(No Model.) 2 Sheets—Sheet 1.

C. BROWN.

APPARATUS FOR SUBMARINE EXPLORATION.

No. 427,149. Patented May 6, 1890

FIG. 1.

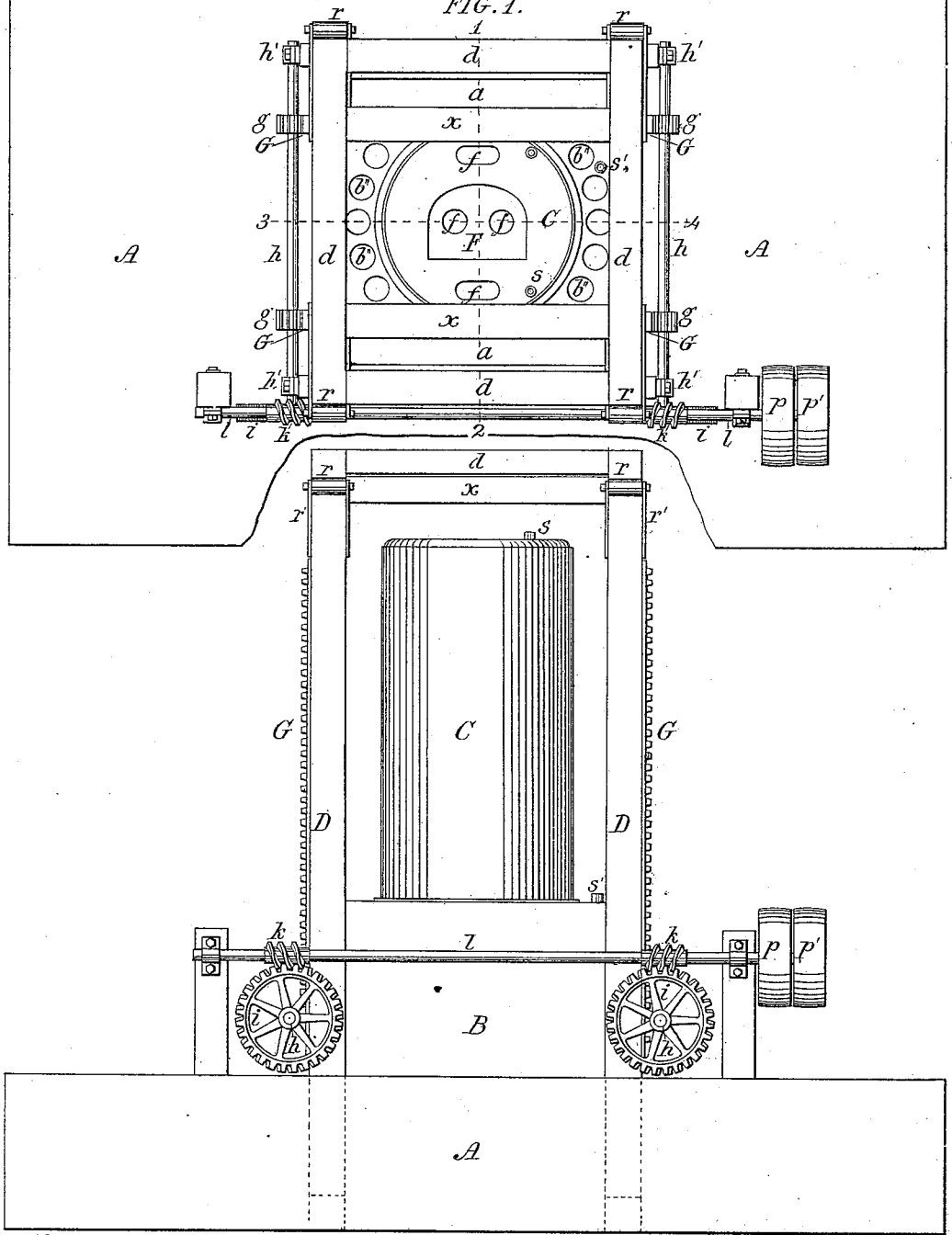


FIG. 2.

Witnesses.
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Frank W. Eastman

Inventor
Calvin Brown
By J. H. Miller
His attorney

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 2 Sheets—Sheet 2.

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FIG. 3.

