(No Model.) 5 Sheets—Sheet 1.

A. WRIGLEY & J. HOPE.

SHIP'S COURSE RECORDER.

No. 465,308. Patented Dec. 15, 1891.

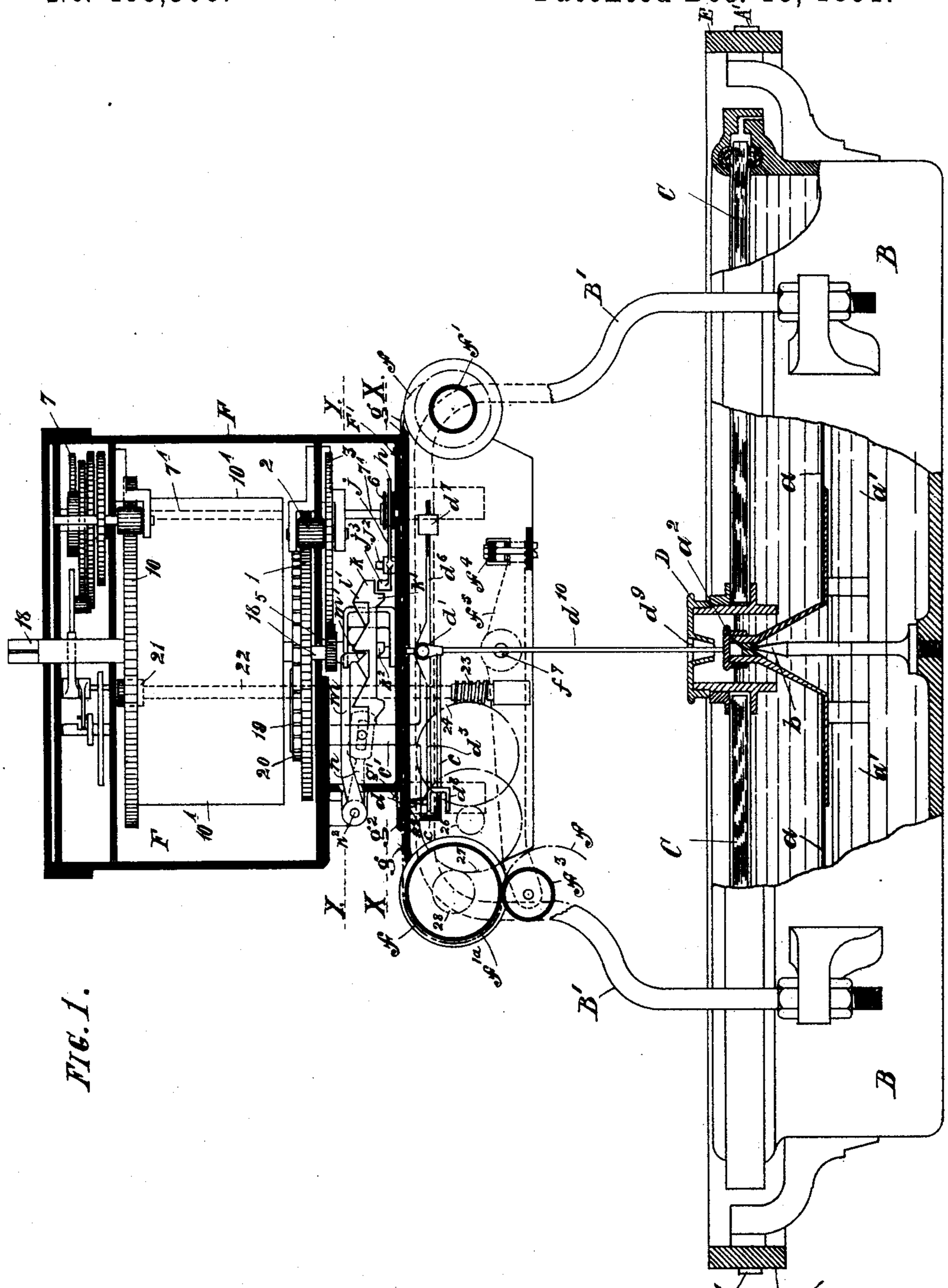

FIG. 1.

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(No Model.) 5 Sheets—Sheet 2.

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FIG. 3.

