery of a large bulk of material into the workings which causes a considerable amount of difficulty to the workmen employed in the mines. When either concrete or bricks are employed in forming roofs, they must be temporarily supported by a large amount of timbering until the concrete or brick work sets. This portion of the mine may not, therefore, be used until the brick work or cement is entirely set. The use of either brick work or cement endangers the workmen employed in putting up the roof, as no protection is given against falling shale or rock during the erection of such roofs.

According to the present invention all of these difficulties are eliminated or decreased by the provision of a roof made up of a plurality of sectional metal liners secured together and supported along opposite sides of the working. The metal plates so employed are relatively light as compared with the amount of brick or concrete necessary in order to form a roof of equal strength, which reduces the bulk of material which must be handled underground. In erecting metal plates in accordance with the present invention, after the first transverse row of plates is erected the workmen can stand under this row of plates while erecting the next row so that during the erection of the arch the workmen are protected from falling shale or rock.

Another advantage of the present invention is that the arch formed of metal plates is self supporting as soon as the roof is erected. The portion of the mine being roofed, for this reason, may be used much sooner than if concrete or brick work were employed.

The thickness of the plates is very small relatively to the thickness of concrete or cement which would be necessary to form a wall of equal strength so that the amount of excavation necessary is greatly reduced.

Concrete or brick walls are subject to leakage, whereas the present invention provides a roof in which leakage may be prevented by tarring the joints between the metal plates.

In the event of an explosion in a mine wherein concrete or brick arches are employed, the brick work or concrete breaks up and usually prevents access to or from the working in which the explosion has occurred. However, in workings wherein roofs of sectional metal are employed such roofs, due to their high tensile strength, will tend to hold together and even if they are distorted and portions thereof fall down into the working, the roofs tend to twist so as to form a relatively open passageway thereby providing means for the workmen to get into and out from the section of the mine in which the explosion has occurred.

Explosive dust is less likely to adhere to metal plates than to either brick work or concrete, and may be more easily removed from metal than from either concrete or brick work.

In the drawings, which illustrate several preferred embodiments of my invention—

Figure 1 is a transverse section through a

mine working showing a roof structure embodying my invention;

Figure 2 is a sectional view taken on the line II—II of Figure 1;

Figure 3 is a partial view similar to Figure 1 showing a modified form of the invention;

Figure 4 is an enlarged sectional view of the means for connecting the arch and support shown in Figure 3; and

Figure 5 is a partial view similar to Figure 1 showing another modification.

Referring to the preferred embodiment of the invention shown in Figures 1 and 2, the arch 2 comprises a plurality of sectional metal members 3 which are provided with side flanges 4 and end flanges 5. Holes 6 are formed in the side flanges and end flanges and are adapted to receive bolts in order to secure the metal members together.

The arch made up of the metal plates 3 is supported on opposite sides of the working by a plurality of metal members 7 which, in the preferred form, constitute I-beams. The supporting members are spaced longitudinally of the working and are connected together adjacent their tops by metal members 8 which preferably also are I-beams. The lower ends of the supports 7 rest on sills 9 which preferably are metal plates.

The supports 7 are braced by a plurality of struts 10 which are spaced longitudinally of the working with one of their ends in contact with the stringer 8 and their opposite ends in contact with brackets 11 set into recesses in the mine working.

In erecting a roof from metal liner plates, such as shown in Figures 1 and 2, the plates are connected together by inserting bolts through the openings 6 and are temporarily supported by timber until the first row of plates is completely assembled. When the row is completely assembled with the end plates resting on the stringers 8, the timber may be removed and a second row of plates secured to the first row. As shown in Figure 2, the joints between the plates are staggered by employing full plates and half plates alternately along the stringers 8. It will be seen that the workmen may connect the next adjacent row of plates while being protected by the row of plates which has already been erected.

Referring to Figures 3 and 4, the connecting means between the arch 2 and the stringers 8 comprises a metal support 12 formed as shown in Figure 4 with a base portion 13 and two flanges 14 and 15. The base portion is provided with an opening 16 adapted to receive a bolt 17 in order to connect the end plate 3 to the support 12. The bottom of the flange 15 rests on the horizontal surface of the stringer 8 and the flange 14 extends below and around the left hand flange 18 of the I-beam 8. In this construction the I-beams 8 are braced by concrete or grouting poured between the outer face of the I-beam and the working.

As shown in Figure 5, the roof 2 is connected to a member 12 as described in the device shown in Figures 3 and 4, but instead of using concrete or grouting to brace the I-beams 8 metal struts 20 are employed. In this modification, the supports 7 instead of being arranged substantially vertically are arranged at an angle. A plurality of metal plates 3 are connected together to form side walls 21 which side walls are supported by metal sills 22.

It is to be understood that the forms of the invention herein shown and described are to be taken as preferred examples and that the invention may be otherwise embodied without departing from the spirit of the invention or the scope of the following claims.

I claim:

1. A tunnel lining, which comprises a plurality of wrought metal plates having flanges provided with openings and extending toward the inside of the tunnel, the openings being provided with bolts for securing the plates together, a plurality of metal members spaced longitudinally of the tunnel on opposite sides thereof, stringers extending longitudinally of the tunnel arranged on the metal members, means for connecting the stringers with the arch, and struts spaced longitudinally of the tunnel for bracing the stringers.

2. A tunnel lining, which comprises a plurality of wrought metal plates having flanges provided with openings and extending toward the inside of the tunnel, the openings being provided with bolts for securing the plates together, a plurality of metal members spaced longitudinally of the tunnel on opposite sides thereof, stringers extending longitudinally of the tunnel arranged on the metal members, means for connecting the stringers with the arch, struts spaced longitudinally of the tunnel for bracing the stringers, and a plurality of connected metal plates forming side walls arranged on opposite sides of the tunnel.

In testimony whereof I have hereunto set my hand.

ROBERT V. PROCTOR.