(No Model.)

H. H. HALL & R. H. BULL.

CAISSON.

No. 346,543. Patented Aug. 3, 1886.

Fig. 1.

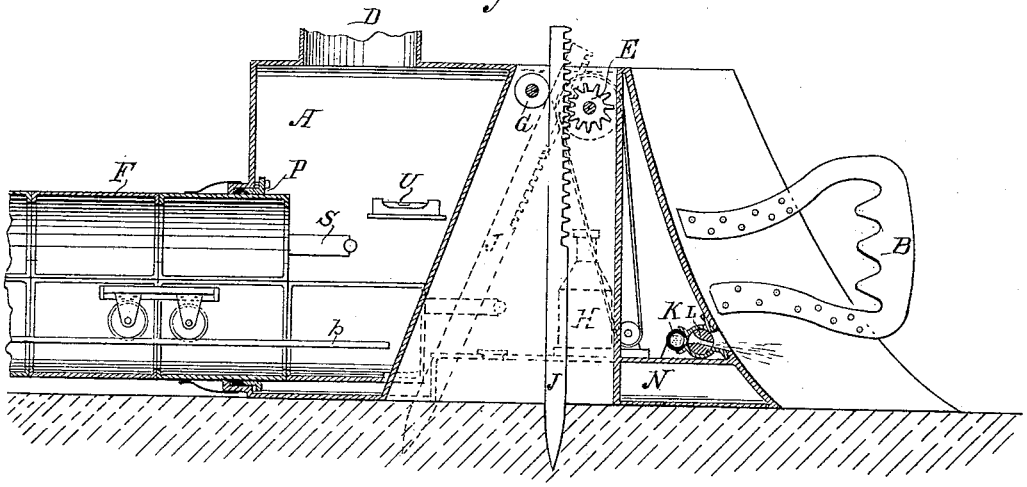


Fig. 2.

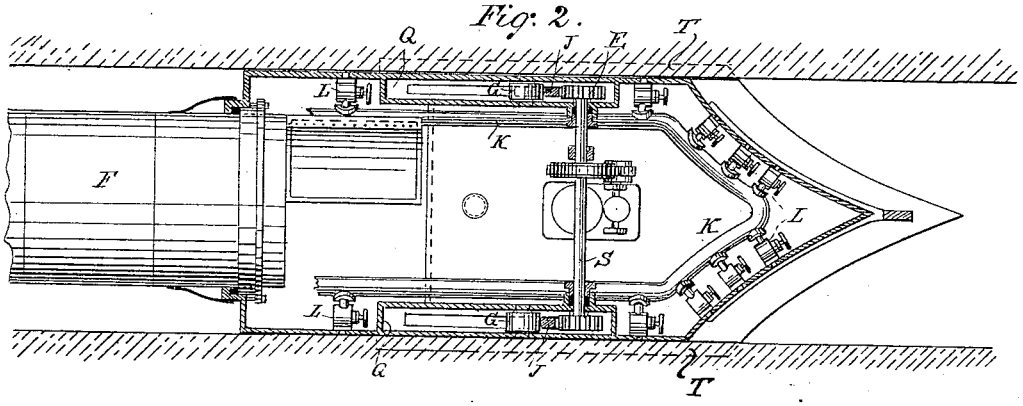


Fig. 4.

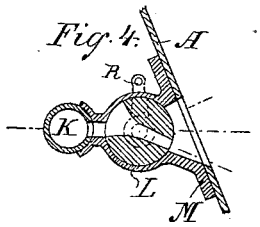
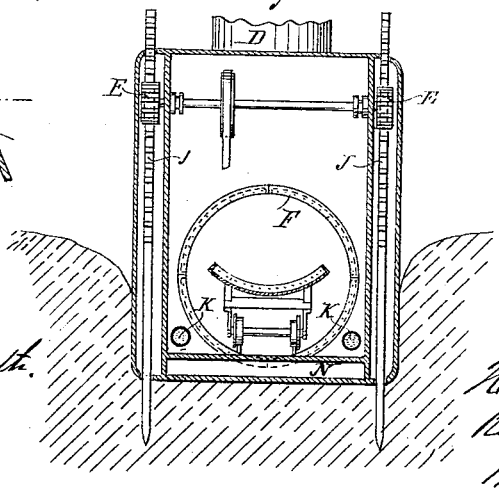


Fig. 3.



