3 Sheets--Sheet 1.

B. T. MOORE.
Ship-Log.

No. 169,024. Patented Oct. 19, 1875.

Fig:1.

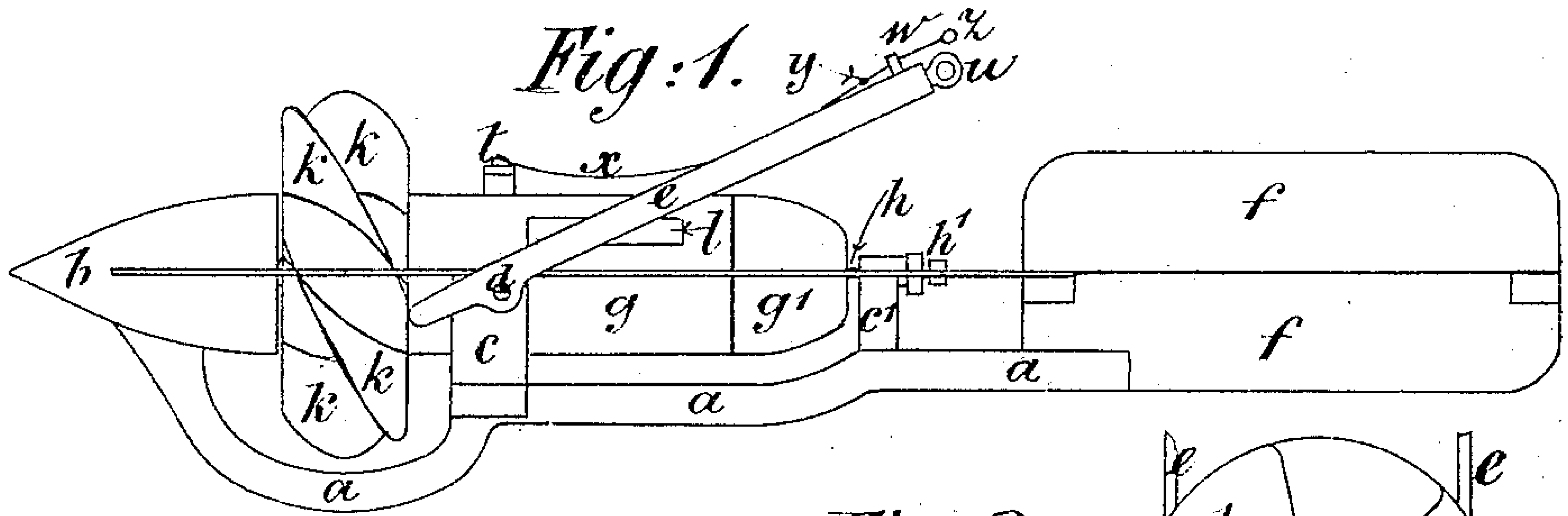


Fig:2.

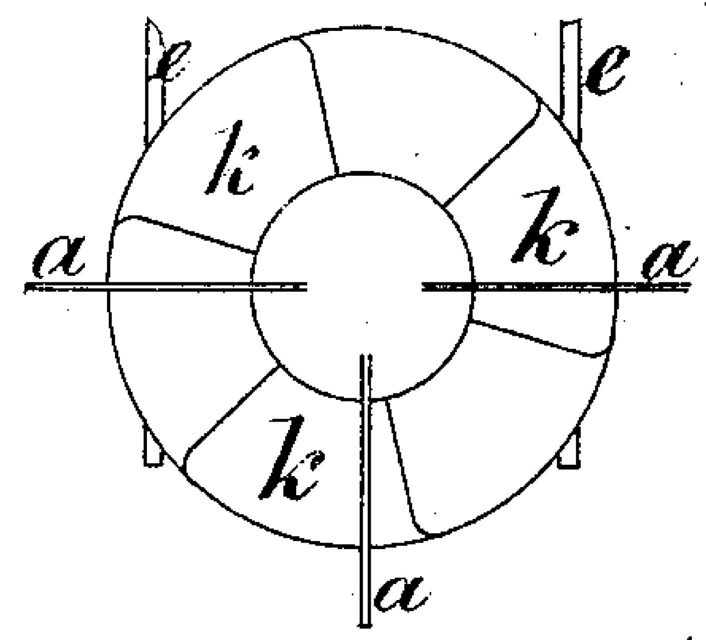


Fig:3.

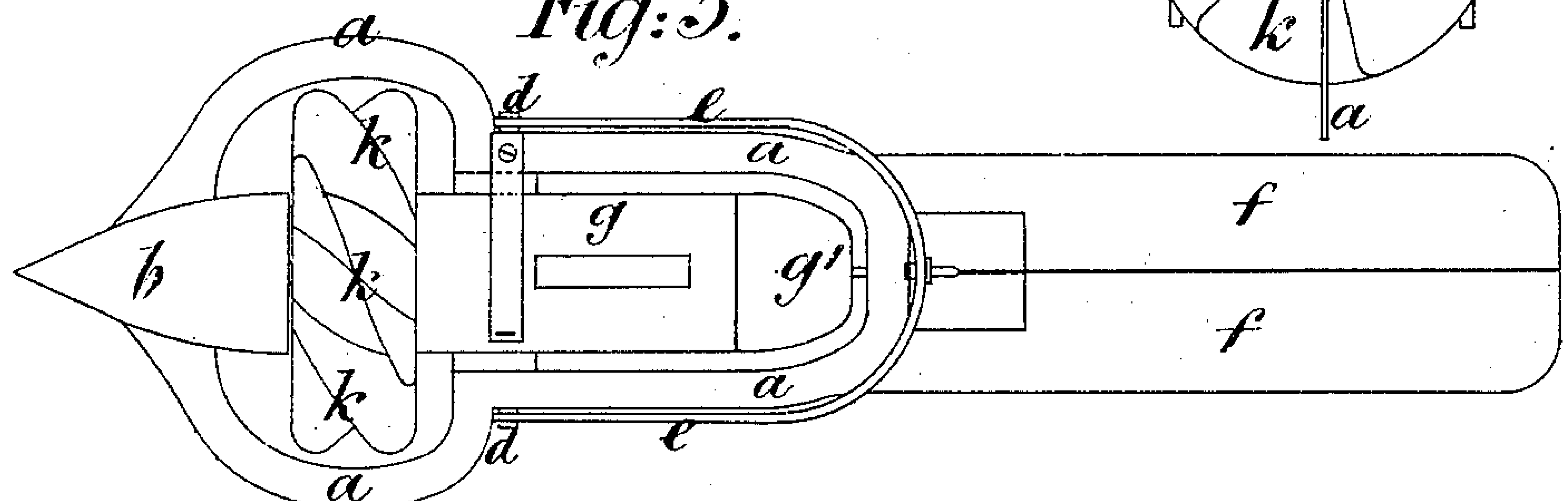
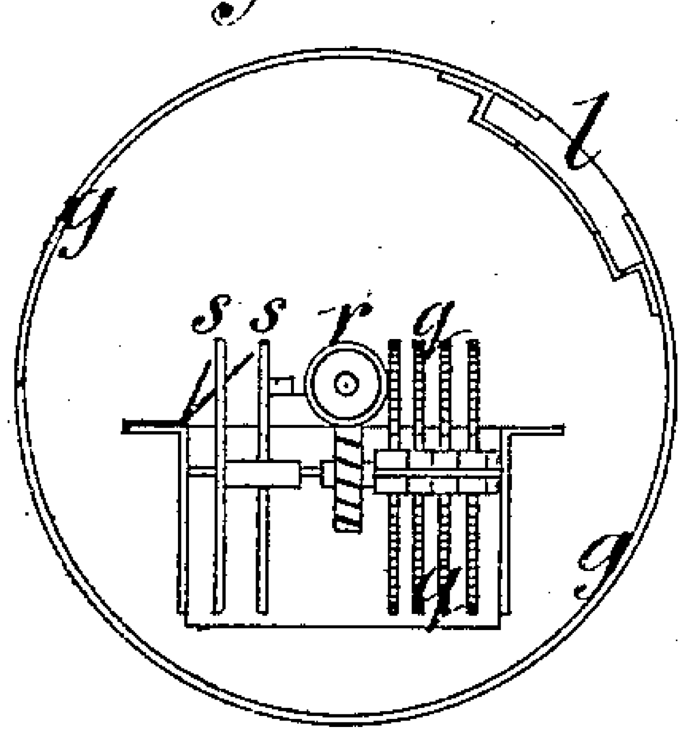


