D. W. SHEPARD.

METAL REINFORCED CONCRETE TIMBERING FOR MINE TUNNELS.

APPLICATION FILED JAN. 25, 1909.

992,813.

Patented May 23, 1911.

3 SHEETS—SHEET 1.

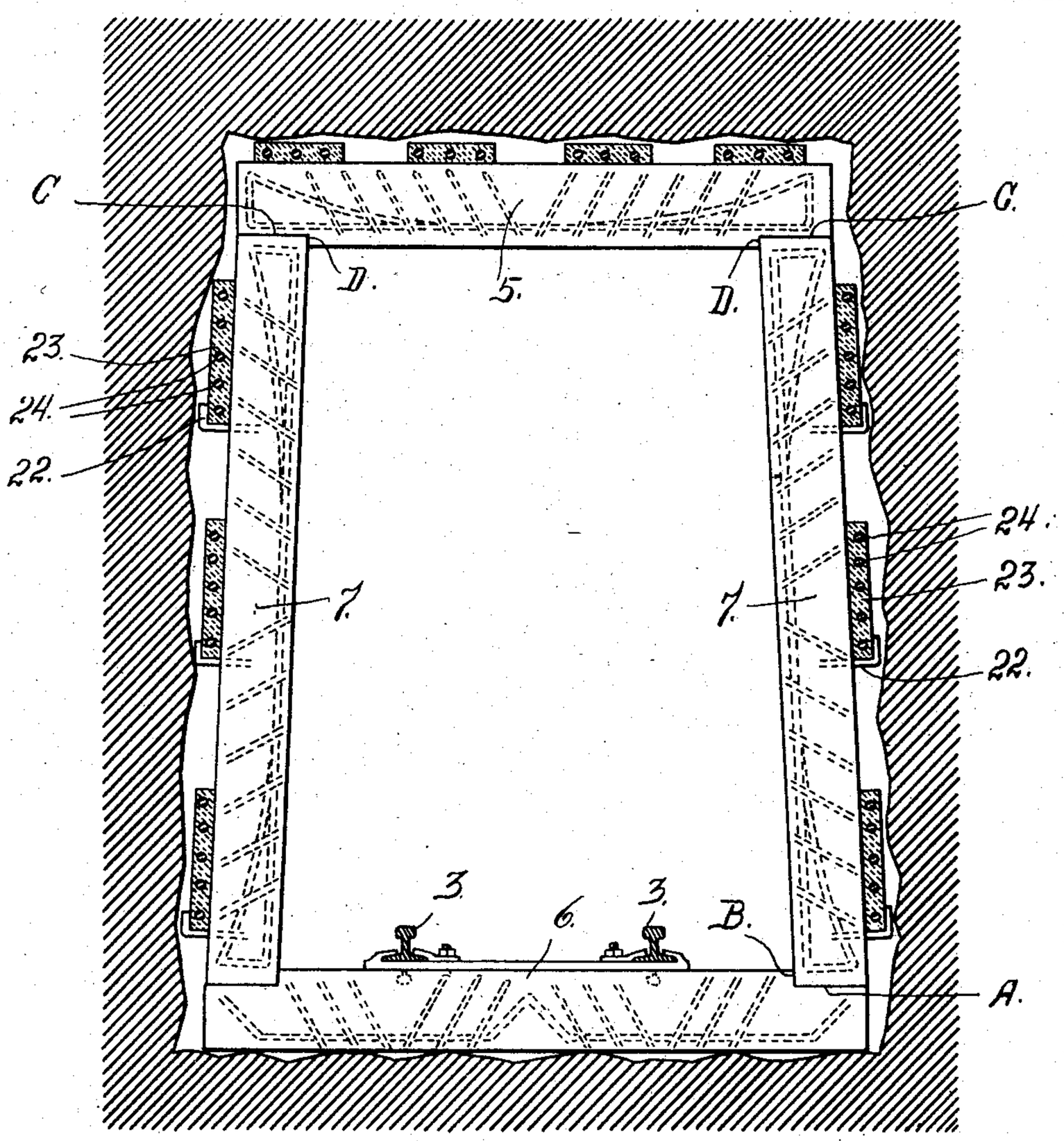

Fig. 1.