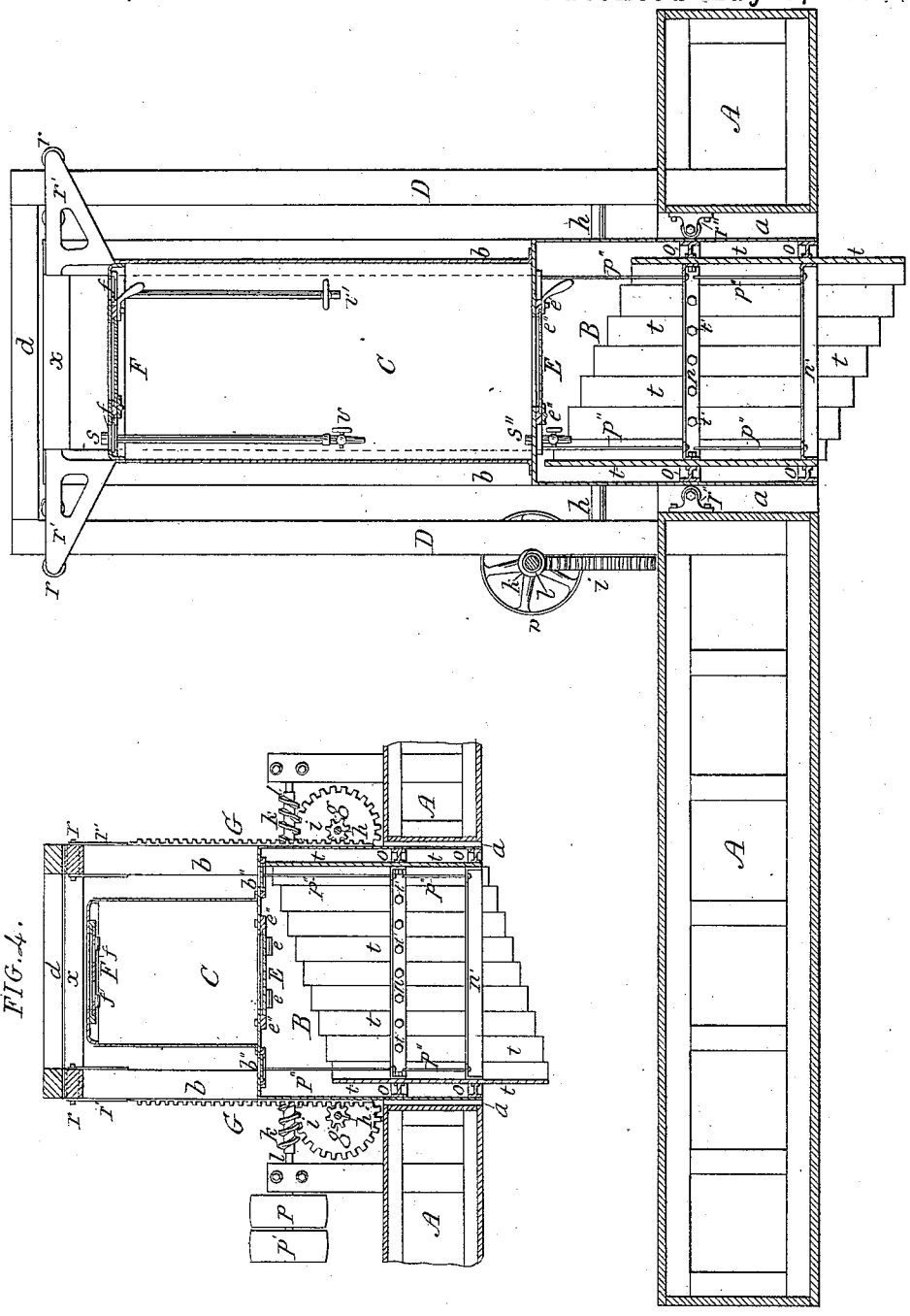


FIG. 4.

Witnesses.
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UNITED STATES PATENT OFFICE.

CALVIN BROWN, OF SAN FRANCISCO, CALIFORNIA.

APPARATUS FOR SUBMARINE EXPLORATION.

SPECIFICATION forming part of Letters Patent No. 427,149, dated May 6, 1890.

Application filed August 14, 1888. Serial No. 282,747. (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 a new and useful Apparatus for Submarine Exploration, Building, and Mining, which I term a "Portable Submarine Caisson," of which the following is a specification.

My invention relates to improvements in apparatus whose purpose is exploration and manual operations under water, and the objects of my improvements are: first, to provide a portable compartment or caisson in which workmen may operate under water and which may be lowered or raised according to the depth of water requiring operations, and moved about from place to place in such water, thus in certain cases dispensing with a coffer-dam; second, to connect such caisson with another compartment or air-lock, in which workmen can operate in conjunction with those in the caisson, transmitting to and from the latter such materials as may require handling in such submarine operations, and the rendering such service as may be required therein; third, to provide in such caisson, a telescoping extension thereto, by which the inconveniences and obstacles in the manual operations upon a sloping or uneven submarine bottom may be overcome by the adjustability of the said telescoping extension; fourth, to adapt said caisson and air-lock to a vessel or float carrying machinery and pneumatic appliances for operating the said caisson and air-lock. I attain these objects by the devices and mechanism illustrated in the accompanying drawings, in which—

Figure 1 is a top view showing a portion of the vessel or float, frame-work, and machinery for lowering or raising the caisson and air-lock. Fig. 2 is a front elevation of the same, showing the relative positions of the caisson and the air-lock, and an end view of the float. Fig. 3 is a vertical section on the line 1 2, Fig. 1, and Fig. 4 a vertical section on a smaller scale on the line 3 4, Fig. 1.

