No. 772,083. PATENTED OCT. 11, 1904.

E. BRETCH.

ELECTRIC MOTOR.

APPLICATION FILED MAY 11, 1903.

NO MODEL. 3 SHEETS—SHEET 1.

Fig. 1.

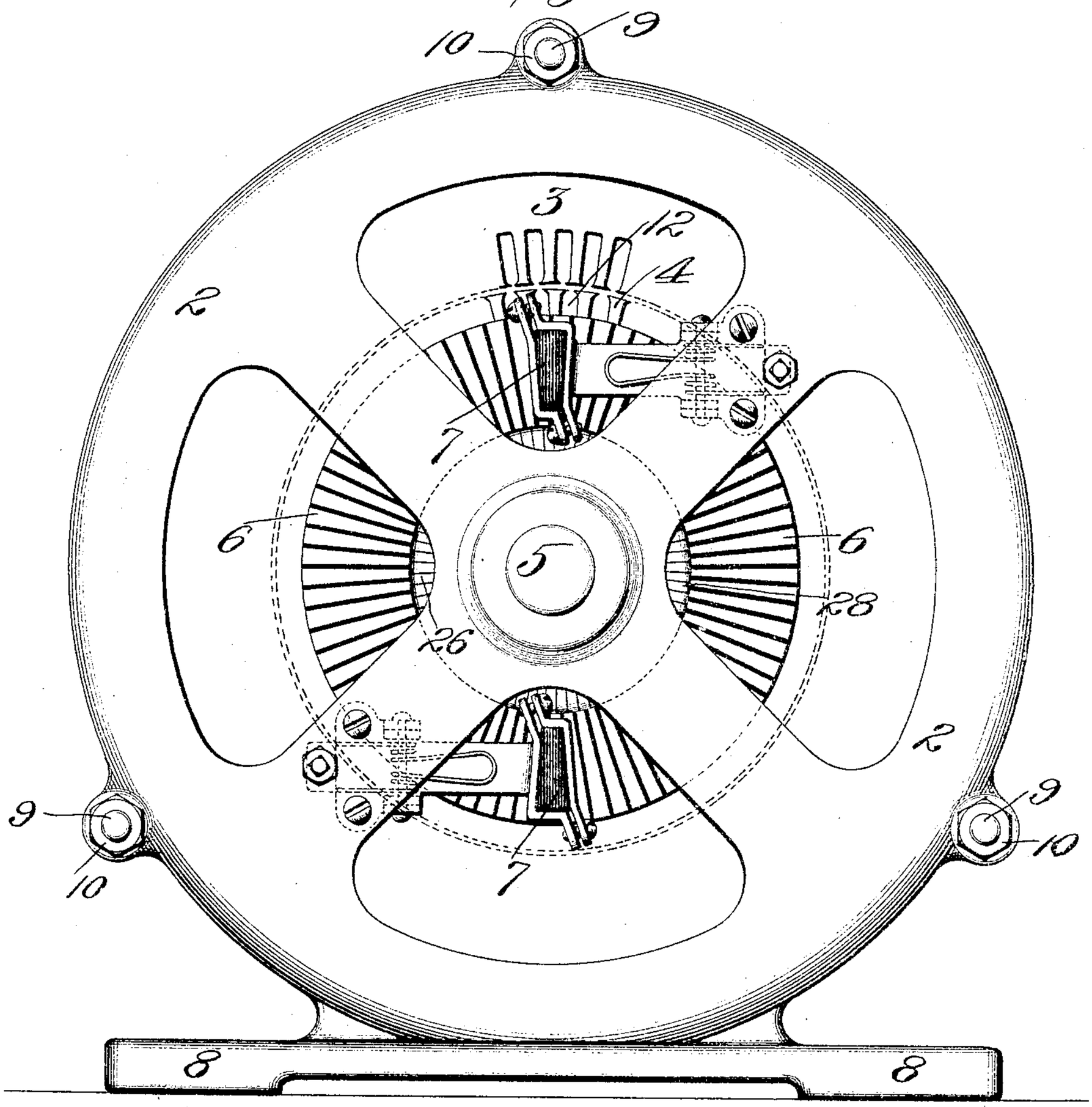
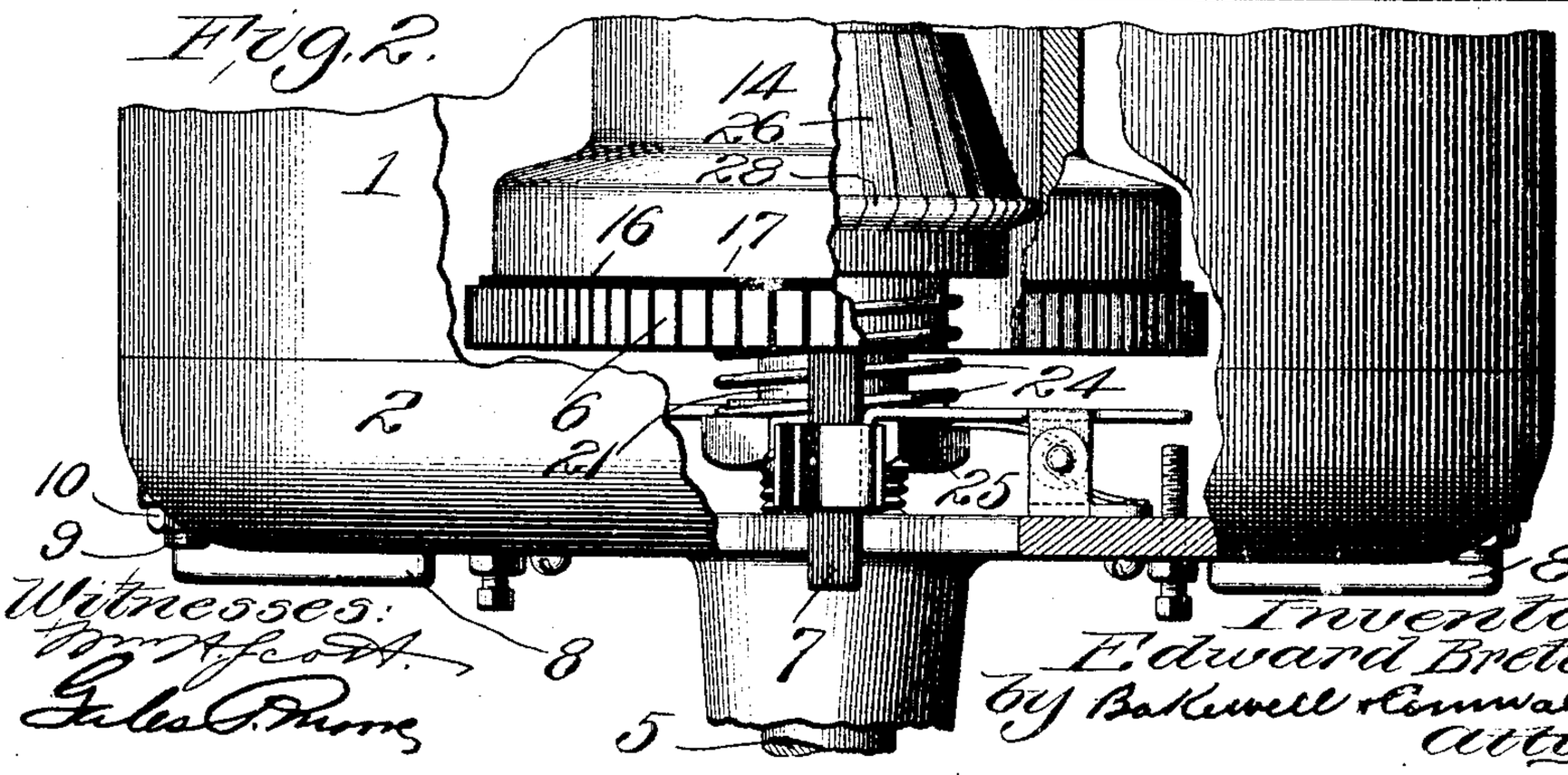