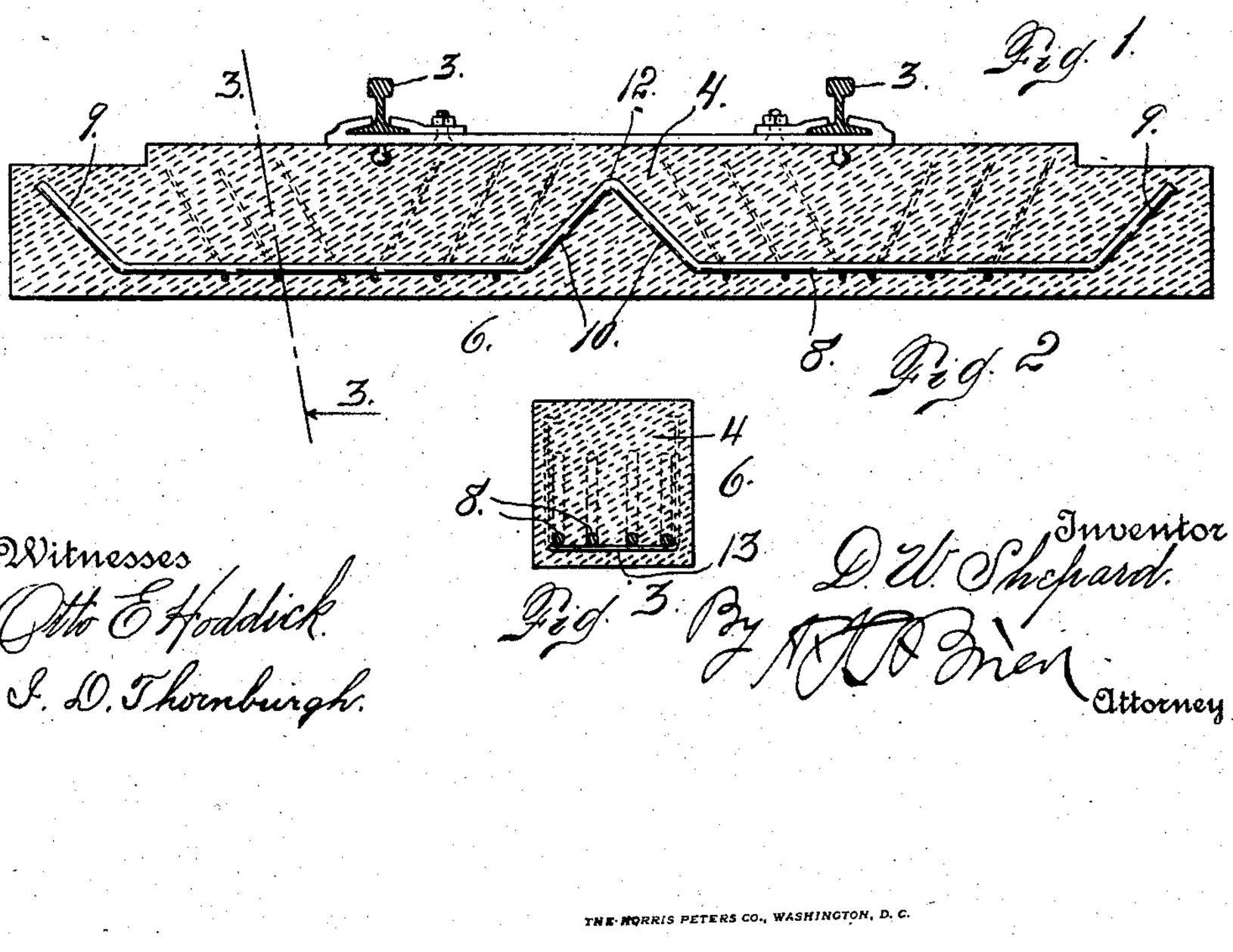

Fig. 2

Fig. 3.