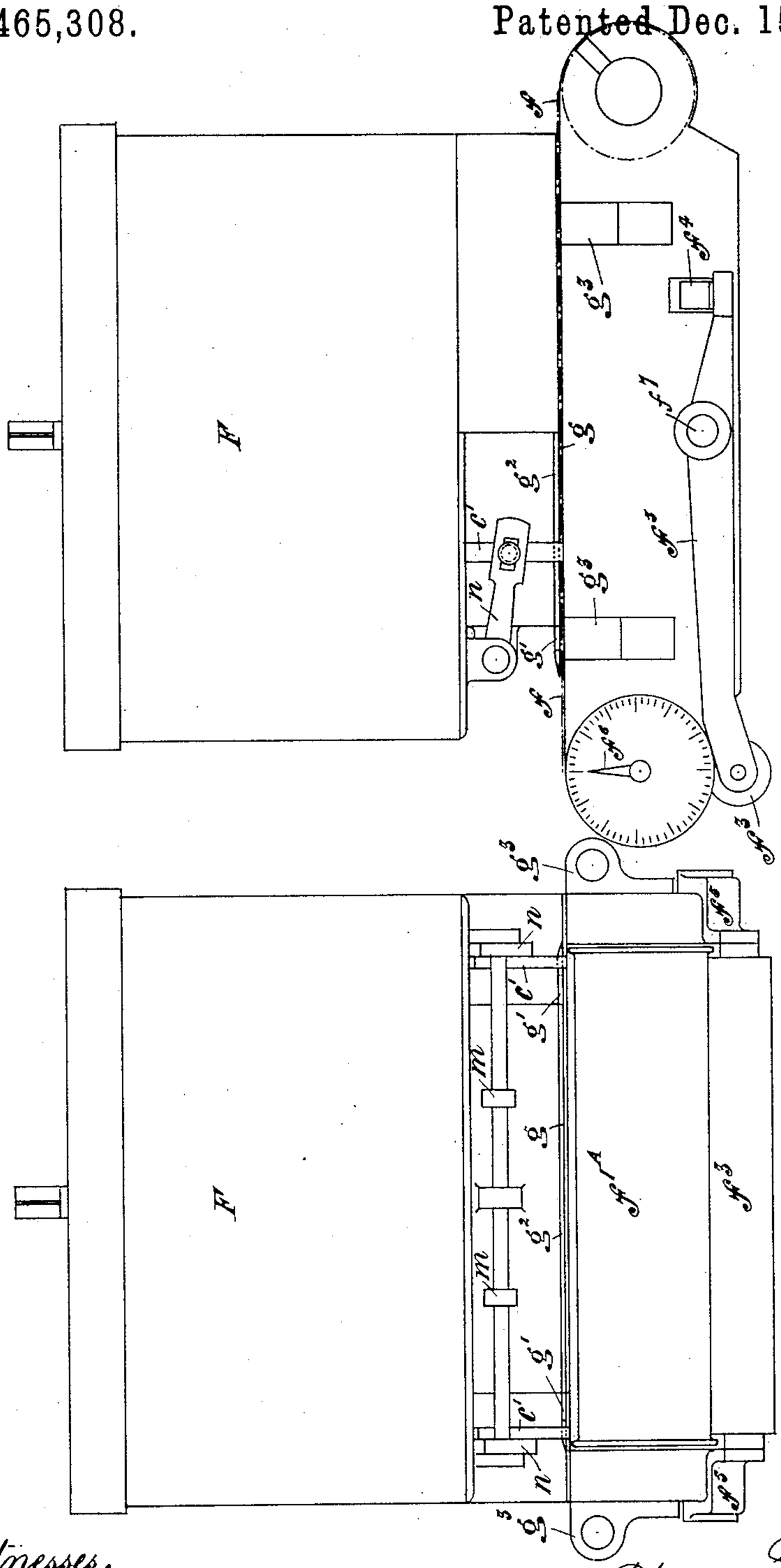

FIG. 2.

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FIG. 5.

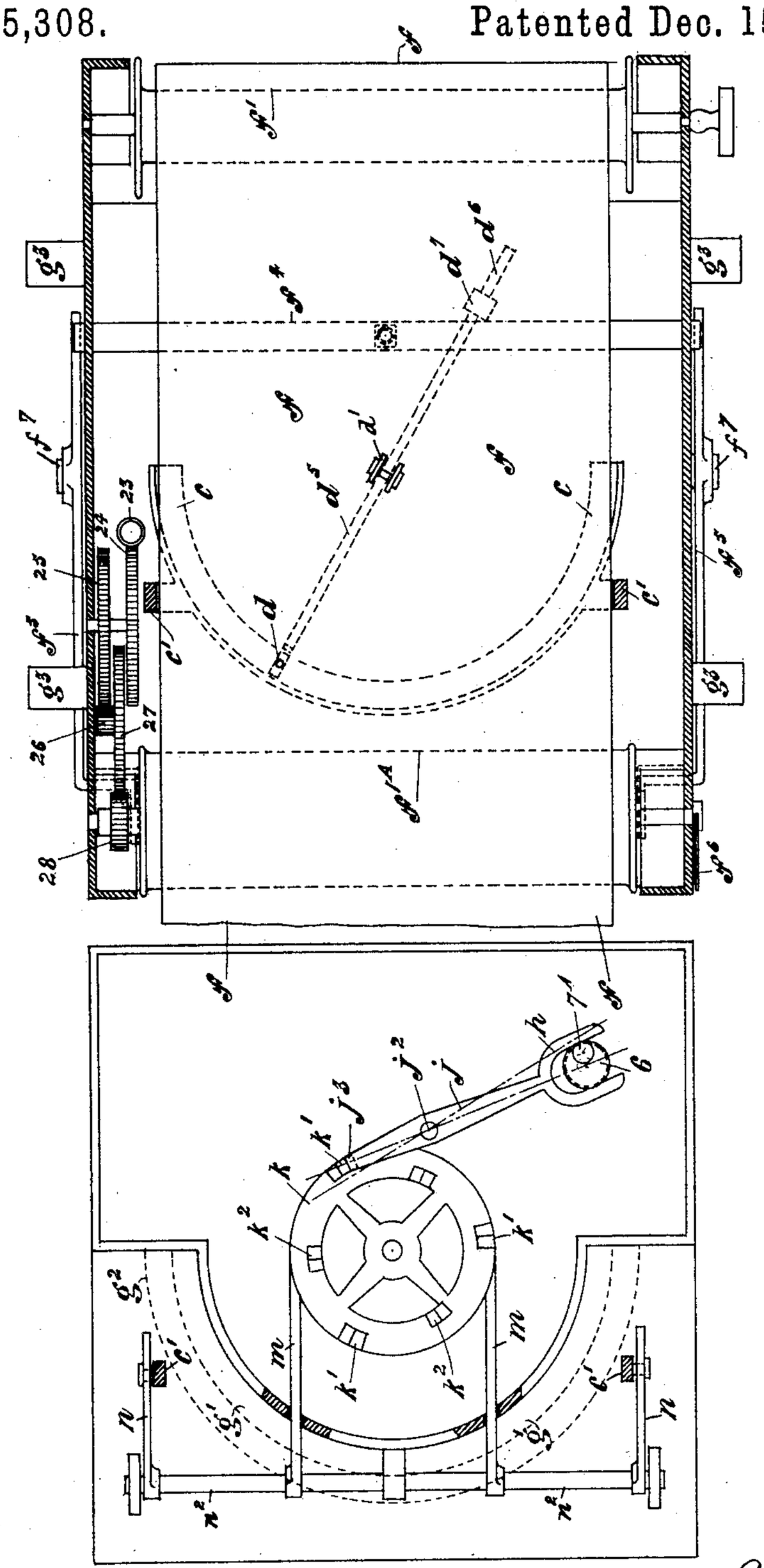

FIG. 4.