Fig:4.



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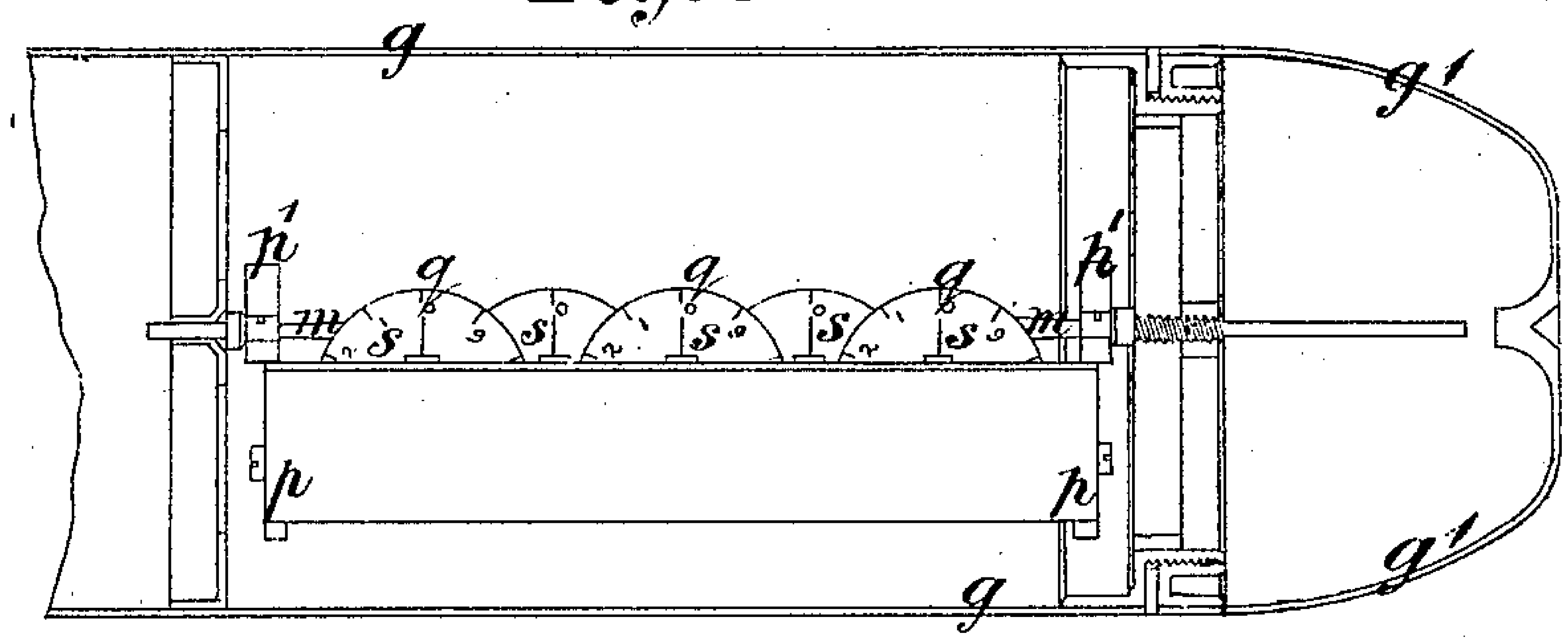
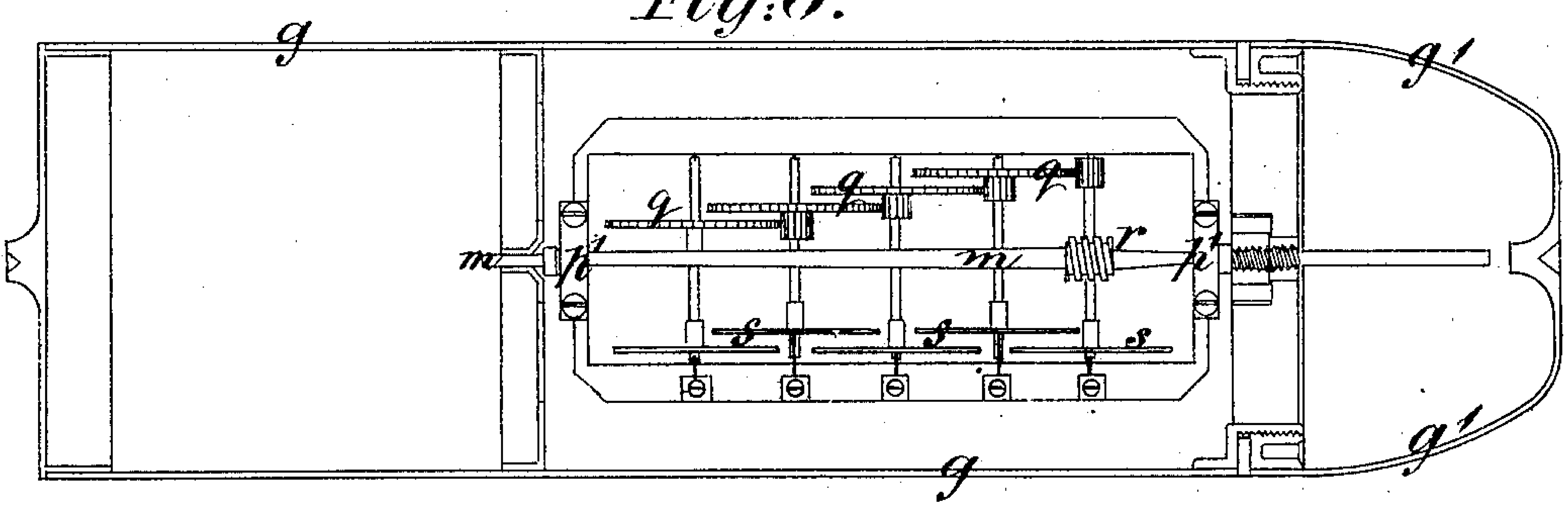


Fig:6.



Witnesses
H. H. Young
F. Stich

B. T. Moore Inventor

By his Attorney
Wm D. Baldwin

B. T. MOORE.

Ship-Log.

No. 169,024.

Patented Oct. 19, 1875.

Fig:1.