Fig. 2.



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NO MODEL. 3 SHEETS—SHEET 2.

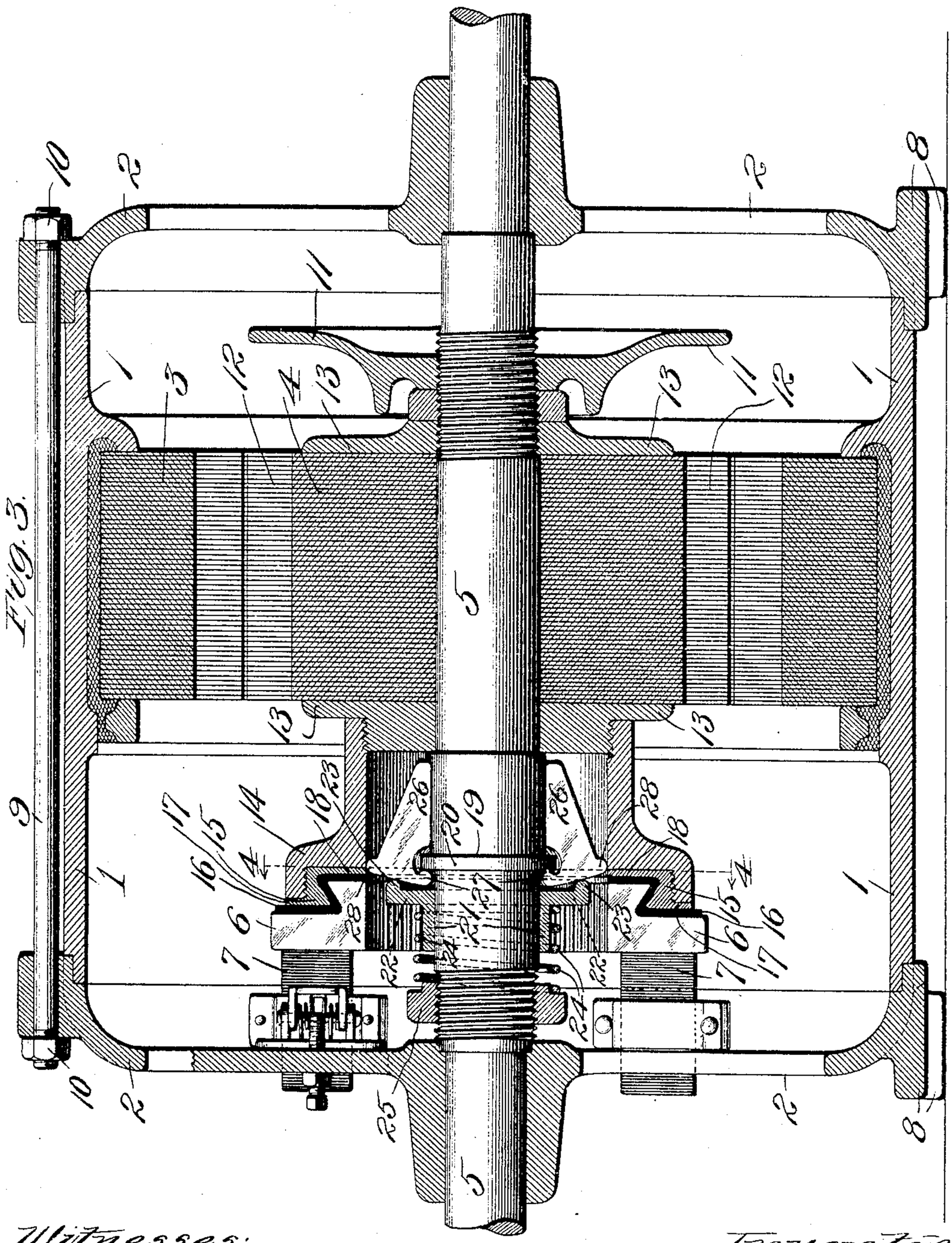

Fig. 3.

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NO MODEL. 3 SHEETS—SHEET 3.

Fig. 4.

