No. 646,309. Patented Mar. 27, 1900.

G. S. NEELEY.

INDUCTION MOTOR.

(Application filed Nov. 18, 1899.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 4.

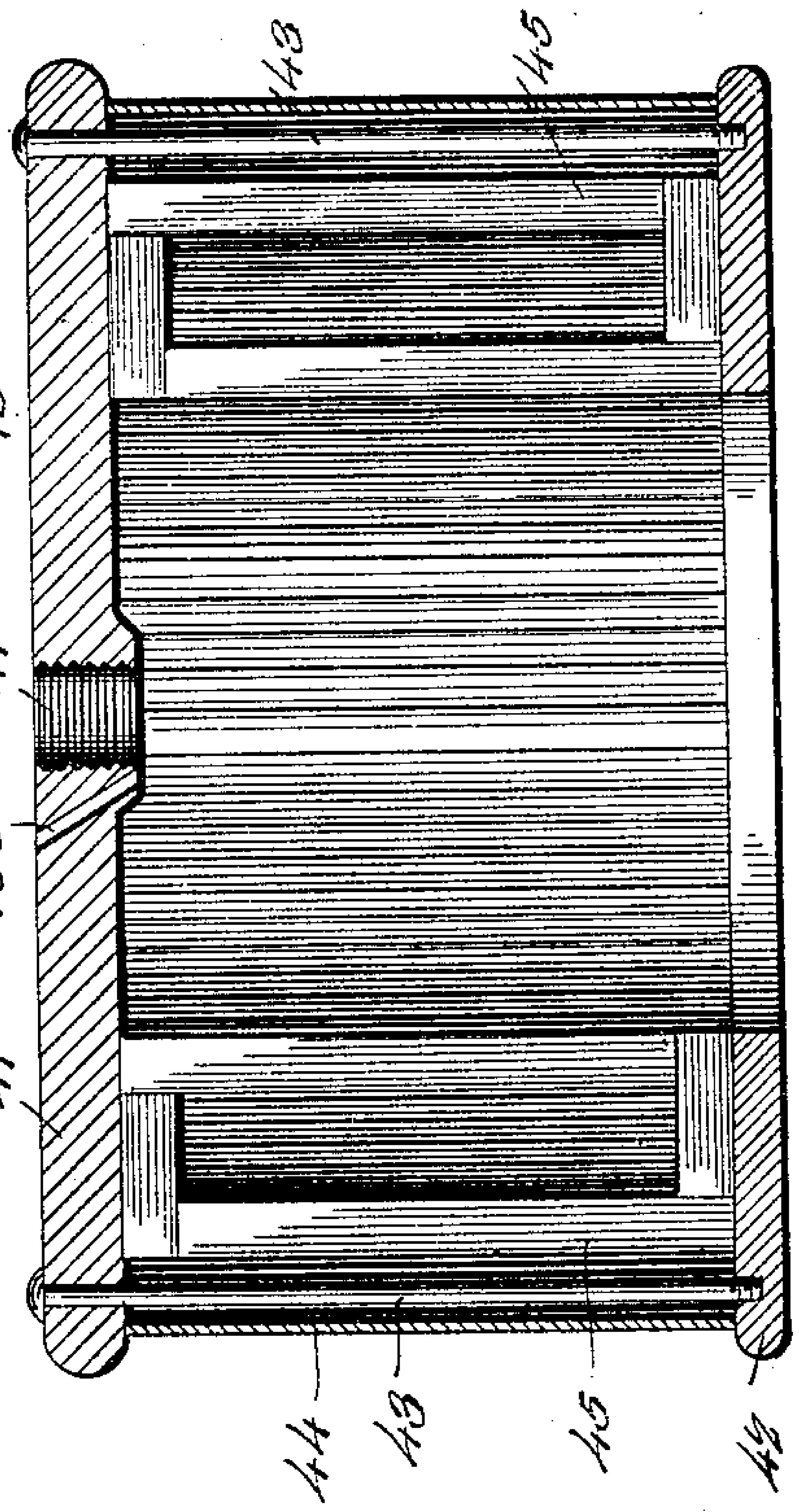


Fig. 6.

