(No Model.) 4 Sheets—Sheet 1.

T. C. KNUDSEN & A. NÖRHOLM.

SHIP'S COMPASS.

No. 457,161. Patented Aug. 4, 1891.

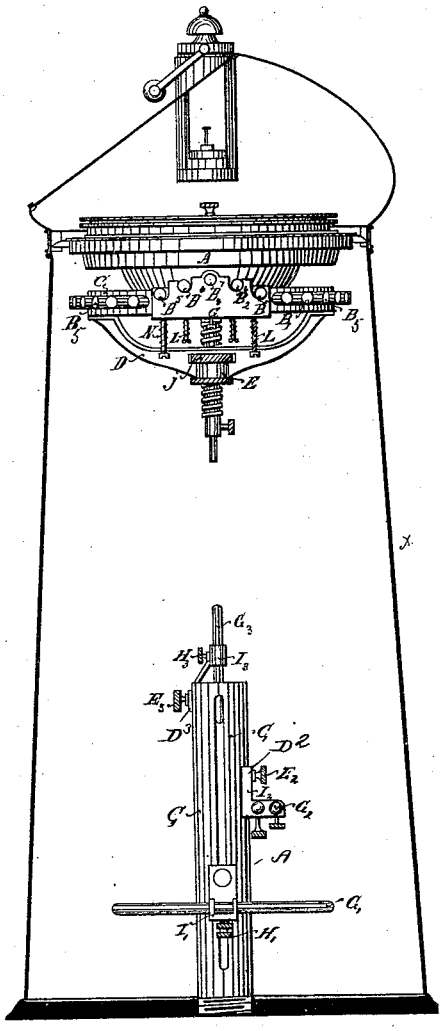

Fig. 1.

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T. C. KNUDSEN & A. NÖRHOLM.

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Fig. 2.

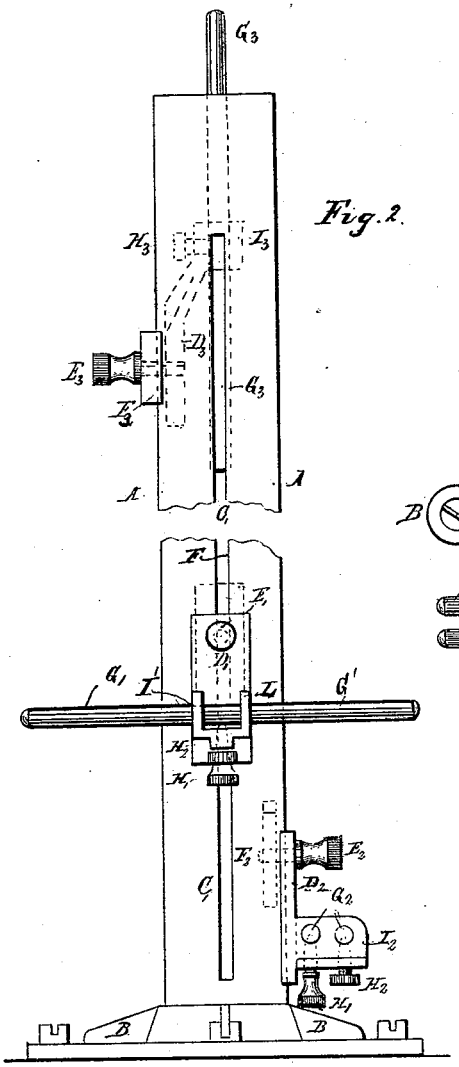
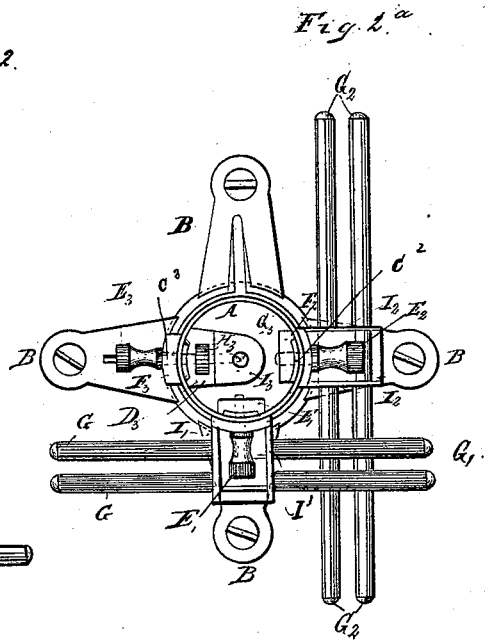