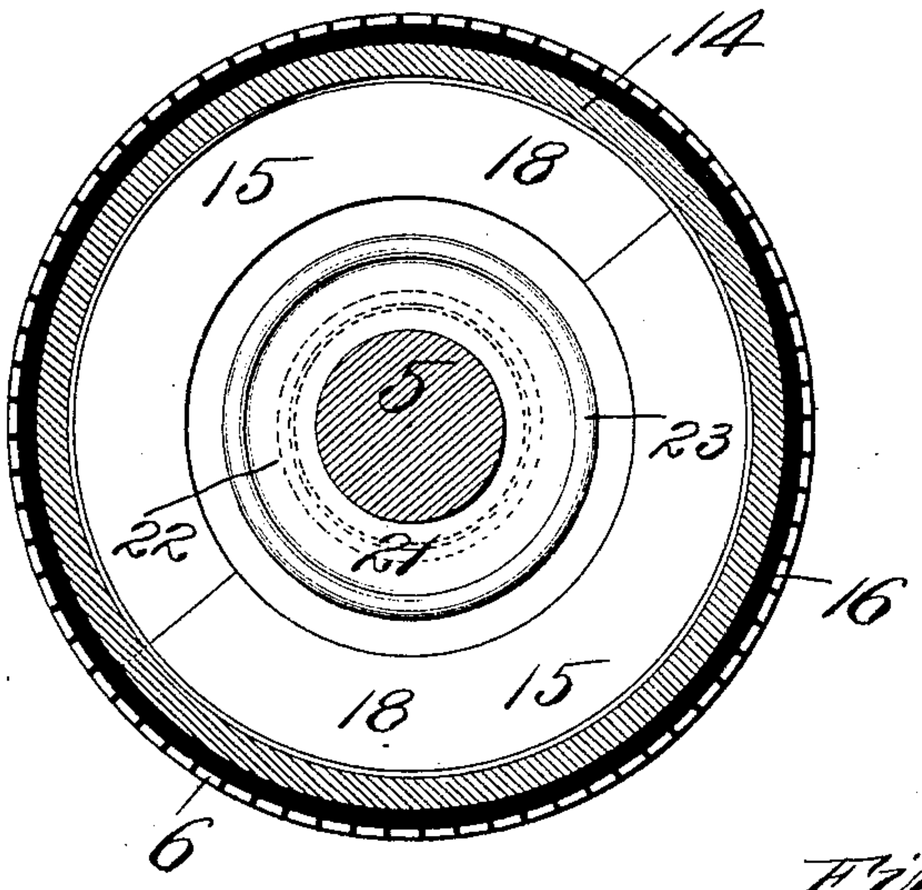


Fig. 5.