Witnesses

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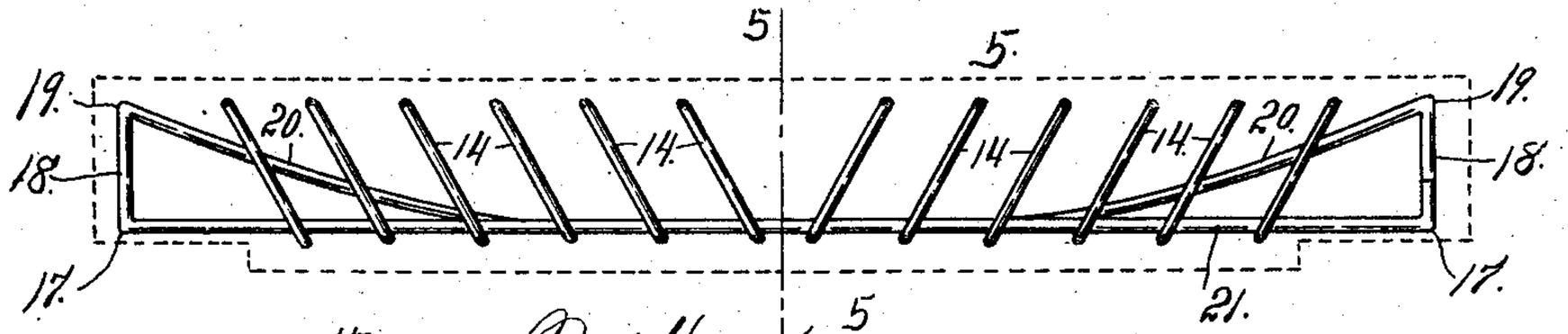

Fig. 4.

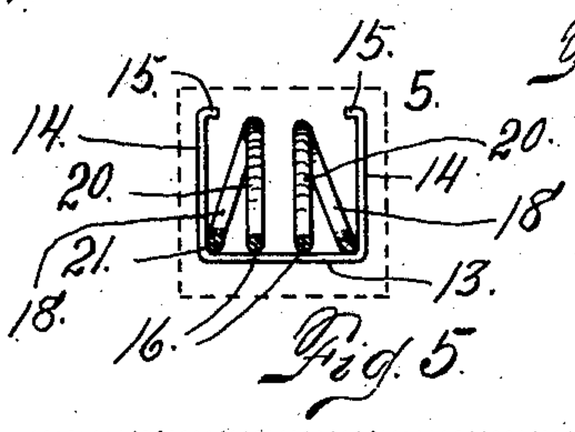

Fig. 5.

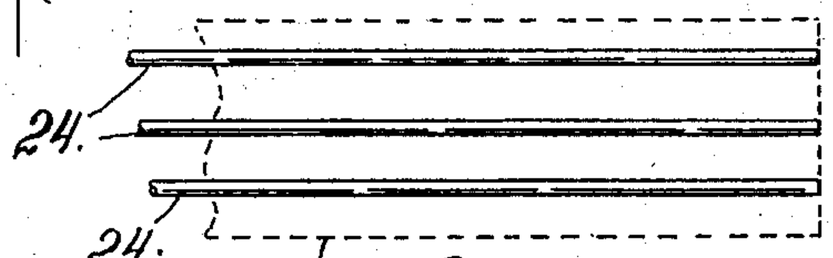

Fig. 6.