Fig. 2a.



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T. C. KNUDSEN & A. NÖRHOLM.

SHIP'S COMPASS.

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Fig 3

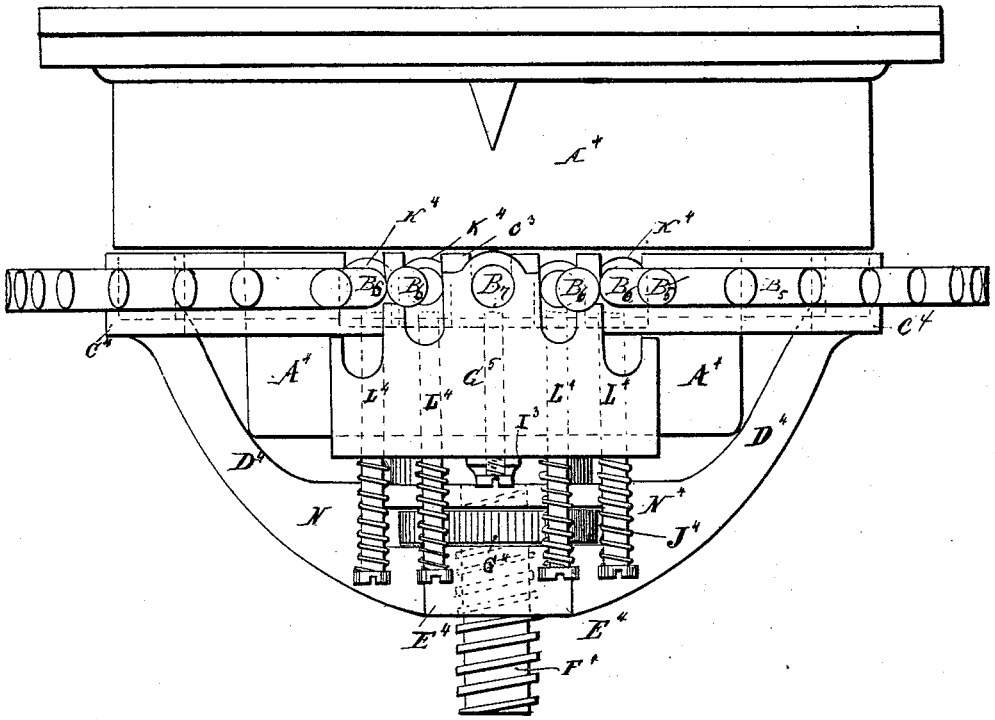
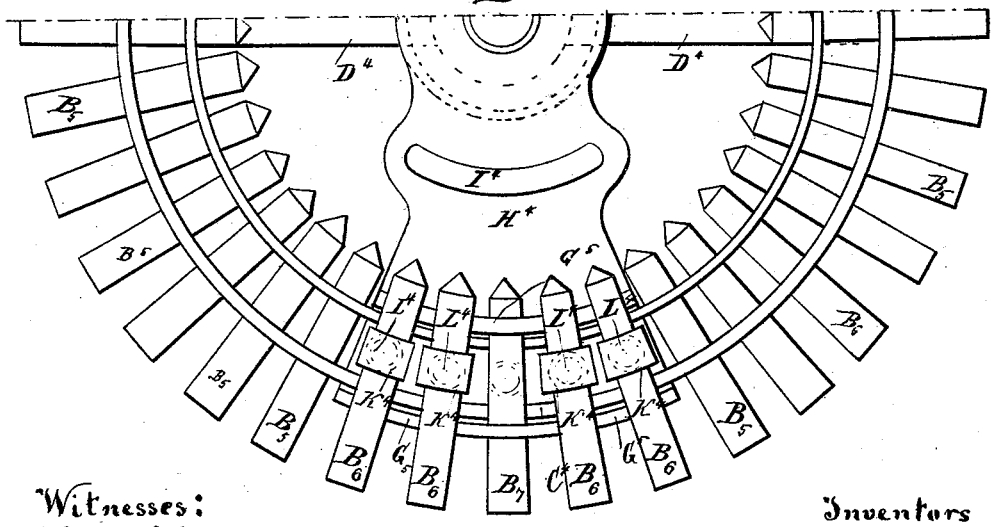


