No. 816,040. PATENTED MAR. 27, 1906.

J. W. RENO.

APPARATUS FOR LINING TUNNELS WITH CONCRETE.

APPLICATION FILED SEPT. 9, 1904.

2 SHEETS—SHEET 1.

Fig. 1

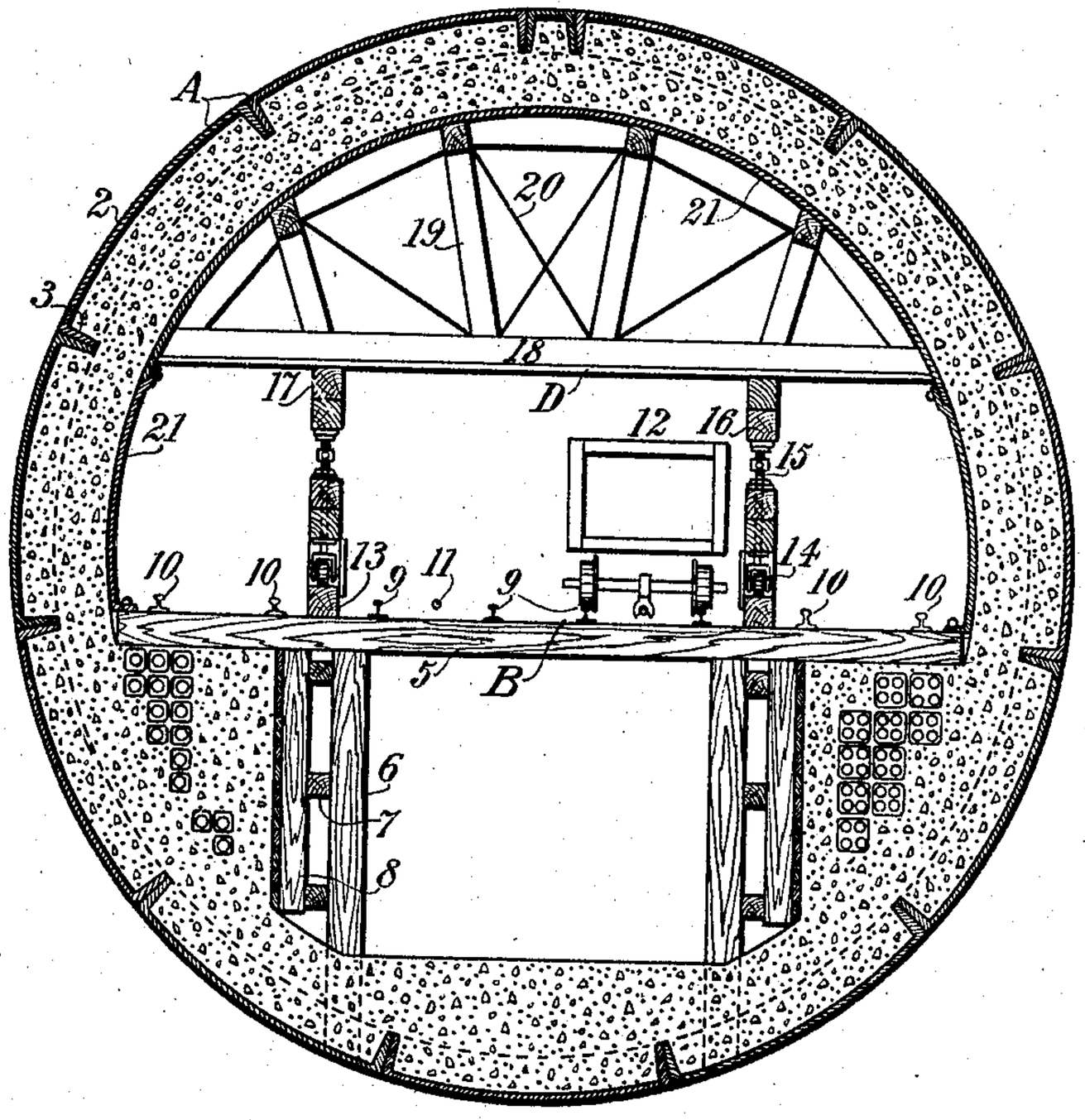

Fig. 2

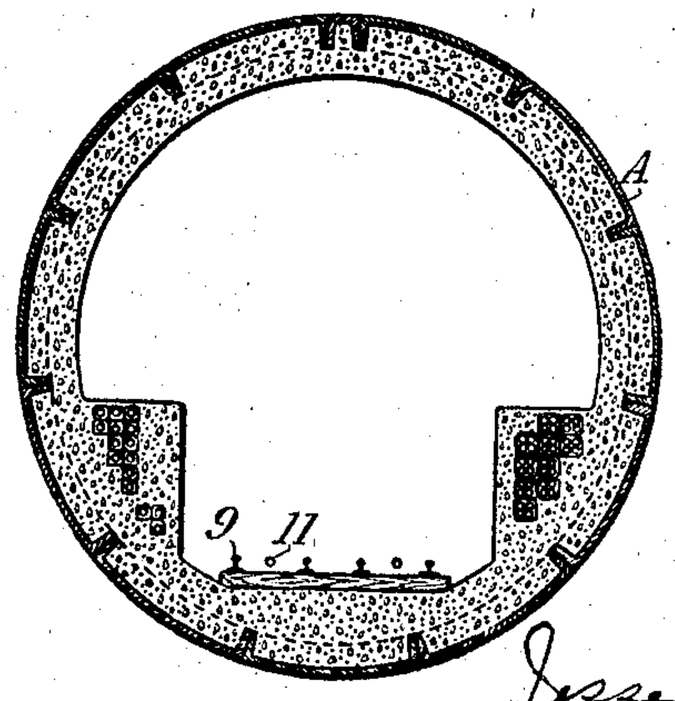

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Fig. 3

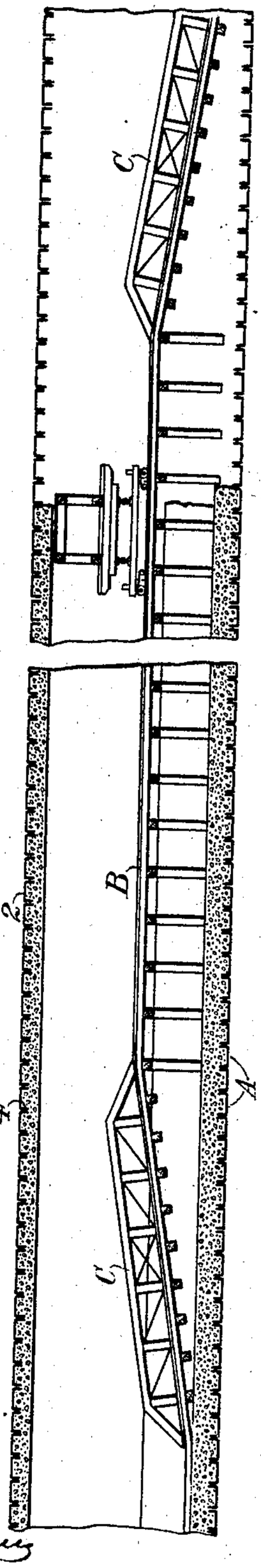
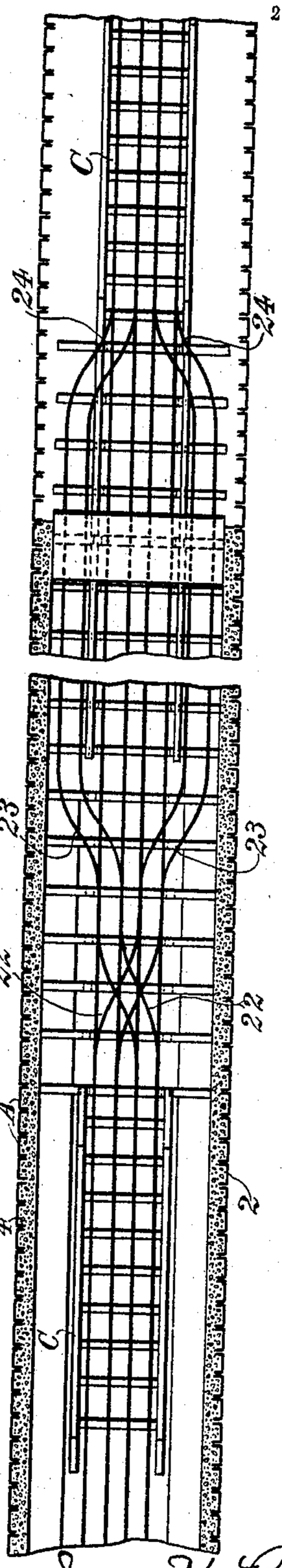


Fig. 4



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APPARATUS FOR LINING TUNNELS WITH CONCRETE.

No. 816,040. Specification of Letters Patent. Patented March 27, 1906.

Application filed September 9, 1904. Serial No. 223,938.

To all whom it may concern:

Be it known that I, JESSE W. RENO, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented a new and useful Apparatus for Lining Tunnels with Concrete, of which the following is a specification.

My invention relates to improvements in methods of and apparatus for the lining of tunnel-tubes with concrete, its object being to carry on the work of applying such lining step by step simultaneously with the driving of the heading and to keep the lining work close to the heading; and it consists in the features of construction and methods of operation hereinafter particularly described and claimed.