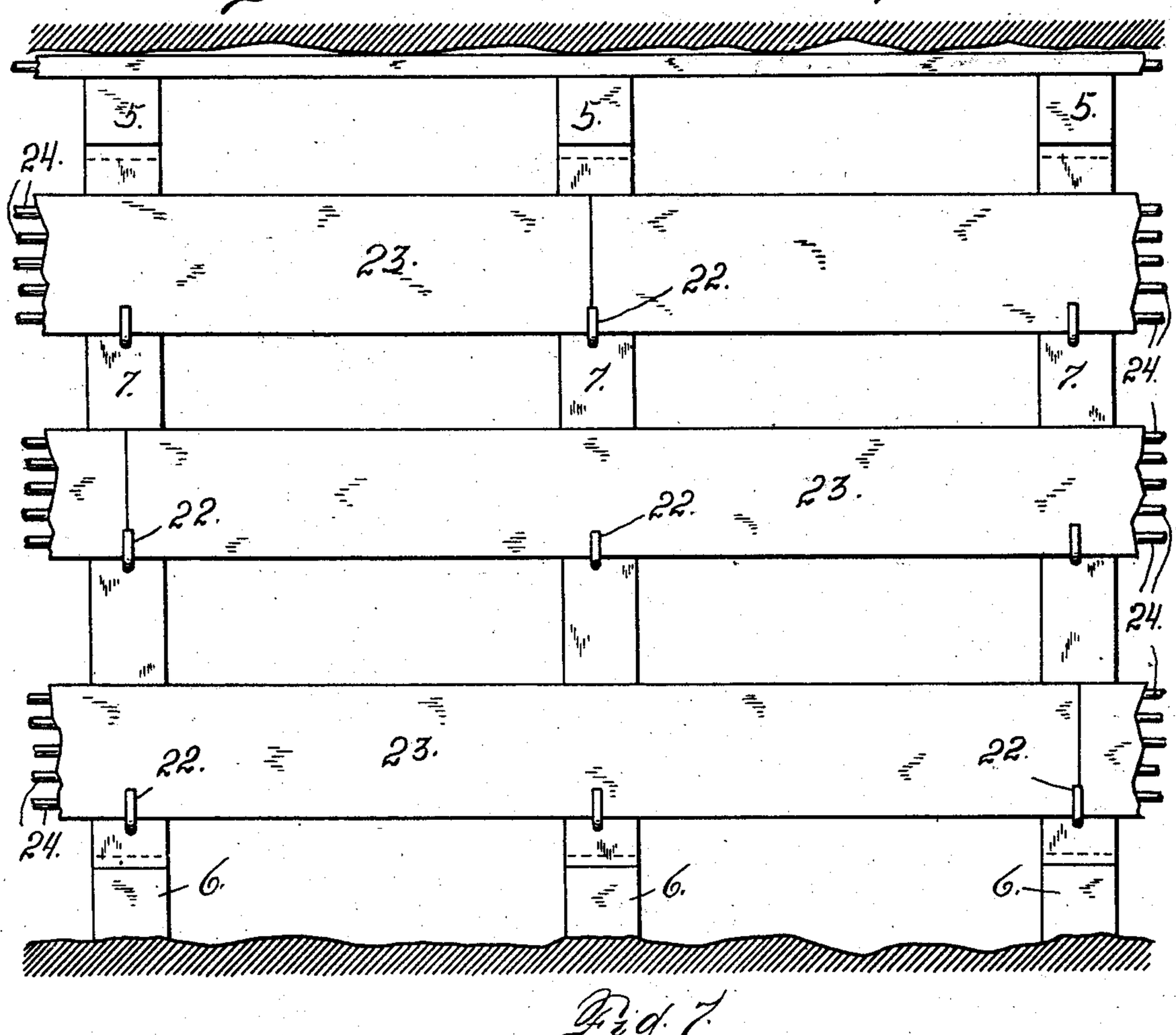

Fig. 7.

Witnesses

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3 SHEETS—SHEET 3.

