W. P. Trowbridge.

Bathometer.

No. 30,182. Patented Aug. 12, 1862.

Fig: 1.

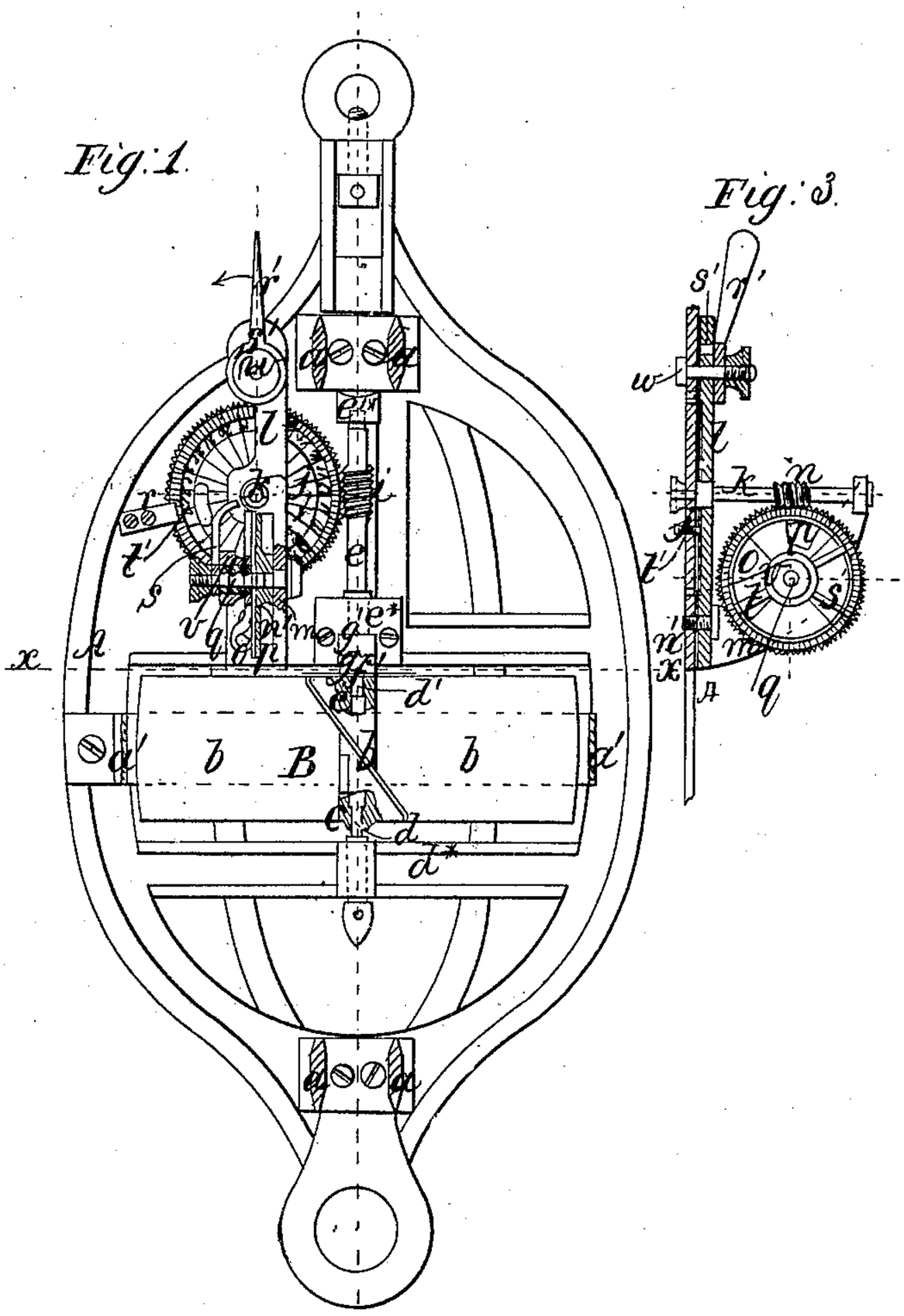
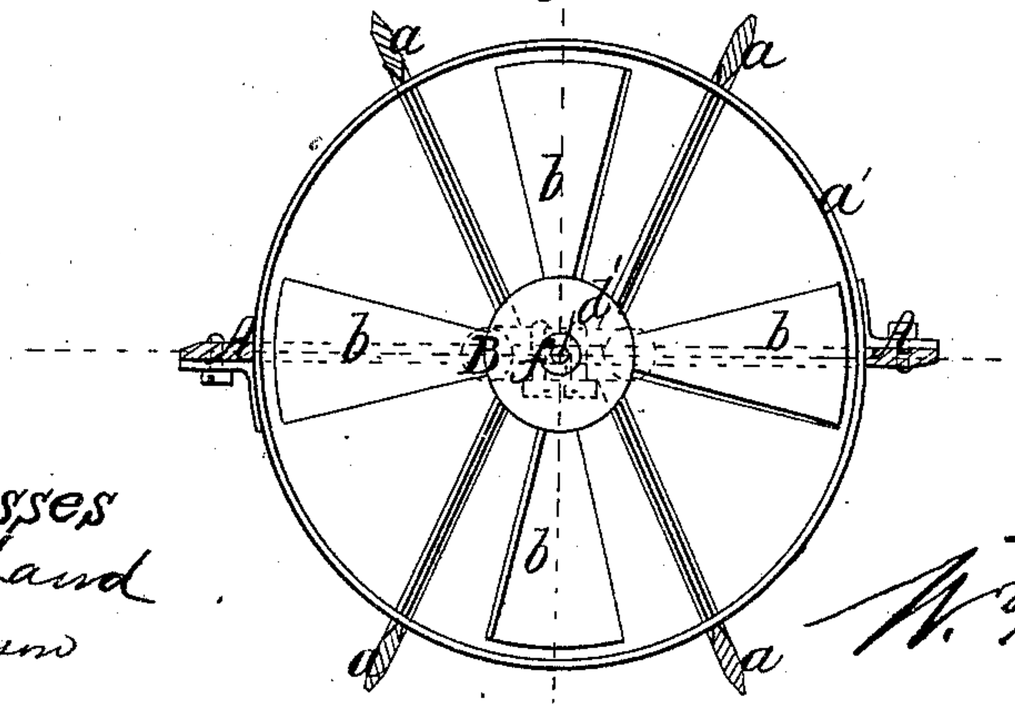


