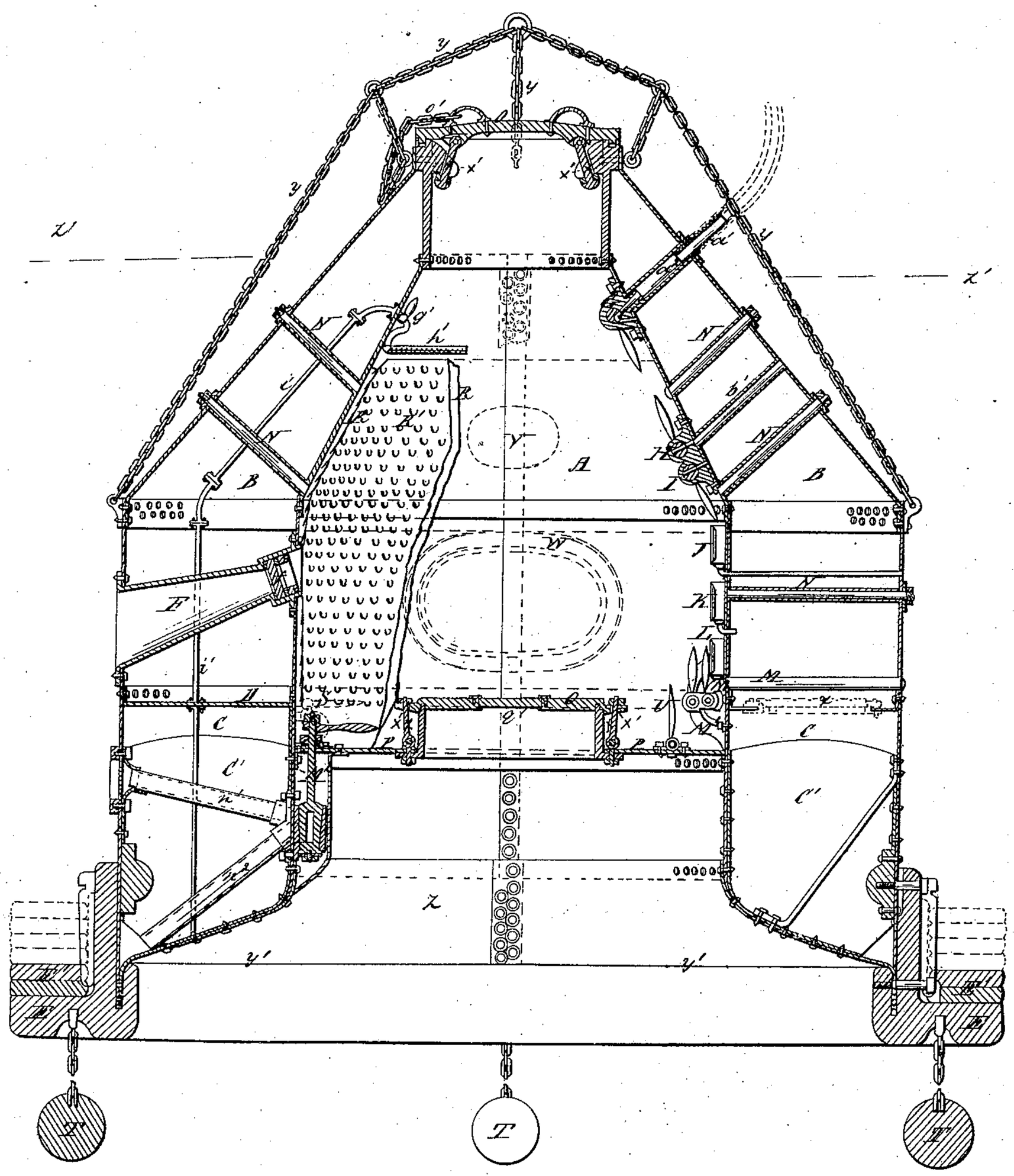
# W. Mont Storm.

## Diving Armor.

No. 54,438. Patented May 1, 1866.



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# UNITED STATES PATENT OFFICE.

WILLIAM MONT STORM, OF NEW YORK, N. Y.

## SUBMARINE EXPLORER.

Specification forming part of Letters Patent No. **54,438**, dated May 1, 1866.

*To all whom it may concern:*

Be it known that I, WILLIAM MONT STORM, of the city, county, and State of New York, have invented certain new and useful Improvements in Submarine Explorers, of which the following specification, taken in connection with the accompanying drawing, embraces a full and clear description.

