No. 662,484. Patented Nov. 27, 1900.

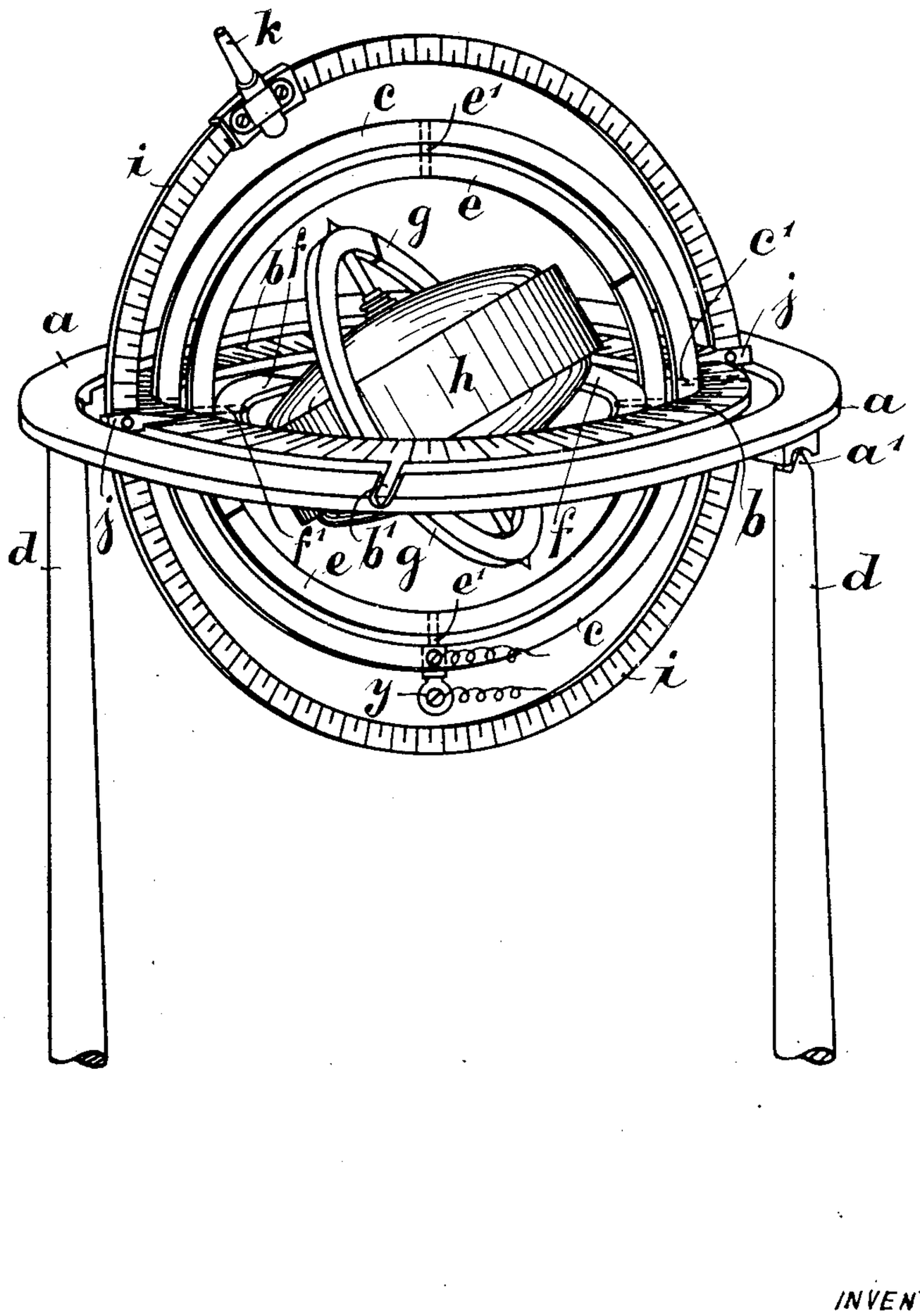
E. ZIEHL.

ELECTRIC TOP FOR GYROSCOPES

(Application filed Dec. 26, 1899.)

(No Model.) 3 Sheets—Sheet 1.

Fig. 1.