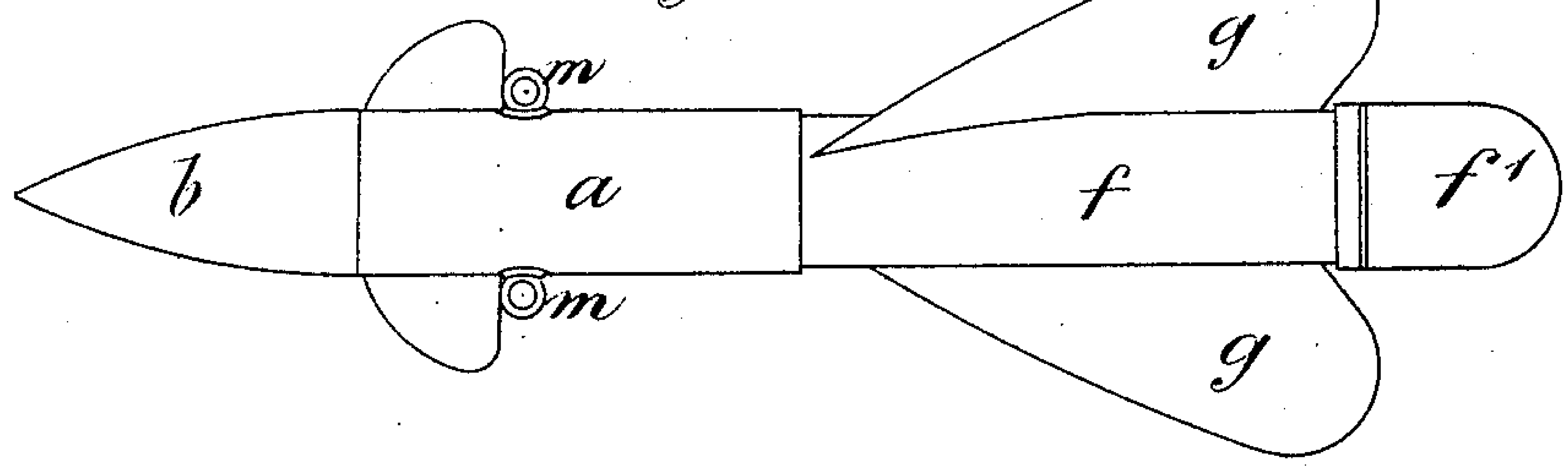


Fig:2.

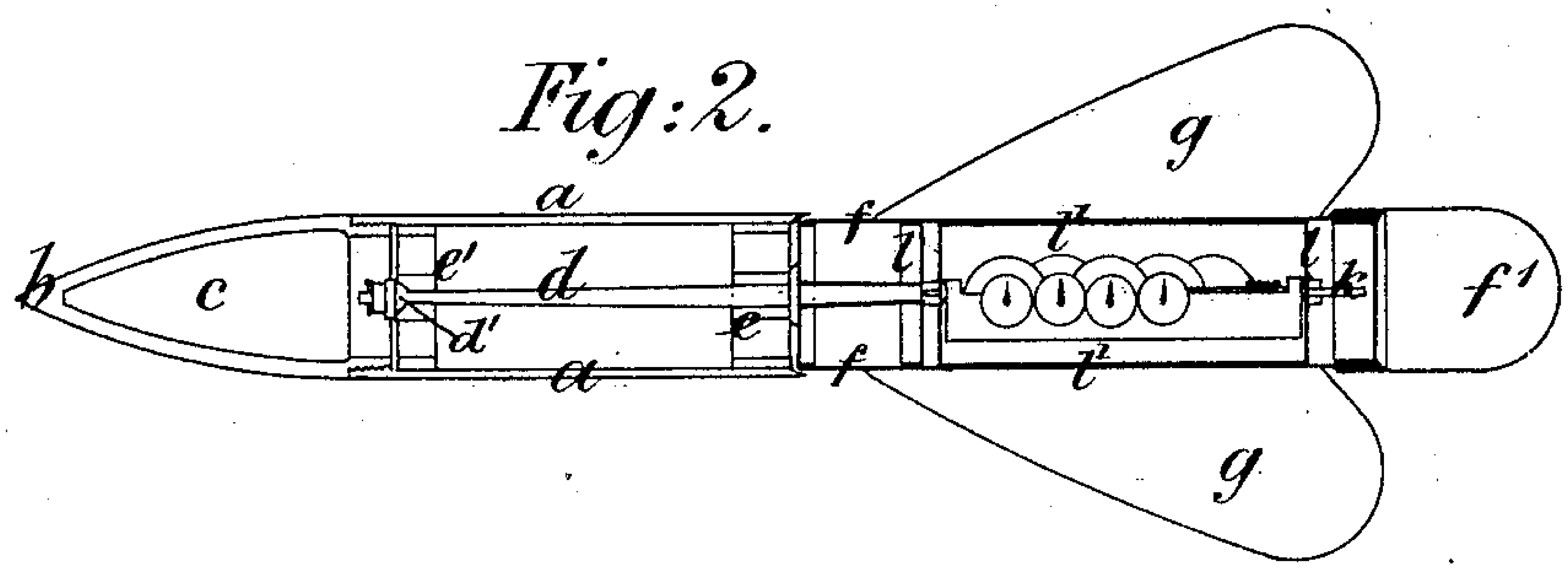


Fig:3.

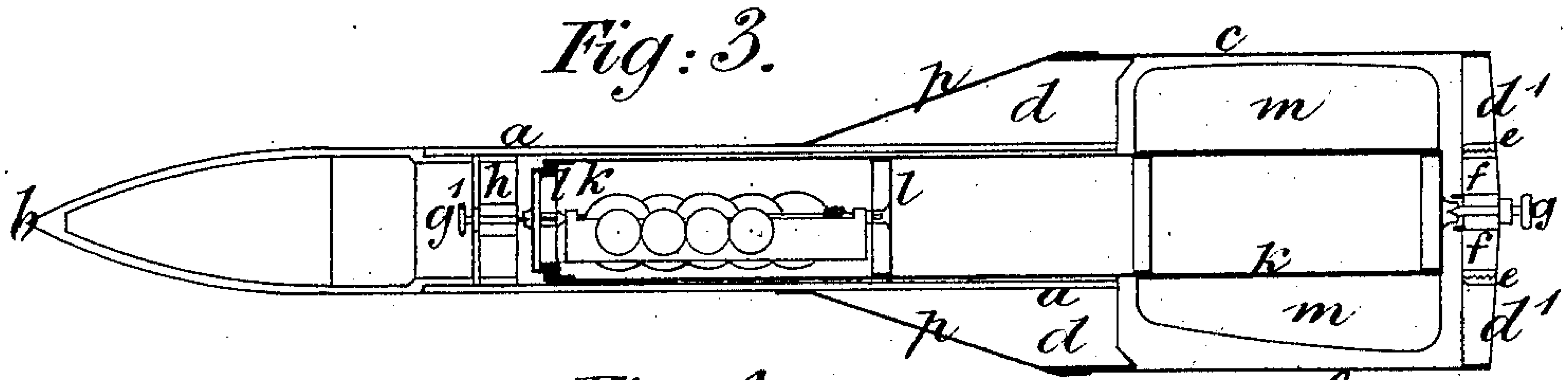


Fig:4.