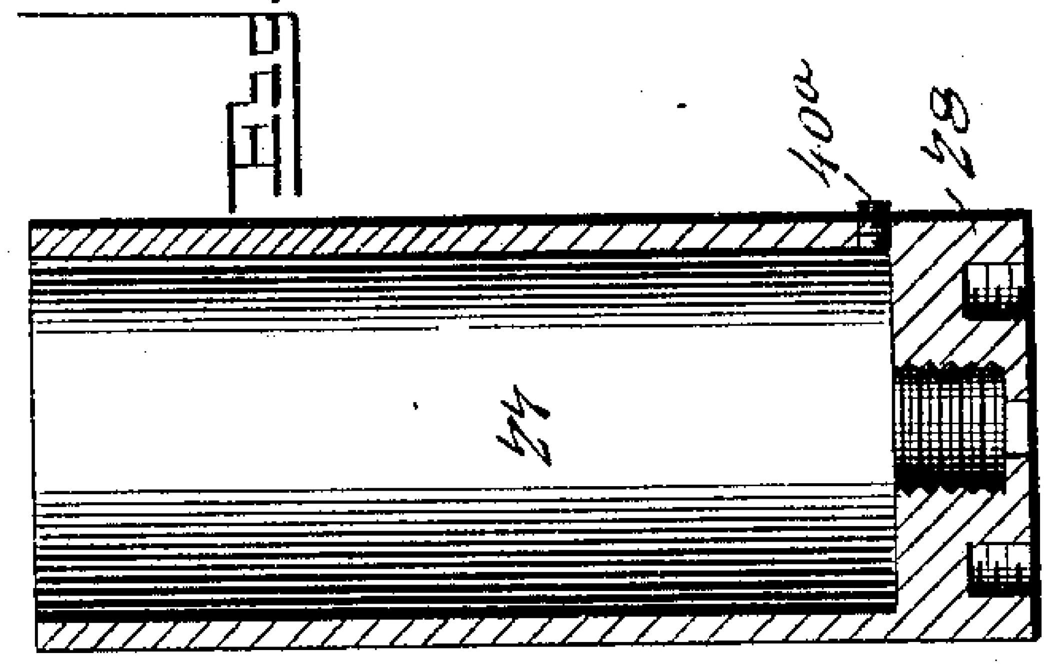


Fig. 5.