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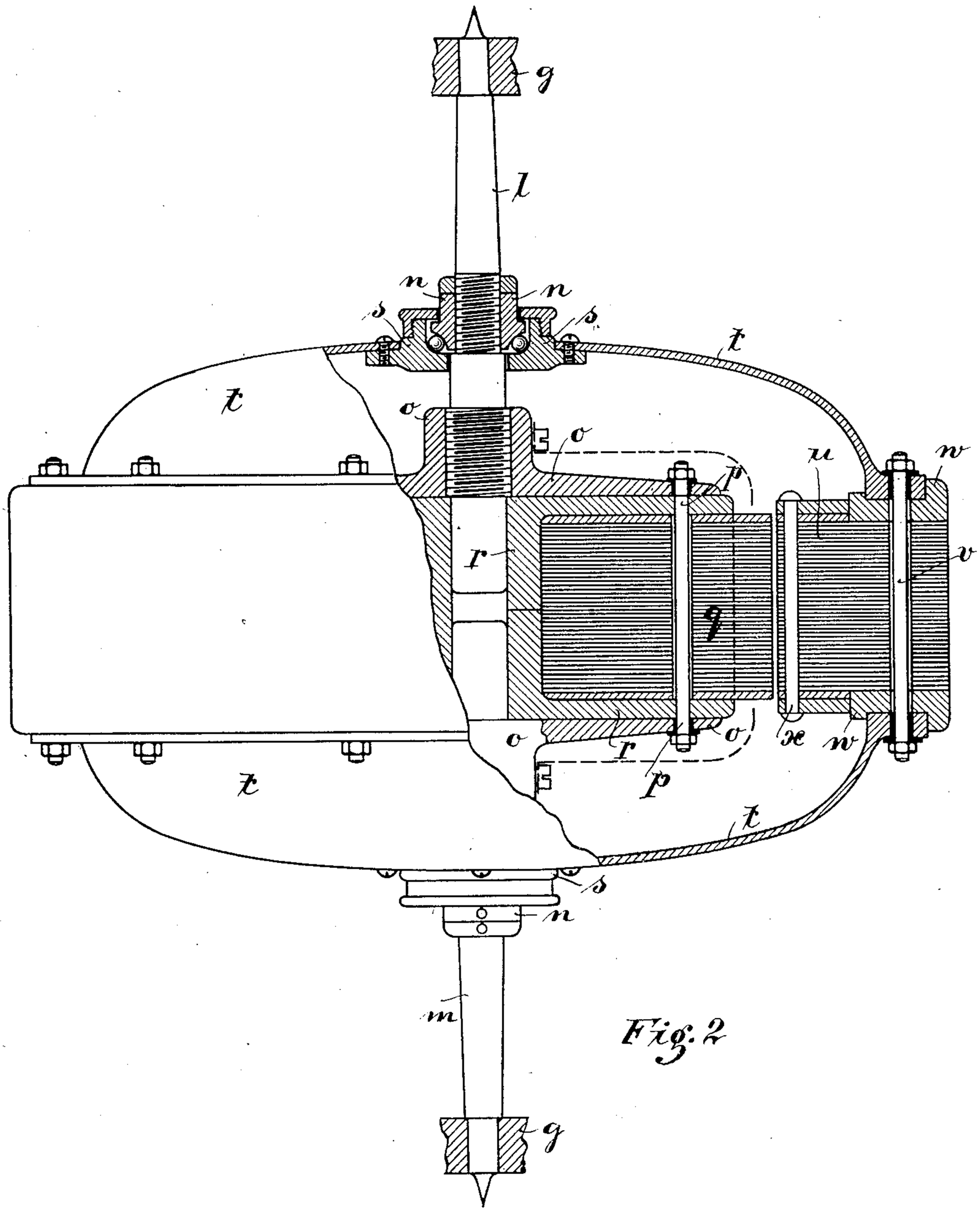

Fig. 2

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(No Model.) 3 Sheets—Sheet 3.

Fig. 3.