The drawing represents a central vertical section.

The basing features of my explorer are taken from what is known and patented as the "Ryerson's Submarine Explorer," reference to which will facilitate the clear understanding of my improvements.

As in the former, there is a working-chamber, A, having an elevated floor, P, and a still more elevated exit-trap or man-hole, Q.

The explorer is also composed of two shells with large space between them, divided horizontally by an air-tight circumferential diaphragm, D, the space B above such diaphragm being a reservoir for compressed air, and the space below such diaphragm being a space for water-ballast, which may properly be termed the "differential ballast." The equipoise-ballast, or that which equalizes in the main the floatent power of the explorer when immersed, and the chamber C and the space below the floor P of the working-chamber being, the former partly and the latter entirely, filled with water, is supplied by the fixed cast-iron ballast-ring E.

As the weight of tools and other apparatus to be taken down would vary greatly according to the submarine work to be performed on different occasions, I superpose upon the properly-adapted fixed ballast-ring other removable ballast-rings, as E′, which may be lowered over the explorer to their places, or by being made in segments (properly connectable when in place) they may be put on laterally and be properly keyed at intervals, so that they cannot move about by any motion of the explorer. This enables me to adjust the floating power of the explorer to the proper degree, according to the load on board, which, if too great, with the ballast-chamber partly filled, is corrected by the removal of one or more of the rings E′, and the ascensive or lifting power, when at the bottom, will be limited by the amount of water I can carry down in the chamber C, to be thence displaced by means presently explained.

C C′ are vertical diaphragms to prevent the water in the chamber from rushing suddenly to one side during any casual oscillation of the explorer.

I propose to make the shell of my explorer of best one-fourth-inch boiler-iron, properly stayed and braced to bear both collapsing and bursting pressure. N N are stay-bolts for this purpose. The vertical portion of the inner shell does not extend down as far as that of the outer shell, but bevels outward to the latter at the bottom, as shown. This permits a more obtuse angular view, embracing a far greater area of vision from the man-hole Q than if the inner shell were carried down to the bottom with cylindrical form, and at the same time this enables the explorer to cover and embrace within its lower or bell portion, Z, (which I call the "working-chamber," in contradistinction to the operating-chamber, mainly devoted to operating the explorer itself,) a much more extensive portion of the bottom.

In lieu of employing a spray-pump, which is an obstruction within the chamber A, as in the Ryerson explorer, (for the purpose of absorbing the carbonic-acid gas from the exhaled air, to the end that it may be repeatedly inhaled, and so a given amount support life for a much longer period,) I line the inner wall of the chamber A with felt, R, which is again covered and shielded by a perforated sheet of zinc, R′, and the felt being kept wet presents an enormous surface of contact with the air in the chamber, in proportion to which surface will be the rapidity of absorption, it being understood that the perforated plate is not closely-compressed against its under layer of felt, and the perforations being of such form as to shed water poured in at the top outwardly against the felt and not permitted to trickle in upon the operators.

The perforations themselves are in the form of lips punched out or deflected from the plane of the sheet and intended to give a more free and general access of the air to the felt.

When the water requires renewal and too much of that already vitiated has accumulated in the water-tight space below the felt, which does not extend down to the floor of the working-chamber, (see drawings,) it may be forced out from such space into the ballast-chamber, through a pipe communicating from one to the other, by the pressure of the air in the chamber A on opening the cock S. Only a

portion of this air-purifying sheathing or lining is shown.

For the purpose of admitting light to the explorer and for looking out I employ four or more flaring tubes, F, set at an angle, as shown, to enable an observer to look downward as well as outward. F is closed near its inner and smaller extremity by a lens, *f*, packed water-tight. F is made of or lined with some proper reflecting material, so as to receive and throw more light into the explorer.

Against the inner wall of the chamber A, opposite to and in line with the focus of *f*, I place another reflector to diffuse and practically increase the light within, the oval V (in red) representing one of such reflectors corresponding to a counterpart of F *f*, located in that section of the explorer opposite to the section shown. I propose to attach these reflectors to the wall of the chamber by means of a short stout spiral spring, or its equivalent, or by means of a ball and socket, to the end that they can be so turned as to throw their light, one or more of them, on a given spot, should occasion require.

W is a man-hole (shown in red) to give access when needed, during construction or repair, to the compressed-air chamber or reservoir B.