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(No Model.) 5 Sheets—Sheet 4.

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FIG. 8.

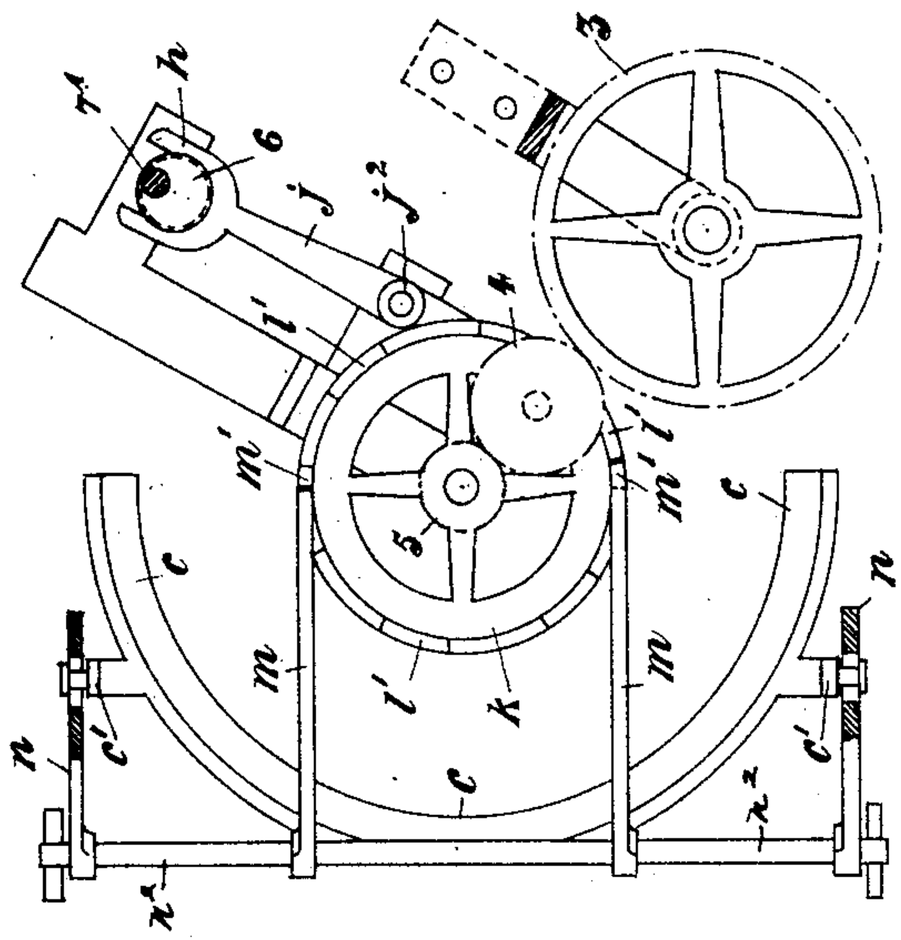

FIG. 6.

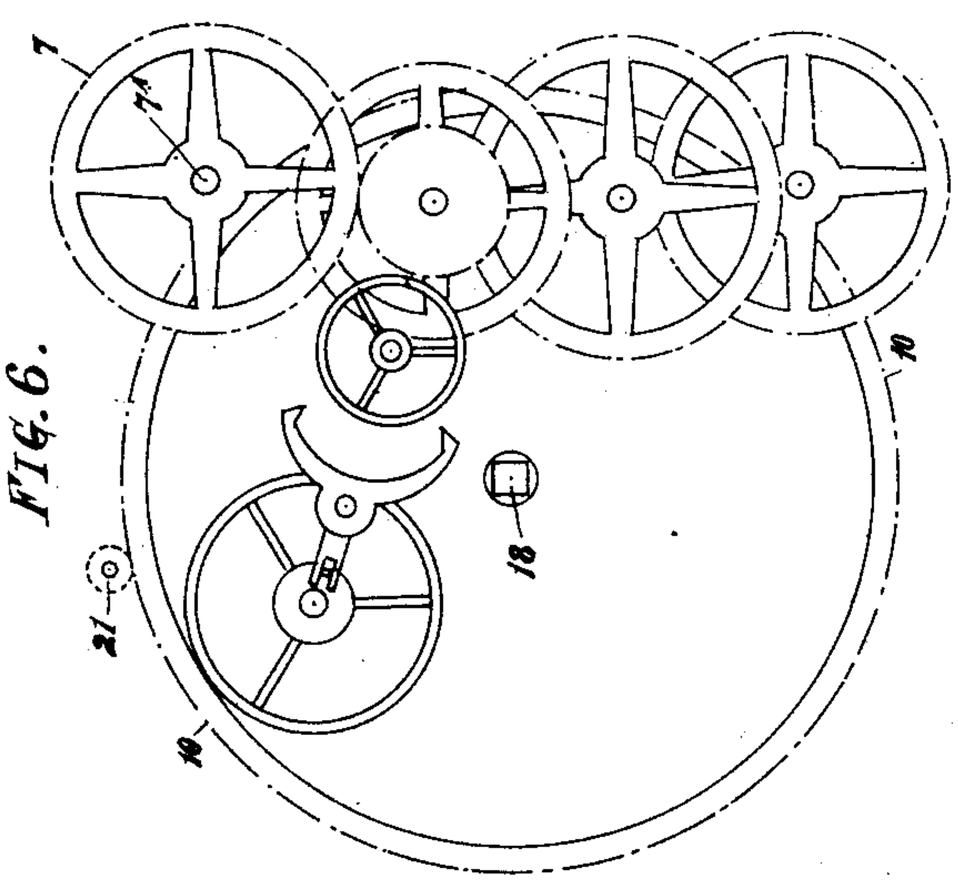

FIG. 7.

