(No Model.) 4 Sheets—Sheet 1.

S. COLERIDGE.

AUTO MOBILE MOORING APPARATUS FOR TORPEDOES.

No. 420,864. Patented Feb. 4, 1890.

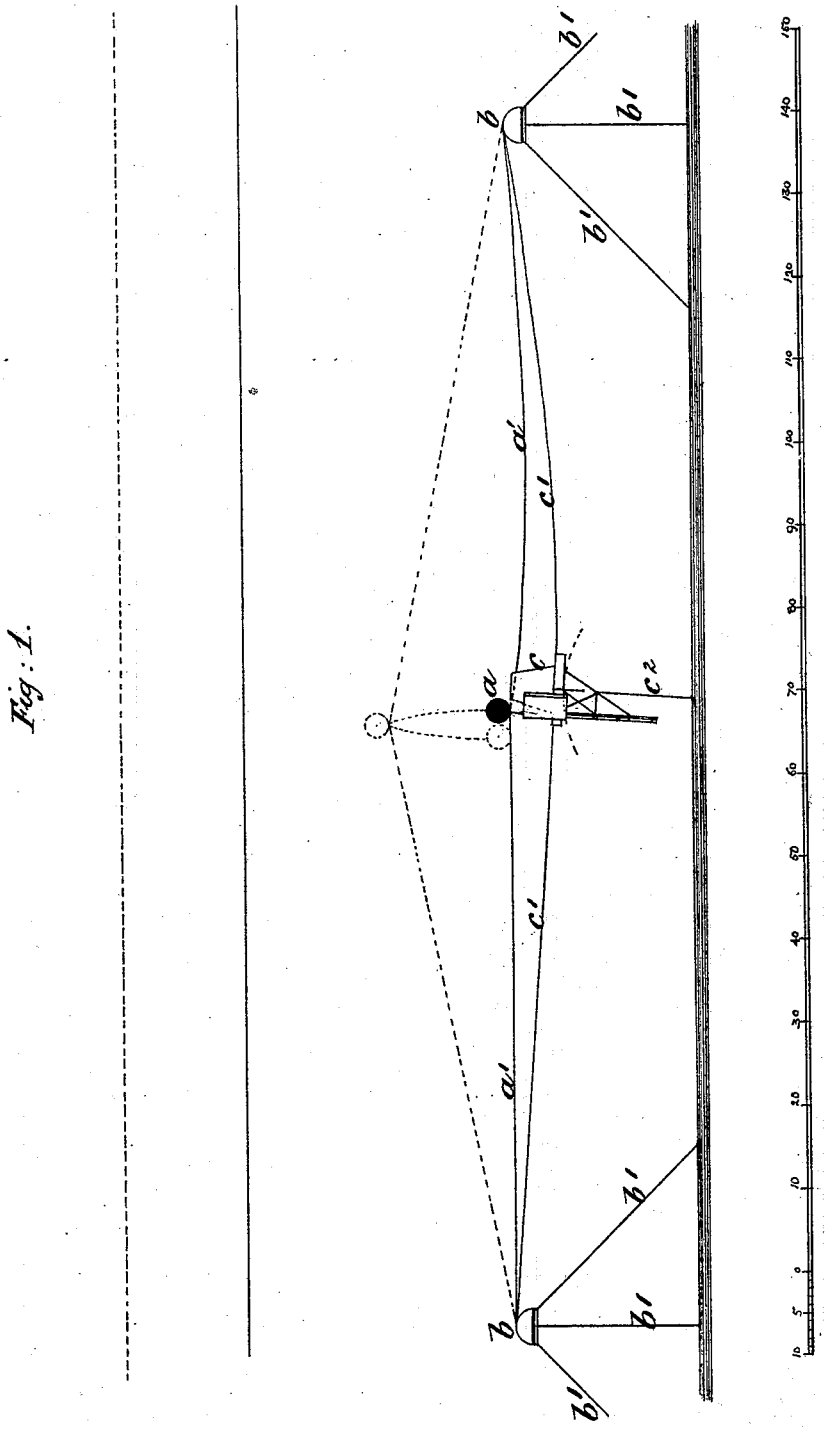

Fig. 1.

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By his attys.
Baldwin Davidson & Wright.

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No. 420,864. Patented Feb. 4, 1890.