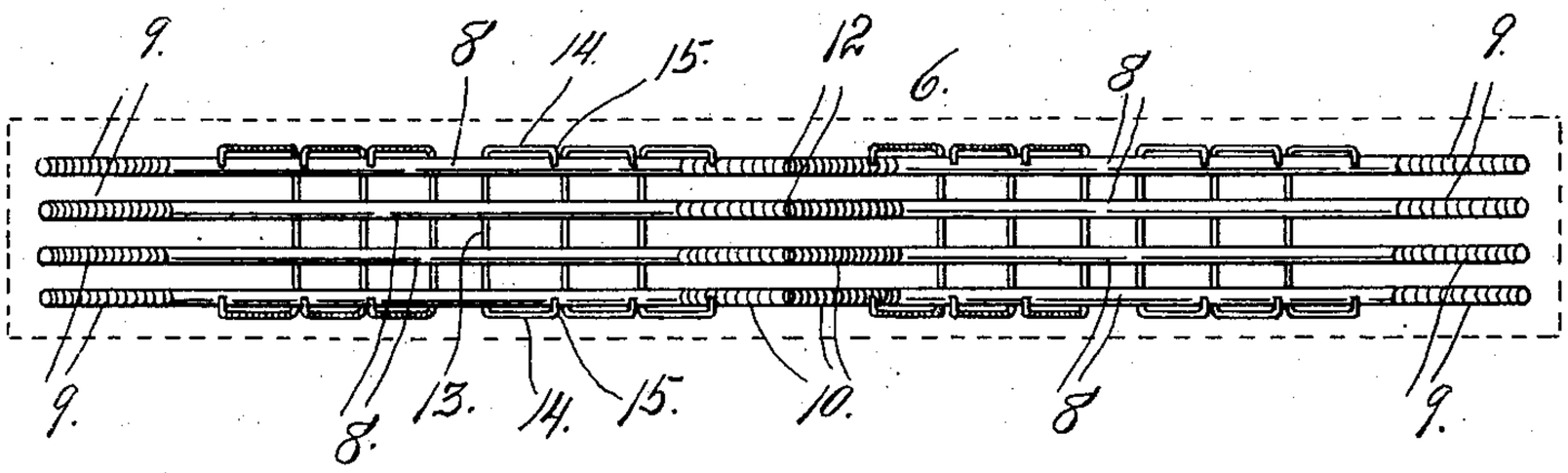

Fig. 8.

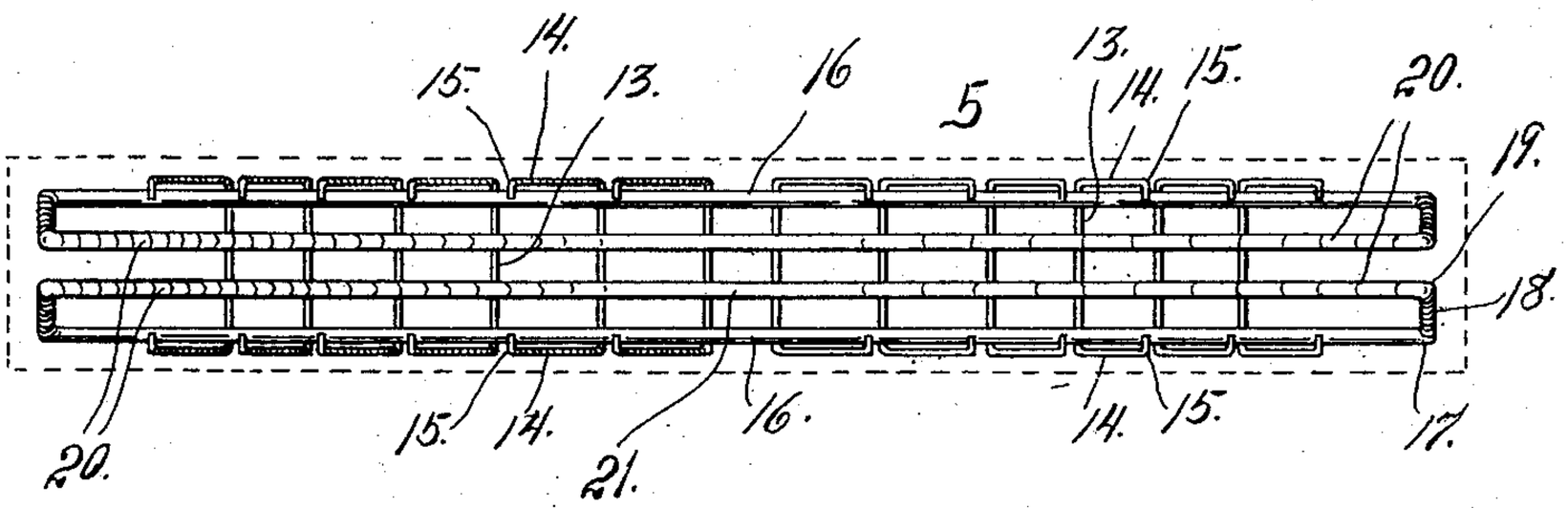

Fig. 9.

Witnesses
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UNITED STATES PATENT OFFICE.

DARWIN W. SHEPARD, OF DENVER, COLORADO, ASSIGNOR TO THE SHEPARD PATENT CEMENT MINE AND TUNNEL TIMBERING COMPANY, OF DENVER, COLORADO.

METAL-REINFORCED-CONCRETE TIMBERING FOR MINE-TUNNELS.

