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C. BROWN.

APPARATUS FOR SUBMARINE MINING AND EXPLORATION.

(Application filed Oct. 22, 1897.)

(No Model.)

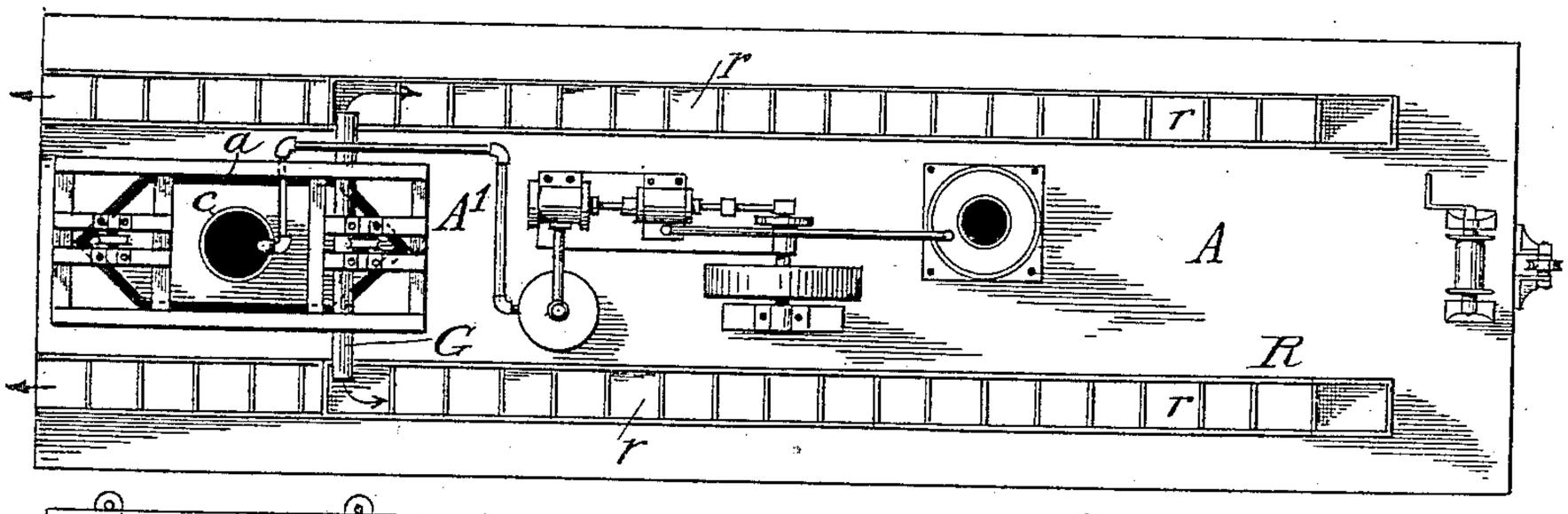


Fig. 1.