Fig: 3.

Fig: 2.



Witnesses
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UNITED STATES PATENT OFFICE.

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IMPROVEMENT IN SOUNDING-INSTRUMENTS.

Specification forming part of Letters Patent No. **36,182**, dated August 12, 1862.

To all whom it may concern:

Be it known that I, W. P. TROWBRIDGE, of the city, county, and State of New York, have invented certain new and useful Improvements in Instruments for Sounding, &c.; and I do hereby declare that the following is a full, clear, and exact description of the same, reference being had to the accompanying drawings, forming a part of this specification, in which—

Figure 1 represents a vertical section of my invention. Fig. 2 is a horizontal section of the same, taken in the plane indicated by the line *x x*, Fig. 1. Fig. 3 is a longitudinal vertical section of the registering apparatus.

Similar letters of reference in the three views indicate corresponding parts.

This invention consists of certain improvements in that class of instruments used for sounding, or as a log, in which a helix or screw-propeller is made to revolve by the action of the water upon the threads or blades of the propeller, the number of revolutions of said propeller being registered by a combination of endless screws and wheels, to which motion is imparted by the revolutions of the propeller, and which are provided with suitable indices to mark the number of revolutions of the registering-wheels.

My invention consists in the combination of the rising and falling blades with a frame-work and registering mechanism in such a manner that the whole weight of the lead and the strain of the line is sustained by the frame-work and not by the axis upon which the blades revolve, said frame-work being composed of thin arched ribs, which protect the blades and the wheel-work from injury.

It consists, further, in certain improvements of the registering mechanism, as will be hereinafter more fully described, the object being to reduce the same to the smallest possible compass, at the same time increasing its capacity and facilitating its operation.

To enable those skilled in the art to make and use my invention, I will proceed to describe its construction and operation with reference to the drawings.

The frame A consists of a flat plate, of brass or other suitable material, cut out to receive the propeller B and the registering mechanism. To this plate four fenders or ribs, *a*, are firmly secured to protect the blades of the propeller and the wheel-work of the registering mechanism from injury.