Fig 4



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(No Model.) 4 Sheets—Sheet 4.

T. C. KNUDSEN & A. NÖRHOLM.

SHIP'S COMPASS.

No. 457,161. Patented Aug. 4, 1891.

Fig 5.

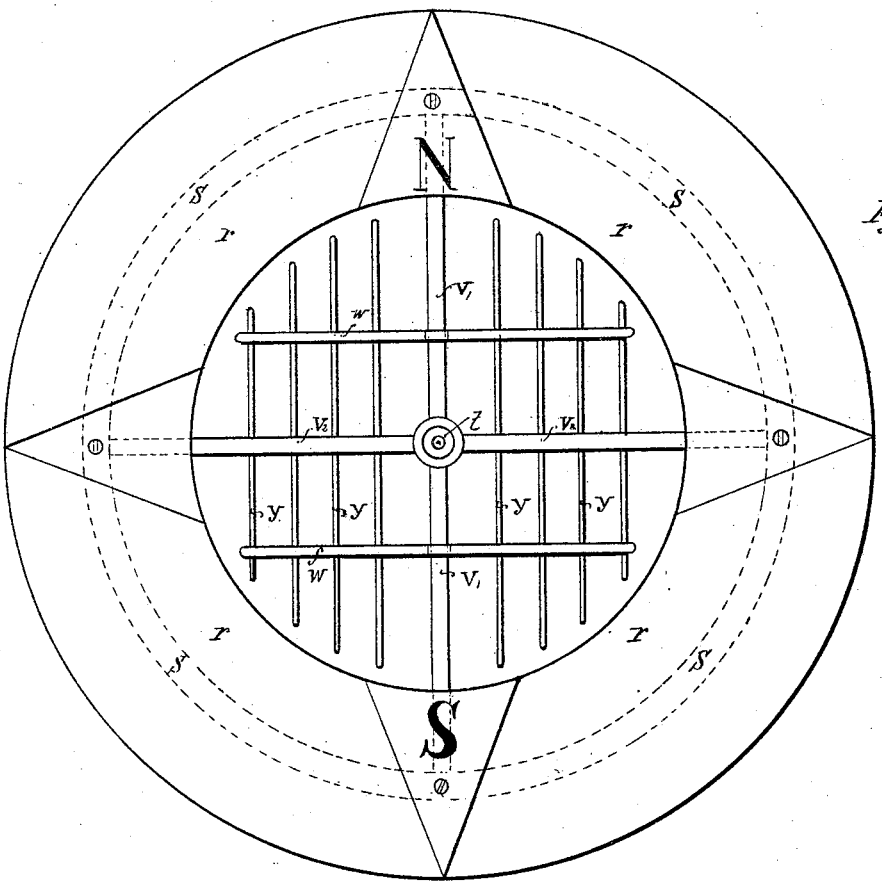

Fig 6.