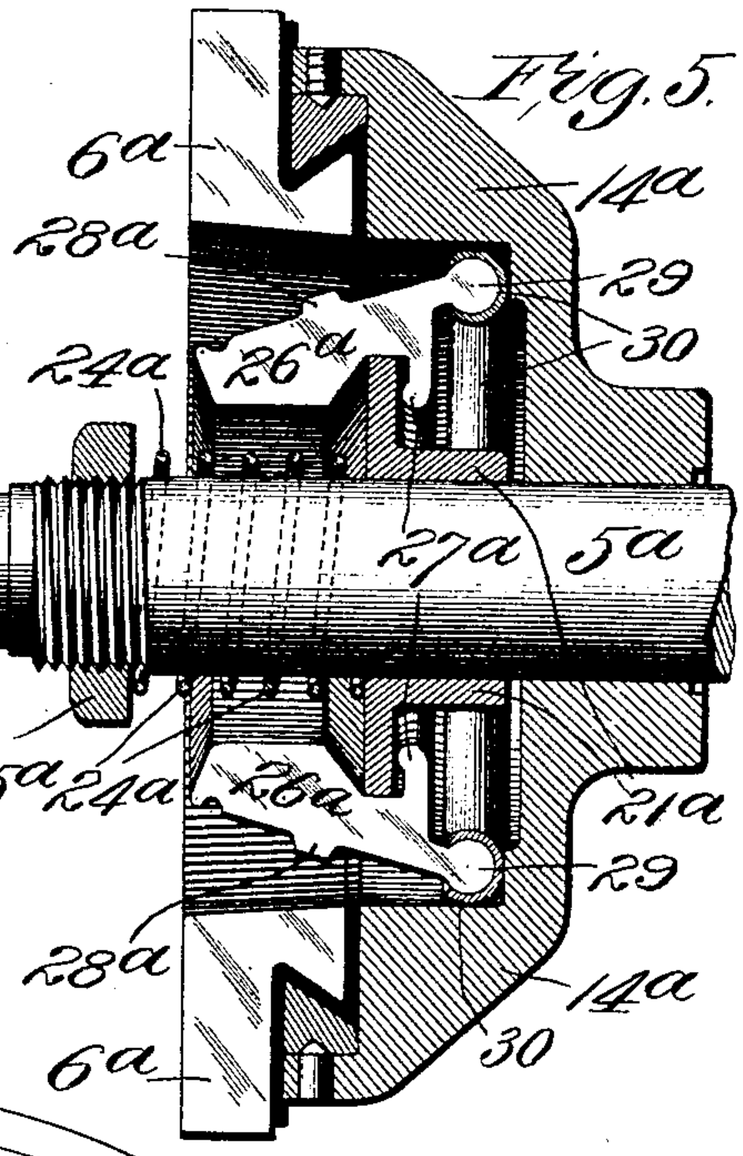
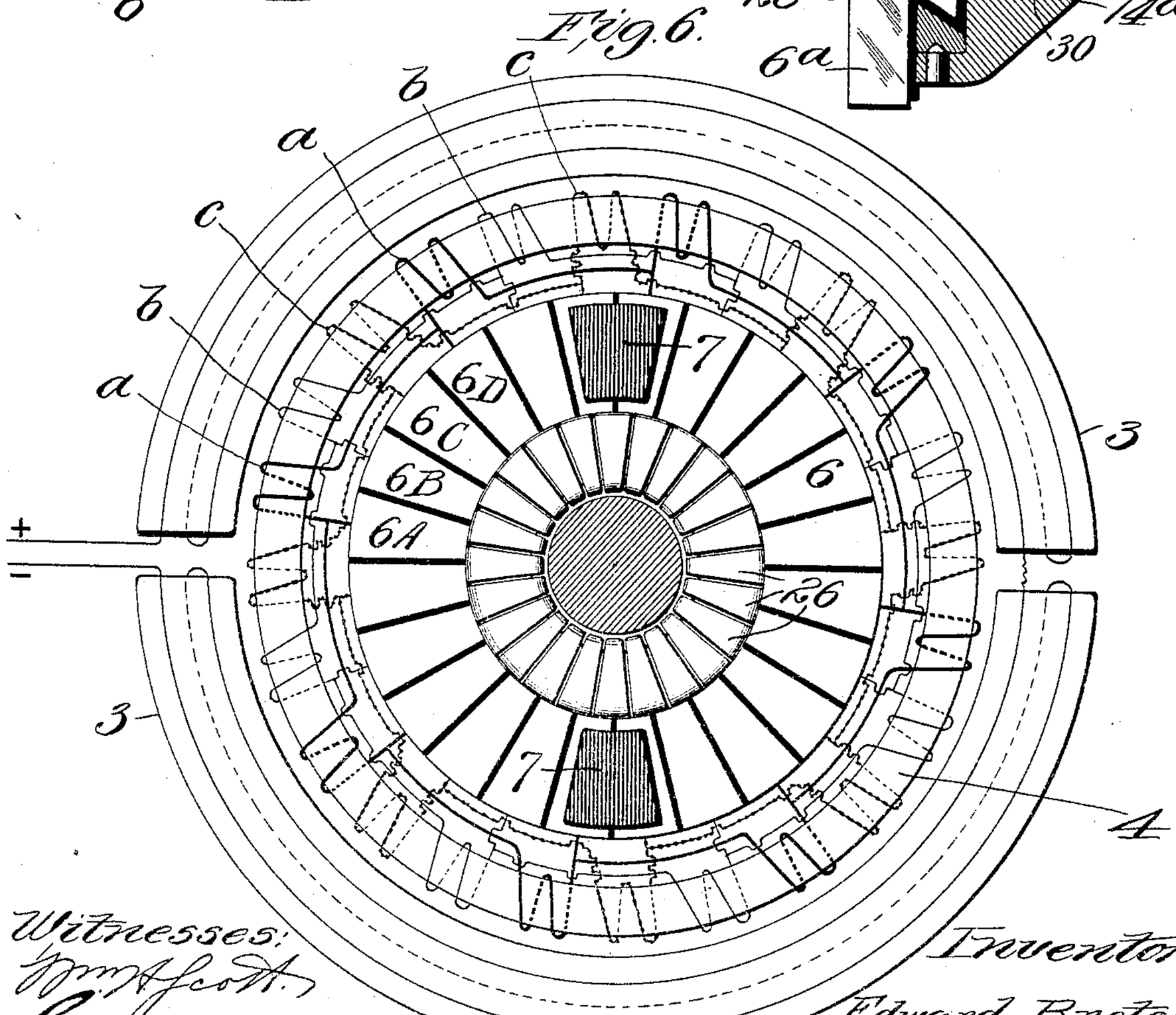


Fig. 6.



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UNITED STATES PATENT OFFICE.

EDWARD BRETCH, OF ST. LOUIS, MISSOURI.

ELECTRIC MOTOR.

SPECIFICATION forming part of Letters Patent No. 772,083, dated October 11, 1904.

Application filed May 11, 1903. Serial No. 156,661. (No model.)