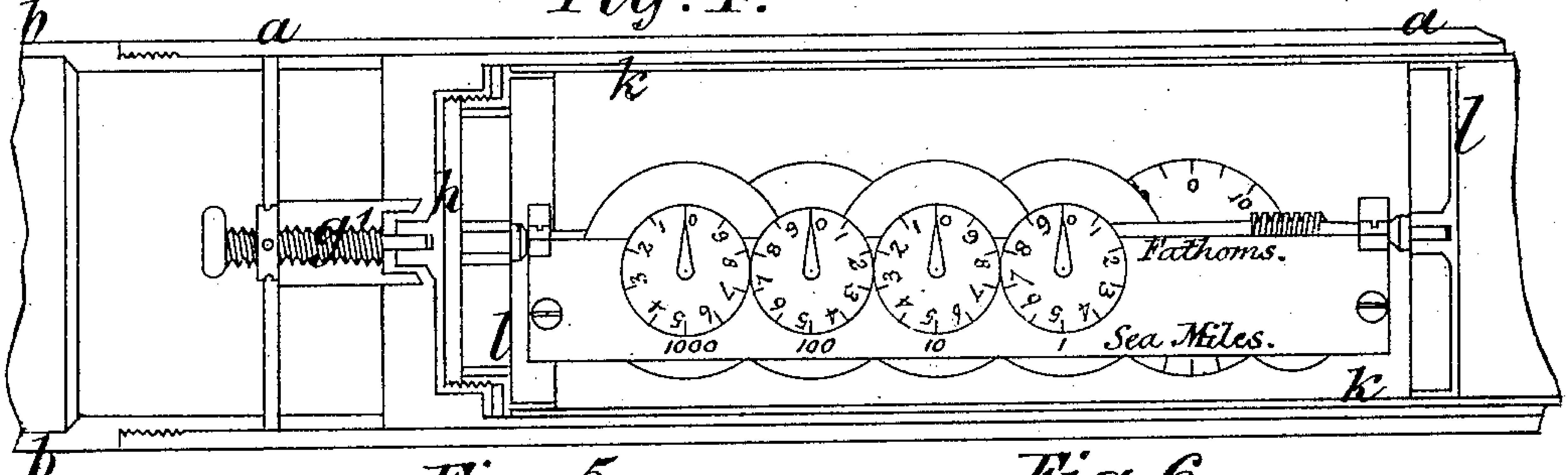


Fig:5.

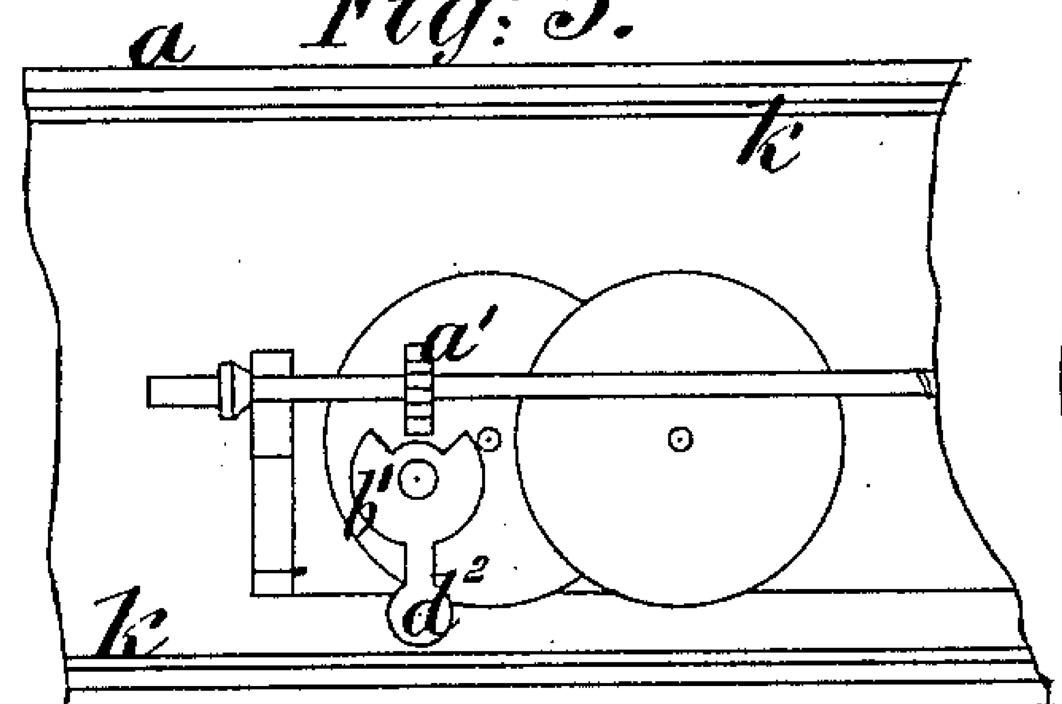
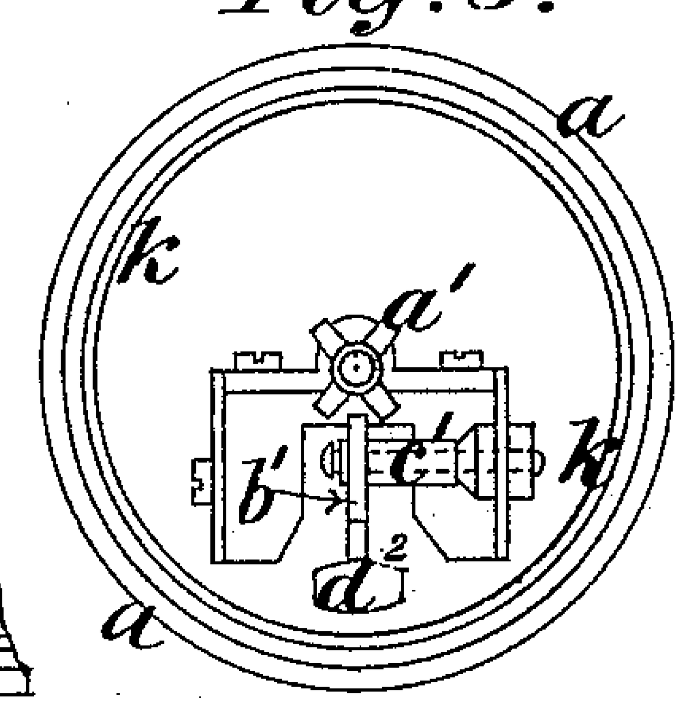


Fig:6.



Witnesses
H. H. Young
F. Hill

B. T. Moore Inventor

By his Attorney Wm D. Baldwin

3 Sheets--Sheet 3.

B. T. MOORE.

Ship-Log.

No. 169,024.

Patented Oct. 19, 1875.

Fig: 1.