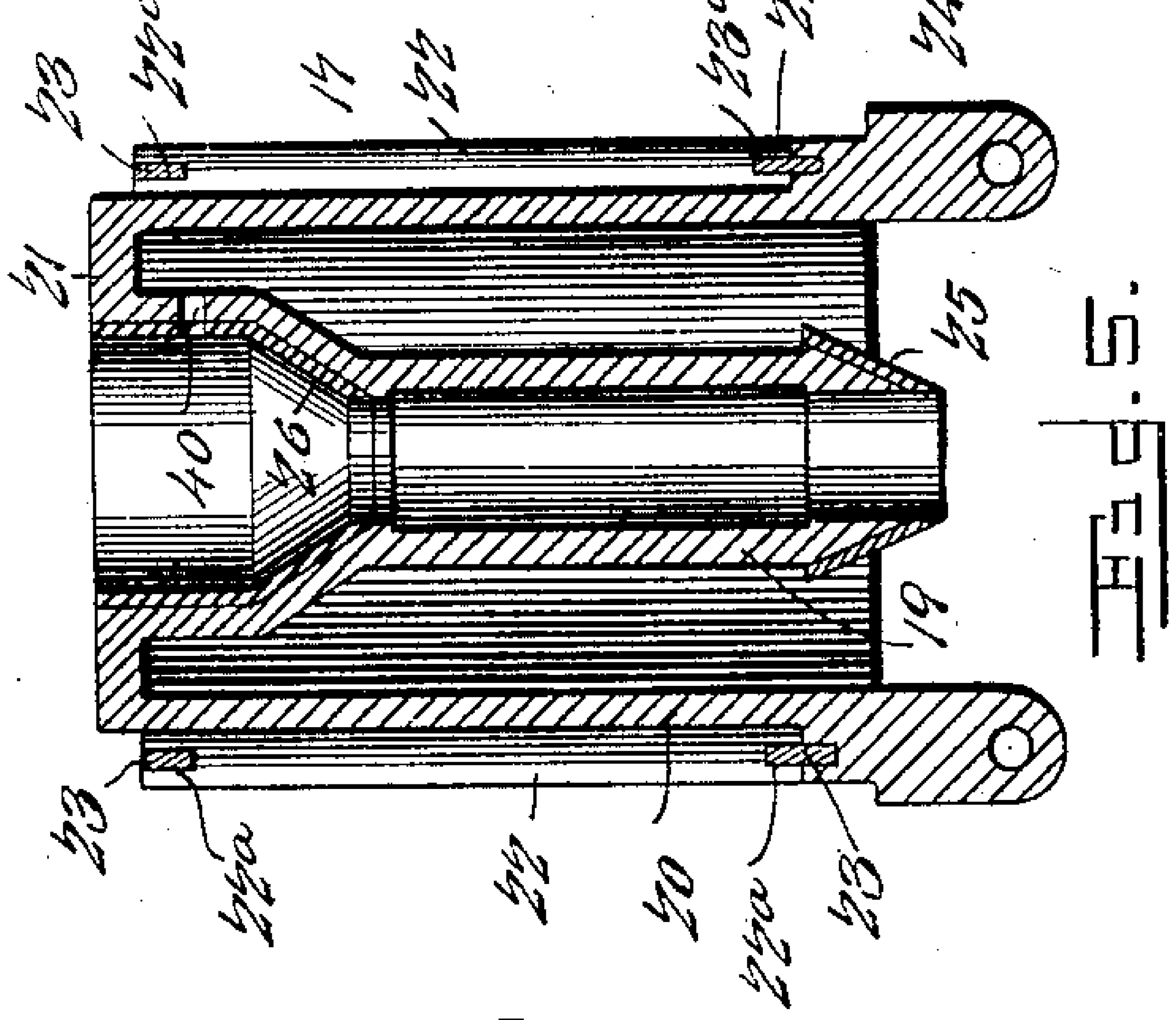
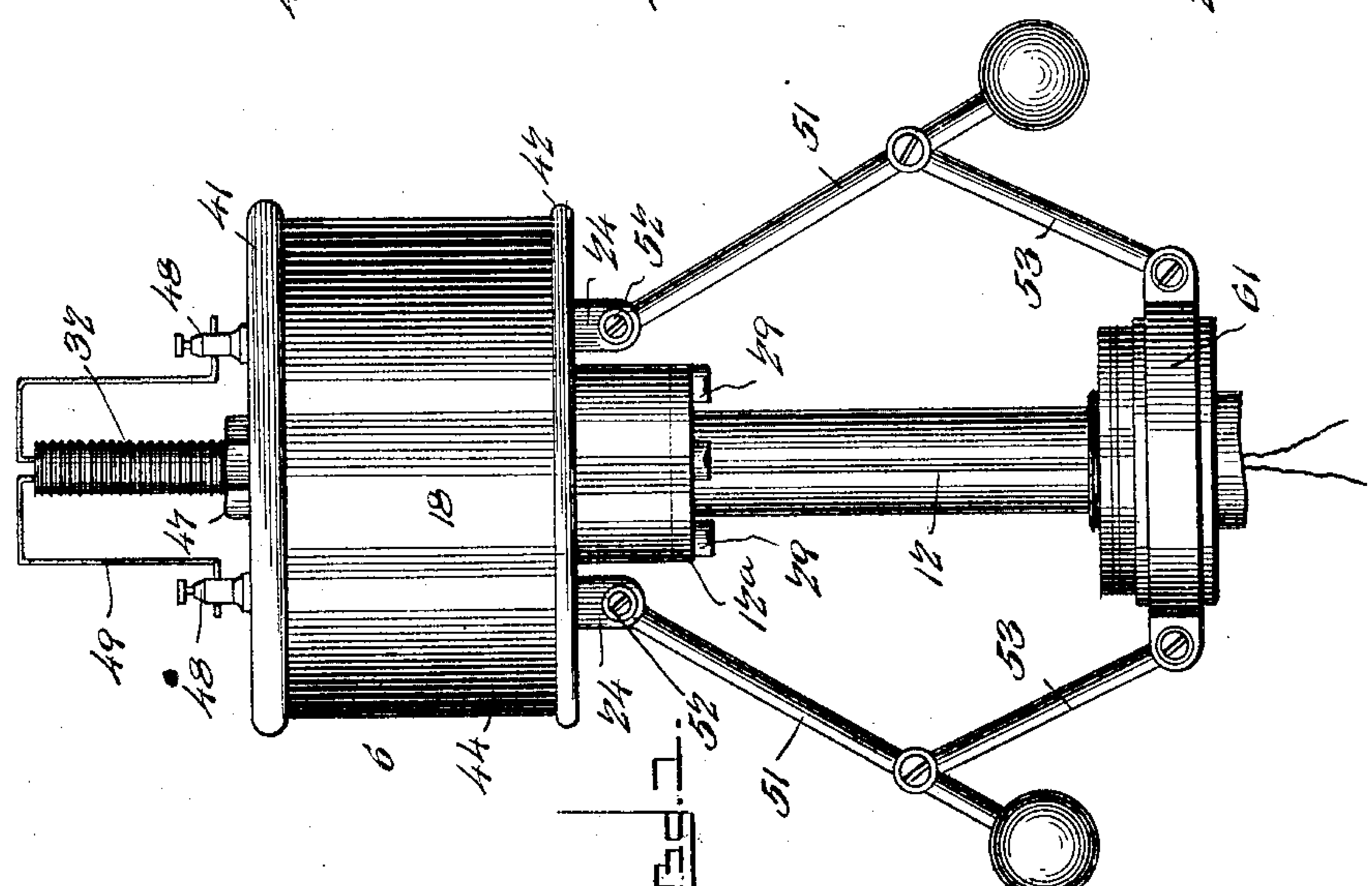