The form given to the frame-work is such as to offer the least resistance to motion in a resisting medium in the direction of the axis of the propeller, or in the direction in which the instrument moves when used. A ring, *a'*, attached to the frame A and passing round the propeller, forms an additional protection for the latter. The blades *b* of the propeller are composed of brass or other tough inflexible material, and they are carefully bent to the form of a screw, the pitch being determined by actual experiment, so that the propeller will make one revolution when moving in the water over the distance of one foot and a half. Said blades are made as long as practicable, and thin, and they are fastened to a hub, *c*, of small diameter. This hub is hollow, and it has its bearings on two pivots, *d d'*, which project into the same to the distance of about a quarter of an inch from top and bottom, as clearly shown in Fig. 1 of the drawings. Said pivots are made very thin, so as to reduce the friction to the smallest possible amount, and the lower pivot is stationary, being inserted into the cross-bar *d** of the frame A. The upper pivot, *d'*, is the prolongation of the arbor *e*, which has one of its bearings in a box, *e**, close over the propeller, and the other in a box, *e'**, at the upper end of the frame A.

The upper end of the hub *c* of the propeller is provided with ratchet-teeth *f*, pointing in the direction in which the propeller rotates when the instrument is in operation, and a ring or collar, *g'*, with corresponding ratchet-teeth, *g*, pointing in the opposite direction at its lower edge, is secured to the lower end of the arbor *e* close over the pivot *d'*. The propeller is allowed to play or rise and fall on the pivots *d d'*, so that when the instrument descends in sounding the resistance of the water will cause the propeller to rise, thereby bringing the teeth *f* to gear into the teeth *g*, and transmitting the motion of the propeller to the arbor *e;* and so soon as the instrument strikes bottom, or when it is drawn up, the propeller falls back, the ratchet-teeth *f* and *g* are thrown out of gear, and the arbor *e* does not partake any longer of the motion of the propeller.

The frame A is provided with two rings or eyes, *h h'*, one at either end, and if the instru-

ment is used for sounding the line is secured to the upper eye, *h*, and the lead is suspended from the lower ring, *h'*, and when used for a log the line is attached to the ring *h'* and the instrument is towed behind the vessel. In both cases the axis of the propeller B is entirely relieved from the strain of the lead and line, and it can therefore be made very thin, so that the friction is reduced to the smallest possible quantity; and, furthermore, by this arrangement I am enabled to make the pivots *d d'* very short, instead of running the axle clear through the hub, and the corrosion of the bearings, which inevitably takes place by the action of the sea-water, has no perceptible effect on the action of the propeller.

In order to register the number of revolutions of the propeller, the arbor *e* is provided with an endless screw, *i*, which gears into a worm-wheel, *j*. The axle *k* of this wheel has its bearings in a double-armed bracket, *l m*, which is connected to the frame A by means of a pivot, *n'*, and it (the axle) is furnished with an endless screw, *n*, which gears in two concentric differential wheels, *o p*. These wheels rotate on a pin, *q*, that is firmly attached to the arm *m* of the bracket *l m*.

The wheels *o p* are so arranged that the number of teeth of the lower wheel, *p*, exceeds the number of teeth of the upper wheel by one, so that one complete revolution of said wheels separates said wheels one tooth, or produces a difference of one tooth in the relative position of the two wheels to each other.

The operation of the recording apparatus is therefore as follows: One revolution of the propeller produces a motion of the wheel *j* of one tooth. One entire revolution of the wheel *j* gives a motion of one tooth to each of the wheels *o p*, and one revolution of these wheels produces a difference of one tooth in their relative position toward each other, so that if three indices are provided, one to mark the number of teeth which the wheel *p* moves, a second to mark the number of teeth which the wheel *o* moves, and a third to mark the number of teeth which measure the difference in the relative position of the wheels *o p*, the number of revolutions of the propeller are indicated in an increasing geometrical ratio, the multipliers being the number of teeth in the respective wheels. For instance, suppose the propeller to turn in the water once in each foot and a half, the wheel *j* to have one hundred teeth, the wheel *o* to have eighty teeth, and the wheel *p* to have eighty-one teeth, then one hundred revolutions of the propeller will give one entire revolution of the wheel *j*, indicating a distance passed over by the instrument in the water of one hundred and fifty feet, (one and a half foot to each tooth.) This will have caused a motion of one tooth on the wheel *o*, which should be shown by the proper index, and hence one tooth of the wheel *o* will represent a distance of one hundred and fifty feet, or twenty-five fathoms. Consequently, there being eighty teeth in this wheel, when it has made one entire revolution the distance passed over by the instrument will be $80 \times 150 = 12{,}000$ feet, or two thousand (2,000) fathoms, and, taking six thousand (6,000) feet to a nautical mile, the value of one revolution of the wheel *o* will be two nautical miles. During this time the two wheels *o p* have become separated by one tooth, and hence the value of the amount of separation shown by one tooth is two nautical miles, and an index that marks this separation will indicate a distance passed over of two nautical miles; and, further, as the revolutions go on the amount of the separation is marked by the index up to eighty teeth before the complete cycle of the wheels is performed, or before they all return to the same relative position toward each other which they occupied at the beginning of the operation. The instrument, therefore, will record $2 \times 80 = 160$ nautical miles; hence it will be seen that three wheels arranged so as to produce the least possible amount of friction are capable to record any distance from one and a half foot, or a quarter-fathom, up to one hundred and sixty miles.