To all whom it may concern:

Be it known that I, EDWARD BRETCH, a citizen of the United States, residing at St. Louis, Missouri, have invented a certain new and useful Improvement in Electric Motors, of which the following is a full, clear, and exact description, such as will enable others skilled in the art to which it appertains to make and use the same, reference being had to the accompanying drawings, forming part of this specification, in which—

Figure 1 is an end view. Fig. 2 is a fragmentary top plan view, partly in section, certain of the parts being broken away. Fig. 3 is a central longitudinal sectional elevation. Fig. 4 is a transverse elevational view on about the line 4 4 of Fig. 3. Fig. 5 is a fragmentary view of the general character of Fig. 3, illustrating a modification; and Fig. 6 is a diagrammatic view illustrating the armature-winding.

This invention relates to electric motors.

One object is to provide a convenient construction by means of which the motor can be automatically short-circuited after the same has attained the desired speed.

A further object is to provide for conveniently adjusting the field-magnet.

A further object is to provide a convenient protector for the armature-coils.

Another object is to provide convenient means for mounting the commutator-segments, and a further object is to provide an improved winding for the armature.

To these ends and also to improve generally upon devices of the character indicated the invention consists in the various matters hereinafter described and claimed.

Referring now more particularly to the drawings, 1 represents the cylindrical body portion of the casing, and 2 the end heads thereof, the field-magnet 3 being secured upon said cylindrical body portion 1 in any suitable manner and the armature 4 being mounted upon the armature-shaft 5 in a manner which is well understood. Said armature-shaft is journaled in the said heads 2. The commutator-segments 6 rotate with the armature, as is usual, and the brushes 7 are mounted upon one of the end heads 2. It is to be noted that the cylindrical body portion 1 of the casing is separate from the heads 2, the supporting-bases 8 being integral with said heads and the heads fitting against the ends of the cylindrical body portion and being clamped in position by means of the bolts 9 and nuts 10. Thus should it be desired to adjust the field circumferentially—as, for example, in order to vary the relationship of the polar projections of the same with respect to the brushes—it is only necessary to loosen the appropriate nuts upon the bolts 9, move the said cylindrical body portion as desired, and then screw the loosened nuts home. The clamping devices or bolts, with their nuts, engage only the heads, so that the cylindrical body portion 1 is free to be adjusted.

Screwed upon the armature-shaft at one end of the armature is a protecting plate or disk 11, which serves to protect the armature-coils. When it is desired to obtain access to the slots 12 between the polar projections of the armature—as, for example, for the purpose of filing these slots—this protecting-disk can be readily removed.

Extending from one of the heads 13, between which the armature is clamped, is the usual supporting-sleeve 14 for the commutator-segments 6. Preferably a divided ring 15 carries the commutator-segments, and this ring is secured upon said supporting-sleeve 14, the usual insulation 16 being interposed between the commutator-segments and the said carrying-ring 15. As shown most clearly in Fig. 3, said ring in cross-section has what may be termed an "exteriorly-threaded" body portion, from the opposite ends of which are extensions 17 and 18, adapted to lie against the end faces of the supporting-sleeve 14, the inner portion of the carrying-ring being notched in order to interlock with the commutator-segments, as shown in Fig. 3. In assembling the parts the commutator-segments are assembled and the split ring is placed in position about said segments with the insulation 16 interposed between the segments and the ring. The ring is then screwed into the supporting-sleeve 14. Manifestly the commutator-segments are firmly clamped by the ring and the ring can be firmly secured to the

supporting-sleeve. By reason of having the ring between the supporting-sleeve and the insulation 16 such insulation is not ground against the end of said supporting-sleeve, as the commutators are secured upon said sleeve.

