

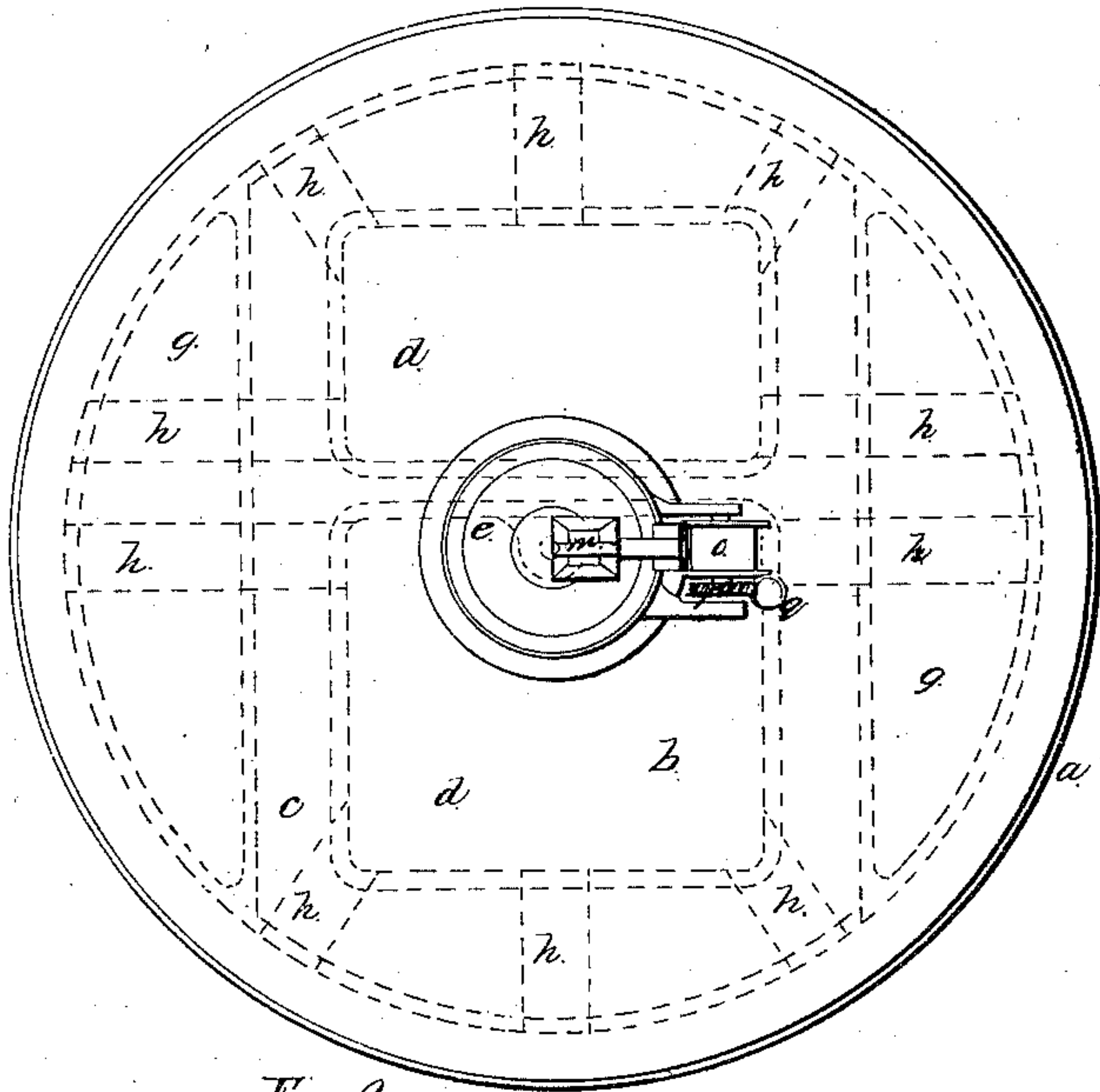
*G. Williamson.*

*Diving Armor.*

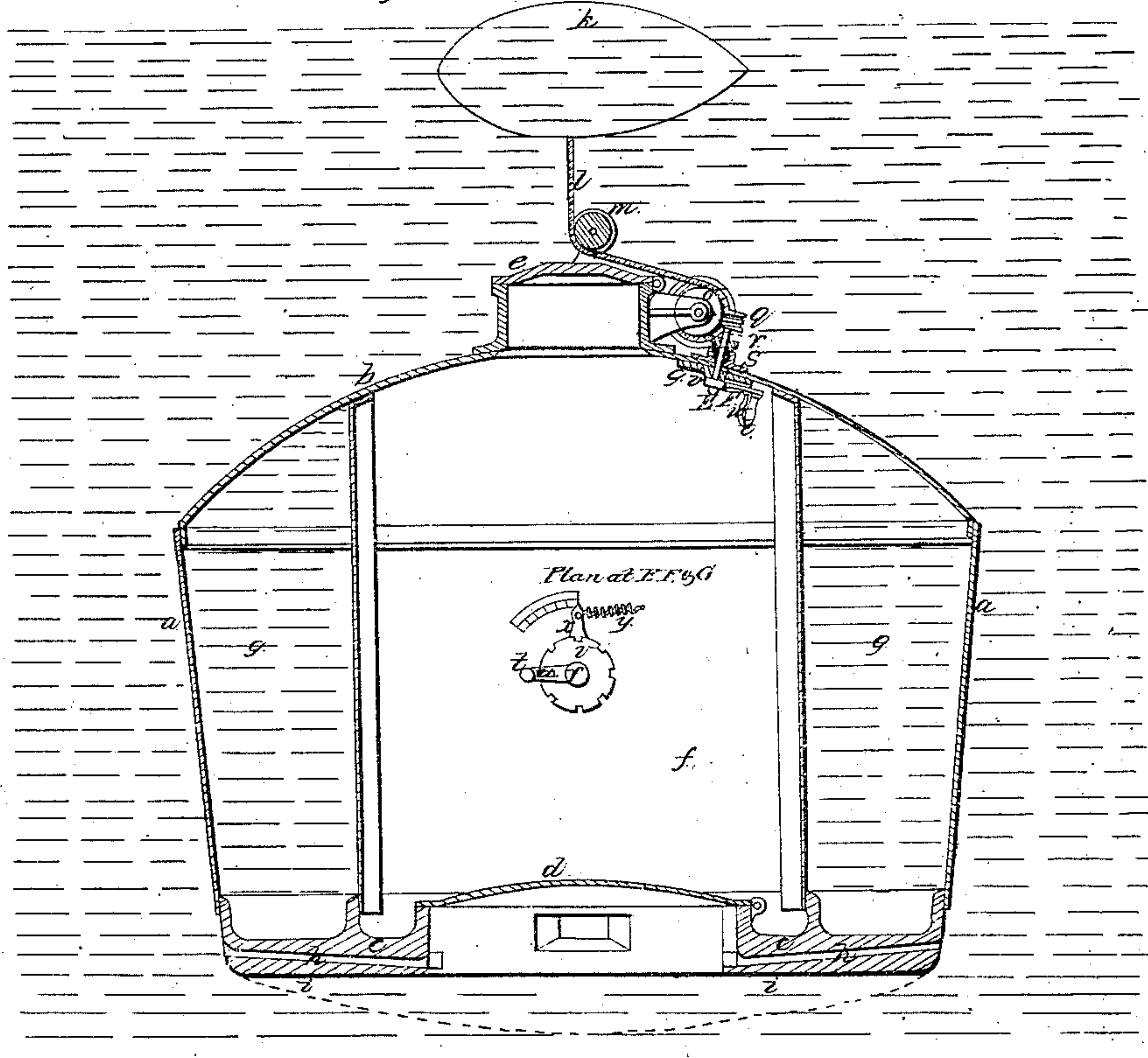
*N<sup>o</sup> 18,260.*

*Patented Sept. 22, 1857.*

*Fig. 1*



*Fig. 2*



*Witnesses:  
N. H. Brown*

*Inventor,  
George Williamson*



# UNITED STATES PATENT OFFICE.

GEORGE WILLIAMSON, OF BROOKLYN, NEW YORK.

## DIVING APPARATUS.

Specification of Letters Patent No. 18,260, dated September 22, 1857.