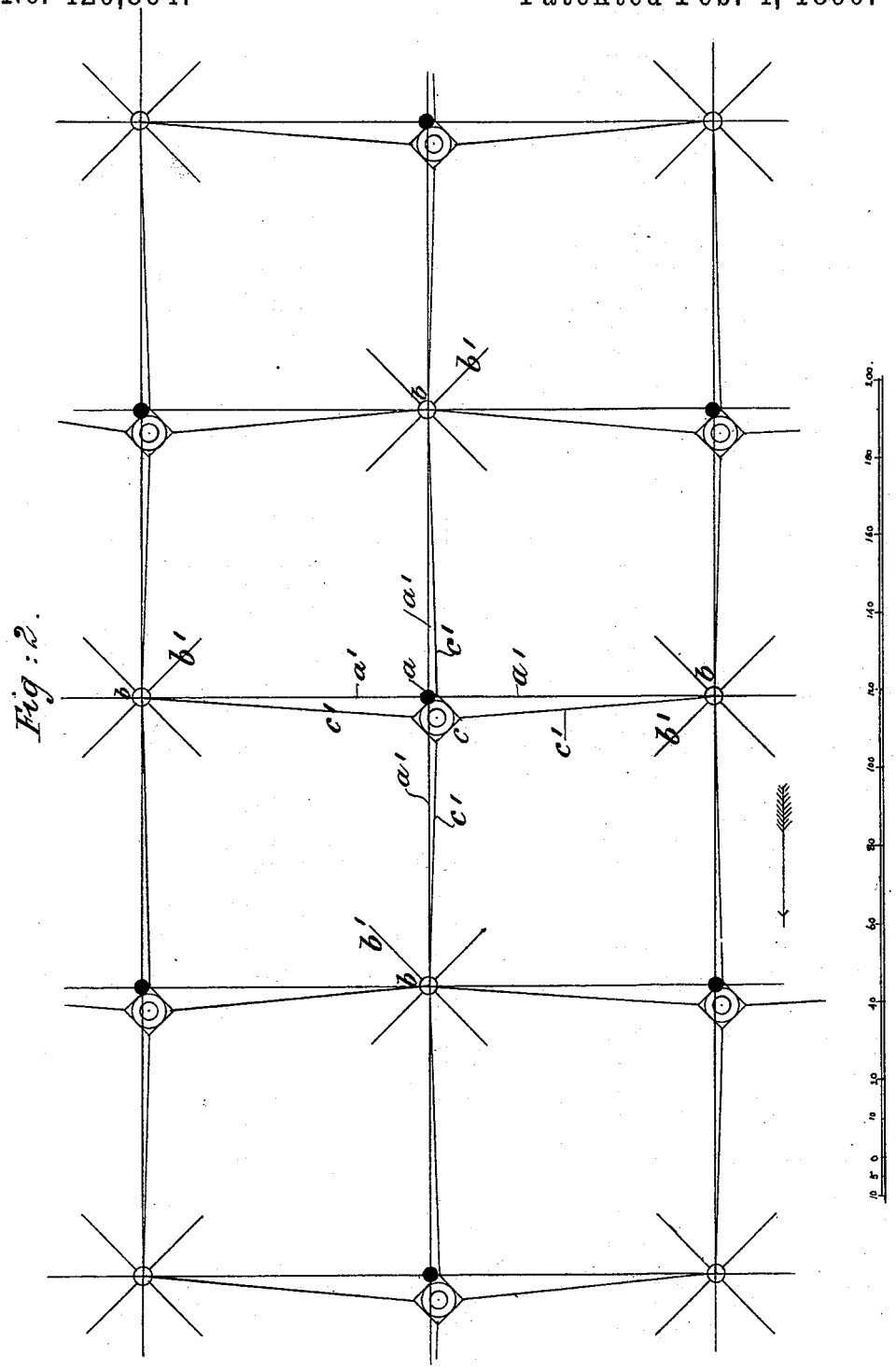

Fig. 2.