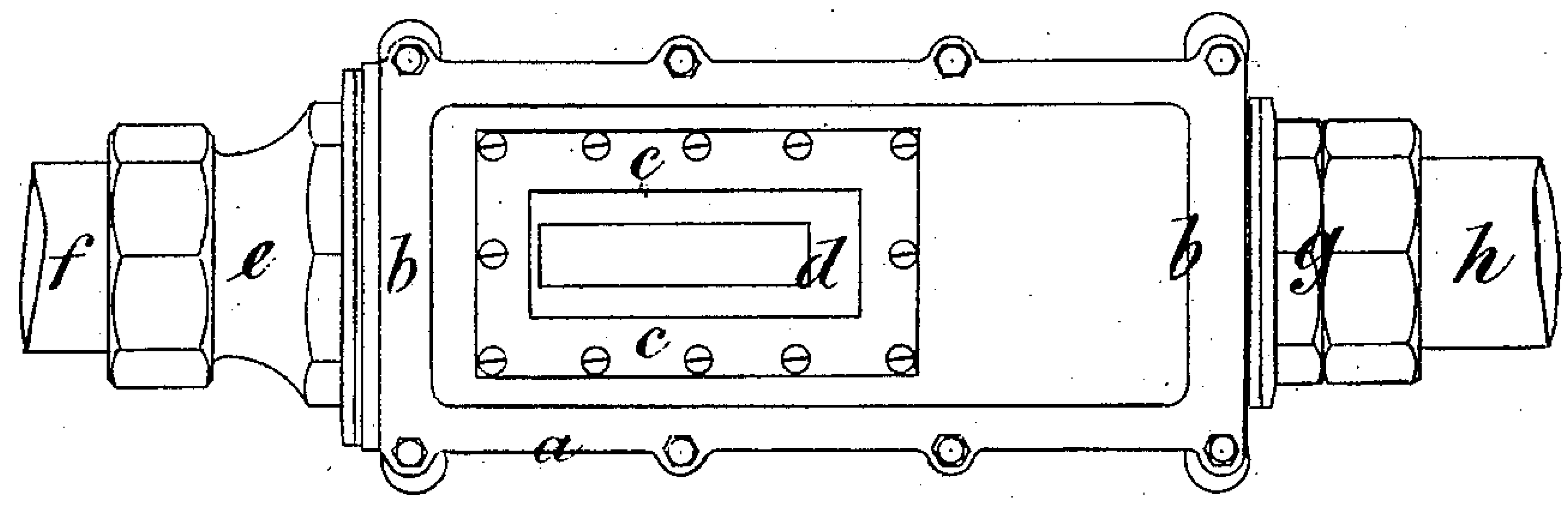


Fig: 2.

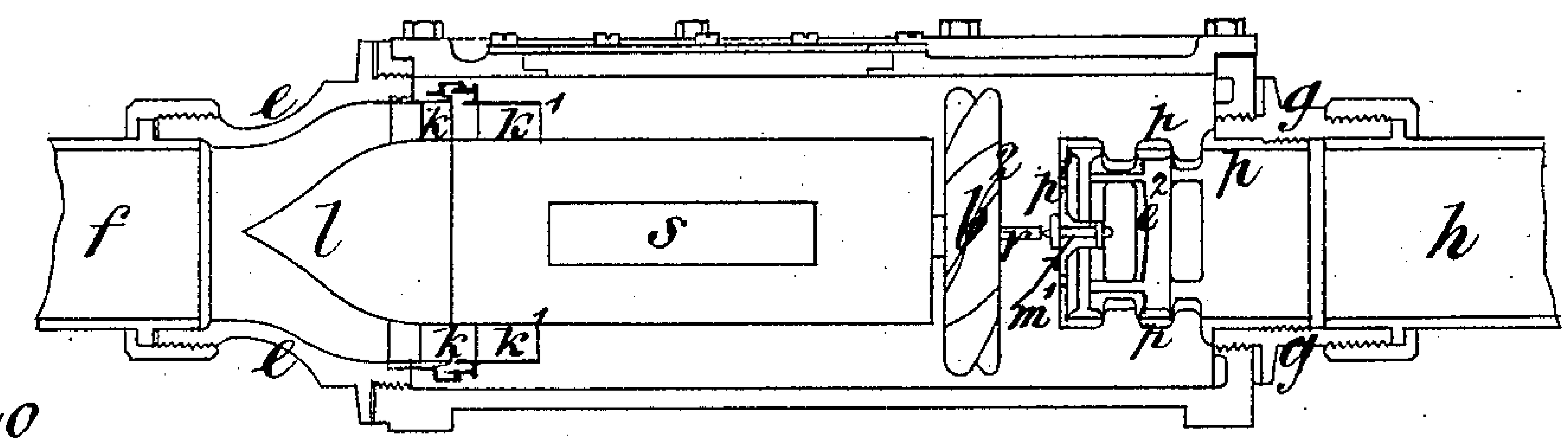


Fig: 3.

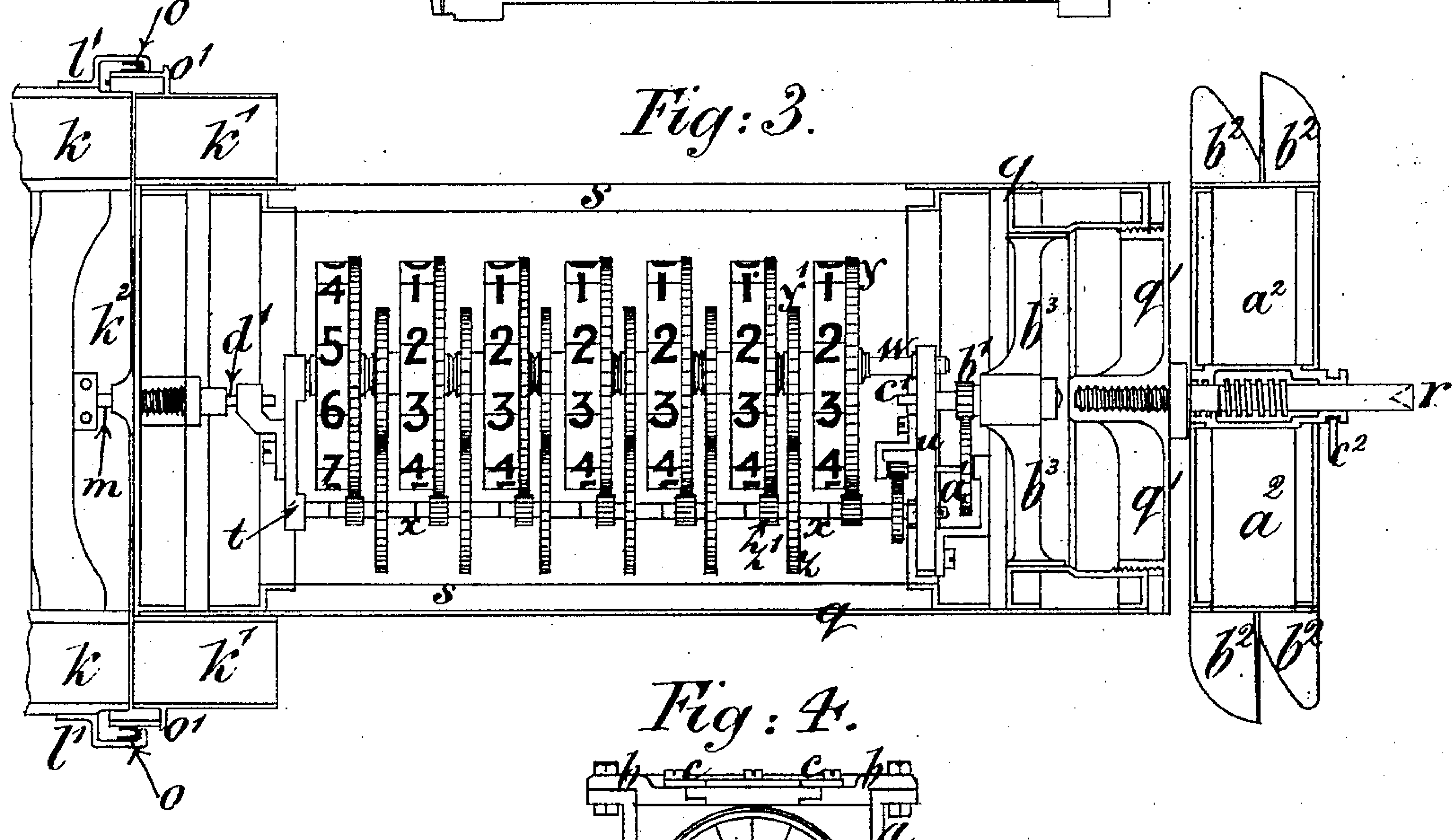
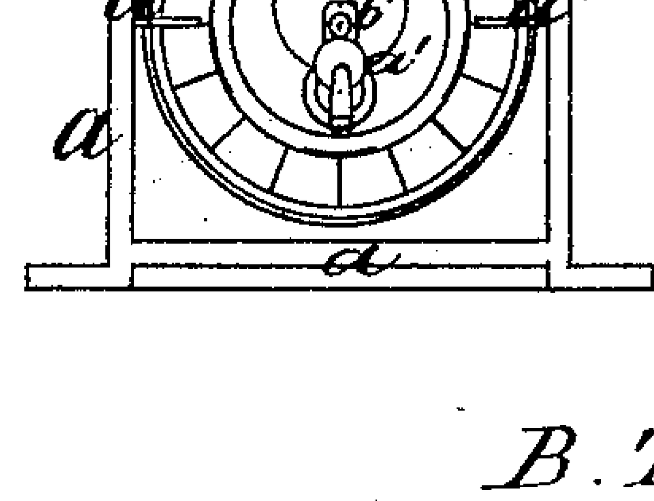