Heretofore motors have been provided with means for automatically short-circuiting the commutator-segments after the motor has started its operation, as shown, for example, by the patent to Pillsbury, No. 718,518, issued January 13, 1903. The primary object of the present invention is to simplify the construction for producing this short-circuiting of the commutator-segments, and this is accomplished, generally speaking, by providing plates which themselves are acted upon by the centrifugal force developed by the rotation of the armature-shaft and themselves are adapted to directly engage the commutator-segments, whereby the same plates which are directly acted upon by the centrifugal force serve as short-circuiting conductors. In the embodiment of the invention illustrated in Fig. 3 the armature-shaft is reduced in order to produce a shoulder 19, and a washer 20, introduced over the reduced portion of the shaft, rests against said shoulder. A sleeve 21 is slidably supported upon said shaft and is provided at its inner end with a radially-extending flange 22, which preferably has a lateral rib 23 extending toward the before-mentioned washer 20. A spring 24 is coiled about the said armature-shaft and sleeve 21 and is confined between the said radially-extending flange 22 and some other suitable abutment, such as the nut 25, screwed upon the armature-shaft. Short-circuiting plates 26 have fingers 27, which are adapted to engage the outer side face of the washer 20, the outer ends of said short-circuiting plates lying against the rib 23 upon the flange of the slidable sleeve 21. When the armature-shaft is at rest, the short-circuiting plates 26 lie in the position shown in Fig. 3, the spring-pressed sleeve 21 serving to retain said plates in said position out of contact with the commutator-segments. As the armature-shaft develops speed, however, centrifugal force serves to cause the short-circuiting plates to swing outwardly upon the fingers 27 as pivots, and the projections 28 of said plates are thus brought into rubbing contact with the commutator-segments, the spring-pressed sleeve 21 being forced outwardly along the shaft by the plates 26. While the plates are held by centrifugal force in what may be termed their "outward" position the motor is short-circuited in a manner which will be well understood; but as soon as the speed of the armature-shaft decreases sufficiently the spring 24 asserts itself and forces the short-circuiting plates into inoperative position. By reason of the construction just described I am enabled to dispense with centrifugally-operated weights which are independent of the short-circuiting plates and can consequently also dispense with the connections heretofore employed between the short-circuiting plates and separate centrifugally-operated weights, thus making it unnecessary to pierce the armature-core for the passage of connecting-rods, &c. I am also enabled to mount substantially the whole short-circuiting mechanism inside of the commutator, whereby a short armature-shaft can be employed, thus making a more rigid construction for a given length of core than is possible when the centrifugally-operated weights are mounted outside of the core and the commutator and are connected by links or the like to the short-circuiting plates. Furthermore, the present construction involves but few parts and provides for direct action, thus making the same inexpensive and avoiding the friction and other disadvantages incident to the somewhat complicated mechanism required when the centrifugally-operated weights are separate pieces from the short-circuiting plates. The construction of short-circuiting mechanism above described also provides for a rubbing contact under heavy pressure, whereby the contacts are kept bright.

In Fig. 5 is illustrated a slightly-modified construction of the short-circuiting mechanism. In said figure, 5^a indicates the armature-shaft, 14^a the supporting-sleeve, 6^a the commutator-segments, 26^a the short-circuiting plates, and 21^a a sleeve slidable upon the armature-shaft and provided with a radially-extending flange 22^a, 25^a being the nut or abutment, and 24^a the spring between said nut and the flange of said sleeve 21^a, whereby said sleeve is normally forced inwardly or toward the core of the armature. The short-circuiting plates are provided with projections 28^a, which are adapted to contact with the commutator-segments, and the inner ends of said plates are rounded, as shown at 29, and are engaged by a circular holder or carrier 30, which is curved about said ends 29, but permits the plates to swing upon their said ends 29 as pivots. Fingers 27^a upon the short-circuiting plates engage the inner face of the flange upon the sleeve 21^a. Normally the parts lie in the positions shown in Fig. 5 with the short-circuiting plates out of contact with the commutator-segments. When, however, the armature-shaft has developed sufficient speed, the short-circuiting plates will be thrown outwardly by centrifugal force in a manner which will be readily apparent, the plates moving against the force of the spring 24^a and having their projections 28^a thrown into contact with the commutator-segments. When the speed of the armature-shaft decreases, the spring 24^a will serve to return the sliding sleeve 21^a and the short-circuiting plates to their normal positions.

Manifestly the armature can be wound in many ways; but I prefer to employ the mul-

tiplex winding illustrated diagrammatically in Fig. 6. The greatest difficulty with alternating-current-commutator motors is the sparking at the commutator due to the brush short-circuiting the armature-coils in passing from one segment to the next. In an armature revolving in an alternating field there is no position in which the armature-coil is not active in generating an electromotive force, so that with the usual winding there is no position in which the coil can be commutated without short-circuiting an active coil. By employing the winding illustrated in Fig. 6 the above-noted difficulties are overcome. As shown in said figure, one commutator-segment, as the segment 6^A, is connected to the winding *a*. The next segment, 6^B, is connected to the winding *b*. The next segment, 6^C, is connected to the winding *c*, and the next segment, 6^D, is connected to the winding *a*, the next segment being connected to the winding *b*, the next to the winding *c*, and so on, so that even if a conductor simultaneously engages two adjacent segments no short-circuiting results. The brushes 7 are of such width that they can simultaneously contact with not more than three commutator-segments. Thus short-circuiting by means of the brushes becomes impossible, for a brush cannot simultaneously engage two commutator-segments which are connected to the same winding. An armature wound as just described can be conveniently used in many ways. For example, it can be used in a motor adapted to be started and then have the windings connected to one another to run as a short-circuited induction-motor, or the armature can be used in order to produce a variable-speed motor. With the winding indicated the armature and field can be connected to the line in series. The armature and the field can be in a shunt to the line. The field can be connected to the line and the armature-brushes can be short-circuited, or the armature-brushes can be connected to the line and the field can be short-circuited.