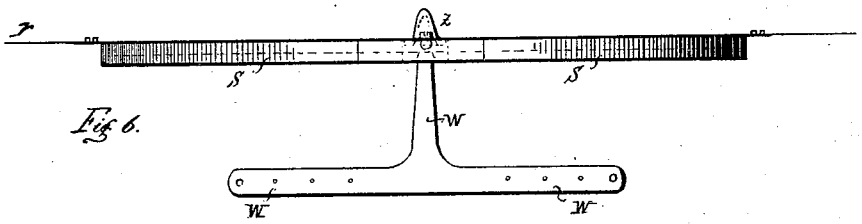

Fig 8.

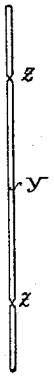

Fig 7.

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UNITED STATES PATENT OFFICE.

THEODOR CORNELIUS KNUDSEN AND ANTON NÖRHOLM, OF COPENHAGEN, DENMARK.

SHIP'S COMPASS.

SPECIFICATION forming part of Letters Patent No. 457,161, dated August 4, 1891.

Application filed April 13, 1889. Serial No. 307,178. (No model.) Patented in England March 9, 1889, No. 4,182; in France May 1, 1889, No. 183,458; in Italy May 2, 1889, No. 25,047; in Norway July 15, 1889, No. 1,252; in Austria-Hungary September 13, 1889, No. 10,572; in Sweden October 31, 1889, No. 2,027, and in Germany December 16, 1889, No. 50,029.

To all whom it may concern:

Be it known that we, THEODOR CORNELIUS KNUDSEN and ANTON NÖRHOLM, citizens of Denmark, and residents of Copenhagen, Denmark, have invented certain new and useful Improvements in Ships' Compasses, (for which we have obtained Letters Patent in the following countries: in France, No. 183,458, issued May 1, 1389; in Germany, No. 50,029, issued December 16, 1889; in England, No. 4,182, issued March 9, 1889; in Austria-Hungary, No. 10,572, issued September 13, 1889; in Italy, No. 25,047, issued May 2, 1889; in Sweden, No. 2,027, issued October 31, 1889, and in Norway, No. 1,252, issued July 15, 1889,) of which the following is a specification.

It is well known that for the purpose of removing the so-called "local attractions" on the ship's compass, caused by the great quantities of iron in vessels, permanent magnets of different size and strength have been arranged adjacent to the compass. The manner in which these permanent magnets were arranged heretofore was connected with numerous and quite serious disadvantages, the principal one of which was that the compasses had to be regulated very frequently, which is connected with more or less difficulties and requires considerable time, and, furthermore, the first adjustment of the magnet was quite difficult.

The object of our invention is to provide an improved compass in which the semicircular deviation and the heeling error are obviated or at least decreased.

In the accompanying drawings, Figure 1 is a vertical longitudinal sectional view of a binnacle provided with our improvements. Fig. 2 is an elevation of a standard in the binnacle for holding the device used for removing the semicircular deviation and heeling error. Fig. 2^a is a plan view of the same. Fig. 3 is a side view of a compass-casing provided with our improved devices for moving the quadrantal deviation. Fig. 4 is a plan view of one-half of the same, the compass-casing not being shown. Fig. 5 is a plan view of the compass-card. Fig. 6 is a side view of the same. Fig. 7 is a sectional view of the magnet-supporting frame, and Fig. 8 is a side view of one of the magnets.

Similar letters of reference indicate corresponding parts.

The tube A is open at the top and closed at the bottom and provided with a base B, which base is secured to the bottom of the casing x of the compass, or said base may be screwed into the bottom of said compass-casing. The said tube A is provided with the two longitudinal slots C and C′, through which slots the lugs of two slides D′ D^2 on the tubular standard pass, said slides being provided with the binding-screws E′ E^2 for locking them at any desired elevation. Said screws engage nuts F′ F^2 in the interior of the tube A and are adapted to slide up and down with the slides. Each slide forms a bearing I′ or I^2 for one or more bar-magnets G′ G^2, which are adjusted centrally on the slides and held in place by means of the binding-screws H′ H^2 in said slides. These magnets serve only for removing the semicircular deviation. When the slides are moved up and down, the magnets at all times remain in horizontal position.