The indices are attached in the following manner: The index *r* of the wheel *j* is firmly secured to the frame A, and the face of said wheel is graduated and marked with figures from 1 to 25, indicating the number of fathoms traveled over by the instrument.

The index *s*, which is intended to show the motion of the wheel *v*, is firmly secured to the end of the pin *q*, that forms the axle of the two differential wheels *o p*, and the wheel *o* is graduated with a series of marks corresponding in number to the teeth of said wheel and numbered, each mark being equivalent to twenty-five fathoms, and consequently four marks to one hundred fathoms. As the wheel progresses and the index remains stationary, the number of fathoms from twenty-five and upward traveled over by the instrument can be determined by the graduation on the wheel *o*. The last index, *t*, is firmly connected to the wheel *p* by means of a hub, *u*, projecting from said wheel through the wheel *o*, and by a nut, *v*, as clearly shown in Fig. 1, the wheel *o* being left free to rotate independent of and between the index *t* and wheel *p*. It is obvious that this index, by means of the graduation on the face of the wheel *o*, will indicate the number of teeth which the two wheels *o p* separate, or, if the two indices *s t* are set to the same point and the instrument is set in motion, the index *t* will draw away from the index *s* one tooth for each revolution of the wheels *o p*, or for every two nautical miles traveled over by the instrument.

Both indices *s t* are fastened by means of nuts with milled edges, so that they can readily be unscrewed when it is desired to set the indices back to zero, and, furthermore, it will be noticed that during the operation of the instrument all the indices are perfectly firm, so that

no slipping can take place, and at the same time they do not interfere with the motion of the wheels.

In sounding it is convenient to have the means of setting the index *r* of the wheel *j* back to zero at each cast. To effect this purpose in a simple and expeditious manner, the bracket *l m*, which carries all the wheels, is connected to the frame A by means of a pivot, *n'*, so that the arm *l* of said bracket swings toward and from the arbor *e* and endless screw *i*, which transmits the motion from the propeller to the registering mechanism. The outer end of said arm is provided with a circular slot described from the center of the pivot *n'*, and this slot catches over a pivot, *w*, that projects from and rotates in the frame A. A handle, *r'*, is firmly secured to this pivot, and an eccentric pin, *s'*, inserted into the lower surface of the hub of said handle projects into a hole in the end of the arm *l* in such a manner that by turning the handle in the direction of the arrow marked near it in Fig. 1 the wheel *j* is thrown out of gear with the endless screw *i*, and by turning the handle in the opposite direction the wheel *j* is brought in gear. A pin, *l'*, projects from the upper surface of the wheel *j*, being inserted in the same in such a position that when said wheel is in gear with the endless screw *i* it (the pin) clears the index *r*; but if by moving the handle *r'* in the direction marked near it in Fig. 1 the wheel *j* is thrown out of gear, leaving said wheel free to be rotated upon its axis in either direction, the pin *t'* comes in contact with the index *r*, and said pin is placed in such a position that when the wheel is turned out of gear and rotated in the direction of the arrow marked upon it in Fig. 1 until the pin *t'* strikes the edge of the index, the center of said index is exactly opposite the starting-point or zero of the graduation on the face of the wheel *j*. By this simple contrivance the setting of the wheel *j* can be effected almost instantaneously without even looking at the same, and it can be done equally well in day-time and at night.

This instrument can be used with equal advantage for sounding and as a log, and it has been proved by actual experiment that it can be cast repeatedly in the same depth, and it will always record the same number.

Having thus fully described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The combination of the rising and falling propeller B and registering mechanism with the frame-work A, substantially in the manner and for the purpose described.

2. The arrangement of the fixed stop *t'*, in combination with the swinging arm *l*, wheel *j*, and index *r*, as and for the purpose specified.

W. P. TROWBRIDGE.

Witnesses:
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