March 17, 1931. C. M. GOODRICH 1,796,752

TUNNEL SHIELD

Filed Aug. 31, 1928 2 Sheets-Sheet 1

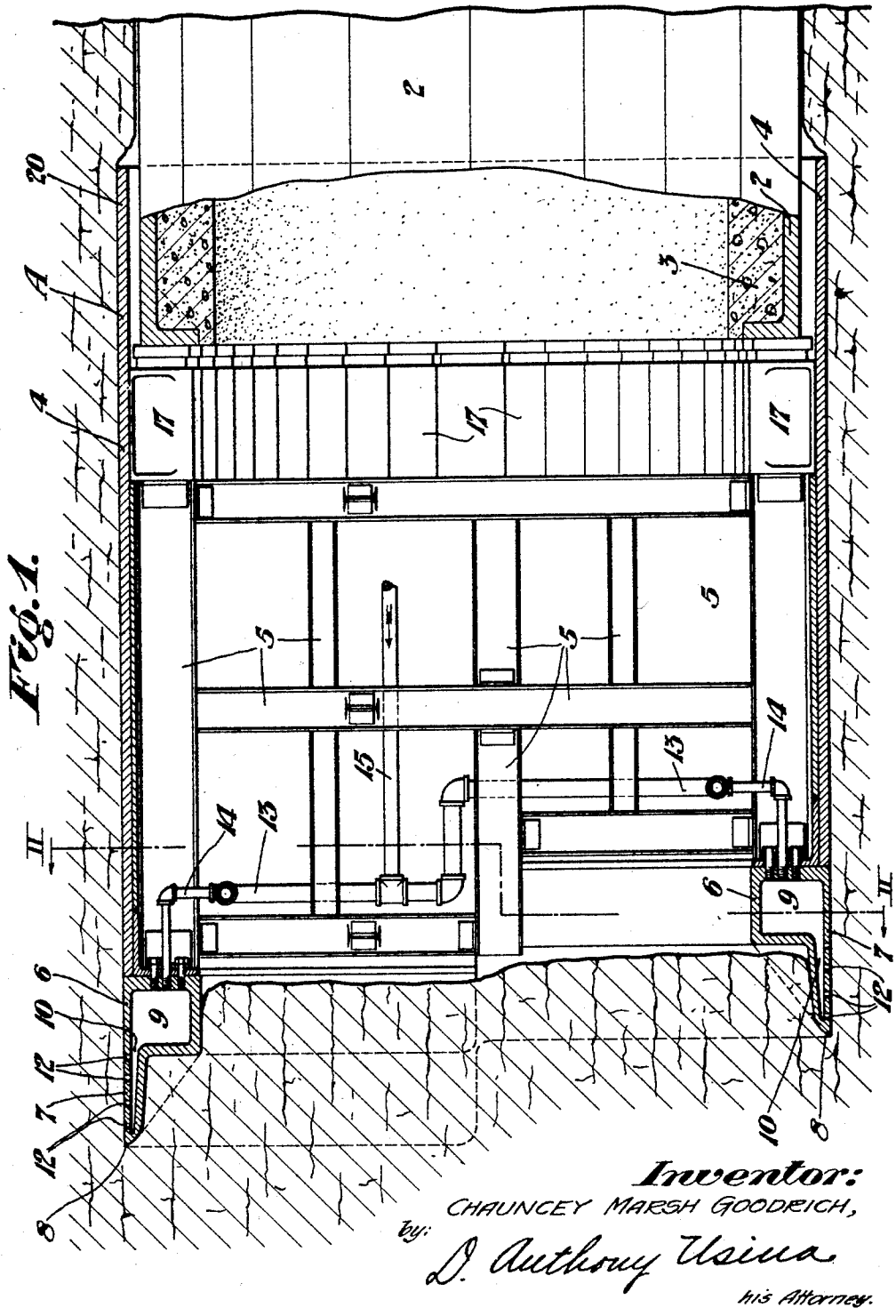


Fig. 1.