Fig: 4.



Witnesses

H. H. Young

F. Stith

B. T. Moore Inventor

By his Attorney

Wm. D. Baldwin

N. PETERS, PHOTO-LITHOGRAPHER, WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

BENJAMIN THEOPHILUS MOORE, OF ELM LODGE, SPRING GROVE, ISLEWORTH, ENGLAND.

IMPROVEMENT IN SHIPS' LOGS.

Specification forming part of Letters Patent No. **169,024**, dated October 19, 1875; application filed February 20, 1875.

To all whom it may concern:

Be it known that I, BENJAMIN THEOPHILUS MOORE, of Elm Lodge, Spring Grove, Isleworth, in the county of Middlesex, England, civil engineer, a subject of the Queen of Great Britain, have invented or discovered new and useful Improvements in Current-Meters, Water-Meters, and Ships' Logs; and I, the said BENJAMIN THEOPHILUS MOORE, do hereby declare the nature of the said invention, and in what manner the same is to be performed, to be particularly described and ascertained in and by the following statement thereof—that is to say:

This invention has for its object improvements in current-meters, water-meters, and ships' logs.

I employ, in the first place, a hollow cylindrical case, free to move about pivots at its extremities in the line of its axis. This hollow case is water-tight, and contains within itself a small frame-work, which carries a train of wheels. This frame-work is suspended from an axle, or upon pivots within the case, and fixed to it, and the train of wheels is connected, by an endless screw, a toothed wheel, or otherwise, with the axle or pivot, or with the case, so that when the case is made to rotate the train of wheels is set in motion, the frame-work, carrying all the wheels of the train, remaining at rest, or nearly so. Thus the number of rotations of the case can be registered by the train of wheels within it. The case is made of metal or glass, or a combination of metal and glass, so that the wheels can be seen within without opening the case. The case is provided with screw-blades on its outside, which, when acted upon by water in motion relative to the case, cause it to rotate.

In the current-meter I support the case in a light frame provided with a rudder-like tail, and suspended by a stirrup and chain in such a manner that it will balance and remain horizontal, or nearly so, in still water.

When the machine is lowered into running water it takes a position, owing to its being suspended so as to balance, such that the axis of the revolving case is in the same direction as the stream. Thus the train of wheels registers the speed of the current at any depth to which the machine may be lowered. The machine is provided, moreover, with a brake, by which the rotation of the case can be started or stopped at any instant while under water. This brake consists of a spring, which presses against the exterior of the case.

When the machine has been lowered it is started by relieving the pressure of the brake on the case by tightening a line passing from it to the hand of the operator, and when the machine has run the time during which it is desired to continue the experiment the line is released, and the brake again comes in contact with the case and stops its rotation.

For the ship-log the framing may be dispensed with, the spindle being attached, by a swivel-joint, to the log-line; but a better arrangement consists in mounting the rotating spindle inside a frame or hollow cylinder, open or partially open, and provided with a tail or rudder and blades to prevent rotation of the outer cylinder.

For the water-meter I place the rotating cylinder or case within a water-tight box, into which the water passes by a pipe at one end, and out again by a pipe at the other.

The revolving case is in a horizontal position, and the box is provided with a plate of glass at the top, through which and the water the registering-wheels can be seen. To make all the water act upon the blades of the case I inclose them within a case, which extends either to the entrance or exit pipe. I also employ blades fixed within the box, against which the water impinges. I further employ a tell-tale or detecter, so arranged that, if by any accident the case should stop or be retarded, and so not register the water passing through the box, the tell-tale immediately begins gradually to close a valve, which prevents the passage of the water. Attention is thus drawn to the meter. I effect this by placing on the axle of the revolving case, and outside it, a small, light wheel, with screw-blades, which is in loose connection with a valve. On the axle is a screw-thread, and within a portion of the travel of the wheel is a corresponding thread. So long as the case revolves properly this small wheel revolves with it at the same or a slightly less rate, and the valve is not affected; but if the case stops or is retarded, the wheel immediately engages the screw on the axis of the case, and begins to close the valve.

In order that my said invention may be most fully understood and readily carried into effect, I will proceed to describe the drawings hereunto annexed.

On Sheet 1 is represented a current-meter constructed according to my invention. Figure 1 is a side elevation. Fig. 2 is a front elevation. Fig. 3 is a plan of the upper side. Figs. 4 and 5 are transverse and longitudinal sections of the revolving cylinder, showing the machinery; and Fig. 6 is a horizontal section of the revolving cylinder, showing the machinery in plan.

a a a is the outer non-rotating frame, consisting of three flat bars—two horizontal and one vertical. *b* is a shield, cylindro-conical in form, to which the bars *a* are all secured. *c* is a band, semicircular in form, which unites the three bars *a* near the middle of their lengths. This band *c* carries two studs or pivots, *d*, about which the whole instrument can turn when suspended by a balancing-support composed of a handle or stirrup, *e*. c^1 c^1 are brackets, which also connect the three bars *a* near their rear end, thus completing the non-rotating frame. *f f* are horizontal and vertical thin plates, firmly attached to the frame *a a a*. *g* is a hollow cylinder, with a dome-shaped cover, *g′*, which screws onto the end of it, forming a water-tight case. This case is free to turn upon two pivots, *h h*, the back pivot *h* being adjustable and fixed by a guiding-nut, h^1. The case *g* is provided with screw-blades *k k k*. At its front end it has a water-tight window of glass, *l*. Within the case is a small spindle, *m*, with its axis coincident with that of the case. This spindle turns with the case when the case revolves. From this spindle *m* a light frame, *p*, is suspended from two bearings, *p′*, at its ends, so that when the case *g* and spindle *m* revolve together this frame *p* remains at rest, or nearly so, the weight of the frame and wheels, and of the wheels which it carries, tending to keep it below the spindle. *q q q* is the train of wheels, all of which are placed within this frame, the first wheel being connected by a worm-wheel with an endless screw, *r*, upon the spindle *m*. When the case *g* is made to rotate upon its bearings *h* this train of wheels is thus set in motion, and the number of rotations is indicated by the revolving dials *s*. These dials are seen through the glass window *l*, without the necessity of opening the case.