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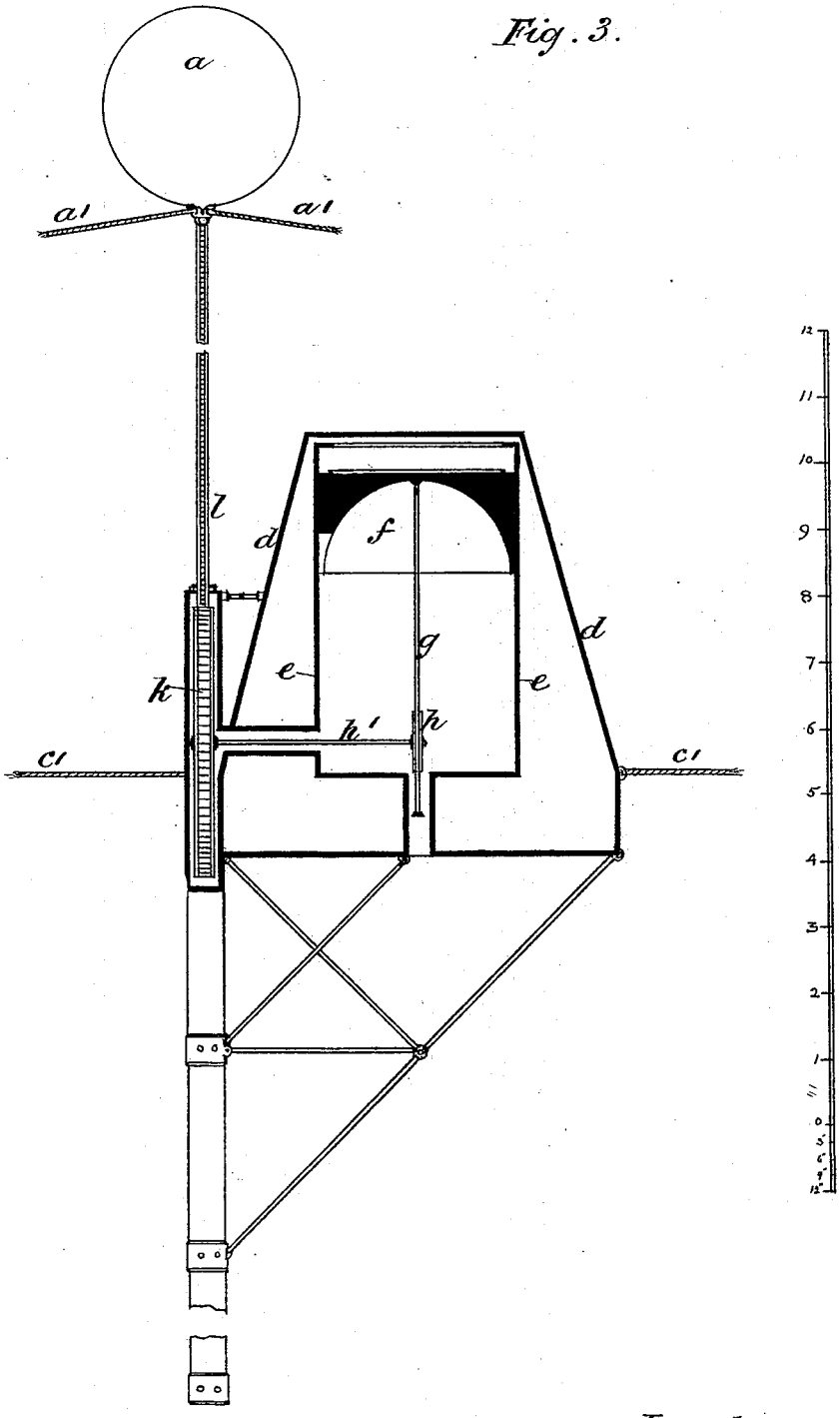
Fig. 3.



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No Model.)

4 Sheets—Sheet 4.

S. COLERIDGE.

AUTO MOBILE MOORING APPARATUS FOR TORPEDOES.

No. 420,864. Patented Feb. 4, 1890.

Fig. 4.

