(No Model.) 2 Sheets—Sheet 1.

C. G. HASTINGS.

HYDRAULIC OR PNEUMATIC TUNNELING SHIELD.

No. 590,887. Patented Sept. 28, 1897.

Fig. 1.

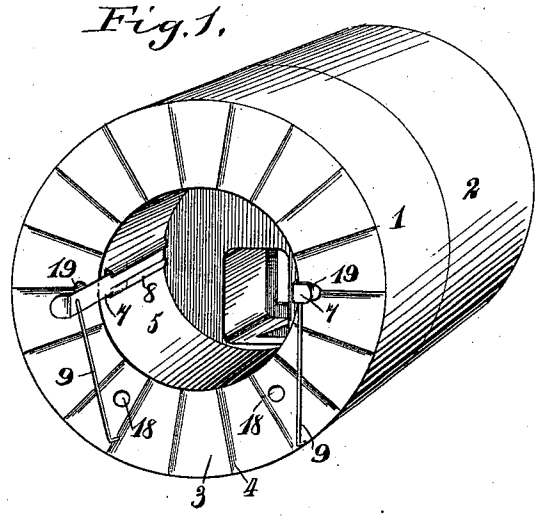


Fig. 2.

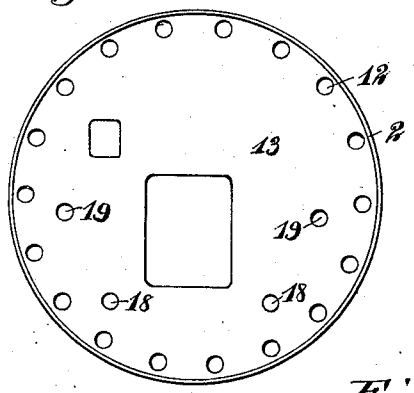


Fig. 3.

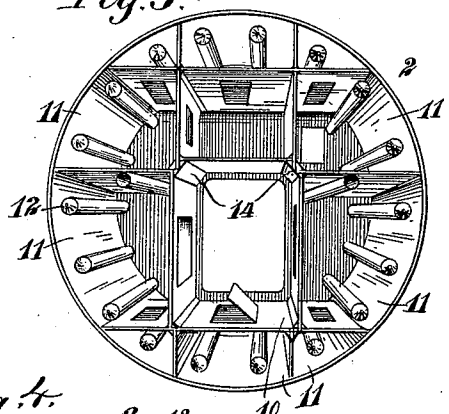
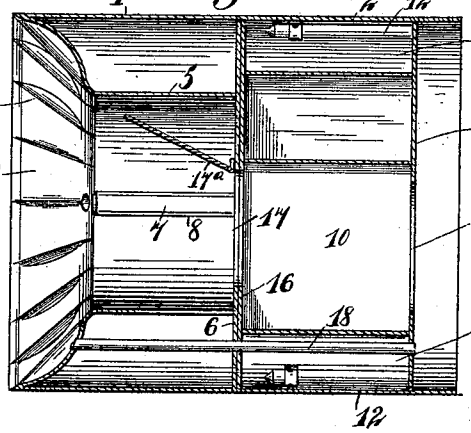


Fig. 4.



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(No Model.) 2 Sheets—Sheet 2.

C. G. HASTINGS.

HYDRAULIC OR PNEUMATIC TUNNELING SHIELD.

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Fig. 5.

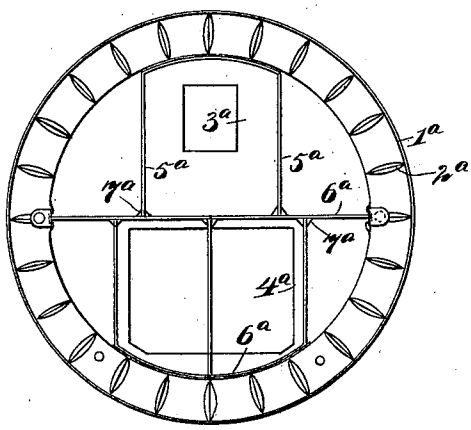


Fig. 6.

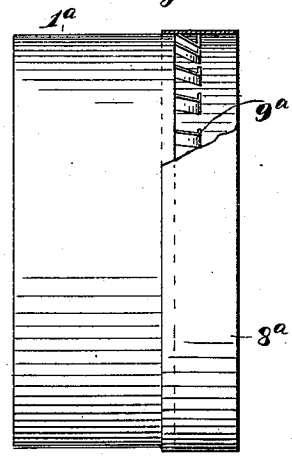


Fig. 7.