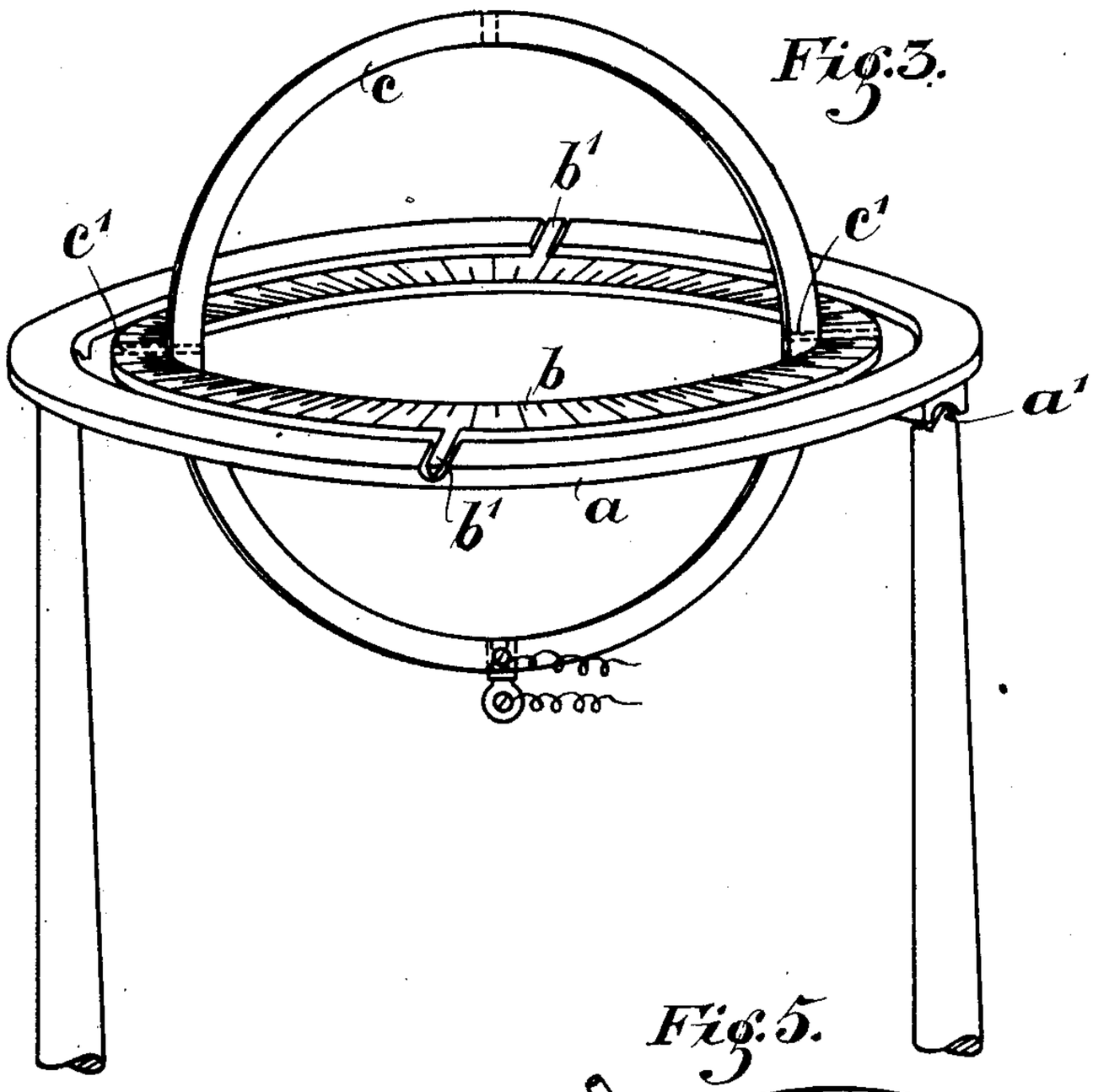


Fig. 5.