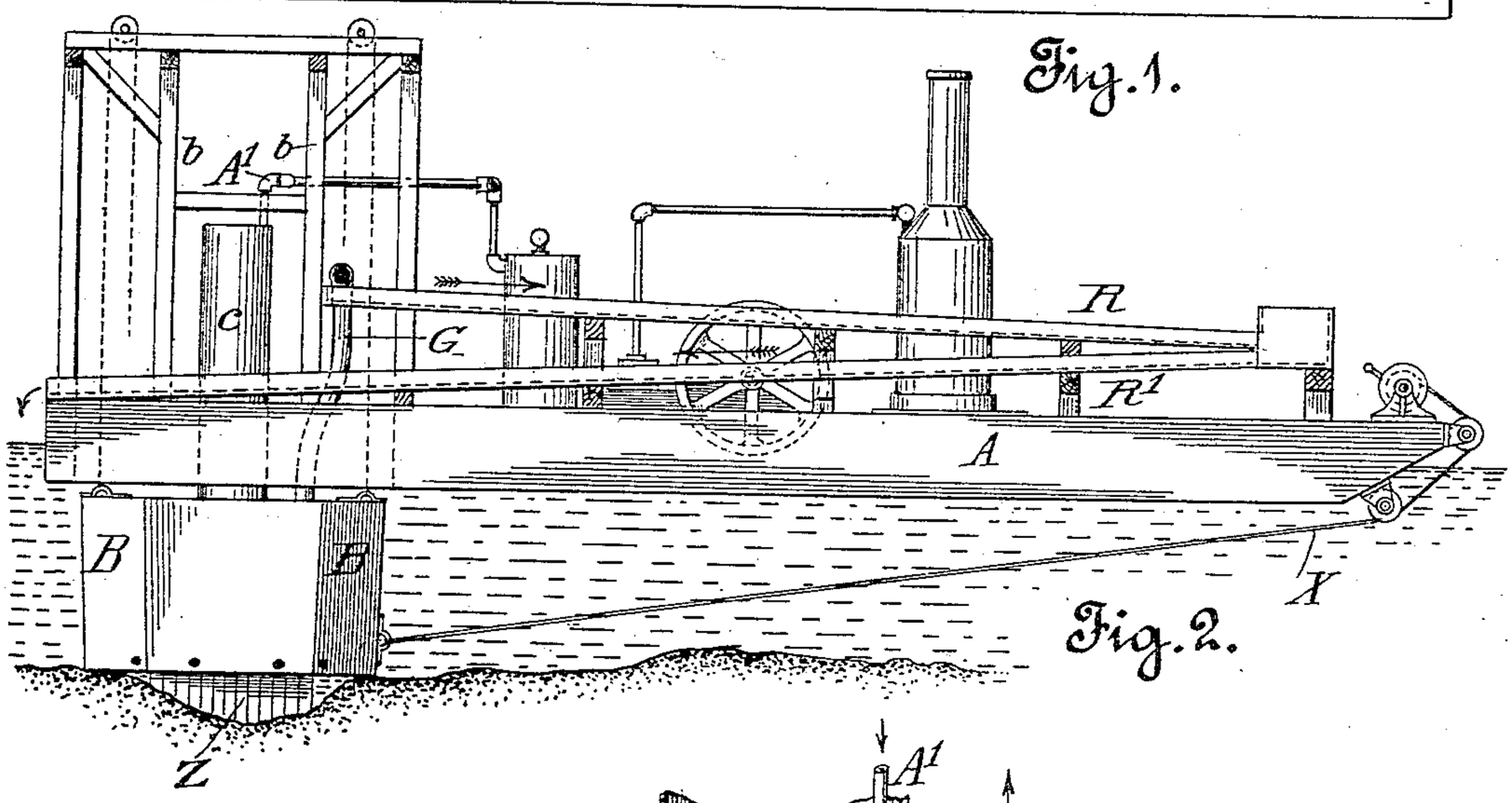