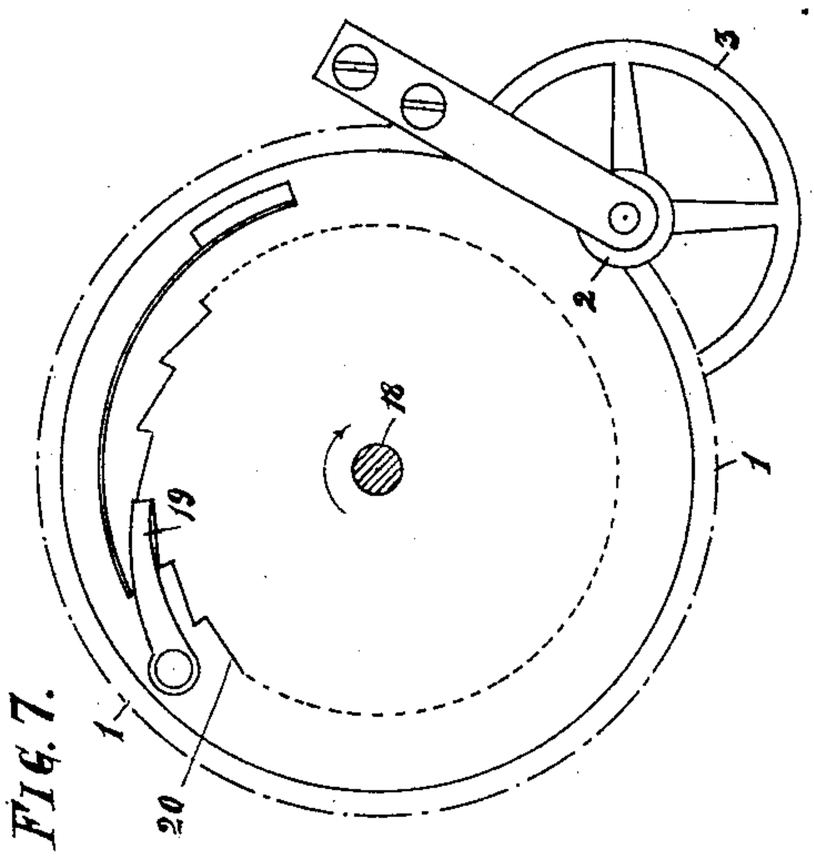

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FIG. 9.