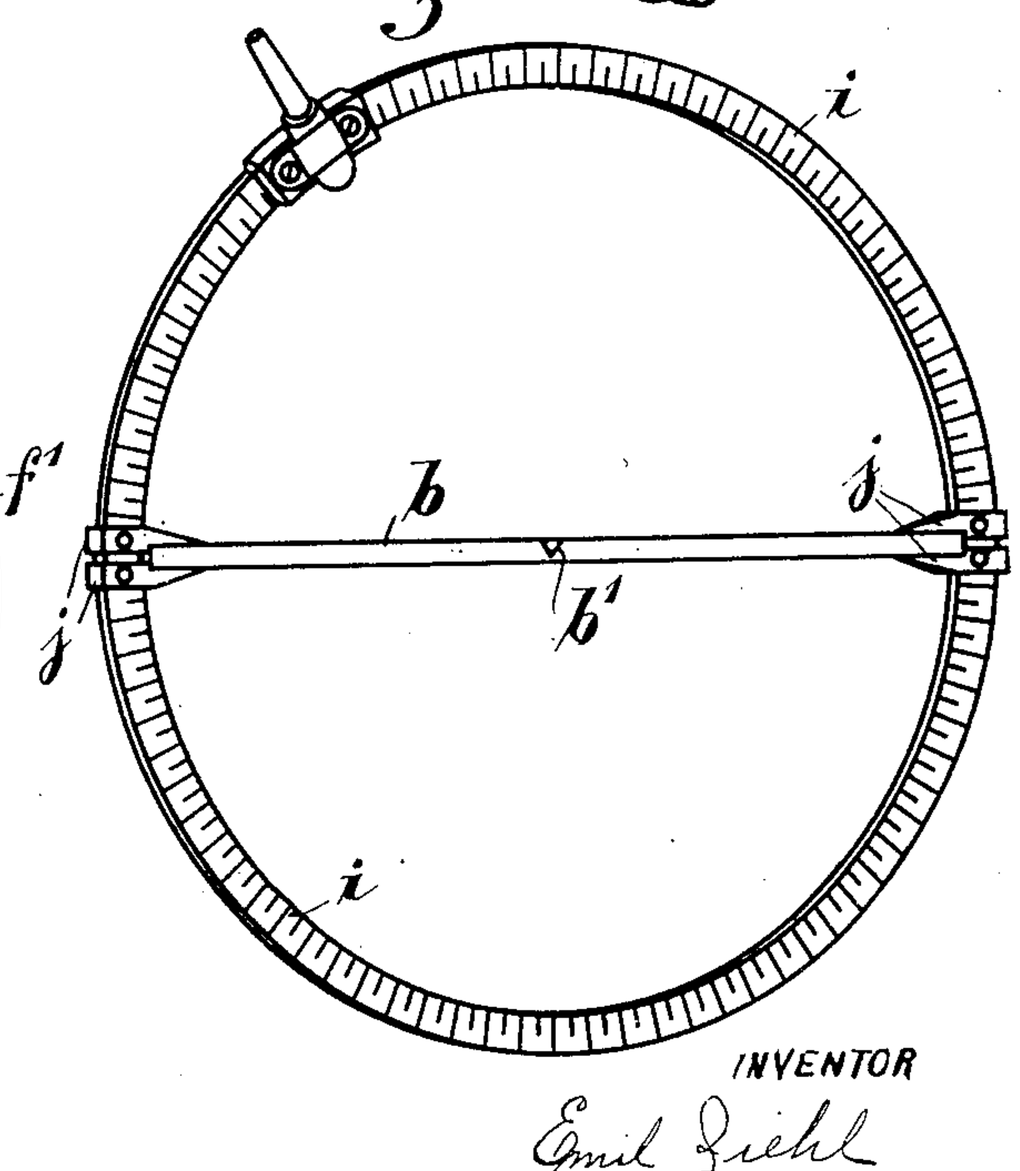
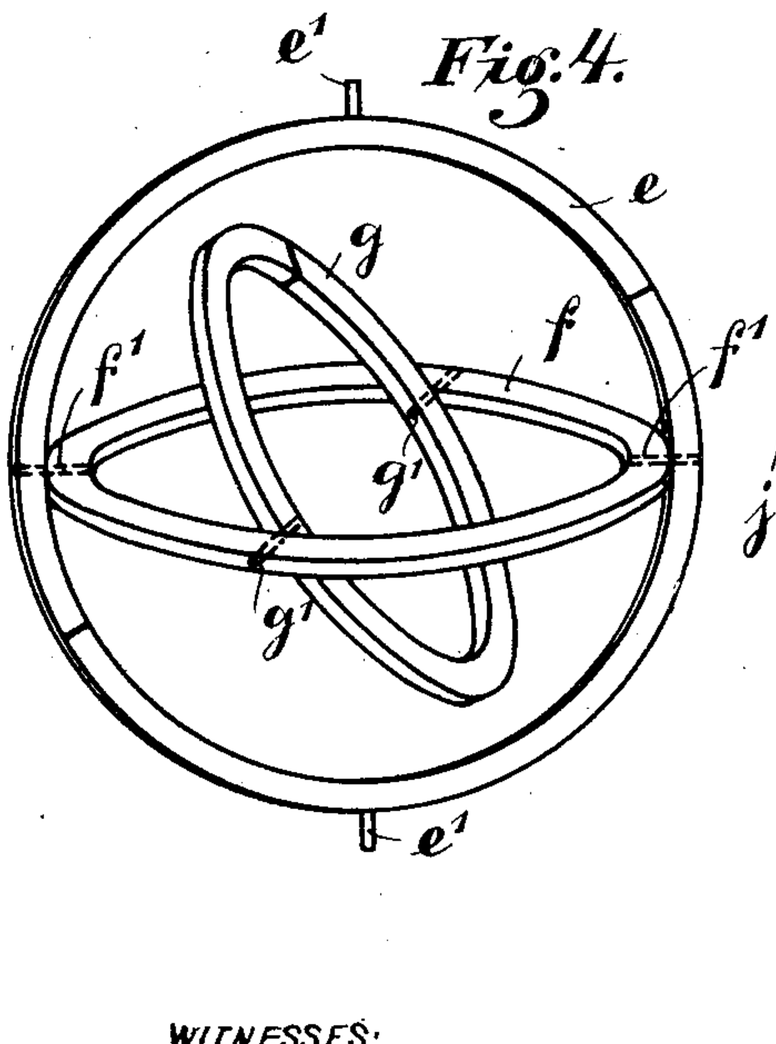