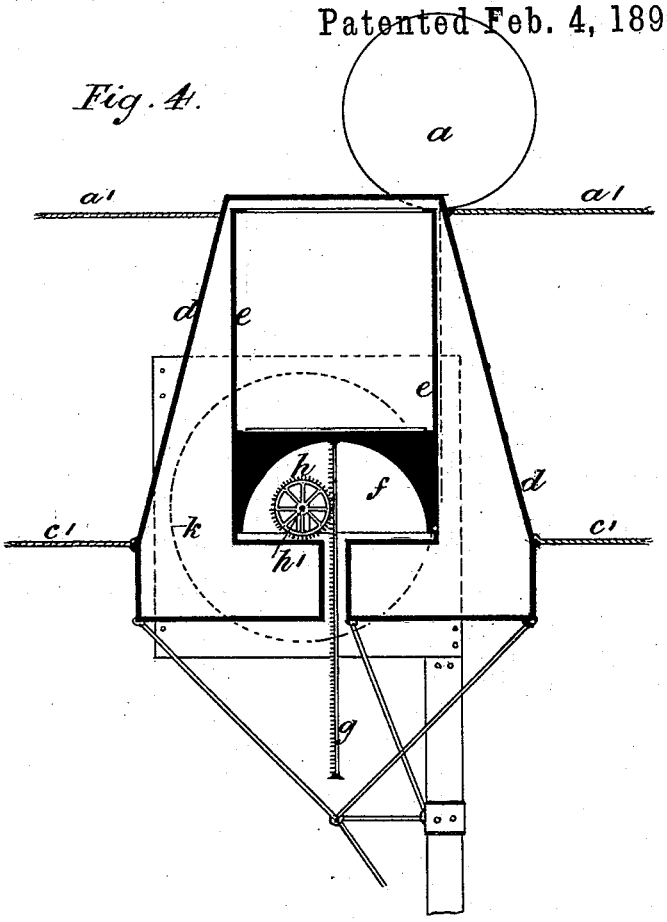
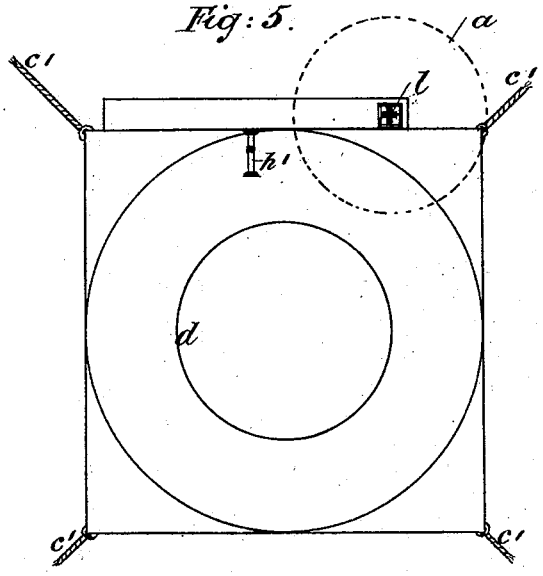


Fig: 5.



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UNITED STATES PATENT OFFICE.

STEPHEN COLERIDGE, OF ADDLESTONE, COUNTY OF SURREY, ENGLAND.

AUTO-MOBILE MOORING APPARATUS FOR TORPEDOES.

SPECIFICATION forming part of Letters Patent No. 420,864, dated February 4, 1890.

Application filed October 16, 1889. Serial No. 327,224. (No model.) Patented in England February 13, 1888, No. 2,157, and in France August 28, 1888, No. 192,648.

To all whom it may concern:

Be it known that I, STEPHEN COLERIDGE, a subject of the Queen of Great Britain, residing at The Cottage, Addlestone, in the county of Surrey, England, have invented certain new and useful Improvements in Mooring Torpedoes and in Apparatus for the Same, (for which I have received Letters Patent in Great Britain, No. 2,157, dated February 13, 1888, and in France, No. 192,648, dated August 28, 1888,) of which the following is a specification.

The object of this invention is to moor torpedoes so that they shall always remain approximately in the same position relatively to the surface of the water. In order to keep them at a constant depth below the surface, I attach them to a regulator fixed to the bottom and actuated by the pressure of the water above it, which winds down or up the mooring-rod as the depth of water diminishes or increases.

In order to prevent the mines from moving laterally, I moor both them and the regulator to buoys moored at a constant distance above the bottom.

Figure 1 shows an elevation, and Fig. 2 a plan, of my method of mooring mines. Figs. 3 to 5 show the regulator to a larger scale.

The full lines in Figs. 1 and 2 show the position of the various parts at low water. Their position at high water is shown in dotted lines in Fig. 1.

a is the torpedo or mine. It is connected by ropes or chains *a'* to buoys *b*, which in their turn are fixed to the bottom by moorings *b'*.

c is the apparatus (which will be described hereinafter) by which the depth of the mine from the surface of the water is kept constant. This apparatus is connected to the buoys *b* by means of moorings *c'*, and it is also moored to the bottom by a mooring c^2, so that its distance from the bottom remains constant.