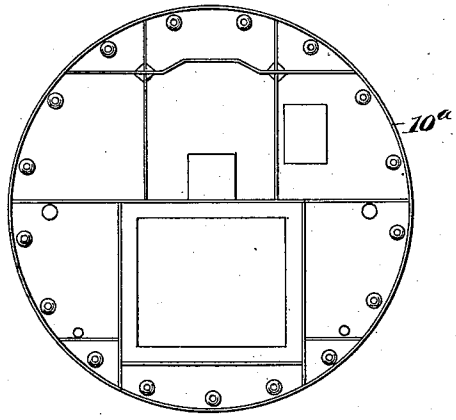
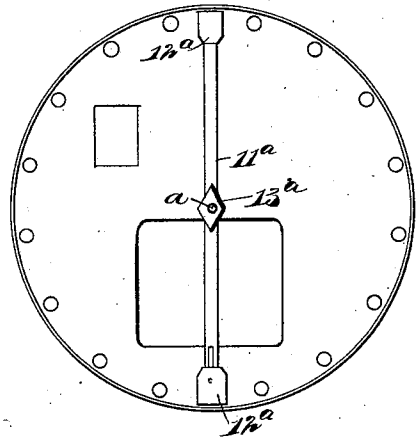


Fig. 8.



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CORNELIUS G. HASTINGS, OF CHICAGO, ILLINOIS.

HYDRAULIC OR PNEUMATIC TUNNELING-SHIELD.

SPECIFICATION forming part of Letters Patent No. 590,887, dated September 28, 1897.

Application filed December 23, 1896. Serial No. 616,821. (No model.)

To all whom it may concern:

Be it known that I, CORNELIUS G. HASTINGS, of Chicago, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Hydraulic or Pneumatic Tunneling-Shields, of which the following is a full, clear, and exact description.

This invention relates to shields employed in excavating or tunneling; and the object is to provide a tunneling-shield that may be forced forward by a comparatively low hydraulic or pneumatic pressure that will be durable and substantial and that can be used with success in the most dangerous underlays or deposits where former methods have more or less proved failures.

The invention consists primarily in a bell-shaped or outwardly-flared cutting-face having cutters arranged radially thereon.

The invention further consists in the construction and novel arrangement of parts, as will hereinafter appear and be particularly pointed out in the appended claims.

Reference is to be had to the accompanying drawings, forming a part of this specification, in which similar characters of reference indicate corresponding parts in all the figures.

Figure 1 is a perspective view showing the front end of a tunneling-shield embodying my invention. Fig. 2 is a rear end view thereof. Fig. 3 is an interior view of the rear section. Fig. 4 is a longitudinal section of the shield. Fig. 5 is a front view of a front or cutting section, showing a slight modification. Fig. 6 is a side view of the front section shown in Fig. 5 and showing another modification. Fig. 7 is an interior view of a rear section of the shield, showing a modification; and Fig. 8 is a rear view thereof.

The device comprises sections 1 2, the front one, 1, of which may be termed the "cutting-section" and the rear one, 2, a "chamber-section." The front section 1 has at its front end an inwardly and rearwardly extending annular flange 3, which is here shown as transversely curved or dished, forming a bell-shaped outer end for the shield, and cutter-blades 4 are arranged radially on the flange 3, and the inner edge of the flange is connected to a cylinder 5, extending through the section 1 to a bulkhead 6 at the rear end of the section.

Arranged to slide longitudinally in the cylinder 5 are two opposite bars 7, and these bars 7 slide in guideways 8, secured to the inner wall of the cylinder 5, and they may have supporting-legs 9 secured to their outer ends. These bars 7 are designed to be moved outward to support a scaffolding on which men may work. When, however, the tunneling device is moved forward, the bars will be moved back into the cylinder.

The rear section 2 of the shield is provided with partitions forming a central working chamber 10 and several surrounding chambers 11, through which are extended the hydraulic pressure or other jacks 12, which open through a bulkhead 13 at the rear end of the section 2. The several partitions are provided with door-closed openings, through which workmen may pass from one chamber to another, and the section may be greatly strengthened by means of corner brace-plates 14. The forward end of the section 2 is provided with a bulkhead 16, which abuts against the bulkhead 6 of the section 1. The bulkhead 13 is provided with an opening into the chamber 10, and the bulkheads 6 and 16 are provided with openings 17, forming communication between the chamber 10 and the interior of the cylinder 5, so that workmen may pass into said cylinder to remove material loosened by the cutters. This opening is provided with a downwardly-swinging door 17^a, designed to close practically air-tight when occasion may require or when danger is threatened by the breaking in of water or quicksand.