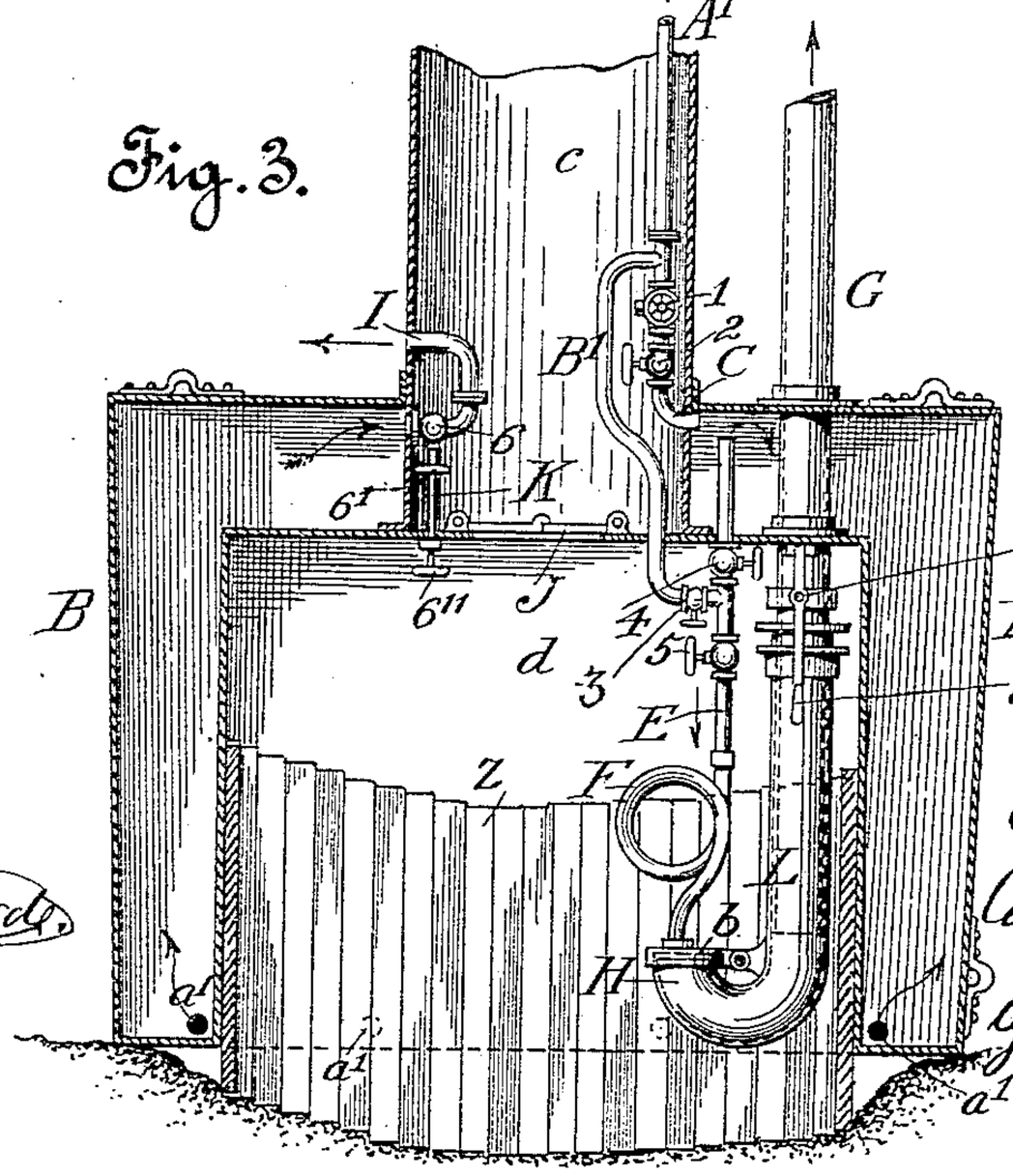