The arrow, Fig. 2, shows the direction of the current. Figs. 3 and 4 are vertical sections, and Fig. 5 is a plan, of the regulating apparatus. Fig. 3 shows the position of the parts at high water, and Fig. 4 at low water.

It consists of an outer casing *d*, within which is a cylinder *e*. The space between the cylinder and the casing is occupied by air, and communicates by an opening with the top of the cylinder. A piston *f* works in the cylinder *e*. Its top is preferably covered with mercury, so as to make an air-tight joint. Fixed to the piston *f* is a rack *g*, which gears with a pinion *h*. At the other end of the axis *h'* of the pinion *h* is fixed a wheel *k*, which gears with a rack upon a rod *l*, which is attached to the mine. The wheel *k* and rod *l* are preferably inclosed in casings, as shown. As the tide rises, the depth of the regulator below the surface increases, forcing the piston *f* upward into the cylinder *e*, thereby compressing the air contained in it and in the space between it and the casing *d*. This motion of the piston causes the pinion *h*, axis *h'*, and wheel *k* to revolve, and thereby the rod *l*, with the mine, is raised. The parts are so proportioned that the distance through which the mine is raised is equal to the rise of the tide. The buoyancy of the mine should be proportioned to its own weight and that of the parts connected to it, so that there shall be no appreciable tendency for the mine to move the regulator.

In the example shown in the drawings the rise of the tide is supposed to be fifteen feet, and the apparatus is moored and strained so that the level of the piston *f* at low tide is thirty-five feet from the surface of the water. When lowered to its mooring, the air-space and cylinder must be filled with air at a pressure equal to that exercised by the water per square foot at the depth of thirty-five feet. In the example given the cubic contents of the entire air-space and cylinder at low tide is one hundred and four cubic feet. (This is allowing three cubic feet for the axle-passage, piston-rod passage, and stays.) Taking the water at sixty-three pounds per cubic foot and the atmospheric pressure at two thousand one hundred and sixty pounds per square foot, the pressure on the piston *f* at low tide is—

$(35\times63\times6\frac{1}{2})+(6\frac{1}{2}\times2160)=28372\frac{1}{2}$ pounds.

At high tide it is—

$(50\times63\times6\frac{1}{2})+(6\frac{1}{2}\times2160)=34515$ pounds.

By Boyle's law—viz., that with gases the volume varies inversely as the pressure—the volume of the air in the air-chamber will diminish inversely as the pressure increases from the greater depth of water as the tide rises. If x be the cubic space occupied by the air at high tide,

$$28372\tfrac{1}{2} : 34515 :: x : 104.$$

Therefore x equals 86 cubic feet. Therefore the difference in the space occupied by the air at high and low tide is eighteen cubic feet. This gives the piston f an oscillation of three feet, which translated onto the wheel h works the mine-rod up and down the fifteen feet required.

I would remark that I do not claim, generally, keeping torpedoes at a constant depth below the surface by means of a regulator consisting of a vessel containing air, which is more or less compressed as the tide rises and falls, for I am aware that this has already been suggested. Such apparatus, however, has never heretofore been kept at a constant distance from the bottom, and its action has therefore been irregular, and additional means of compensation have been required.

What I claim is—

1. The combination of a torpedo, a regulator operated by the pressure of water above it, connections between the torpedo and the regulator, and moorings connected to the regulator and holding it at a fixed distance from the bottom, substantially as set forth.

2. The combination of a torpedo, a regulator operated by the pressure of water above it, a mooring connecting the torpedo with the regulator, and automatically wound in or let out to lower and raise the torpedo, and moorings connected to the regulator and holding it at a fixed distance from the bottom, substantially as set forth.

3. The combination of a torpedo, a regulating apparatus consisting of an air-cylinder, a piston therein, a rack connected with the piston, a pinion gearing with said rack, an axis which carries the pinion, a wheel on said axis, a rack connected to the torpedo and gearing with the wheel on the axis, and moorings connected to the regulating apparatus and holding it at a fixed distance from the bottom, substantially as set forth.

4. The combination of a torpedo and a regulating apparatus consisting of an air-cylinder, a piston working therein, a mooring connected with the torpedo, and gearing connecting said mooring to the piston of the regulating apparatus.

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