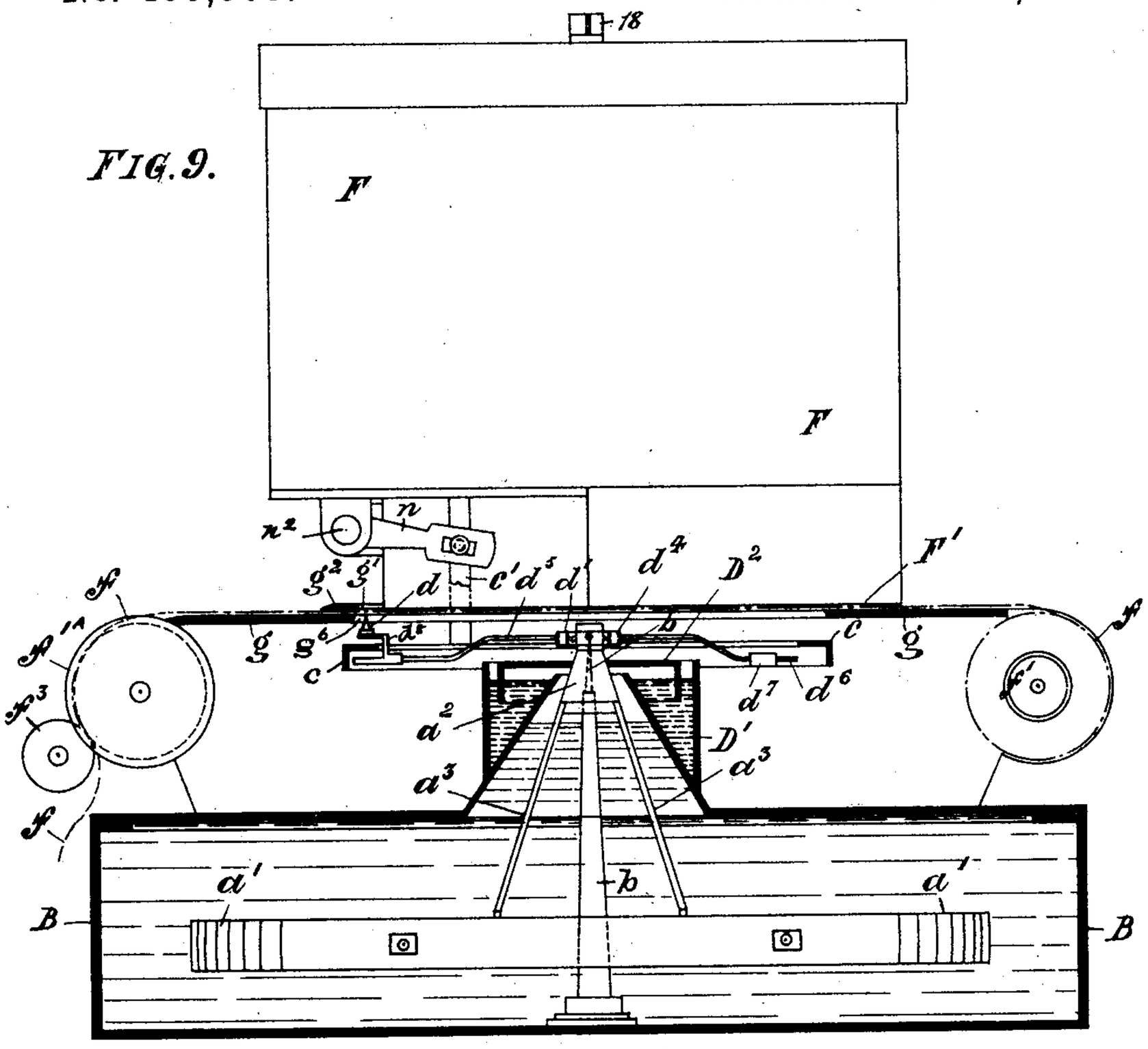
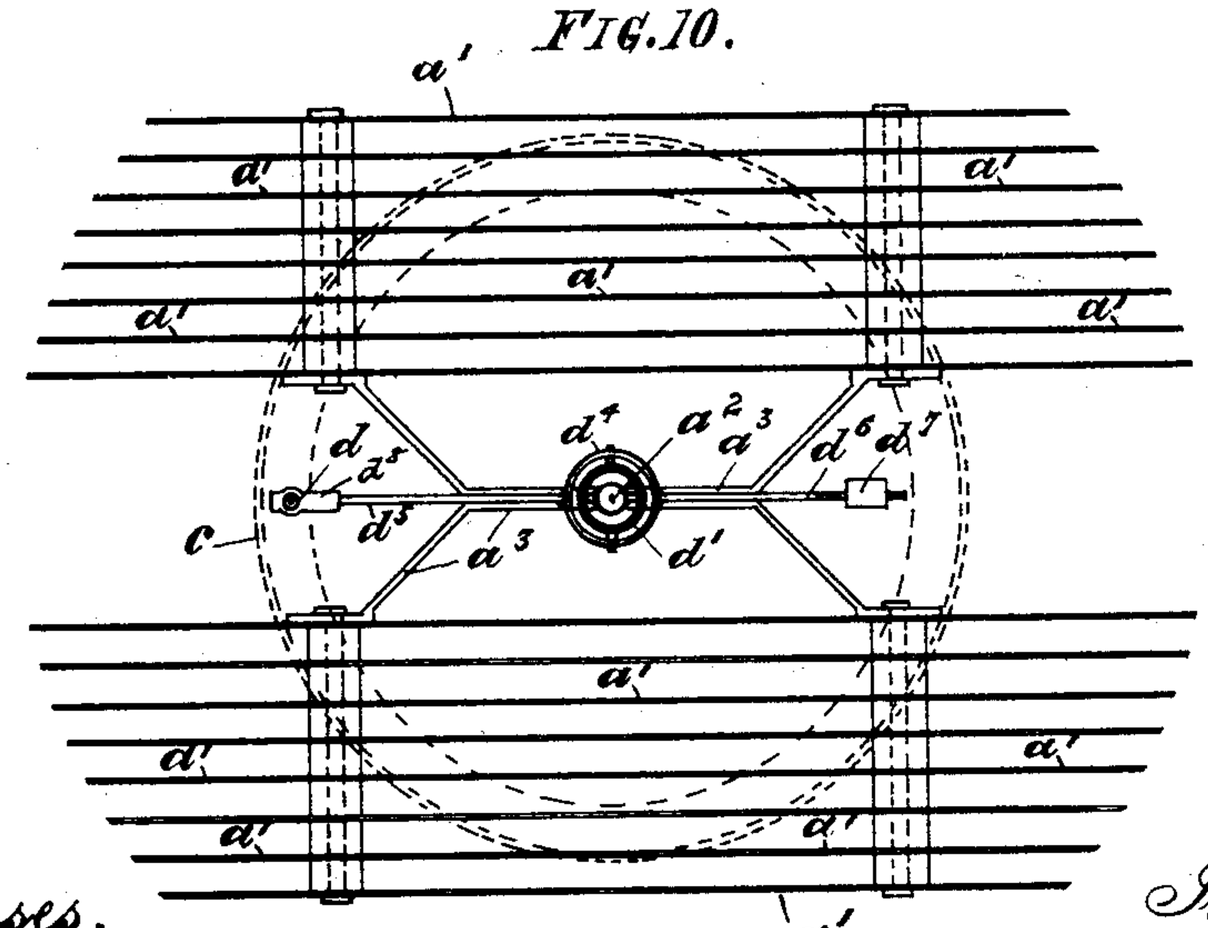


FIG. 10.



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UNITED STATES PATENT OFFICE.

ARTHUR WRIGLEY AND JOHN HOPE, OF LIVERPOOL, ENGLAND.

SHIP'S COURSE-RECORDER.

SPECIFICATION forming part of Letters Patent No. 465,308, dated December 15, 1891.

Application filed January 14, 1891. Serial No. 377,751. (No model.)

To all whom it may concern:

Be it known that we, ARTHUR WRIGLEY and JOHN HOPE, both subjects of the Queen of Great Britain and Ireland, residing at Liverpool, England, have invented certain new and useful Improvements in Ships' Course-Recording Apparatus or Compasses; and we do hereby declare that the following is a full, clear, and exact description of the invention, which will enable others skilled in the art to which it appertains to make and use the same.