Air-pipes 18 extend through the lower portions of the sections, and above these pipes are larger pipes 19, through which water or running quicksand may be forced should such elements be encountered. The rear bulkhead 13 is provided with an opening 20, through which a man for operating the hoisting-crane may enter.

In operation the shield will be forced longitudinally into the ground by means of the hydraulic or other jacks, which will have their pistons engaged against the end of the masonry or other lining in the finished por-

tion of the tunnel rearward of the shell. The distance of movement will substantially equal the length of the jack-pistons, and of course the several jacks will be simultaneously operated. As the shell moves forward the cutters 4 will loosen the earth, which may be removed through the chamber 10 to carts or cars for conveying it away.

In Fig. 5 I have shown a cutting-section 1^a, more particularly adapted for the construction of large tunnels. In this figure I have shown the front end of the section as provided with cutters 2^a, somewhat similar to the cutters 4, as described, and operating in the same manner. The rear wall of this section 1^a is provided with door-closed openings 3^a 4^a and arranged within the section are stays comprising vertical partitions 5^a and horizontally-disposed partitions 6^a. Working chambers are provided by means of these partitions, formed between the chambers. These vertical partitions are braced one with another by corner-braces 7^a.

In Fig. 6 I have shown a hood 8^a removably attached to the rear end of the section 1^a. This hood 8^a is provided on its inner sides with brackets or chairs 9^a. By providing the section 1^a with this hood the device is well adapted for sinking tunnels, shafts, caissons, or the like. The chairs 9^a are designed to support the linings of the shaft. In operation the operating-jacks will be placed between the several chairs.

In Fig. 7 I have shown a rear section 10^a, somewhat similar to the rear section 2 first described. This section is provided with vertical and horizontal partitions having working chambers. On the rear wall of this section 10^a is pivotally mounted at *a* a hoisting-crane beam 11^a. This crane-beam 11^a has adjustable heads 12^a on its ends for properly placing or alining the segments of iron linings in places where an iron lining is used entirely for tunneling purposes. In the center of the crane 11^a is placed a target or center sighting device 13^a to enable an engineer to get his center line of the tunnel without resorting to more difficult means. The crane 11^a will be operated by any suitable power to raise the alining segments and hold them in place until fastened. As the details of this crane form no part of the claims in this application, I do not deem it necessary to further set them forth.

It will be seen that tunneling-shields embodying my invention may be employed for any size of tunnel or shaft.

Having thus described my invention, I claim as new and desire to secure by Letters Patent—

1. A tunneling-shield, having an inwardly and rearwardly extended annular flange at its front end, cutters on said flange, and a number of partitions in the rear portion of the shield forming walls of communicating chambers, substantially as specified.

2. A tunneling-shield, having a bell-shaped annular flange in its front end, radial cutters thereon, a cylinder extended from said flange to a bulkhead at the rear end of the shield, and scaffold-supports movable in said cylinder, substantially as specified.

3. A tunneling-shell, comprising two sections, the forward one of which has a bell-shaped flange provided with cutters, and the rear one of which has a working chamber and surrounding chambers, and jacks in said outer chambers, and the air and water pipes, substantially as specified.

4. A tunneling-shield having a bell-shaped end and provided with radially-arranged cutters thereon, and with partitions within the shield forming braces and working chambers therein, substantially as described.

5. A tunneling-shield, comprising a front section having cutters at its front end and a bulkhead at its rear end, and a rear section having partitions forming braces and working chambers, substantially as described.

6. A tunneling-shield, comprising a front section having cutters at its forward end, a rear section having a plurality of chambers, a hood removably mounted on the rear end of said rear section, brackets or chairs arranged in said hood, a crane beam or arm mounted to rotate on the rear wall of said rear section, and a target in the center of said crane beam or arm, substantially as specified.

7. In a tunneling-shield, the combination with the body of the shield having guideways on its inner surface, of bars sliding in said guideways and provided with feet or legs at their outer ends, substantially as and for the purpose set forth.

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