X (shown in red) is a man-hole through the diaphragm D to give access to the ballast-chamber.

To enable the scuttle O and trap Q to be taken off or put on quickly, and when on to be held firmly, I employ toggle-bolts *x x*, that swing in between strong jaws *x' x'*, when by screwing up the nuts on the extremities of the toggle bolts O and Q are firmly drawn home. They and their seats, having proper tongues and grooves around their circumference filled with india-rubber, render their joints air and water tight, all as shown.

On the interior wall of the chamber A, I locate three fac-simile pressure-gages, J, K, and L, the first communicating with the external water, and the needle of each gage while indicating on the scale opposite one extremity of its needle a given pressure in pounds, its other extremity indicates on a scale marked for feet the corresponding depth to which the explorer is submerged. K communicates with the compressed-air chamber B, showing the surplus of pressure over that of the water without and the number of feet to which the explorer may descend and have Q removed without the admission of water. L shows the existing pressure within the operating-chamber A.

To facilitate the hoisting overboard of the explorer I supply it with a chain-harness, *y*, so connected to the explorer as to distribute the strain on the shell to eight different points, as will be readily understood by the drawing.

I will now proceed to describe the operation of my explorer, in doing which the purpose and operation of other parts or appurtenances not before referred to will be also explained.

We will suppose the explorer just to have been lowered into the water from the deck of a vessel, for instance, the scuttle O being off and hanging by its guard-chain *o'*, while the trap Q is tightly in place.

When the explorer is lowered into the water a quantity of air will be inclosed and confined and compressed in the bell portion or working-chamber Z, under the floor P of the chamber A. This air must be allowed to escape before the explorer descends, inasmuch as in the descent the air would become more and more compressed, thus diminishing, as it were, the displacement of the explorer, causing it to descend with an accelerating velocity, which must be obviated, and is as follows: An operator enters the explorer by O, and by opening the cock U, which communicates through the floor of chamber A, the air will rush into the latter until chamber Z is filled with water, when the cock is closed. Next he opens the cock $M^2$, when water will rush into and through the pipe *n'* and through the cock $M^2$, and down through the pipe $n^2$, emptying into and filling to the destined extent the chamber C. The air contained in C will pass to the outside of the explorer, through the pipe M, by opening the cock M.

When C is sufficiently filled $M^2$ and M are closed, the tools and the remaining operators are now taken aboard, and we will suppose the explorer to be now immersed to the line *z' z'*. And here it would be proper to explain the purpose and importance of the conical form of the top of my explorer. First, it is necessary while the operators, tools, &c., are being put aboard that the scuttle O shall be considerably elevated above the water, especially in rough weather, so that the waves shall not wash over and into the operating-chamber; but it will be perceived that if the upper portion of such an explorer retained the cylindrical form, like that of the lower portion, then, if its top had any material elevation above the water, it would tax largely the contents of my water-ballast chamber to overcome the buoyancy of a portion of the explorer, so capacious as it would be if of cylindrical form.

On the attendant vessel there is supposed to be a steam-pump for forcing air, from which extends a strong wire-bound hose or other flexible conduit having at its other extremity a screw-nozzle, *a'*, that screws into a tube, $a^2$, which communicates, by means of the cock G, with the compressed-air reservoir B. Now, the scuttle O being closed, a signal is given from within by rapping with a hammer, for instance, and the operation of pumping may be commenced and continued until there is such a pressure in B shown by gage K as shall considerably exceed that corresponding to the depth to which it is desired to descend, which is supposed to be previously known by sounding. When there is sufficient pressure in B the

cock G can be closed; and the air-chamber of the steam-pump on the attendant vessel being provided with a safety-valve, and it in turn mounted with a whistle, on the closing of G such safety-valve will almost immediately open, sounding the whistle and giving notice to stop pumping and detach the hose.

I is a cock for admitting air from the reservoir B into chamber A, and while the pumping is going on this cock should be partially opened, permitting a gradually-increasing pressure in such chamber, whereby each operator ascertains to what extent he can endure it, and if unable to bear the necessary pressure I can be closed, and H, which is the cock to permit the escape of foul air from time to time outward through the tube $b'$, which being opened, will let off the pressure gradually. O can then be removed, and the defective operator retire.

When there is sufficient pressure there in the explorer a predetermined signal can be given and $a'$, with its hose detached, and a further quantity of water be admitted to the chamber C, in the manner before described, sufficient to equal the displacement of the yet unsubmerged conical top of the explorer, when the latter will descend steadily to the bottom with a velocity regulated by the admission or expulsion of water from the chamber C, not only the velocity of descent but its extent being constantly indicated by the movement of the needle of the gage J, and so of the ascent.