Our invention consists of the combination of certain mechanical devices arranged to coact with reference to each other to produce the results hereinafter fully specified, the points of novelty being designated in the claims concluding this specification.

According to one construction of a ship's course-recording apparatus provided with or having in connection with it improvements according to this invention there is employed a compass-card combined with magnets in the ordinary way, or magnets only, and mounted on a pivot; a spring, electric, or other equivalent motor mechanism; gimbals by and upon which the above mechanisms are mounted and swing; a diagram-sheet of paper or other suitable material and means for holding, guiding, and moving same; a device adapted to be controlled by the position of the magnets and provided with a marker by which the diagram is marked and the course registered; mechanism operated by the motor by which the marker is actuated, and a table over and upon which the diagram moves.

When the above combination of parts is used, the motor has to perform the functions of moving forward the diagram-sheet at a uniform rate of speed, corresponding with suitable divisions of time and to actuate the marker at equal and predetermined intervals of time, and such motor may consist of a suitable spring-driven clock-work. The actuation of the marker is a sudden one, and is effected, preferably, by an escapement motion, which allows the motor to operate at certain intervals of time, the length of time of operation at each escapement being only sufficient to rapidly and suddenly actuate the marker.

The above sets forth generally the nature of this invention, and to make it clear we will describe it with the aid of the drawings accompanying the specification and forming a part thereof.

The drawings, together with the description of them, set forth examples of apparatus designed, constructed, and adapted to operate in accordance with the method of recording a ship's course above generally described.

In the various views I use the same letters and figures of reference to denote the same or like parts wherever they occur.

Figure 1 is an elevation, shown partly in section, of an apparatus having the arrangement or combination of parts specified above and where the magnets and card work in a liquid. Fig. 2 is an end view, and Fig. 3 is a side elevation, of the recording mechanism. Figs. 4 and 5 are sectional plans taken at the lines X X and Y Y, respectively, in Fig. 1, Fig. 4 being seen from the under side. Figs. 6 and 7 show the motor mechanism. Fig. 8 shows the mechanism for operating the marker in plan. Fig. 9 illustrates in part sectional elevation a recording apparatus according to this invention, in which the mechanism is employed in connection with magnets without a compass-card. Fig. 10 is a plan of the magnets and marking device used in the apparatus shown in Fig. 9.

Referring to the drawings, the apparatus shown is what is known as a "liquid-compass," *a* being the compass-card and *a'* the magnets beneath it.

B is the bowl which contains the compass-card *a* and magnets *a'* and the liquid in which they work.

C is the glass cover.

The only communication of the surface of the liquid in the bowl B with the outside atmosphere is through the aperture d^9, provided in the cap D, this cap being supported by the glass C.

E is the gimbal-ring by which the compass-

bowl B is supported, A′ being the supporting-journals, it being understood that the ring E itself is gimbaled to a suitable support or case in the usual way.

b is the pivot on which the card *a* swings, and a^2 is the socket of the card *a* and magnets *a′* and on which it is free to turn.

d is the point of the marking device and consists of a pricker.

f is the traveling diagram-sheet.

f′, f'^{A}, and f^3 are respectively rollers serving as a means for storing a continuous length of diagram-paper and drawing it off and moving it past the marker-point *d*.

g is the table over which the diagram-sheet *f* passes.

B′ are standards which support the upper mechanism of the apparatus from the bowl B by passing through snugs g^3 on the table *g*.

F designates generally the motor mechanism.

The diagram-sheet passes between the table *g* and the bottom of the case in which the motor mechanism F is contained, and in the path in which the pricker-point *d* works, is provided with a projecting plate g^2, having an aperture *g′* or an equivalent recess or depression therein, the table *g* being also provided with a corresponding aperture g^6. These apertures are provided along the whole path of the pricker *d*. The aperture *g′* in the plate g^2 is provided for the purpose of allowing the pricker *d* to pass well through the diagram.

The function of the marking device is to puncture the traveling chart *f* at certain predetermined intervals of time, and we will now describe the means by which this action is directly effected and the details of construction of this mechanism by which the puncturing is carried out.

Referring more particularly to Figs. 1 to 8, the socket a^2 of the magnets *a′* is connected to the marking device by means of the standard d^{10}, such device being disposed below the table *g* and working upward in its piercing action. The marker device consists of a pricker-bar d^5, having at its end the point *d*, at which end it is bifurcated, and at the other end d^6 is provided with a counterbalance-weight d^7. Its connection with the standard d^{10} is a free one, and consists of a jaw *d′* and pin passing through it and the bar d^5. This bar is free to move about its axis in the vertical plane. The action of the marking device in puncturing the diagram-sheet *f* is effected by the angle-shaped bar *c*, which is operated by the motor. Its motion consists in being suddenly and intermittently raised and lowered. The horizontal flange of the bar *c* is disposed directly in the bifurcated end d^8 of the marker and is continued round in an arc of a circle, so that for all angular positions of the pricker *d* in relation to the axis thereof and the diagram this flange will act upon the pricker-bar d^5 directly under the pricker *d*. The movement of the bar *c* is effected at certain intervals of time—say minute intervals—by the motor mechanism at F through the side rods *c′*, which are connected to the bar *c*. The motor is a spring one, and one spring only is employed to actuate all the parts and perform all the functions of the apparatus. The marking device is worked and controlled by an escapement mechanism. In this mechanism we employ a wheel *k*, on the lower side of which there are two sets of projections *k′* and k^2, such projections being arranged at different radii. In connection with this wheel we employ the lever *j* with the stop j^3 at its end. It is fulcrumed at j^2 in the center, and is provided at the opposite end with a fork *h*, which embraces an eccentric cam 6. This cam 6 is mounted on the shaft 7^A, and is worked from the wheel 7 through the gearing shown in Fig. 6, which gearing is operated, primarily, from the toothed wheel 10, fixed to the cylinder 10^A, within which the spring of the motor is fixed. The wheel *k* on the other hand is operated through the wheel 1, pinion 2, toothed wheel 3, idle-wheel 4, and pinion 5.