992,813. Specification of Letters Patent. **Patented May 23, 1911.**

Application filed January 25, 1909. Serial No. 474,005.

To all whom it may concern:

Be it known that I, DARWIN W. SHEPARD, a citizen of the United States, residing in the city and county of Denver and State of Colorado, have invented certain new and useful Improvements in Metal-Reinforced-Concrete Timbering for Mine-Tunnels; and I do declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, and to the letters and figures of reference marked thereon, which form a part of this specification.

My invention relates to improvements in metal reinforced concrete timbering for mine tunnels. It is evident that this timbering may be employed for tunneling purposes whether for mining or other uses.

The beams, which are employed in my improved construction, are composed of concrete, or similar material, my object being to provide these beams with a metal reinforcement, which shall be so distributed as to give the beams the necessary strength or capacity to resist strains to the maximum degree. In accomplishing this purpose, I provide the beams with metal rods extending longitudinally, and also with coöperating stirrups, which are arranged to coöperate with the longitudinal reinforcement for the purpose aforesaid.

Having briefly outlined my improved construction, as well as the objects I expect to attain therefrom, I will proceed to describe the invention, reference being made to the accompanying drawing, in which is illustrated the embodiment thereof.

In this drawing Figure 1 is a cross section taken through a tunnel, with my improved timbering shown in elevation. Fig. 2 is a longitudinal section taken through one of the bottom beams of the tunnel. Fig. 3 is a transverse section of the same, taken on the line 3—3, Fig. 2. Fig. 4 is a side elevation, showing the metal reinforcement for one of the top beams of the tunnel, the outlines of the beam being indicated by dotted lines. Fig. 5 is a cross section of the same, being a section taken on the line 5—5, Fig. 4. Fig. 6 is a top plan view, illustrating metal reinforcement for one of the lagging or side bars employed in connection with the beams. Fig. 7 is a side elevation of the section of the timbering of the tunnel viewed from the outside, the lagging being broken away at both ends to expose the metal reinforcement. Fig. 8 is a top plan view, illustrating the metal reinforcement of one of the bottom beams of a tunnel. In this case the body of the beam is outlined or indicated by dotted lines. Fig. 9 is a similar view of one of the side beams, though in this case it must be assumed that the beam is laid with its inner vertical surface downwardly. In this case the top view of the beam would be the outside view, if the beam were occupying an approximately vertical position, as is necessary in the tunnel.

It may be stated that Fig. 4 illustrates the metal reinforcement of the side beams as well as that of the top beams of the tunnel, though the form indicated by the dotted outline is that of the top beam.

The same reference characters indicate the same parts in all the views.

Let the numeral 5 designate a top beam; 6 a bottom beam, and 7 the side beams, constituting the timbering of a mine or other tunnel. I will first describe the bottom beam 6 in detail.

Let the numeral 4 designate the body of the beam, which is composed of concrete or similar material. Extending lengthwise of this beam is a number of rods 8, forming a part of the metal reinforcement. The greater portion of these rods occupies a position near the bottom of the beam; their extremities, however, are upturned, as shown at 9, occupying a position forming an angle of about 45° with the vertical. The central portion of each rod is bent upwardly, forming two parts 10, making angles of about 45° with the vertical, and meeting in an apex, as shown at 12 midway between the extremities of the beam, and occupying a position above the center thereof. On the opposite sides of the center of the beam, and between the parts 10 and 9 of the metal reinforcement, the beam is equipped with stirrups whose bottom members 13 are located immediately below the rods 8. The sides of these stirrups extend upwardly, and are inclined as illustrated in the drawing. As shown, a number of these stirrups are located on each side of the lines of strain or pressure, these lines being indicated by the rails 3 of a car track. As shown in the drawing, three of the stirrups are inclined toward the left,

while three other stirrups are inclined toward the right on opposite sides of planes, cutting the rails 3 longitudinally and the beam 6 transversely. This arrangement of the stirrups is believed to be most advantageous where the beams are used for supporting railway tracks and trains which pass thereover. As shown in the drawing, each stirrup is provided with side members 14, which extend upwardly from the opposite extremities of the bottom member 13. The free extremities of the side members 14 are bent inwardly for anchoring purposes, as shown at 15.