Similar letters refer to similar parts throughout the several views.

The float A, constructed with a well-hole *a* near one end for the passage up and down of the caisson B with its connected air-lock C, constitutes their support and means for moving from place to place in the water, and also carrying the frame-posts D D and the machinery for operating the apparatus. It may be built of any suitable materials and of any capacity.

The upright posts D D, connected at the top with cross-pieces or caps *d d*, constitute a frame-work built solidly into the body of the float A and extending above it to such height as may be required by the intended operations of the apparatus in any given depth of water. Within this frame-work the caisson B and air-lock C are placed, and so that they may pass freely through the well-hole *a*.

The caisson B, open at the bottom, is made preferably of rectangular box-like shape, of either wood or metal, with posts *b b* at the corners running from the bottom, if desired, and extending above its top to any required height below the cross-pieces or caps *d d* of the frame-posts D D, thus constituting a frame-work connected by cross-pieces *x x* at their upper ends, giving strength and guidance to the caisson, and forming the support of the racks G G G G.

In the roof of the caisson B is placed a man-hole closed by the door E, opening downward, hinged at *e e*, and kept closed by the button *e'*. The door E is provided with a frame *e''*, secured to the roof of the caisson, and closes against a rubber gasket in the said frame or upon the door itself, so as to be air-tight. The caisson is also provided with thick glass lights *b'' b'' b''*, set in metal frames secured to the roof. To the internal sides of the caisson are fastened horizontal metal or wooden ribs *o o o o*, by means of rivets or otherwise, serving to strengthen the caisson and for another purpose described farther on.

The air-lock C, made cylindrical or otherwise, and preferably of sheet or boiler iron, is connected with the roof of the caisson B by means of a flange and bolts and nuts, with an air-tight joint. It has sufficient space to admit of the number of persons required for operating in the caisson and in the air-lock, and who may be entering or leaving the apparatus at the same time. Its roof is furnished with a man-hole and door F, the latter

being hinged and kept closed in a manner similar to that described for the man-hole and door E in the roof of the caisson B. This air-lock C is lighted by glass lights *f f f f*, secured in proper frames in the roof, two of which may be placed in the door F.

In both the caisson B and air-lock C are placed couplings S S′ for connecting thereto air hose or pipes for supplying air under pressure from an air pump or compressor. The caisson B may also receive a supply of air, if required on occasions, from the air-lock through the valve S″.

The racks G G G G, fastened to the posts *b b* of the caisson B, move the latter with the air-lock C up and down by being simultaneously operated by the pinions *g g g g* and the worm-wheels *i i*, placed on the shafts *h h*, motion being given to the worms *k k* by power applied to their shafts *l l* either by hand-cranks, gearing, or pulley *p*, *p′* being a loose pulley. The engagement or mesh of the racks G G G G and the pinions *g g g g* is effected by the attachment of the shafts *h h* to the fixed posts D D at *h′ h′*.

For guiding the passage of the caisson B and attached air-lock C through the well-hole *a* of the float A and in their raising and lowering, rollers *r r r r* are provided, being attached to cheek-pieces *r′ r′ r′ r′*, bolted upon the upper ends of the caisson-posts *b b*, which rollers clasp the fixed posts D D and revolve upon them as the caisson-frame is moved up and down. Additional guiding-rollers *r″ r″* are also provided and fastened on two opposite sides of the well-hole *a*, so as to roll upon the caisson-posts *b b*.

In the caisson B are placed two frames of angle-iron or of wood—an upper one *n* and a lower one *n′*. These frames are made to conform to the sides of the caisson and parallel thereto, the upper one *n* being suspended from the roof of the caisson by the rods *p″ p″* or other means and the lower one *n′* from the frame *n* in a similar manner. These frames are placed opposite the ribs O O O O and at such a distance therefrom as will leave a space or groove for the admission of the tongued and grooved planks *t t t*, which thus operating through the grooves formed by the ribs O O O O and the frames *n* and *n′*, constitute a telescoping device, by means of which the working depth of caisson to a certain extent may be increased beyond the depth permitted by the limit of its fixed construction, and also for providing facilities for adapting the sides of this extended working space or inclosure to an uneven or sloping submarine bottom by the adjustment of the movable planks thereto. The separate planks *t t t* may be adjusted as circumstances require and kept in place by the set-screws *t′ t′ t′* or by pins or dogs driven into them and resting upon the flanges of the frames *n n′*.