To operate the above-described two sets of gearing, one end of the motor-spring within the cylinder 10^A is connected to such cylinder, while the other end is connected to the winding-shaft 18, such connections being made in any known suitable way, and the winding up of the spring being effected by rotating the shaft 18 in the direction of the arrow shown in Fig. 7. The tension of the spring of the motor is retained by and subsequently given out to a pawl 19, which engages with a ratchet-wheel 20, the pawl being pivoted to the wheel 1 and the ratchet-wheel 20 being fixed to the shaft 18. During the process of winding, the upper gearing (shown in Fig. 1)—that is, the gearing above the cylinder 10^A, and which is fixed to and operated by the wheel 10—remains stationary. The motor-spring is placed concentrically with the axis of the magnets *a′*—that is to say, its axis is coincident with the axis of the magnets—and thus the influence of the spring upon the magnets is neutralized.

The action of the marking-device-actuating mechanism is effected as follows: The cam 6, by its rotation from the upper gearing above specified, causes the bar *j* to be oscillated, and in such oscillations alternately moves the stop j^3 of the bar *j* to and fro from the respective paths of the outer and inner sets of studs *k′* and k^2, thereby allowing the wheel *k* at each oscillation of the bar *j* to move from one stud *k′* to the succeeding stud k^2, then again back to another stud *k′*,

and so on alternately. In each of these movements the upper projections l' of the wheel k act upon the turned-down ends m' of the levers m, which are rigidly mounted on the shaft n^2, first raising them and then allowing them to fall. The force of the spring being constantly exerted upon the wheel k, tending to rotate it, it follows that the instant the wheel is freed by the action of the cam 6 it is instantly rotated and the full stroke, which is a portion of a circle, is made. During this stroke, which takes only a moment of time, the whole action of recording is effected. These motions—*i. e.*, the lift and fall of the levers m—are transmitted to the semicircular angle-bar c and so to the pricker-point d through the levers n, which are fixed on the ends of the shaft n^2, on which the levers m are mounted, and the vertical rods c', which are formed and arranged vertically on the bar c at each side, and are guided above and below by the frame or case F, through which they pass and work.

The diagram-sheet f is coiled on the barrel f' on the right-hand side of the drawings in Fig. 1 and passes between the table g and the bottom F′ of the motor-case F and the guide-plate g^2, and is fed forward by rotating the opposite roller f'^{A}, the paper being pressed onto the surface of such roller by another roller f^3 kept up to and pressed upon the other surface of the paper by means of the spring f^4, acting through the levers f^5, fulcrumed at f^7, and to the opposite ends of which the roller f^3 is mounted. The pointer f^6 indicates the time taken by a revolution of the roller f'. The movement of the winding-off roller f' is effected through the pinion 21, (operated by the toothed wheel 10,) shaft 22, worm 23, worm-wheel 24, toothed wheel 25 on the shaft of the worm-wheel 24, pinion 26, toothed wheel 27 on the same axis as pinion 26, and, lastly, pinion 28, which is mounted on the axis of the winding-off roller f'^{A}. This gear is best shown in Figs. 1 and 5.

The motor is kept in constant motion and is a time-keeper. Any suitable clock-work motor may therefore be employed in the apparatus.

The whole apparatus must of course be constructed so as to keep a true balance in its supports.

Figs. 9 and 10 illustrate a modification of our ship's course-recording apparatus, in which the recording mechanism is employed in connection with magnets without a compass-card. The magnets a' in this case are supported from the socket a^2 by the bars a^3, and the pricker-bar d^5 in this case is connected to the socket a^2 by gimbal-rings d' and d^4, which lie in the same plane as the point of the pivot b, by which the magnets a' are supported. By this mode of mounting it the oscillations of the magnets out of the horizontal plane, due to the rolling or pitching of the ship, are not to any material degree imparted to the marking device, and hence its oscillations out of the horizontal plane, due to those of the magnets, are practically insignificant, and, moreover, by this arrangement the magnets and marking device are enabled to move out of the respective horizontal planes in which they lie without having an effect upon each other. Hence, although they are connected together, they have perfect freedom in these respects; but at the same time the position of the marking device is fully controlled by the magnets in respect of angular motion about its axis. The angle-bar c is in this case circular, and the pricker-bar d^5 is free to pass all round. The roof of the bowl B is provided with a cup D′, which is filled with liquid, and the socket a^2 is provided with a cap D^2, which dips into the liquid-cap D′ and makes an air-tight joint, and so prevents escape of vapor of the liquid in the bowl. The mechanisms for actuating the marking-device pricker-point d and the chart in this case are the same as those set forth with reference to Figs. 1 to 8. In this case the whole apparatus will be mounted on gimbals in a suitable support in the same plane as the point of support of the pricker-bar d^5, as in the previously-described arrangement.

In using the apparatus on a ship about to steer on a settled course the pricker-bar d^5 of the marking device should be so set that it lies over the center line of the diagram f when the ship lies in that course—that is to say, assuming the vessel were about to sail in an easterly course, when the ship's head lies in that course the marking-device pointer d should stand in line with the center of the diagram. To comply with this condition, the bowl B containing the magnets (which always lie north and south) and carrying the diagram-sheet f should be moved so that the center line of the diagram, which represents such easterly course, is in line with the marker-bar d^5, so that any deviation that the ship's head may make from this easterly course will be correspondingly marked upon the diagram. Should the bowl and diagram not be moved, the marker d will mark the diagram with a line parallel with the center line, such line representing the easterly-course line, and any deviation from this line will show the deviation in the course of the ship.