Fig. 7.



Witnesses

E. K. Stewart.

H. J. Bernhard

George S. Neeley Inventor

By his Attorneys,

C. A. Snow & Co.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

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Fig. 2.

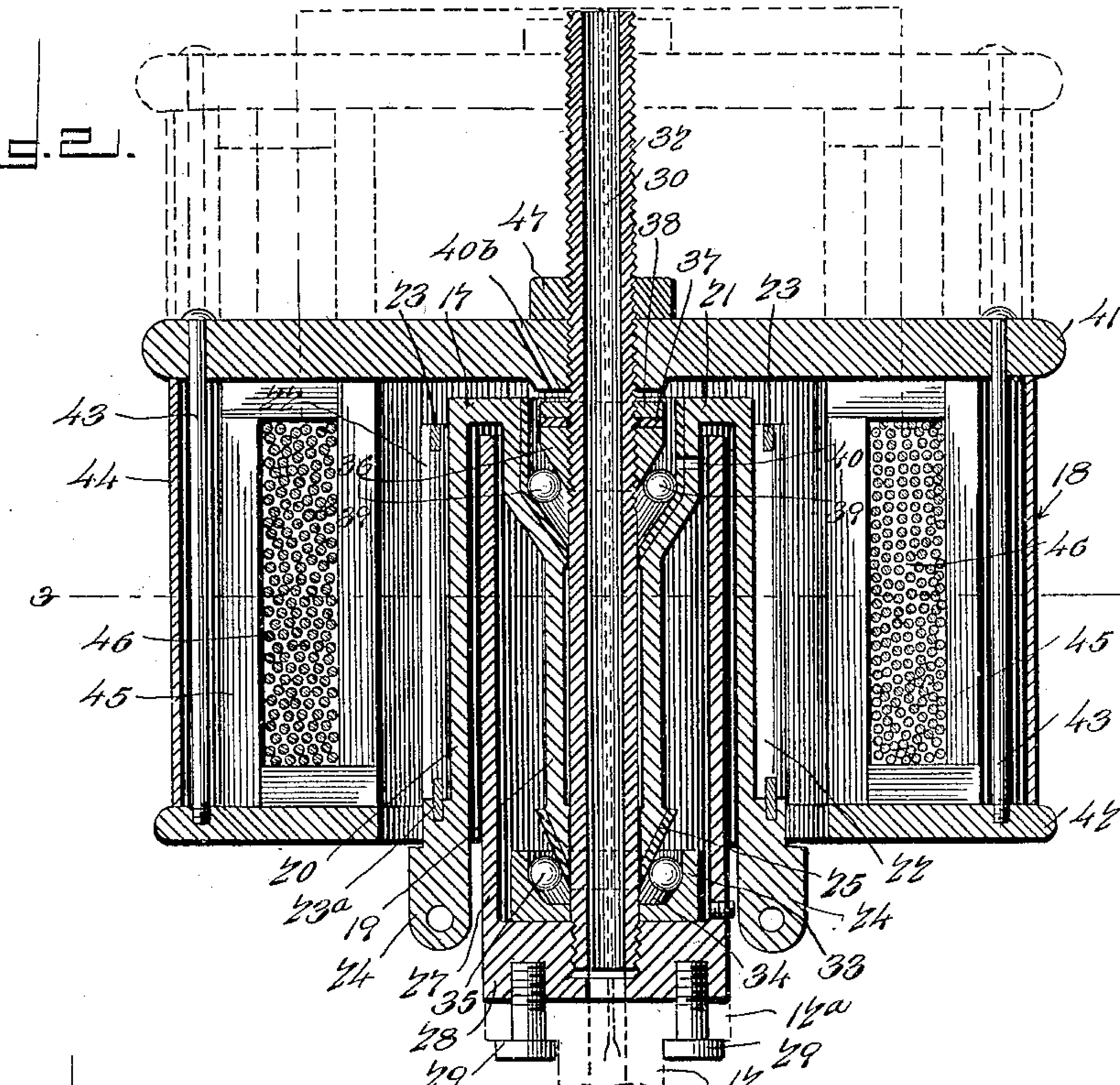
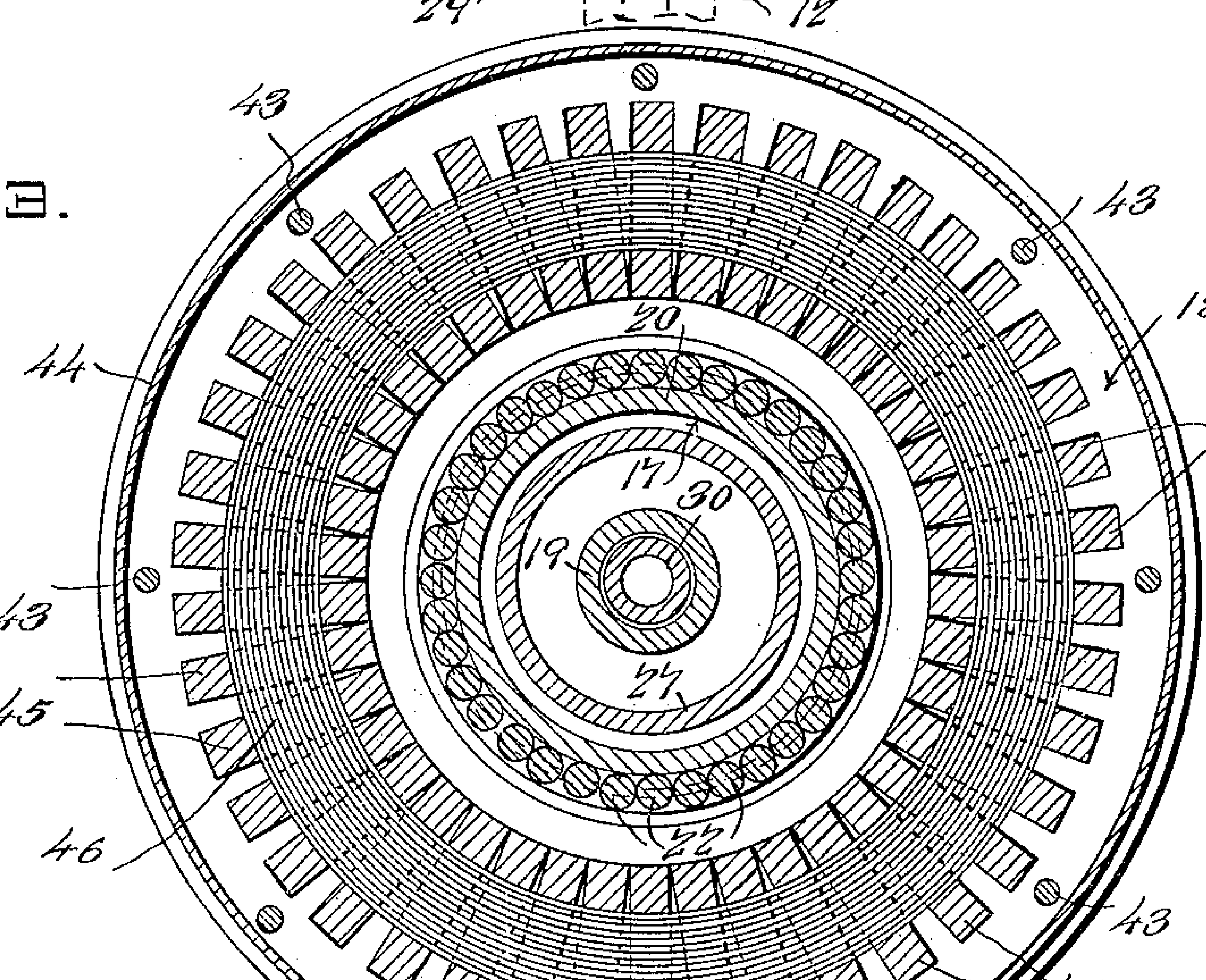