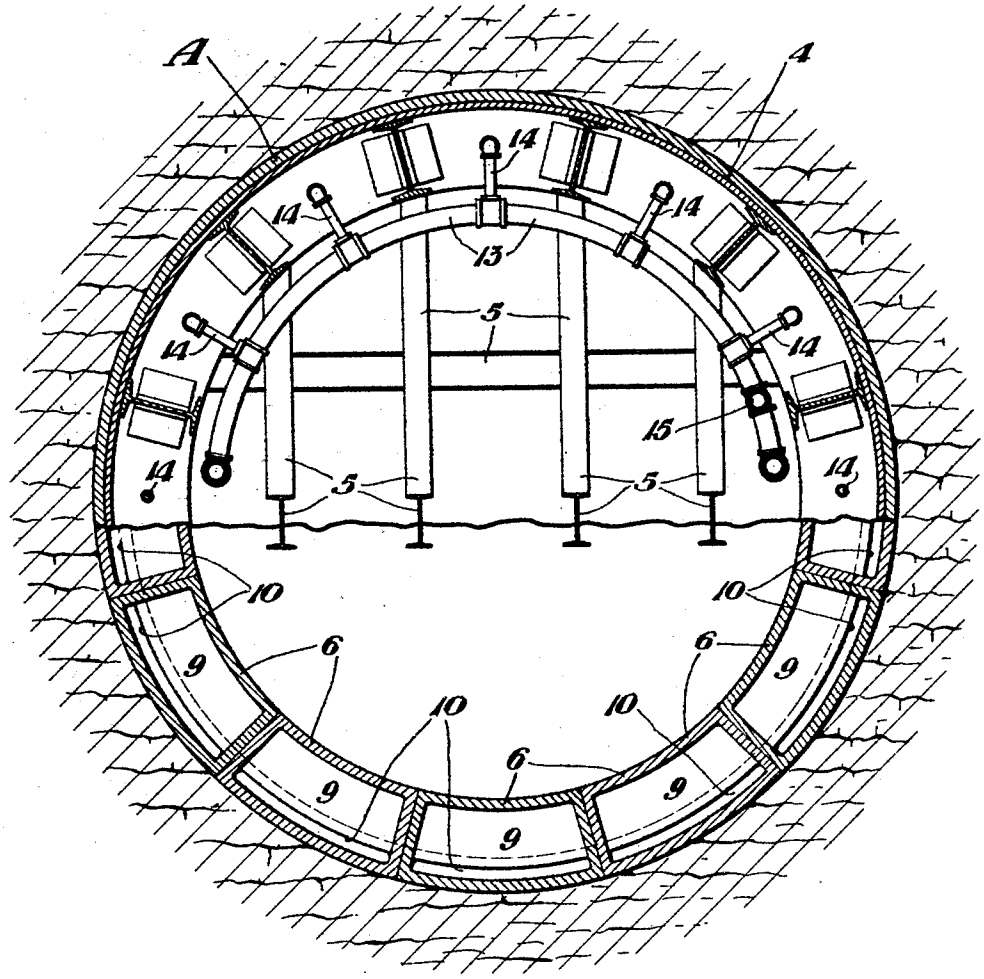
Inventor:
CHAUNCEY MARSH GOODRICH,
by: D. Anthony Usina
his Attorney.

March 17, 1931. C. M. GOODRICH 1,796,752

TUNNEL SHIELD

Filed Aug. 31, 1928 2 Sheets-Sheet 2

Fig. 2.



Inventor:
CHAUNCEY MARSH GOODRICH,
by: D. Anthony Usina
his Attorney

Patented Mar. 17, 1931 1,796,752

UNITED STATES PATENT OFFICE

CHAUNCEY MARSH GOODRICH, OF WINDSOR, ONTARIO, CANADA

TUNNEL SHIELD

Application filed August 31, 1928. Serial No. 303,286.

This invention relates to shields used in the digging of large tunnels, such as used for vehicular and railroad traffic, and has for its object the provision of a novel construction whereby the power and force necessary to move said shields forward into the earth face is materially reduced.

When digging large tunnels like that in which shields of the class to which this invention pertains are used, the opening is first started by the usual digging methods and the tunnel casing is placed as the work progresses. After the work has progressed sufficiently, the shield will be assembled in the pit previously excavated, will be jacked forward into the tunnel proper, the jacks operating at first against the blocking in the pit and later against the lining of the tunnel.