Fig. 2.

Fig. 3.



Witnesses.

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UNITED STATES PATENT OFFICE.

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APPARATUS FOR SUBMARINE MINING AND EXPLORATION.

SPECIFICATION forming part of Letters Patent No. 616,567, dated December 27, 1898.

Application filed October 22, 1897. Serial No. 656,038. (No model.)

To all whom it may concern:

Be it known that I, CALVIN BROWN, a citizen of the United States, residing at San Francisco, in the county of San Francisco and State of California, have invented certain new and useful Improvements in Apparatus for Submarine Mining and Exploration; and I do hereby declare that the following is a full, clear, and exact description thereof.

This invention relates to apparatus for submarine exploration and operations, and more particularly to improvements upon the invention described and shown in Letters Patent of the United States granted to me May 6, 1890, and numbered 427,149. In that patent was described a portable pneumatic caisson and air-lock carried by a floating vessel provided with pneumatic and mechanical apparatus by which the caisson might be submerged, cleared of water, and used in various kinds of submarine operations. The present improvements relate more particularly to the means employed for providing the caisson with water-ballast and regulating the same, and also to means for raising excavated material from the bottom to the deck of the scow.

In the patent referred to the caisson was raised and lowered by a rack-and-pinion motion operated by worm-gearing acting simultaneously at both ends or both sides. This movement is thoroughly practicable and effective in still water; but where there is even a moderate wave movement a rigid connection of the caisson to its supporting-frame is disadvantageous. Motion of the scow under such circumstances would be communicated to the caisson and might result in a twisting and binding of the gearing, so that the caisson would not respond readily to the mechanical means supplied for raising it, and where haste is required at times such a stoppage or delay of the raising appliances might produce more or less serious consequences. In the present case therefore I have dispensed with all this connecting-gearing and have suspended the caisson and its air-lock in such a way that the scow may rise and fall vertically and swing laterally independently of the caisson itself. I provide chambers for water-ballast and air pipes and valves for controlling the admission of water to them, the capacity of such chambers being sufficient to sink the caisson and the regulating-valves being under control from the interior of the caisson and also of the air-lock.

I have also shown the apparatus in the present case as particularly adapted to submarine mining operations, with devices for raising excavated material to the deck of the scow connected to ore-washing apparatus. These devices for raising such material are operated and controlled by compressed air supplied from the same source as that employed for filling the caisson and air-lock.

For a full comprehension of the invention reference must be made to the following detailed description and to the accompanying drawings, in which—

Figure 1 is a plan view of the scow and apparatus carried by it. Fig. 2 is a side elevation of the same; and Fig. 3, a longitudinal vertical section of the caisson, air-lock, and water-compartments.

In the drawings, A represents a scow or float of any suitable size and capacity and provided near one end with a well *a* to receive the caisson and air-lock, which in their general construction are like those described in the patent heretofore referred to. Instead, however, of connecting the caisson to its supporting-framework by a rigid rack-and-pinion gearing it is supported loosely between the uprights *b b*, so that the scow may move freely in all directions without affecting the caisson itself.

B B represent water-tight chambers or compartments firmly secured to the caisson and extending partly over its top to the air-lock *c*, Fig. 3. Such chambers are preferably of triangular form, as shown, in order to offer as little resistance to the current as possible, and, like the caisson, as shown in Fig. 2, taper slightly downward. Their wedge shape and this downward taper also tend to prevent the caisson from becoming jammed on the bottom in crevices or among rocks and boulders and make it easier to extricate the caisson from any such obstructions.

The caisson is loosely supported, as before mentioned, but may be supported from above by a rope or cable in connection with any ordinary tackle, so that, if necessary, it may be raised independently of the lifting-chamber, and I have also shown a guy-rope X, extend-

ing from the caisson to a winch at the stern of the scow for holding it against the pressure of the current. The caisson is also preferably provided with an inner sheathing Z, composed of separately-adjustable strips, which rest upon the bottom and conform to inequalities in the surface. The air-lock *c*, the working-chamber *d*, and the sinking and raising chambers B B are supplied with air through the pipe A′ and its branches B′ C E connected with an air-tank or with an air pump or compressor.

J is a hatch between the air-lock *c* and the working-chamber *d*, closed by a proper door.

I is a pipe leading from the sinking and raising chambers B B to outside of the caisson. It is provided with a valve 6, to which is attached a spindle K, provided with the two hand-wheels 6′ and 6″.

G is a discharging-pipe through which excavated materials are elevated from the working-chamber *d*. It is made with a slip-joint L, terminating at the bottom in a curved inlet or hopper H, to which is attached a cap *b*, into which a flexible hose-pipe F enters, connecting with the branch air-pipe E. In the discharging-pipe G is a stop-valve 7, operated by a lever 7′.

a′ a′ are holes in the bottom of the sinking and raising chamber B B for the inlet and outlet of water used for lowering and raising the caisson.