Fig. 4.



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UNITED STATES PATENT OFFICE.

EMIL ZIEHL, OF BERLIN, GERMANY.

ELECTRIC TOP FOR GYROSCOPES.

SPECIFICATION forming part of Letters Patent No. 662,484, dated November 27, 1900.

Application filed December 26, 1899. Serial No. 741,685. (No model.)

To all whom it may concern:

Be it known that I, EMIL ZIEHL, engineer, a subject of the German Emperor, residing at Chausséestrasse 17–18, city of Berlin, in the Kingdom of Prussia, German Empire, have invented certain new and useful Improvements in Electric Tops for Gyroscopes, of which the following is a full, clear, and exact description.

The present invention relates to an electric top for gyroscopes, which in spite of its light weight can receive a large amount of motive power and is perfectly symmetrically constructed.

This new instrument possesses two groups of rotatably-journaled rings. The one group has in view the creation of a plane which is always parallel to the apparent horizon. The other group comprises the hanging of the electric top, said hanging being in neutral equilibrium. Both groups consist of three Cardan rings, the three axes of rotation of which stand vertically to each other. The swinging body of the top forms the outer induced part of an electromotor, the inner induced part of which sits on the axis of the top, which does not partake in the rotation. The axis of the top, which is stationary with regard to the rotation, is also journaled rotatably or pivotally for the purpose of avoiding shocks in starting in the hanging of the top, but with somewhat greater friction than prevails between the axis of the top and the rotating body, so that it recedes somewhat in opposite direction to the normal rotating direction in starting the motor, but then comes to rest again of its own accord.

Figure 1 of the accompanying drawings illustrates the new top in combination with an instrument for geographical determination of position, which latter, however, is not claimed as new in the present application. Fig. 2 shows the top itself, partly in elevation and partly in section. Fig. 3 shows the group of rings used for the creation of a plane being always parallel to the apparent horizon. Fig. 4 shows the hanging of the electric top in neutral equilibrium. Fig. 5 shows the arrangement of a ring provided with graduation which can be displaced by means of slide-blocks by almost one hundred and eighty degrees on the ring, which is always parallel to the apparent horizon, and which also carries a collimator, also adjustable by almost one hundred and eighty degrees.