The shield serves to support the earth walls of the tunnel in advance of the tunnel casing as the work progresses, and also serves to provide elevated stations from which workmen may cut or dig the earth face.

After the workmen have dug away the earth face as much as possible, the shield will be advanced over the space from which the earth has been removed and will have its forward edge forced into the earth face as far as possible by extending hydraulic jacks which are positioned between the forward end of the tunnel casing and the rear end of the shield.

In the drawings—

Figure 1 is a longitudinal sectional view through a tunnel shield in position in a tunnel.

Figure 2 is a transverse sectional elevation taken on the line II—II of Figure 1.

Referring more particularly to the drawings, the numeral 2 designates the tunnel casing which has been completed by a layer of concrete 3 over its inner surface.

The advance shield A which is used to advance the tunnel opening through the earth face is positioned in front or forward of the tunnel casing and comprises a shell 4 supported by a suitable framework composed of heavy structural shapes 5. The forward edge of the shield is composed of a series of cutting segments 6 bolted to the structural shapes 5 and to each other.

The segments 6 are composed of castings and have relatively thin blade portions 7 terminating at their forward ends in cutting edges 8, and at their rear ends in hollow portions 9 forming fluid reservoirs for a purpose to be described.

The relatively thin blade portions 7 are formed hollow to provide a conduit 10 which communicates with the reservoirs 9. A plurality of outlet openings 12 are formed in the outer walls of the blade portions 7 so as to provide for the escape of fluid from the conduit 10.

A manifold pipe 13 extends around the interior of the shield A at a point rearward of the cutting segments 6 and is connected to the rear end of the reservoir 9 of each of said segments by branch pipes 14. A fluid supply pipe 15 is connected to the manifold pipe 13 and leads from any suitable source of supply of fluid under pressure.

The upper half of the forward end of the shield A is projected a material distance forward of the lower half so as to form a protective barrier for the men working at the lower levels of the tunnel face in case of a cave-in or fall of earth.

The rear end of the shield-shell 4 projects materially beyond the supporting frame composed of the structural shapes 5, as at 20, so as to provide a clear space in which to erect the next unit of the tunnel casing 2.

The shield A is adapted to be advanced into the earth face by a series of hydraulic jacks 17 which are secured to the framework of the shield and are adapted to bear against the tunnel casing 2.

In operation, when it is desired to advance the shield A either air or water is forced under pressure through the manifold pipe 13 and branch pipes 14, into the reservoirs 9 of the cutting segments 6, and this air or water is then forced out through the openings 12 in the outer walls of the cutting segments so as to form a film around the cutting segments and thus materially reduce the force necessary to advance the shield A into the earth face.

After the air or other fluid is forced out of the cutting segments, or substantially simultaneously therewith, the jacks 17 will be extended so as to bear against the tunnel casing 2 and force the shield forward into the earth face. The fluid film will act as a vehicle and materially reduce the frictional resistance between the shield A and the earth.

Heretofore, when the cutting segments have been made solid and no means was provided for forcing fluid out between the shield A and the earth, it has required a force of from four to five thousand tons to advance the shield A into the earth, while in using the apparatus of this invention, the force necessary to advance the shield A is reduced to a relatively small fraction of this amount.

This reduction in power necessary to advance the shield A provides a material saving in the cost of the work, and also permits lighter construction of the parts.

While I have shown and described one specific embodiment of my invention, it will be understood that I do not wish to be limited thereto since various modifications may be made without departing from the scope thereof, as defined in the appended claim.

I claim—

In a tunnel shield a cutting edge segment, said segment having a beveled forward cutting edge and having a relatively thin portion extending rearwardly for an appreciable distance to form an entering portion, said entering portion having its outer and inner walls spaced apart over at least a portion of the area of said entering portion to form a conduit, said segment having its inner wall stepped upwardly at the rear of said entering portion to form a relatively large reservoir communicating with said conduit, said entering portion of said segment being provided with a plurality of outlet openings in its outer wall communicating with said conduit at right angles to said conduit, whereby fluid delivered to said reservoir will flow through said conduit and said outlet openings.

In testimony whereof, I have hereunto set my hand.

CHAUNCEY MARSH GOODRICH.