Fig. 3.



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UNITED STATES PATENT OFFICE.

GEORGE S. NEELEY, OF FERGUSON, MISSOURI, ASSIGNOR OF ONE-HALF TO ALBERT KOPPITZ, OF PACIFIC, MISSOURI.

INDUCTION-MOTOR.

SPECIFICATION forming part of Letters Patent No. 646,309, dated March 27, 1900.

Original application filed June 7, 1898, Serial No. 682,849. Divided and this application filed November 18, 1899. Serial No. 737,521. (No model.)

To all whom it may concern:

Be it known that I, GEORGE S. NEELEY, a citizen of the United States, residing at Ferguson, in the county of St. Louis and State of Missouri, have invented a new and useful Induction-Motor, of which the following is a specification.

My invention is an improvement in electric motors of that class known as "induction-motors."

The subject-matter of this application constitutes a division of a prior application filed by me on June 7, 1898, Serial No. 682,849, for an automatic dynamo-regulator, in which application my said improved induction-motor constitutes one element of the regulator system from the fact that it is included in a shunt from the working circuit and the rotary armature carries the revoluble element of a centrifugal governor mechanism, as will more fully appear by a reference to said system as disclosed in the aforesaid application.

While I employ the induction-motor as an element of an automatic dynamo-regulating system, it is to be understood that said motor is not restricted to this specific adaptation, because I reserve the right to employ the motor for any and all purposes for which it may be useful.

The primary object of this invention is to provide an improved construction of induction-motor whose fields may be adjusted to variable positions with relation to the armature for regulating the speed and rotative strength of the motor without involving disturbance of other elements of a system in which the motor may be employed.

A further object of the invention is to provide a construction of motor designed to operate with minimum friction and wear on the several parts and also to insure constant lubrication of the elements.