*To all whom it may concern:*

Be it known that I, GEORGE WILLIAMSON, of Brooklyn, Kings county, State of New York, have invented certain new and useful Improvements in Nautili or Diving Apparatus; and I do hereby declare that the following is a full, clear, and exact description thereof, reference being had to the accompanying drawings, making part of this specification, in which—

Figure 1 is a plan of the nautilus with my improvements added thereto; Fig. 2, a vertical section; and Fig. 3 an inverted plan of the index and its connections, to indicate the amount of buoyant power derived from the float.

The same letters indicate like parts in all the figures.

It is not deemed necessary to describe and represent all the appendages of a nautilus, as they are well known to all persons skilled in this branch of the arts.

In the accompanying drawings *a* represents the outer shell of the well known nautilus, *b* the roof, *c* the floor with its hinged hatchway *d* for giving access through the bottom, and *e* the movable hatchway or cover to close up the man-hole at top. The inside is divided by suitable partitions into three compartments, viz., *f* the working chamber, and *g, g* the floating chambers, one on each side. The manner in which compressed air is to be supplied to, or discharged from, these three compartments, and the manner in which water is to be admitted to, or discharged from, the floating chambers, to decrease or increase the buoyant power of the nautilus, it is not deemed necessary to describe, as they are well known. It is sufficient to say that, by suitable and well known means, the working chamber is to be supplied with air, compressed under a pressure to correspond with the pressure of the column of the surrounding water at any determined depth, and that the floating chambers are supplied with compressed air or water as it is desired to sink or rise.

As the nautilus has heretofore been constructed it has been found very difficult to operate it in rising or sinking, and particularly when applied to raising weights, and also in moving from place to place in the progress of the work to be executed. As

water is not compressible to any practical extent its density does not materially vary at different depths, so that when sufficient buoyancy is given to the nautilus for the purpose of rising, after starting, it goes on moving upward with accelerated velocity which in some instances becomes dangerous, and so with reference to sinking. The mere change of weight by one of the operatives stepping out at bottom through the hatchway would give to the apparatus sufficient buoyant power to carry it up with considerable velocity, and often with such velocity as to leave the operative at the bottom. These difficulties have been partly obviated by the use of anchors connecting the nautilus with the bottom through the hatchway; but the presence of the connections through the hatchway inconveniences the maneuvers of the operatives, and the use of such anchors renders it extremely inconvenient to move the nautilus laterally during the progress of the work, and as it is often important to operate between the surface and the bottom, the use of anchors in such cases has been found objectionable. Another difficulty which has been experienced in practice arises from the action of the compressed air in the working chamber when the bottom hatchway is open. As the nautilus rises the pressure of the incumbent column of water decreases, and hence the compressed air in the working chamber expands in the same ratio, and escapes through the hatchway at bottom; and in escaping the air displaces the water below the bottom of the nautilus in a segment of a sphere, as indicated by the dotted line in Fig. 2, the convexity increasing as the pressure of the column of water decreases. The water thus displaced just under the bottom of the nautilus increases the upward tendency or buoyant power to an extent which is often dangerous to the operatives and to the apparatus itself, and it will be seen that in sinking, with the hatchway open, the reverse of this effect will take place, for the increasing pressure of the incumbent column of water, beyond the pressure of the air in the working chamber at the time of starting, will cause the water to enter through the hatchway into the working chamber to establish an equilibrium, thereby increasing the downward tendency or sinking power to such an extent as to



cause the nautilus to strike the bottom with violence.

The object of my invention is to avoid the evils above pointed out, and to render the apparatus readily controllable by the operatives within; and my said invention consists, first, making channel ways *h, h*, or air passages in the thickness of the bottom, or between the bottom surface *i* of the nautilus and the floor *c* of the working chamber, and extending from the opening or hatchway to receive the expanding air, and opening outward at the sides for escape, preferring to incline them slightly upward to facilitate the escape of the air, as represented at Fig. 2. In this way as soon as the pressure of the air in the working chamber exceeds the pressure of the column of water to force the water below the upper edge of the channel ways *h, h* the air will escape through them until the required equilibrium is restored, so that the buoyancy of the apparatus cannot be increased in rising by the expansion of the air in the working chamber. And my said invention consists, secondly, in combining with the nautilus a buoy, or float, connected therewith by a rope, or its equivalent, and mechanism for working the same from the inside of the nautilus, so as to regulate the immersion of the float or buoy and thereby cause the nautilus to be more or less suspended thereto at any depth required, and to be free to move from place to place in a horizontal plane, and also to leave the hatchway unencumbered, and admit of the operatives getting out through the bottom hatchway when required without the danger of the nautilus rising to the surface.