In addition to the above-mentioned slides, a third slide D^3 is arranged in the tube and can be locked at any desired elevation by means of the screw E^3, passing through a vertical slot in the tube and passed through a block F^3 on the outside of the tube. The slide D^3 serves to hold the vertical magnet G^3 in the line of the axis of the tube A, which magnet serves only for removing the heeling error. The slide D^3 is provided with a suitable bearing or support for the said vertical magnet D^3, which magnet is held in place and supported by the binding-screw H^3.

For removing the quadrantal deviation caused by the local attractions we arrange a series of soft-iron cylindrical rods in a circle and horizontally around the compass, some of which rods are vertically adjustable. As long as the soft-iron rods are in a common horizontal plane and also in the plane of the magnetic needle, the setting power of the needle is increased, for the reason that said iron rods are made of very soft iron and are induced

by the earth's magnetism and also by the magnetism of the needle. Magnetic poles are thus formed in said iron rods, which coact on the rose with the natural magnetic poles of the earth, and thus increase the power of the rose to set in the direction north-south. It is well known that in any soft iron magnetic poles are very easily formed by induction.

Referring to Figs. 3 and 4, A^4 represents a compass-casing; B^5, B^6, and B^7, the soft-iron rods; C^4, a vertically-adjustable horizontal ring in which the rods B^5, B^6, and B^7 rest. D^4 are stems which connect the ring C^4 with the hub E^4, said hub surrounding a screw-spindle F^4 on the under side of the compass-casing, and in said arms a nut G^4 is mounted to turn, so that by turning said nut the ring C^4 can be raised or lowered in relation to the compass. The two diametrically-opposite iron rods B^7 are not to participate in the movement of the ring C^4, and for this reason rest in a supporting-plate G^5, projecting from arms H^4, which are adjustably fixed by means of screws I^3 to the under side of the casing, said screws passing through the segmental slots I^4 in the under side of the compass-casing. The rods will only rest in their notches in the ring C^4 when said ring is in its highest position. The prongs between the notches in the supporting-plate G^4 project for all positions of said ring C^4 upward between the iron bars B^5 B^6 B^7 and are supported by the ring C^4, so that said ring C^4 is compelled to follow the plates G when the same are adjusted laterally. For the rods B^6 suitable notches are provided in the supporting-plate G^4, which notches are lower than the bearings for the rods B^7. The rods B^6 rest in notches in the ring C^4, so that when said ring is lowered in relation to the supporting-plate G^4 the remaining rods can descend with the ring and said rods B^6 remain in the notches in the supporting-plate G^4. The rods B^6 are surrounded by rings K^4, secured to rods L^4, passing through suitable apertures in the ring C^4, which rods are surrounded by spiral springs N^4, the upper ends of said springs resting against the under side of the arms H^4 and their lower ends against the heads on the lower ends of said rods. Said springs serve to draw the rods B^6 downward and at all times press them upon their bearings or notches. When the ring C^4 is brought to its highest position, as shown in Fig. 3, all the rods B^5 B^6 B^7 are arranged around the compass-casing in a horizontal plane, in which plane is also the needle. If the ring C^4 is lowered, then the plane described by the several rods will not be horizontal, but will form a curved surface, the two curves of which are diametrically opposite to each other and the curvature of which increases proportionately to the distance that the ring C^4 is lowered. During the time that the ring C^4 is being lowered the rods B^5 at all times remain horizontal and radial to the compass. The two curves formed by the rods B^6 and B^7 by the lowering of the ring C^4 together cause a deviation of the compass-needle in the courses N E, S E, S W, N W, which deviation increases correspondingly with the increase of the curvature of the said curves and with the distance that the ring C^4 is lowered, and this deviation can be utilized for neutralizing the quadrantal deviation produced by the local attractions, providing that the semicircular deviation has first been neutralized when the ship is in the courses N E, S W or N W and S E, or vice versa. The ring C^4 cannot only be raised and lowered for neutralizing the quadrantal deviation, but with the supporting-plates G^4 the rods B^5 B^6 B^7 can be adjusted laterally around the compass. If the quadrantal deviation in the ship is plus, the rods are so adjusted that the rods B^7 are transverse to the axis of the vessel. If, on the contrary, the quadrantal deviation is minus, the binding-screws that hold the arms H^4 are loosened and the arms H^4 and the ring C^4 are turned until the rods B^7 are parallel with the longitudinal axis of the vessel, and then the parts are locked in place. If masses of iron are arranged unsymmetrically in the body of the vessel, a deviation occurs, which is known as the "constant E." To neutralize this deviation, the slots I^4 are provided in the arms H^4 to permit of adjusting the arms H^4 and the ring C^4 to the right or left, according as the constant E is plus or minus.