Suspended from the bottom of the fixed ballast-ring, by chains about four and one-half feet in length, are anchor-weights T T T, that when they strike bottom relieve the explorer of so much weight and check its downward course, as well as holding it in place afterward, which, however, should have been reduced to a minimum by the expulsion of a little water from C when the gage J indicated that bottom was nearly reached. Now, if the pressure in the operating-chamber is not equal to that of the water without it is made so and a trifling excess by opening for the requisite time the cock I. $M^2$ is now opened, permitting more water to enter C. At the same time U is opened, permitting air to pass down into Z, these cocks being opened to such an extent, respectively, as to let water into C at about the same rate that it is displaced from Z, keeping the explorer poised as near as may be, when the water in Z is displaced down about to the line $y'$, which may be told by looking through the glass bull's-eye $q'$ in the center of $g$. The latter may be removed and the operators, one by one, pass out with their implements, a further quantity of water, equivalent to their weight, being admitted meantime to chamber C by one operator or watchman, who shall always remain in the explorer if convenient.

I should have before stated that the water to wet the felt R of the air-purifier can be supplied continuously or intermittently by opening the cock $g'$, which communicates on the one side with a circular perforated tube or sprinkler, $h'$, and in the opposite direction with a pipe, $i'$, which extends down through chamber B and diaphragm D and to near the bottom of chamber C, and by admitting an air-pressure on the top of the water in C, by opening the cock M′, there will be a constant force to impel the water up to the air-purifier R R′. Operations being complete for the time, operators and implements are returned to chamber A, Q is closed, and $M^2$ is opened, as also M′, and the water in C will be driven on through $n^2$ and $n'$ until the explorer begins to ascend with the desired rapidity, when M′ $M^2$ are closed. On reaching the surface H is opened and the pressure in A let off gradually down to the atmospheric pressure, when the scuttle O may be removed, &c.

It is hardly necessary to mention that the air in A may be renewed from time to time by opening I to let in fresh air, and H to let the exhausted air escape. Inasmuch as the exhausted air would be of a higher temperature and lighter than the air in B, I would, in practice, locate H near the top of the chamber A, and the cock I near the bottom of the same, and the two cocks being simultaneously opened, the exhausted air could be underflowed and expelled by the fresh air with the least loss of the latter.

I have anticipated various modes of giving lateral propulsion and directing my explorer when suspended in mid-water, and among these modes is the application of a pipe communicating with the chamber A, and there closed by a cock, and projecting radially through both shells of my explorer to the outside, and there, branching right and left horizontally, close around the outside of the outer shell and terminating respectively with a nozzle, the length of these branches being such as to embrace conjointly about one-quarter of the circumference of the explorer. It would be evident, now, by permitting the exit of air through these nozzles, the explorer will be propelled in the opposite direction somewhat on the principle of a sky-rocket; or, again, if the radial pipe at its terminus within the chamber A had connected to it another pipe running down into the bottom of the water-ballast chamber C, then, by letting on air-pressure from the chamber B, water would be forced out of the aforesaid nozzles and the explorer would be propelled by a force such as propels a reaction water-wheel or Barker's mill.

Having now fully described the nature of my invention, what I claim, and desire to secure by Letters Patent, is—

1. The hinged or toggle bolts, with their clutching-jaws and binding-nuts, all combined and operating substantially as described, for fastening in place the scuttle O and trap.

2. The application of the three pressure-gages J K L, prepared and applied in the manner and for the purposes described.

3. The lookouts F, constructed substantially as described, and combined with the water-tight lens $f$, as described.

4. Making the ballast-ring of my explorer compound, to wit: of a permanently-fixed portion, E, combined with a series of removable portions or sections, E′, in the manner and for the purpose set forth.

5. The air-purifying lining R R′ to the working-chamber of my explorer, constructed and operating substantially as described.

6. The combination of the annular sprinkler *h′*, cock *g′*, and pipe *i′*, operating together, as described, for the purpose described.

7. The application, in conjunction with the lookouts F, or their equivalent, of the reflectors V, in the manner and for the purpose described.

8. In combination with my purifier, the water-space at its bottom and the cock S, constructed and operating in the manner and for the purpose described.

9. The cock G, constructed and applied substantially in the manner and for the purpose explained.

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