The float or buoy *k* may be of any suitable construction and size to give the required floating capacity. To the bottom of this is attached a chain, cord, or rope *l* which passes down around a pulley *m* mounted in the cap *e* of the man-hole at top, and thence it passes to, and around, a capstan cylinder *o* mounted in suitable brackets on the top. The arbor of the capstan cylinder carries a worm wheel *p*, the cogs of which are engaged by the thread of a screw or worm *q* on the outer end of an arbor *r* which passes through a stuffing box *s* in the top of the nautilus; and the inner end of the said arbor carries a crank handle *t* by which the operatives can wind up or let out the rope *l* from inside, and thereby regulate the lifting power. If the nautilus is resting on the bottom, and the capstan is turned so far that the float will only displace its own weight of water, the buoyancy of the float will not add anything to the lifting power of the nautilus; but if the capstan be turned to wind up the rope the immersion of the float will be increased, thereby tending to lift the nautilus; and this may be increased, if the float be of sufficient capacity, until

the nautilus will be lifted up from the bottom and hang suspended to the float at any desired height below the surface of the water, and in that condition may be moved about as the work to be performed may require without any danger of rising to the surface,—a result which could not be obtained if the nautilus depended upon its own specific gravity, for in that case the moment it acquired sufficient lifting force to rise it would continue to rise until it reached the surface of the water. Besides, the use of the float in the manner specified, avoids all the other inconveniences pointed out above as being attendant on the use of anchors.

The third and last part of my invention relates to the method of indicating the amount of lifting power which the float is exerting on the nautilus; and this part of my invention consists in combining a balance or scale with the capstan and float so that the scale will indicate to the operatives inside the amount of force which the nautilus is exerting on the float to sink it—that is to say, the lifting power of the float. This part of my invention I have applied by attaching a spring catch *u* to the crank handle *t*, which catch, when liberated, enters one of a series of notches in the face of a wheel *v* fitted loosely on the arbor *r* of the crank handle, so that when the catch is in either of the notches the said wheel will turn with the arbor and crank handle. The catch is so formed that the operative in grasping the handle to turn the capstan liberates the catch from the wheel, and on liberating the catch from the hand it falls in the nearest notch to re-connect the parts. This notched wheel is provided with an arm or index pointer *x* connected to a spring *y* which is in turn attached to some part of the roof of the nautilus. The roof is marked off into index divisions suitably numbered according to the tension of the spring to indicate the number of pounds applied to distend it.

From the foregoing it will be seen that when the nautilus is suspended to the float the pull of the rope on the capstan will tend to turn it with a force due to the sinking power of the nautilus, and as the capstan is connected with the index wheel by the catch on the handle, and the index arm to the spring, the pull on the rope, due to the sinking force, will be exerted on the spring which alone prevents the capstan from turning, and hence the index hand will indicate the weight actually suspended to the float; and if that be greater than the weight of an operative he may get out of the nautilus without danger of its rising. This indication is important for many other operations not necessary to enumerate.

I do not wish to be understood as limiting my claim of invention to the special con-



struction specified, as my invention of improvements may be applied by the substitution of equivalent means.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. The employment, in combination with the nautilus, of the channel ways for the escape, at the sides, of the compressed air from the working chambers, substantially as described, the said channel ways being made in the thickness of the bottom of the nautilus,—that is, between the floor of the working chamber and the outer bottom surface of the nautilus, as set forth and for the purpose specified.

2. I also claim combining the nautilus with, and suspending it to, a float or buoy in the manner substantially as herein described, so that the apparatus for operating the connecting rope, or equivalent, may be worked from the inside of the nautilus, as described, and for the purpose specified.

3. And I also claim combining a spring balance or scale with the combined nautilus and float, substantially as herein specified, and for the purpose set forth.

GEORGE WILLIAMSON.

Witnesses:

WM. H. BISHOP,  
HORACE ANDREWS.