I am aware that minor changes in the construction, arrangement, and combination of the several parts of my device can be made and substituted for those herein shown and described without in the least departing from the nature and principle of my invention.

Having thus described the invention, what is claimed as new, and desired to be secured by Letters Patent, is—

1. In a motor, the combination with casing-heads, of a casing portion adjustable with relation to said heads, a field-magnet carried by said adjustable casing portion, and means for securing said heads and casing portion together; substantially as described.

2. In a motor, the combination with casing-heads, and brushes supported upon one of said heads, of a main casing portion intermediate said heads and having its opposite ends engaged by said respective heads, said main casing portion being separate from said heads and adjustable circumferentially with respect thereto, a field-magnet upon said main casing portion, and clamping-bolts engaging said heads; substantially as described.

3. In a motor, a magnet-core, and a separate protecting-plate for said core; substantially as described.

4. In a motor, the combination with a shaft, of an armature thereon, a clamping-head for said armature, and a separate protecting-plate removably mounted upon said shaft; substantially as described.

5. In a motor, the combination with a commutator, and a rotatable shaft, of short-circuiting plates carried by said shaft and adapted to be moved by centrifugal force acting directly thereon, said plates having movement to cause them to contact with said commutator; substantially as described.

6. In a motor, the combination with a commutator, and a rotatable shaft, of short-circuiting plates pivotally mounted upon said shaft and having movement to cause them to contact with said commutator; substantially as described.

7. In a motor, the combination with the commutator, and a rotatable shaft, of short-circuiting plates mounted upon said shaft and adapted to be directly acted upon by centrifugal force, said plates having movement to cause them to contact with said commutator, and means for returning said plates to inoperative position; substantially as described.

8. In a motor, the combination with the commutator, and a rotatable shaft, of short-circuiting plates mounted upon said shaft and adapted to be directly acted upon by centrifugal force, said plates having movement to cause them to contact with said commutator, and yielding means tending to hold said plates in inoperative position; substantially as described.

9. In a motor, the combination with the commutator, and a rotatable shaft, of short-circuiting plates mounted upon said shaft and adapted to be directly operated upon by centrifugal force, said plates having movement to cause them to contact with said commutator, and a spring-pressed sleeve slidably mounted upon said shaft and normally in position to hold said plates in inoperative position; substantially as described.

10. In a motor, the combination with the commutator, and a rotatable shaft, of an annular projection upon said shaft, a spring-pressed sleeve slidably mounted upon said shaft, and short-circuiting plates against whose ends said sleeve bears and provided with fingers engaging said annular projection intermediate said projection and said sleeve; substantially as described.

11. In a motor, the combination with a commutator, and a rotatable shaft having a re-

duced portion whereby a shoulder is produced, of a washer fitting against said shoulder, a spring-pressed slidable sleeve upon said shaft, and short-circuiting plates against whose ends said sleeve bears and provided with fingers intermediate said washer and sleeve, said plates having movement to cause them to engage said commutator; substantially as described.

12. In a motor, the combination with a support, of commutator-segments, insulation between said commutator-segments and said support, and a carrying member supporting said commutator-segments and secured to said support, said carrying member being between the entire surface of said support and said insulation; substantially as described.

13. In a motor, the combination with a support, of commutator-segments, a carrying member having threaded engagement with said support and intermediate said commutator-segments and said support, and insulation between said commutator-segments and said carrying member, said carrying member being between said insulation and the entire adjacent surface of said support; substantially as described.

14. In a motor, the combination with a hollow commutator, of short-circuiting mechanism for being directly acted upon by centrifugal force and for contacting with said commutator, said mechanism being wholly mounted within said commutator; substantially as described.

15. In an electric motor, the combination with the rotary member thereof, of a casing carried by said rotary member, insulated contacts carried by said casing, and a centrifugal device within said casing and operating means connected therewith for electrically connecting said contacts; substantially as described.

In testimony whereof I hereunto affix my signature, in the presence of two witnesses, this 7th day of May, 1903.

EDWARD BRETCH.

Witnesses:
GALES P. MOORE,
GEORGE BAKEWELL.