The operation of the caisson is as follows: After the workmen have entered the air-lock *c* and shut themselves in preparatory to a descent under water, opening the hatch J to the working-chamber *d*, the apparatus is ready to be lowered. The valve 6 is opened, letting the air escape from the sinking and raising chamber B B through the pipe I, which action admits the water to this chamber through the small holes *a a*. This valve 6 may be operated from either the air-lock or the working-chamber by means of the spindle K and the hand-wheels 6′ and 6″. As the air escapes from the sinking and raising chambers B B water flows in through the holes *a′ a′* and the caisson sinks to any desired depth, permitting the workmen to carry on their operations. If now the caisson is to be raised, the water in the chambers B B is discharged through the holes *a a* by admitting the compressed air through either or both the valves 2 and 4, the caisson slowly rising as this discharge is effected. Thus it is seen that the operation of raising and lowering the apparatus may be effected either from the air-lock *c* or the working-chamber *d*, the air and water space of the chambers B B being made of a sufficient capacity for the purpose of the required movement. Air is supplied to the working-chamber *d* through the valve 3, attached to the branch pipe B′, the air-lock being supplied through the valve 1 in the main pipe A′ if the air be needed in the air-lock when the hatch J is closed. Thus these two divisions of the caisson can be independently supplied, as occasion may require, this arrangement also admitting of opening the air-lock at pleasure to the atmosphere, provided when the caisson is sunk and workmen are in the working-chamber the hatch J is closed.

The process of elevating excavated materials through the discharge-pipe G is effected by placing them with a certain quantity of water in the hopper H, the stop-valve 7 being closed. The cap *b* is now secured on the hopper and the valve 5 opened, admitting a strong pressure of compressed air to act upon the contents of the hopper, which are thus forced upward to the deck of the scow and deposited in the sluice-box, where they are washed. The slip-joint L is for the purpose of regulating the discharge-pipe G at various depths.

The ore-washing apparatus may be of any desired kind or style. I have shown, however sluice-boxes R of ordinary construction provided with riffles *r* and extending along the deck of the scow for its entire length or a sufficient distance. Additional length may also be secured, as shown in Fig. 2, by a return-box R′, extending forward toward the bow of the float. The sluice-boxes may of course be provided with amalgamating-plates and other devices used in separating the precious metals by the washing process.

This invention is thus particularly adapted to mining operations in the auriferous beds of rivers where the depth of water is too great to permit the use of the customary appliances employed in the shallows at or near the shore. The adaptability of the caisson to exploring and prospecting, as well as to the subsequent operations, is evident, and its economical advantages are just as apparent, the whole process up to and including the washing and separation of the material being performed upon the scow itself at all seasons of the year and at stages of high water, which ordinarily put a stop to mining operations of this character.

What I claim is—

1. In apparatus for submarine exploration, &c., the combination of a supporting structure, a pneumatic caisson, a discharge-pipe extending from the interior of the caisson upwardly, and having an open mouth within the caisson, a cover for closing said mouth, an air-supply, and a pipe connecting said air-supply with the discharge-pipe.

2. In apparatus for submarine exploration, &c., the combination of a float, a vertically-movable caisson carried thereby, a longitudinally-adjustable discharge-pipe extending from the interior of the caisson to the deck of the float, an air-supply, and an extensible connection from said air-supply to said discharge-pipe, substantially as and for the purposes set forth.

3. In apparatus for submarine exploration, &c., the combination of a float or scow, a caisson and air-lock carried thereby, sinking and raising compartments on the caisson, an air-supply, water inlets and exits to and from

said compartments, and valves on the caisson and in the air-lock for regulating the supply of air and water to said compartments, substantially as set forth.

4. The combination with the float and its vertically-movable caisson, of a discharge-pipe extending from the interior of the caisson to the deck of the float and having an adjustable slip-joint, and an air-supply pipe having a flexible connection with said discharge-pipe, substantially as and for the purposes set forth.

5. In combination with a pneumatic caisson, sinking and raising chambers connected thereto of pointed or wedge shape substantially as and for the purposes set forth.

In testimony whereof I have affixed my signature, in presence of two witnesses, this 13th day of October, 1897.

CALVIN BROWN.

Witnesses:
L. W. SEELY,
WILFRED L. BROWN.