In the accompanying drawings, forming part of this specification, Figure 1 is a cross-section of a tunnel, showing the tube, the concrete lining in place therein, and my improved apparatus in working position. Fig. 2 is a smaller cross-section of the tube in finished condition, with the temporary framework and concreting center or shield removed. Fig. 3 is a longitudinal section of the tunnel, showing the temporary platform upon which the concreting operations are carried on, the shield in place thereupon, and the bridges at each end of the platform for carrying the cars from the bottom of the tunnel onto the platform, and vice versa; and Fig. 4 is a horizontal section of the tunnel and a plan view of the platform and tracks.

In the drawings, A represents the tunnel-tube, made up of segments 2, having longitudinal flanges 3 and circumferential flanges 4.

B is a temporary platform, arranged substantially in the plane of the horizontal diameter of the tunnel and made up of cross-timbers 5, posts 6, furring-strips 7, and studs 8. Longitudinally of the frame B are arranged series of tracks 9 and 10. Between the rails of the central racks 9 and the corresponding tracks in the bottom of the tube at each end of the platform is provided a cable 11 for the propelling of the material-cars 12, running upon said tracks to and from the heading. At each end of the temporary platform is arranged a bridge C, upon which are arranged tracks 9, connecting with the rails of corresponding tracks 9 in the bottom of the tunnel. Upon the platform switches 22, 23, and 24 are also provided, as shown in Fig. 4, by means of which cars may be run from either of the tracks 9 onto the siding-tracks 10 on the platform, and from such sidings onto the main tracks at either end of the platform, as clearly shown in Fig. 4. While the cable 11 is shown in working relation with the tracks 9, it is obvious that it could by proper guide-sheaves be carried from the tracks upon the bridges C between the side-tracks 10, in which case the through traffic over the platform would be along the sidings 10 instead of the central tracks. In either case the through traffic of material to and from the heading is thus carried upon two of the four tracks upon the platform, leaving the other two tracks free for material-cars for the concreting operations. Arranged longitudinally of the platform B are also stringers 13, serving as tracks for the trucks 14, which carry jacks 15, supporting the stringers 16, upon which in turn rest the longitudinal timbers 17 of the center D. This center is made up of the channel-iron cross-pieces 18, struts 19, braces 20, and covering-plates 21. The construction and method of using the center are disclosed and covered in my prior patent, No. 761,786, dated June 7, 1904. The gist of this invention is a modification upon my other method and apparatus, as disclosed in said patent, whereby the through traffic of material-cars between entrance and heading is maintained along the bottom of the tunnel, excepting at the point where the lining operations are at the time being carried on, where such cars are carried over the bridges and platform.

The apparatus is operated as follows: The heading being driven far enough to afford sufficient space within the completed tube in the rear thereof for concreting purposes, a temporary platform B is erected, provided with tracks and the connecting bridges and tracks, as above described. Material-cars are operated over the bridges and platform, and the concreting operations conducted thereon until the arch and invert of the tunnel for the length of the platform has been lined. After this the bridges C are detached from the platform, and the rear sections or bents of the platform are transferred to the other end to extend the platform forward toward the heading, and tracks are laid upon the bottom of the completed part of the tunnel. The bridges are then connected to the platform thus advanced and the foregoing-described operation repeated. Ordinarily I prefer to operate the material-cars over the central tracks upon the platform. In some

cases, however, it may be desirable to switch them from the middle tracks to the outside tracks, returning them to the middle tracks as they pass off from the platform onto the bridge. In either case the cars with concreting materials are brought in on the tracks leading from the entrance and set upon the tracks on the platform which are not required for the through traffic.

I claim—

1. In tunnel construction, means for carrying on simultaneously the several operations of driving the heading, erecting a tube in the bore, and lining said tube in the rear of the heading progressively as the heading advances, comprising a substantially diametric platform adjustably arranged at the point of lining operations, through-tracks thereover connecting entrance with heading for material-cars, and subsidiary tracks for concreting apparatus interconnecting with said through-tracks.

2. In tunnel construction, means for circumferentially and step by step lining the tube with concrete as the heading advances, comprising a temporary platform and approach-bridges adapted to be advanced with the progress of the work, through-tracks from entrance to heading passing over said bridges and platform, and subsidiary tracks upon said platform connecting with said through-tracks.

3. In tunnel construction, in combination with the tunnel-tube, a temporary diametric platform, removable bridges at each end thereof leading from the bottom of the tube to the platform, through-tracks running along the bottom of the tube and over said bridges and platform between entrance and heading, subsidiary parallel tracks on said platform, and switches interconnecting said subsidiary and through tracks.

4. In tunnel construction, in combination with the tunnel-tube, a substantially diametric platform adapted to be longitudinally adjusted therein, a removable bridge leading from each end of said platform to the bottom of the tunnel, main tracks along the bottom of the tunnel and over said bridges and platform, side tracks upon said platform, switches connecting the side tracks with the main tracks and concreting apparatus adjustably arranged on said platform.

In witness whereof I have hereunto set my hand, at the city of New York, this 7th day of September, 1904.

JESSE W. RENO.

Witnesses:
J. T. CRANE,
T. D. MERWIN