Referring to Figs. 9 to 12, the paper disk R is fastened to a ring S of very thin angle sheet-iron. The ring S is connected with the cap T at the center of the rose by the tubes V' V^2, the walls of which are made as thin as possible. To each tube V' V^2 a T-shaped dependent bracket W is fastened, the cross-piece of which is arranged below the rose and parallel with the same. Each cross-piece is provided with a series of apertures for receiving the compass-needle *y*. For the purpose of avoiding soldering the compass-needles on the cross-pieces, whereby the magnetic properties of the needles might be interfered with, the needles have notches *z*, as shown in Fig. 12, into which notches the edges of the apertures in the cross-pieces W pass. The cross-pieces W are made hollow of sheet-iron, as shown in Fig. 11, for the purpose of making them strong and as light as possible.

Having thus described our invention, we claim as new and desire to secure by Letters Patent—

1. The combination, with a compass-casing, of a ring of iron rods surrounding the same, and means for adjusting some of the rods vertically, substantially as set forth.

2. The combination, with a ship's-compass casing, of a ring of iron rods surrounding the same, and supporting-plates for holding some of the rods, substantially as set forth.

3. The combination, with a ship's-compass casing, of a ring of iron rods surrounding the same, means for adjusting some of the rods higher than others, and means for turning

the rods and supporting devices of the same around the casing, substantially as set forth.

4. The combination, with a ship's-compass casing, of a ring surrounding the same, iron rods on said ring, and means for adjusting the ring, substantially as set forth.

5. The combination, with a ship's-compass casing, of a ring surrounding the same, iron rods on said ring, supporting-plates having stepped notches for supporting said iron rods, and means for adjusting the ring vertically, substantially as set forth.

6. The combination, with a ship's-compass casing, of a ring surrounding the same, a hub connected by arms with said ring, a screw projecting from the bottom of the casing, and a nut arranged within a slot of said hub and engaged with the thread of the screw, substantially as set forth.

7. The combination, with a ship's-compass casing, of a screw projecting down from the same, a hub on said screw, a ring supported by arms from said hub, iron rods held by said ring, a nut mounted in the slot of the hub and engaging the screw, arms supporting some of said rods, and stepped notches on the top edges of said supporting-plates, substantially as set forth.

8. In a ship's compass, the combination of a tubular standard provided with slots, slides provided with lugs engaging said slots, bar magnets supported on said slides, set-screws passing through said slides and slots, and nuts on the interior of said standard engaged by said set-screws.

9. A rose for a ship's compass, consisting of a frame composed of a ring S, diametrical tubes $V' V^2$, dependent T-shaped brackets W, connected with said tubes and provided with apertures, notched needles supported in said brackets in said apertures, and a disk supported on said frame.

In testimony whereof we affix our signatures in presence of two witnesses.

THEODOR CORNELIUS KNUDSEN.
ANTON NÖRHOLM.

Witnesses:
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WILH. PIEFFER.