The instrument is suspended by the handle or stirrup *e*, the pivot *d* being placed in such a position that in still water the axis of the revolving case hangs horizontally and the instrument in stable equilibrium. *t* is a spring, fixed to the frame *a* by a screw. It embraces firmly a portion of the cylinder *g*, acting upon it as a friction-brake, and preventing its rotation. At the top of the handle *e* is a swivel, *u*, to which a cord can be attached. *w* is a projecting piece, with a small hole in it, through which a fine line or cord, *x*, passes, and which is attached to the end of the spring *t*. This cord *x* has a stop, *y*, upon it, which prevents the spring being overstrained when the cord is drawn up, as will be afterward explained.

The method of using the instrument is as follows: A cord is attached to the swivel *u*, of sufficient length to lower the instrument to the depth required, and another lighter cord is attached to the ring *z* at the end of the cord *x*. When the instrument is at the required depth, the running water, acting upon the plates *f f*, immediately causes the instrument to place itself, with the axis of the case *g*, parallel to the stream. The time then being noted, the spring *t* is disengaged from the cylinder *g* by drawing up the lighter cord, when the running water, acting on the screw-blades *k*, sets the cylinder *g* in rotation with an angular velocity, proportional, or nearly so, to the velocity of the stream at the depth in question. The instrument is stopped again, at any instant, by letting go the spring *t*.

The reading of the dials is noted before the instrument is lowered into the water, and again after it is drawn up, the difference giving the number of rotations in the observed time, and from this the velocity of the stream is immediately found, when the rate of the instrument is known.

The first dial indicates ten revolutions of the cylinder; the second, a hundred; the third, a thousand, and so on—the whole train registering a hundred thousand revolutions.

On Sheet 2 are shown ships' logs constructed according to my invention. Fig. 1 is a plan; and Fig. 2 is a longitudinal vertical section, showing the machinery in elevation.

a a is a strong non-rotating tube of brass, with a pointed cover, *b*, screwed into the front of it. This cover is filled, or partially filled, with lead, *c*. A strong spindle, *d*, turns in bearings *e* and e^1, fixed to the tubular frame *a*. To this spindle a hollow tube, *f*, is firmly attached. This tube has a cover, *f′*, screwed into it, and the case is made water-tight throughout. It is provided with four or more screw-blades, *g*. A frame, containing a train of wheels similar to those of the current-meter, is suspended from a spindle, *k*, which is supported by two disks, *l* and *l*, connected together by two bars, *l′ l′*. The disks *l* fit the case *f* water-tight, like a piston, and the whole frame slides into the case *f* when the cover *f′* is removed. This case may be provided with glass, as a current-meter. When the log is drawn through the water, the blades *g* cause the case *f* to rotate about its axis, and the wheel-work is set in motion in the same manner as in the current-meter. The blades and wheel-work are so adjusted that the first dial indicates one sea mile; the second, ten, and so on for each revolution.

The pull upon the spindle *d* is sustained by a conical collar, d^1, at its front end, to which it is secured by a nut and cotter. The friction caused by the pull between the collar d^1 and the bearing e^1 may be reduced by using friction-rollers; but I prefer to overcome this friction by increasing the power of the blades *g*.

This log may be drawn by a ring attached to its front end, as is usual, or any other simple swivel-like connection may be made between the log-line and the spindle; but I make use of a balancing-support consisting of two rings or eyes, *m m*, attached to the non-rotating frame or supporting-tube *a* in such position that when the log is suspended from them in still water, its axis will be horizontal, as in the current-meter. By this arrangement the log has not the same tendency to rise to the surface as when drawn from the front, but will travel at some depth below the surface.

By using two flat blades or rings fixed to the tube *a*, and inclined slightly downward toward the front, the log may be made to travel at a still greater depth below the surface.

Fig. 3 represents a longitudinal section of a log with protected blades. Fig. 4 is a portion of the log, showing the machinery in elevation. Figs. 5 and 6 are sections of the same, showing the self-acting gear for starting and stopping the wheel-work when the protected log is used as a deep-current meter.

a a is a strong non-rotating case or tube, with pointed end *b* screwed into it, and filled, or partly filled, with lead. This tube *a* is rigidly connected with a larger and lighter tube, *c*, by four strong bars, *d*, at right angles to each other, and a similar cross-frame, d^1, is fixed to the end of it. This frame terminates in a ring, *e*, into which another ring with cross-bars, *f*, can be screwed. This frame *f* carries a pivot, *g*, screwed into it, and a corresponding pivot, *g′*, is screwed into a ring-frame, *h*, fixed inside the tube *a* near its front end. A tubular case, *k k*, water-tight, and strengthened by diaphragms *l l*, rotates about these pivots *g* and *g′* clear of the outer tube *a*. This case *k* contains a frame and wheel-work, as before described, and is set in rotation by screw-blades *m* and *m* when the log is drawn through the water. Any number of blades may be used, but I prefer five or more. The tube *a* has a sliding or hinged shutter, and the case *k* a glass window, similar to that in the current-meter, the shutter and glass being so arranged that the dials can be seen through the glass when the shutter is opened. This log is drawn opposite the opening. This log is drawn through the water in the same manner as before. The blades *m* are attached to a tube, which slides over the case *k*, and is prevented from rotating upon it by a pin. When the frame *f* is removed the case *k* can be drawn out through the ring *e*, leaving the blades within the cylinder *c*. *p p* is a truncated hollow cone slipped over the front end of this log, and resting against the four arms *d*. This cone is perforated all over, so as to allow water to pass freely through the tube *c c*, but to throw off weeds or other floating matters which may impinge against it.

The instrument shown in Figs. 3 and 4 is intended to be used as a deep-sea current-meter as well as a log. For this purpose the case *k* is made very strong, and without a glass window, and it may be filled with oil or other liquid to prevent collapse. The same blades and the same machinery are employed. As it is important that the instrument, when used as a deep-sea current-meter, should not register the rotation of the case *k* while it is descending in the water, or while being drawn up, I stop the motion of the wheel-work in the following manner: On the spindle which supports the frame containing the wheel-work I fix a small wheel, a^1, Figs. 5 and 6, having a few coarse teeth. Immediately below this wheel a^1 is a small disk, b^1, attached to a boss, c^1, which turns freely upon a pivot secured to one side of the suspended frame. This disk is weighted on one side by a bob, d^2, and hangs on the pivot like a pendulum. The opposite part of the disk is cut away, as shown in Fig. 5, so that the wheel a^1 may rotate freely when the instrument does not deviate considerably from the horizontal.