A further object of my invention is to provide an automatically-controlled electric motor in which the magnetic field and armature are capable of relative lateral movement, and thereby adapted to vary the area of the armature within the magnetic field and combined with a centrifugal governor to automatically vary the said area.

With these ends in view the invention consists of an induction-motor comprising a carrier having the field-coils and a revoluble armature, said carrier being adjustable with the field-coils relative to said armature.

The invention further consists in the novel combination of elements and in the construction and arrangement of parts, which will be hereinafter fully described and claimed.

To enable others to understand the invention, I have illustrated one adaptation thereof in the accompanying drawings, forming a part of this specification, in which—

Figure 1 is a side elevation of my induction-motor, showing it in operative relation to a centrifugal governor. Fig. 2 is a vertical sectional view, on an enlarged scale, through the improved motor, the dotted line representing an adjustment of the carrier and the field with relation to the armature. Fig. 3 is a horizontal transverse section taken in the plane indicated by the dotted line 3 3 of Fig. 2. Fig. 4 is a detail sectional elevation of the motor field-carrier, omitting the field-coils and showing the carrier removed from the motor-spindle and the armature. Fig. 5 is a detail sectional elevation of the motor-armature. Fig. 6 is a detail view of the lubricator-cup for the motor-armature.

The same numerals of reference are used to indicate like and corresponding parts in each of the several figures of the drawings.

The induction-motor is designated in its entirety by the numeral 6, and it is supported or carried on a stationary vertical column or standard 12. This column is preferably tubular, and on it is mounted by peculiar devices the revoluble armature which constitutes the rotary element of the motor, while the other normally-stationary motor element is secured firmly to the spindle for the purpose of adjusting said motor member relative to the rotary member, whereby the speed and rotative strength of the motor may be regulated without involving disarrangement of other parts which may be used in connection with the motor.

The rotary element of my induction-motor is embodied in the form of an armature-spider, the same being revolubly fitted to the tubular spindle on the fixed supporting-standard 12. The stationary motor element is a field-carrier which is attached to the spindle to remain normally in a stationary relation to the rotative armature-spider, said field-carrier being adjustable endwise with relation to the armature. The rotative armature-spider 17 is peculiarly constructed for the purpose of using the same in connection with bearings which insure great freedom of rotation to said armature-spider and provide for the proper and constant lubrication of the rotary motor element. The spider consists of a tubular hub 19 and a cylindrical shell 20, which are joined together at one end by a web or head 21, all of said parts being made, preferably, in a single piece of metal—as, for instance, by casting the same. The armature-spider is represented very clearly by Figs. 2 and 5 of the drawings, in which the web 21 is shown as closing the space between the upper end of the sleeve-like hub 19 and the cylindrical shell 20; but the space at the opposite end of said armature-spider is open for the reception of a stationary lubricating-reservoir 27. To the external surface of the cylindrical shell 20, forming a part of the armature-spider, is applied a series of short-circuited copper bars 22, which are set close together and constitute a closed circuit around the external surface of the cylindrical shell 20. These bars have grooves 22^a formed in their ends to snugly receive the copper bands or ribbons 23 23^a, which bands serve to hold the circuit or series of copper bars against the periphery of the cylinder 20, forming a part of the armature-spider. The external cylinder 20 is furthermore provided with the depending short arms 24, that extend below the stationary field-carrier 18 of the motor for the purpose of properly attaching to the rotary armature-spider the weighted lever-arms of a centrifugal governor mechanism. (See Fig. 1.)