The diagram may be marked with lines running parallel with the direction of its length and motion and with semicircular lines or arcs of circles intersecting such parallel lines, the radius of which is that of the radius of the pricker from its pivot, and in the center of the diagram there may be provided a more strongly-marked line. The points of

intersection of the arc lines and the parallel lines would correspond with divisions of a circle.

At the edges of the chart divisions of time may be marked in hours, a suitable distance for travel of the diagram past the marker for each hour being about three inches; but it may be more or less than this, as desired. Hence it will be seen that the longitudinal dimensions of the diagram are or correspond with divisions of time, and that the lateral dimensions taken in arcs of circles correspond with or denote parts or divisions of a circle, and are used, in connection with the markings of the marking device upon the diagram, as measures for each moment of time of the extent, if any, of the divergencies of the line marked from the center line of the diagram—*i. e.*, from the set course in which it has been desired to steer the ship—while the markings taken longitudinally at any point indicate the time at which such marking is recorded. The pricker may be conveniently caused (and regulated) to make one mark or puncture per minute.

We desire it to be distinctly understood that our invention is not limited to the precise forms or constructions of devices or combinations of devices illustrated or described, since their equivalents may be employed, and various modifications not differing or departing from their essential or controlling features or purposes may be substituted without departing from either the principal, purposes, or scope of the several features of the invention; also, we wish to state that the improvements connected with the recording apparatus and the manner of its operation and the parts employed therefor may, by simple modifications, be readily adapted and employed in combinations with recording compasses or apparatus of other types than the one illustrated and particularly described. On the other hand, we wish it to be understood that we make no claim, generally, to a recording mariner's compass or apparatus—that is, a compass or apparatus by which the course sailed by a ship has been proposed to be produced and recorded upon a diagram—as we are aware that such a type of apparatus has heretofore been suggested; but

What we do claim in respect of or under the herein-described invention is—

1. In a ship's course-recording apparatus, the combination of a diagram, sheet, or chart, magnets adapted to retain a north and south position, a marking device by which said diagram or chart is marked and connected to said magnets by a free-joint connection, whereby said magnets and marker are free to be moved out of the plane in which they respectively lie without affecting each other.

2. In a ship's course-recording apparatus, the combination of a diagram, sheet, or chart, magnets adapted to retain a north and south position, a marking device disposed in a different horizontal plane to that of the magnets, but connected thereto by a suitable loose joint connection and having its position controlled thereby, and the marking-point of said marker being disposed outside the vertical plane of its own axis and that of the magnets, and a mass connected with said marking-point and disposed on the opposite side of said axis by which said marker is counterbalanced.

3. In a ship's course-recording apparatus, the combination of magnets suitably mounted and adapted to remain in a north and south position, a marker mechanism separate from said magnets and gimbaled to the magnet-mounting about the axis thereof, said gimbals being disposed in substantially the same plane as that of the point of bearing of the mounting of said magnets with their supporting device, and a diagram sheet or chart adapted to be moved past said marker.

4. In a ship's course-recording apparatus wherein the course traveled is marked upon a diagram sheet or chart, the combination of magnets suitably mounted and adapted to remain in a north and south position, a marker device connected with said magnets by a gimbal-joint connection and controlled thereby, the plain in which the gimbals are disposed being slightly above the center of gravity of said marking device.

5. In a ship's course-recording apparatus, the combination of magnets suitably mounted and adapted to remain in a north and south position, a marking device the position of which is controlled by said magnets, a diagram sheet or chart adapted to be moved and marked by said marker, and a spring-motor the center of the spring of which is coincident with the vertical axis of the magnets, whereby its influence upon the magnets is neutralized.

6. In a ship's course-recording apparatus, the combination of magnets a' and the marking device d^5, connected thereto, the point of support of said marking device being coincident with the point of support of the magnets and having a bifurcated end d^8, the bar c, meshing with said bifurcated end, and suitable motor mechanism, the expenditure of the power of which is adapted to raise and lower said bifurcated end, substantially as set forth.

7. In a ship's course-recording apparatus, the combination of the vessel B, having a suitable liquid therein, magnets a', disposed and working in said vessel, the marker d^5, connected with said magnets and having a pricker d on the end thereof, bar c, connected or meshing with the end of said marker, an escapement mechanism connected with said

bar *c* and through which it is intermittently and suddenly operated, and the spring-motor F by which said escapement is operated, substantially as set forth.

8. The combination of the magnets *a*, pivot *b*, on which said magnets are mounted, magnet-mounting a^2, gimbals d' d^4, mounted on the mounting a^2, marker-bar d^5, mounted on said gimbals, and pricker marking-point *d*, substantially as set forth.

9. The combination of the marker d^5, having a point *d*, the bar *c* for working said marker, the escapement-wheel *k*, the escapement-lever *j* by which said wheel *k* is controlled, and the spring-motor by which said lever *j* and bar *c* are operated, substantially as set forth.

In testimony whereof we, the said ARTHUR WRIGLEY and JOHN HOPE, hereunto affix our signatures in presence of two witnesses.

ARTHUR WRIGLEY.
JOHN HOPE.

Witnesses to the signature of the said Arthur Wrigley:

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9 *Belvedere Bath, Clerk.*

JANE KATE WALLIS,
4 *Residences, South Kensington Museum, S. W., Spinster.*

Witnesses to the signature of the said John Hope:

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14 *Water Street, Liverpool.*

J. A. COUBROUGH,
15 *Water Street, Liverpool.*