When, however, it is descending in the water, or being drawn up, its axis is so much inclined from the horizontal that the disk, in either case, passes between the teeth of the wheel *a*, and the frame which carries the wheel-work thus becomes locked to the spindle, and rotates with it and with the case *k*, and the wheel-work does not register.

When the descent of the instrument is stopped, it immediately becomes horizontal, or nearly so, the disk b^1 is disengaged from the wheel a^1, and the wheel-work is set in motion.

This mechanism for starting and stopping the instrument may also be applied to the current-meter, (shown on Sheet 1 of the drawings,) the spring-brake being dispensed with.

On Sheet 3 of the drawings there is shown a water-meter constructed according to my invention. Fig. 1 is a general plan of the box with glass window in cover. Fig. 2 is a vertical longitudinal section, showing internal arrangements generally. Fig. 3 is a vertical section of revolving cylinder with machinery and tell-tale. Fig. 4 is a transverse section through glass-cylinder.

a a a is a strong box of cast-iron, tinned inside (or otherwise) to protect it from rust; *b*, a water-tight cover, having an aperture, *d*, in which is a thick plate of glass, secured to the cover by the frame *c*, and water-tight. *e* is a short connecting-piece, screwed water-tight into the box *a*, and connected with the supply-pipe *f*, as shown in the drawing. *g* is another short connection, screwed water-tight into the opposite end of the box *a*, and connected with the delivery-pipe *h*, as shown in the drawing. A stop-valve, strainer, and dirt-box are connected with the pipe *f*, as usual in water-meters, and the pipe *h* has also a stop-valve connected with it. These are not shown in the drawings. k is a frame, consisting of two concentric rings connected together by blades, afterward described; and k^2 is a bar, which supports the pivot m in the center of these rings. l is a shield or cut-water, which causes all the water to pass between the two rings k. p is a cylinder, screwed into the tube g, having eight or other number of openings for the passage of water, and a cover, p', screwed upon the end of it. This cover supports a pivot, m', exactly opposite the pivot m. A cylindrical case, q q, having a cover, q', screwed into one end, and a spindle, r, attached to this cover, is supported on the pivots m and m', about which it can rotate freely. This case has a glass tube, s, let into it, leaving five or more openings, as shown, and is water-tight both where the glass is attached and at the cover q'.

Within this case a frame and train of wheels may be placed, as in the current-meter, the dials, in this case, having their faces horizontal, so as to enable them to be seen from above through the glass plate d and the glass cylinder s. By means of these dials the number of revolutions of the cylinder q may be counted.

But for the water-meter I prefer another arrangement of the machinery, which I will now describe. t and u are two bars, to which two parallel spindles, w and x, are firmly attached at their ends. w carries a series of wheels and disks, and x a series of wheels and pinions. The first of these disk-wheels, y, is rigidly connected with the wheel y', but not with the second disk-wheel, and the wheel z and pinion z' are attached to the same short tube which rides loosely on the spindle x, and the same arrangement holds good for all the other disks, wheels, and pinions in the series. a^1 is a small wheel and pinion, which connects the series of wheels and pinions just described with another pinion, b^1. This pinion b^1 is part of a bearing or pivot, c^1, which supports one end, u, of the frame, the other end being supported by a pivot, d^1, attached to the end of the cylinder q. The axes of these pivots c^1 and d^1 coincide with the axis of the case q, c^1 being supported by a movable bar, b^3.

The frame, with the machinery just described, turns freely upon the pivot c^1 and d^1, and remains at rest, or nearly so, when these pivots are caused to rotate by the rotation of the case q upon its bearings at m'; and m but the wheel a^1 being in gear with the pivot b^1, the whole of the wheel-work is then set in motion. The wheel-work is so arranged that the first disk makes ten revolutions for one of the second, the second ten for one of the third, and so on. The case q has a series of blades, k^1, inclosed by an outer ring. The water, passing between the rings k, is diverted by a series of fixed blades, which cause it to impinge upon the blades k^1, by which the case q is set in motion. In order to make all the water pass through these blades an elastic water-tight joint is employed. This consists of a trough-like flange, l', fixed to the outer of the rings k. A fine ring, o, is placed within this flange, and is pressed tightly against a projecting plane surface, o', upon the ring, which incloses the blades k^1 by spiral or other springs, (not shown in the drawing,) and the water is prevented from passing between this ring o and the case l' by a cupped leather ring, as shown in Fig. 3. The pressure of the water on the back of the ring o renders this joint more secure. The blades k^1 are so constructed, and the wheel-work so adjusted, that when the cylinder q is set in motion, by water passing through the meter, the first wheel y makes one revolution for every ten gallons, the second one for every one hundred, and so on. The reading of these wheels is distinctly visible through the glass plate d and the glass cylinder s, while the latter is in rotation.

In the event of any accident happening to the meter, whereby the rotating cylinder q might be stopped, the water would flow through without registration. To prevent this I employ a small hollow cylinder, a^2, provided with screw-blades b^2, which rides loosely upon the spindle r, upon which a screw-thread is cut, and a corresponding thread is formed in the nave of the cylinder a^2. A curved cross-head, c^2, has two small rods attached to it, which pass through small holes in the cover p' of the cylinder p, and are rigidly connected with an equilibrium-valve, e^2, fitting easily inside the cylinder p. The blades b^2 are so formed that the cylinder a^2 shall rotate in the same direction as the case q, but with less angular velocity. When, however, the case q stops, or its rotation is much retarded, the cylinder a^2 continues to rotate, and engages the screw upon the spindle r, and thus moves slowly away from the case q, moving the valve e^2, so as to prevent the passage of the water through the openings in the cylinder p. Attention is then drawn to the meter. This small rotating cylinder and valve are not essential parts of this water-meter. It may be omitted altogether, the spindle r being made much shorter, and the pivot m' supported by a bar attached immediately to the tube g. a^3 are straight water-guides. These guides prevent the rotation of the water after it has passed through the blades k and k^1.

From the foregoing description it will be seen that the current-meter, ship's log, and water-meter are each provided with a water-tight case, having a removable cover or section to afford access to the interior, which case is caused to revolve by external blades or screws, upon which the water acts, and has removably suspended within it a frame carrying all the wheels of a train of counting-wheels and their dials, thus admitting of the removal of the wheels and dials in a body for inspection, repair, &c., and of their replacement, without disturbing their relative positions or working order in the pendulous frame.

Having thus described the nature of my

said invention, and the manner of performing the same, I would have it understood that I claim—

1. The combination of the removable pendulous frame, the train of counting-wheels and dials, all carried by said frame, the water-tight case, in which the frame is suspended, and the blades for rotating the case and setting the wheels in motion, these members being constructed and operating substantially as set forth, whereby all the wheels and dials of the train remain, while in operation, in a corresponding state of equilibrium relatively to the revolving case, and may readily be removed from, or placed in, the case without disturbing their relative positions in the frame.

2. The combination, substantially as hereinbefore set forth, of the non-rotating frame or case, the revolving water-tight case, the counting-wheels, and their supporting-frame, suspended within the revolving case.

3. The combination, substantially as hereinbefore set forth, of the water-tight revolving case, its suspended counting-wheels, the non-rotating frame or outer case, and the balancing suspending-support, for the purpose specified.

B. T. MOORE.

Witnesses:
WILMER M. HARRIS,
JOHN DEAN,
Both of No. 17 *Gracechurch St., London, E. C.*