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1,530,768

A. HAAG

TUNNELING APPARATUS

Filed Jan. 17, 1922

Fig. 1.

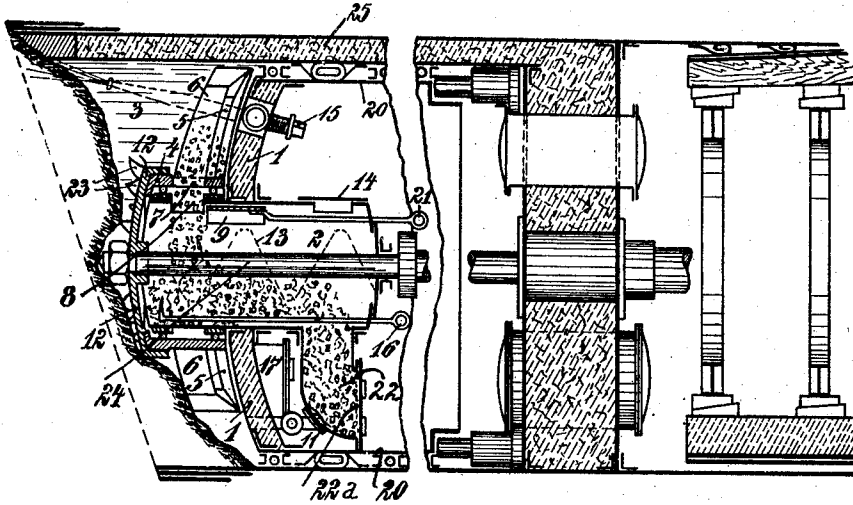
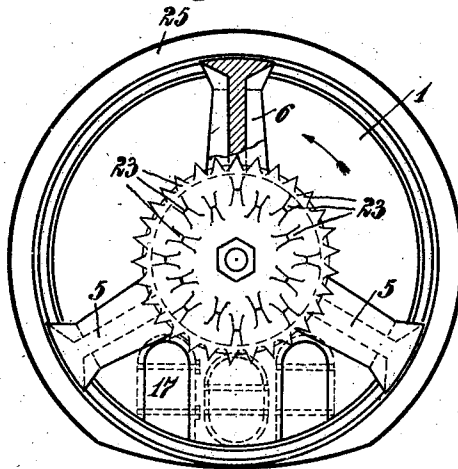


Fig. 2.



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UNITED STATES PATENT OFFICE.

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TUNNELING APPARATUS.

Application filed January 17, 1922. Serial No. 529,864.

To all whom it may concern:

Be it known that I, ADOLF HAAG, a citizen of Switzerland, residing at Nikolassee, near Berlin, Germany, have invented certain new and useful Improvements in Tunneling Apparatus, of which the following is a specification.

My invention relates to tunnel shields and more especially to a shield adapted for use in constructing tunnels under water.

According to the present invention I provide the shield with a chamber or lock opening in front of and behind the shield, where it can be closed by suitable gates, and further with a rotary dredging device adapted to be actuated from within and which detaches the earth and carries it into the lock wherein the earth is discharged through the shield into the tunnel.

In the drawings affixed to this specification and forming part thereof, a shield embodying my invention is illustrated diagrammatically by way of example. In the drawings—

Fig. 1 is a longitudinal section and

Fig. 2 is a front view of my improved shield partly in cross section.

Referring to the drawings, 1 is the shield proper and 20 is the cylinder carrying it, said cylinder being capable of revolving within the tubings 25. A chamber or lock 2 is arranged in a central opening of the shield, the front end of the lock projecting into the space 3 in front of the shield which is as a rule filled with water, the front end of the chamber being surrounded by the annular boss 4 of the rotary dredger.

A plurality of arms 5 projecting radially from said boss have their end formed like buckets or cutting blades, and may be supported on the front wall 1 by any suitable means (not shown). Channels 6 are provided on the arms 5 which register with openings 7 in the boss 4. The earth which is loosened or cut away from the bank by the arms 5 is raised by them and drops through the respective opening 7 in the boss into an opening 8 at the top of the front portion of the lock chamber 2. The opening 8 can be closed from within the tunnel by a slide 9 fixed to a handle 21. With the lower portion of the inner end of the lock chamber 2 a discharge tube 22 is connected, which is gradually filled with the earth discharged from the lock 2. When the lock 2 and the discharge tube 22 are com-

pletely filled with earth, the opening 8 is closed by means of the slide 9 and the earth or mixture of earth and water, as the case may be, are discharged by supplying air under pressure to the lock chamber 2 after having opened the discharge gate 22^a of tube 22. The water may be discharged alone in the space in front of the wall 1 by opening a valve 11 at the bottom of the tube 22 and supplying air under pressure to the lock chamber 2 while the discharge gate 22^a is still closed. Then the discharge gate is opened and the earth may be discharged into the space behind the wall 1.

In those cases where the rotary dredger can perform its work by rotating in one direction only, a single channel 6 on each dredging arm 5 will suffice. In the modification disclosed in the drawings, the arms 5 are shown as provided with a separate channel on either side so that the dredger will do its work in either direction, the channels which face the direction of rotation, being in operation, while the others are idle.

The dredging device 4, 5, 6 can be operated by various means. In the example illustrated, the boss 4 carries a cap 12 with steel teeth 23 secured to it and the cap and the boss 4 are actuated together by a horizontal shaft 24 extending axially through the lock chamber 2. A helical conveyer 13 or equivalent conveying means may be secured to the shaft, as shown in dotted lines, which moves the earth in the lock chamber 2 toward its rear end. The earth can also be scraped rearwards by means of hooks 16. At the top of the rear end of the lock chamber 2, a man hole 14 may be provided. Rocks and other obstructions are removed, while the dredger is at rest, by means of tools, jet pipes or the like, which may be temporarily inserted in the wall 1, as indicated at 15. The teeth 23 on the cap 12 form an excavation for the front end of the advancing lock 2.

Where the water can be removed from the space in front of the shield, by aid of pumps or by compressed air, and where there is no danger of water rushing into the space 3, the doors 17 provided in the wall 1 may be opened in order to break the earth in the space 3 by hand and to convey it into the tube 20.

I wish it to be understood that I do not desire to be limited to the exact details of

construction shown and described, for obvious modifications will occur to a person skilled in the art.

I claim:

5 1. A tunnel shield capable of operating under water, comprising in combination a lock chamber extending thru the shield, means in front of the shield and adapted to be operated from behind the shield for de-
10 taching earth and for conveying it into the projected portion of said lock chamber and means operatable from within the shield for closing said lock chamber against the out-
15 side for the purpose of removing the earth contained in the chamber to the interior of the shield.

2. A tunnel shield comprising in combina-
tion, a lock chamber extending through the
shield, a shaft extending axially through
20 said lock chamber, a toothed cap on the front end of said shaft and a rotary dredger

on said shaft for conveying the earth de-
tached by said toothed cap into said lock
chamber.

3. A tunnel shield comprising in combina- 25
tion, a lock chamber extending through the shield, an annular boss encircling said chamber in front of said shield, radial cut-
ters on said boss, each cutter having at least
30 one channel for conveying the detached earth into said chamber, said boss having an opening at the inner end of each chan-
neled cutter, said chamber having an open- 35
ing in its upper portion adapted to register with said boss openings as they pass by during rotation, and means adapted to be
operated from within the tunnel for clos-
ing said lock chamber opening, and means
for removing the earth delivered into said
lock chamber. 40

In testimony whereof I affix my signature.

ADOLF HAAG.