The metal reinforcement of the top beams consists of rods having straight bottom members 16, which occupy positions near the bottom of the beam, and whose extremities are turned upwardly at right angles, as shown at 17, and deflected inwardly, as shown at 18. These deflected end portions terminate at 19, where the rod is curved downwardly from its opposite extremities, as shown at 20. These curved portions of the rod are continued into a straight, or approximately straight, portion 21, which is centrally located between the extremities of the beam and parallel therewith. The members 16, 18, 20 and 21, as illustrated in the drawing, are formed from a single rod bent as explained. As illustrated (see Fig. 5), the beam is provided with two of these rods, thus giving the beam four metal reinforcing members, extending lengthwise thereof. Each beam is further provided with a series of stirrups of substantially the same construction as those heretofore described, and composed of the bottom members 13; side members 14, and inwardly turned free extremities 15. A series of these stirrups is inclined in opposite directions on opposite sides of the central portion of the beam, in order to give the latter the necessary strength to resist strains when pressure is applied from above, as when these beams constitute the top timbers of the tunnel.

The side beams 7 have substantially the same metal reinforcement as the top beams 5. In describing the reinforcement of the side beams, however, it must be explained that the members 16 are located near the inner surface of the side beam, but near the bottom surface of the top beam; while the parts 18, which are located at the extremities of the side beam, extend outwardly from the bend 17, the parts 20 being curved inwardly from the bends 19, while the members 21 are located near the inner surface of the beam and in the same plane as the corresponding portion of the members 16. It will also be necessary to state that the stirrups in the case of the side beams are upwardly inclined above the central portion of the beam and downwardly inclined below its central portion. It will thus be seen that the metal reinforcement of the side beams is substantially that of the top beams, but by reason of the different position in which the side beams are placed, the location of the various members of the metal reinforcement requires a separate description, as herein given. It will be understood that in the formation of these beams, the metal reinforcing parts will be arranged and properly supported within the molds in which the beams are formed, the plastic material being poured into the molds until reinforcing parts are embedded therein.

Each of the side beams 7 is equipped with hooks 22, having upwardly turned extremities. These hooks form the support for the lagging members 23, which consist of slabs composed of concrete and metal reinforced by the use of rods 24. These slabs are used for both the side and top walls of the tunnel. The top slabs are simply laid upon the upper surface of the top beams 5.

As illustrated in the drawing (see Fig. 1), the ends of the bottom beam 6 are slightly cut away, as shown at A., forming offsets B., where they are engaged by the lower extremities of the side beam 7; while the extremities of the top beams are similarly cut away from their lower surface, as shown at C. and offset at D., where they are engaged by the upper extremities of the side beam 7. Furthermore, the side beams are preferably slightly inclined inwardly from their lower extremities as they extend upwardly.

Having thus described my invention, what I claim is:

1. A timbering structure for tunnels, comprising a framework composed of upright side beams, metal reinforcing rods extending lengthwise of the said beams, each of the said rods being formed into a loop and having its opposite ends brought together at one end of the beam, one side of the loop being straight, while the other side of the loop is curved so that its central portion lies in the same plane as the straight portion of the loop, the opposite ends of the loop being arranged to occupy a plane transversely of that occupied by the two sides of the loop, the said ends being inclined toward the center of the beam, whereby the two sides of the loop are spaced apart, substantially as described.

2. A tunneling structure composed of beams having metal rods extending lengthwise of the beams, the rods of the top and side beams consisting of a loop extending lengthwise of the beam and having its opposite ends brought together at one end of the beam, one side of the loop being straight and lying near the outer surface of the beam, while the other side of the loop is curved so that its central portion lies in the

same plane as the straight side of the loop, the opposite ends of the loop being arranged to occupy a plane transversely of that occupied by the two side members, whereby the extremities of the curved side of the loop are arranged near the opposite side of the beam from that of the straight side of the loop, the said end portions of the loop being inclined toward the center of the beam, whereby the two sides of the loop are spaced apart, substantially as described.

In testimony whereof I affix my signature in presence of two witnesses.

DARWIN W. SHEPARD.

Witnesses:
JESSIE F. HOBART,
A. EBERT O'BRIEN.