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UNITED STATES PATENT OFFICE.

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CAISSON.

SPECIFICATION forming part of Letters Patent No. 346,543, dated August 3, 1886.

Application filed February 25, 1886. Serial No. 193,209. (No model.)

To all whom it may concern:

Be it known that we, HAYDEN H. HALL, residing at New Hamburg, in the county of Dutchess and State of New York, and RICHARD H. BULL, residing in the city, county, and State of New York, have invented certain new and useful Improvements in Caissons for Laying Submarine Tunnels and Tubes, of which the following is a description in such full, clear, concise, and exact terms as will enable any one skilled in the art to which our invention belongs, or with which it is most nearly connected, to make and use the same, reference being had to the accompanying drawings, making part of this specification, and to the letters and figures of reference marked thereon.

In said drawings, Figure 1 illustrates a sectional elevation of our improved caisson; Fig. 2, a sectional plan view, and Fig. 3 an end view, of the same. Fig. 4 illustrates detail parts of the same.

Similar letters of reference indicate corresponding parts in all the figures of drawings.

Our present invention relates to the method of laying submarine tunnels or tubes, substantially illustrated and described in a patent granted to said Hayden H. Hall, dated February 3, 1885, and numbered 311,656, to which reference is here made for a description of the general functions of the caisson referred to in this patent, and for the general mode and means of applying and employing the same in the construction of such works, this specification being confined to a description of the novel devices, combinations of devices, and methods which constitute our present improvements. It will however be understood that these improvements are applicable to other forms of caisson than that described in said Letters Patent, as they may be applied to any form of caisson operating on the same general plan.

Referring to Fig. 1 of the drawings, A is a caisson; D, the ventilating or access tube; P *o*, the stuffing-box and valve or other device for making a tight joint between the caisson and the tube, F, which is being laid, and B the clevis to which power may be applied for moving the caisson. Near the bottom of the caisson, and preferably extending around both sides and its prow, we provide a strong supply-pipe, K, having branches L L L, leading to and through the external skin of the caisson, as illustrated in Fig. 2. The number and disposition of these branches and outlets will be determined by the character of the work to done. Each of said branches is provided with a cock, L M. The supply-pipe K is connected to hydraulic pumps or to the exhaust of hydraulic rams used in propelling the caisson by pressure against the end of the tube or tunnel, and the branches L L, when open, form bent ways for the discharge of said power to accomplish what is known as "hydraulic dredging" to relieve the caisson of impediments to its progress. Instead of hydraulics, condensed air may be used for the same purpose. Any suitable cock may be used for the purpose of opening and closing said branches, and any suitable connection between the supply-pipe and the exterior of the caisson; but we prefer to employ some device by means of which the direction of the dredging agent may be directed or varied at will. One form of such device is indicated at Fig. 4, in which a plug, L, is provided with and operated by a handle, R, said plug being accurately fitted in bearings M, open to the supply-pipe and to the exterior of the caisson, and being free to revolve in said bearings. As will be seen by reference to Fig. 4, when the plug is in the position indicated the branch is open and the dredging agent is directed downward. By turning said plug with a left-hand revolution the said agent may be made to flow out horizontally or upward, while the branch still remains open. When it is desired to close the branch, the plug is turned still farther to the right or the left, as will be readily understood. The object of these pipes and cocks is to relieve the caisson of obstructions to its passage by means operated from the inside of the caisson. It is plain that the pressure of the water upon the front of the caisson is considerably greater than the pressure against its rear end. This is due to the fact that a larger pressure-surface is exposed in front than at the back, where the tunnel-tube enters.