The operation of my apparatus is as follows: The float A being brought near the required point, and the connections with the air-pump or compressor being made by hose or pipes to the couplings S S′ of the caisson B and air-lock C, the workmen enter the latter, and after closing and fastening the door F are prepared to descend with the apparatus into the water, the man-hole of the caisson being open. Air from the air-pump or compressor, or from an auxiliary receiver, is now let into the apparatus by means of the valve V, and by a signal given to the attendants on the float A motion is given to the machinery outside, the descent of the caisson and air-lock is slowly made, while the continued supply and pressure of air forces out the water from the caisson as it is lowered. When the caisson reaches the position required for the operations of the workmen, a signal is given and the outside attendants stop further motion and descent, and the caisson, after the expulsion of water, is ready to be entered by those who are to work therein, leaving such as are required to remain in the air-lock, if any there be. The caisson workmen now close the door E, provided it be required to open that of the air-lock for any purpose, it being always carefully borne in mind by them that while the latter remains open and they are under water they must keep the caisson-door closed. While the air-lock door F is kept shut the caisson-door E may remain open, giving free communication between the two compartments. A system of correspondence, by any suitable method, may be established between the operators in the caisson and air-lock and the outside attendants, so that all instructions may be communicated and understood. Conceiving the caisson B to be lowered near to the depth at which operations are to be carried on, which may be at the bottom of the water, or at some other point above it where work is to be done, the signal for stopping the machinery is given. At the same time another has been given for moving the float A up or down stream or laterally, until the exact locality is reached, the lights in the roof of the apparatus enabling the workmen to perceive it. The caisson, now cleared of all water by the air-pressure, may be grounded upon the exact spot or kept a little above it, if desired, and the work carried on. Suppose excavation to be required, the men in the caisson fill a bucket with the material and by means of tackle hoist it to the air-lock, where it is received by workmen stationed therein, and then close the door E. From the air-lock, after letting off the pressure by the valve V and opening the door E, this material is passed and disposed of outside, the empty bucket returned, and after closing the air-lock door F and renewing the air-pressure in the lock, sent again to the caisson, where in the meantime another filled bucket is ready for ascent and discharge. In a similar manner the handling of other materials may be effected, either in going from or being re-

ceived into the caisson, as in depositing concrete and in constructing wood and metal work and masonry under water.

The action of the telescoping device in the caisson B, besides serving to extend its working depth and adapting it to the inequalities of a rough or sloping submarine bottom, permits a compensating action against the effect of any change or draft of the float A by loading it when the caisson is down, or of its fall in consequence of tidal lowering of the water-surface. The planks *t t t*, being lowered beyond the bottom of the caisson and resting upon the submarine bottom and left to slide freely in the grooves between the frames *n n'*, will rise as the float falls and thus prevent any strain upon the rack and pinion attached to the caisson-frame, thus giving time and opportunity for the deliberate adjustment of the machinery to the circumstances of the contact of the caisson with the submarine bottom.

It is to be mentioned that seats or benches for the accommodation of the workmen in the caisson, and for depositing their tools thereon, may be provided by simply laying planks across the chamber, resting their ends upon the frames *n n'*. It is further to be stated that the said telescoping device affords convenient means for lining the sides of any submarine excavation or pit by transferring the planks *t t t* thereto, fresh planks being provided in their place for ordinary use.

I am aware that, prior to my invention various forms of submarine combined caissons and air-locks have been used, (but to my knowledge none of a portable character,) and I do not broadly claim such; but

What I do claim, and desire to secure by Letters Patent, is—

1. The combination of a caisson B, air-lock C, attached to posts *b b b b*, constituting a movable frame carrying said caisson and air-lock, provided with guide-rollers *r r r r* and with racks G G G G, with a floating vessel A, made with a well-hole *a* and with a fixed framework D D *d d*, and furnished with machinery for working the pinions *g g g g* upon the racks G G G G for lowering and raising the said caisson and air-lock, and transporting the same from place to place, all as substantially described.

2. In a caisson, a telescoping device formed by adjustable planks *t t t* or their equivalents, sliding in a groove formed by the frames *n n'* and the ribs O O O O, and provided with set-screws or their equivalents, for the purposes specified, and all substantially as set forth.

3. In combination with the caisson B, connected to a vertically-adjustable frame-work, an independently-adjustable extension, supported by the caisson and adapted to telescope within the same, substantially as described.

4. In combination with the caisson B, connected to a vertically-adjustable frame-work, a telescoping extension supported by said caisson, and means for securing said extension in position, substantially as described.

5. In combination with the caisson B, an extension supported thereby and composed of sections, each section being independently adjustable, substantially as described.

In witness whereof I have hereunto set my hand this 1st day of June, A. D. 1888.

CALVIN BROWN.

Witnesses:
FRANK W. EASTMAN,
J. H. MILLER.