The ring *a* is mounted on the edges *a'* of the pillars *d*. Ring *b* is journaled rotatably with edges *b'* on the ring *a* and ring *c* by means of pivots *c'* in ring *b*. In the ring *c* the ring *e* is journaled rotatably by means of the pivots *e'*, in ring *e* the ring *f* is journaled by means of pivots *f'*, and finally in the ring *f* the ring *g* is journaled by means of pivots *g'*. The latter ring *g* carries the top *h*, which remains always parallel with its axis.

In order to be able to measure the angle formed by the axis of the top with regard to the apparent horizon, a ring *i* is arranged in the space between the ring *a*, mounted on the pillars *d*, and the ring *b*, said ring *i* in consequence of the clutches *j* holding the ring *b* being able to revolve around its axis, which is vertical to the plane of the ring *b*. An accurately radially adjusted telescope *k* is movably secured on the ring *i*, with which the ends of the top axles are observed. On the graduated circle *i* is read off the inclination of the top axle to the apparent horizon—that is, to the plane of the ring *b*. The latter itself is provided with degrees and a compass-card. This enables the direction of the compass-needle, and thus the position of the top the axis of which stands parallel to the axis of the earth, to be controlled by means of the projection of the axis of the top and the plane of the ring *i*.

The rings *c e f g* are, as usual, not entirely made out of electrically-conducting material, but consist of two metal halves insulated from each other. In this manner the current conducted through wires to the ring *c* by means of the pins *y* can find its way through the ring itself as far as the two axle ends of the top without having to use wires, collector-brushes, or other devices impeding free motion.

The top (see Fig. 2) forming the object of the present invention, which is driven with single-phase alternating current, is constructed as follows: The shaft of the top placed in the ring *g* consists of two equal parts *l* and *m*, which are nevertheless not conductingly connected with each other. Each half of the shaft is screw-threaded at two places, the first of which holds the bush

n for a ball-bearing, while on the inner one is placed the metal boss o, which supports the inducting portion of the motor. The iron core q of the inducting part, formed of plates in the usual manner and held together by insulated screws, is encircled by the insulating-lining r of the boss o. The ends of the winding are joined to the boss o. On the boss s of the ball-bearing are fastened the caps t, which bear the outside and induced portion of the motor. This part also consists of a core u of iron plates, which is held between the caps t, having insulated linings w, by means of insulating-screws. In this case the winding consists of short-circuited copper rods x. The arrangement is so planned that the friction of the induced parts upon the bushes n is less than that of the pivots of the shafts l and m in the ring g, so that it commences to run without a jerk, while at the first increase of torque both parts can rotate in opposite directions, until finally as the acceleration decreases to the constant speed the inner inducing part remains stationary. The rotating part is outside, and consequently it can receive the greatest possible energy, as the latter in equal size and number of revolutions increases with the square of the distance from the rotary axis.

Two of the instruments described above are necessary for geographical survey. For this purpose the top axles of the two instruments are first placed in a spot the geographical position of which is accurately known in the requisite position—that is to say, so that they are vertical to each other and that one thereof is parallel to the earth's axis. The axle of this top will then form at different degrees of latitude and that of the other top at different degrees of longitude a different angle with the meridian. Then the motors are set working, which during the whole time that the instruments are in use are driven by alternating current of constant potential and frequency. Slight variations in the number of revolutions do not noticeably affect the accuracy. If it is desired to determine the position of a given place, it is only necessary to read off the angle of inclination of the top axles of the two instruments to the apparent horizon, and the result is obtained after a perfectly simple calculation or by means of tables.

The casing of the top forms a rotary body which, in connection with the shaft, carries the motor.

Having now particularly described and ascertained the nature of my said invention and in what manner the same is to be performed, I declare that what I claim is—

1. An improved electric top comprising the axle, the bearings therefor, the rotary body carried by the axle and arranged to turn about the same and an inducing-body mounted on the axle, while said rotary body acts as induced part, the friction at the bearings of the shaft being greater than at the bearings between the shaft and rotary body.

2. In combination with a gyroscope having rings, an electric top having its axle-bearing in one of the rings and comprising the rotary body carried by the axle and arranged to turn about the same and an inducing-body mounted on the axle, while said rotary body acts as induced part, substantially as shown and described.

In witness whereof I have hereunto set my hand in presence of two witnesses.

EMIL ZIEHL.

Witnesses:
G. H. ZAHN,
KARL HÄHULEIN.