Chock or chocks S should be provided between the end of the tube and the caisson, to resist the telescopic pressure on the caisson

when the hydraulics employed in moving the caisson forward are removed or relaxed. These chocks at one end rest against the end of the tunnel-tube, and at the other end against a projection from the inside of the caisson. The caisson may be shoved ahead by means of hydraulic pressure exerted upon the end of the tunnel.

We also provide one caisson with water-tight compartments constructed in convenient positions and provided with any suitable means for filling and emptying them, to increase, diminish, or regulate the weight of the caisson and its displacement. This greatly promotes the convenience of handling the caisson. Such a compartment is shown at N. The caisson is weighted with pig-lead or other convenient ballast until it has about the required gravity, and then water is admitted to or pumped out of these compartments to regulate its weight as the work proceeds and its varying requirements demand.

In the patent above referred to spiles or spuds are provided to anchor the caisson, said spuds passing down through the floor of the caisson and into the earth beneath, to keep it from shifting while at work; but in the device there described no provision is made to prevent the caisson turning or moving laterally or out of line while it is being pushed forward. To supply this want, we provide a traveling spud, J, on each side of the caisson, free to oscillate or move to an incline position as its point remains fixed in the ground and the caisson progresses. This spud operates in an oblong water-compartment, open at the bottom, formed on the side of the caisson, and said spud is provided on one side with gear-teeth meshing in a gear-wheel sustained on and operated by shafting extending through a stuffing-box to the interior of the caisson, by means of which the spud is raised and lowered. A friction-wheel, G, bearing against the opposite side of said spud, is placed in such a position that it will keep the same in gear with the wheel E throughout the whole latitude of its travel, the gear-teeth on the spud and on the wheel E being cut deep enough to permit of a certain amount of lateral play in the spud without disengaging its teeth from the cog-wheel E. When the caisson is moved forward, these spuds, remaining fixed in the earth, are drawn to the position illustrated by the spud drawn in dotted lines in Fig. 1. The spuds are then, one at a time, drawn up, swung to the perpendicular position, and again driven into the earth. By these means the caisson is never free from the control of said spuds or anchors, either while it is in motion or at rest, and is not liable to be turned, shifted, or thrown out of the direct line in moving forward.

A lateral projection or flange, T, extends along both sides of the caisson on the outside at the bottom, which operates substantially like the flange on the landside of an ordinary plow, and for the same purpose—that is to say, it serves to keep the caisson from tilting, and acts to prevent it being deflected from its proper course.

A level or levels, U, may be arranged in the caisson, suitably scaled to denote the inclination of the caisson and the grade at which it is traveling. Any device which will indicate the inclination of the caisson may be used, and we have indicated such a device by the level U.

When it is desired to remove the caisson from the tunnel or tube while it is submerged, we construct a water-tight bulk-head at the end of the tube and one in the cassion, just in front of the tube, and by means of faucets and vent-holes, or other suitable contrivances we admit water into the space between said bulk-heads, and then draw the caisson away. This relieves the partial vacuum which would otherwise be formed between the bulk-heads when the caisson is drawn forward, and materially aids in the separation of the two.

Having thus described our invention, we claim and desire to secure by Letters Patent—

1. In a traveling caisson, the combination of an oscillating spud in gear with mechanism to raise and lower the same and a bearing-roller revolving about a stationary axis so placed that said spud will be tangent to its circumference while it remains in gear with said mechanism and oscillates, substantially as described.

2. In a traveling caisson, a spud arranged outside of the air-chamber of said caisson, combined with mechanism for raising and lowering the same, arranged within said air-chamber, substantially as described.

3. In a traveling caisson, ways leading from the inside to the outside of said caisson, for the purpose of carrying and discharging a dredging agent, combined with a cock, substantially as described, by means of which said agent is discharged in more than one direction, and said ways are closed, substantially as set forth.

4. In a traveling caisson, the combination of a tube in process of construction with a chock bearing at one end against the end of said tube, and at the other end against a support in the inside of said caisson, substantially as described.

5. The combination of a traveling caisson with a horizontal flange projecting laterally therefrom, substantially as described.

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