The sleeve-like internal hub 19 of the armature-spider is constructed with two conical bearings, one of which, at the lower end of the sleeve-like hub, is external thereto, while the other bearing, at the upper end of said sleeve-like hub, is internal thereof. Both of these conical bearings are faced with metal, designed to reinforce the bearing-surface and increase the durability of the armature-spider, and with these hard-metal conical bearings are combined series of bearing-balls that reduce the friction to a minimum and insure great freedom of rotation to the motor-armature. The external conical bearing at the lower end of the motor-armature is indicated by the numeral 25; but the internal conical bearing at the upper end of the sleeve-like hub is produced by flaring the hub and lining the same with hard metal to produce the said internal conical bearing, (indicated at 26.) The lubricant-reservoir 27 is introduced into or through the lower open end of the armature-spider, said reservoir 27 being of such length as to supply the lubricant to the upper bearing 26 as well as to the lower bearing 25. Said lubricant-reservoir is shown in the form of a cylindrical shell, open at its upper end and closed at the lower extremity by a head 28, the latter being preferably integral with the shell. The head of the lubricant-reservoir is fitted to or rests upon an enlargement or disk 12^a on the upper extremity of the standard 12, as indicated by dotted lines in Fig. 2, so that the reservoir may be fastened to the standard by the screws 29; but it will be understood that the reservoir may be secured in place by any equivalent devices. It will be understood that the stationary lubricant-reservoir fits loosely in the armature-spider between the sleeve-like hub and the external shell thereof, the upper extremity of said reservoir terminating close to the web 21, which closes the head of the armature-spider.

By fastening the reservoir firmly to the supporting-standard 12 it serves as the support for a tubular spindle 30, the latter serving as the axis around which the armature-spider may rotate with ease and freedom. The spindle is threaded externally at its lower end for the purpose of screwing the same into the bottom 28 of the stationary reservoir, so that the spindle is secured firmly to said reservoir, and this tubular spindle extends vertically through the sleeve-like hub of the armature-spider and through the upper part of the field-carrier 18. The upper part of this fixed spindle 30 is externally threaded at 32 for a considerable distance, so as to allow the proper vertical adjustment of the field-carrier thereon, and this spindle thus serves in a twofold capacity, because it provides the axis of rotation for the armature-spider and as the support for the field-carrier. A lower bearing-cup 33 is arranged on the bottom of the stationary lubricant reservoir in operative relation to the lower external conical bearing 25 of the armature-spider, and between the faces of this bearing-cup 33 and the hard-metal lining of the conical bearing 25 is interposed a series of bearing-balls 35. Said bearing-balls travel against the external conical bearing 25, and they are confined within the ball-race 34, which is provided in the upper side of the bearing-cup 33.

The upper cone-bearing 36, which coacts with the internal conical bearing-surface 26 of the armature-spider, is secured rigidly to the threaded part 32 of the tubular spindle 30. Said bearing 36 is in the form of a cone having a central threaded opening adapted to be screwed on the threaded part of the stationary spindle 30, said cone occupying a position within and concentric with the internal bearing-surface 26 of the armature-spider, thus disposing the bearing-cone 36 in a position for its conical face to oppose the similar face on the bearing 26. Between the opposing faces of the cone and the bearing-surface 26 of the armature-spider is interposed a series of bearing-balls

39, adapted to ride against said casing. Said bearing-cone 36 is adjustable lengthwise on the tubular fixed spindle 30 by rotating it on the threaded part 32 for the purpose of compensating for any wear which may take place on the upper and lower conical bearing of the revoluble armature-spider. The upper conical bearing 36 is held securely in its adjusted position by a washer 37 and a jam-nut 38, said washer being fitted loosely on the spindle and resting upon the cone, while the jam-nut is screwed on the spindle in order to restrain the cone from displacement thereon.

The upper end of the cylindrical reservoir 27 terminates in the horizontal plane of the bearing-cone 36, and communication between the reservoir and the sleeve-like hub is established by a port 40, which is formed in the flared upper part of said hub 19, thus permitting the lubricant from the reservoir to pass freely into the space between the fixed spindle and the hub of the armature-spider. A port 40^a is provided in the lower part of the cylindrical reservoir 27 for the extraction of lubricant from the reservoir, and a similar port 40^b is provided in the upper head of the field-carrier 18 for introducing the lubricant into the reservoir and the hub of the armature-spider, the lower port 40^a being closed by a suitable plug.

The stationary field-carrier 18 of my improved induction-motor consists of a head 41, a base-ring 42, the bolts 43, and the casing or shell 44. The head and the base-ring 41 42 are parallel to each other, and the cylindrical casing 44 is interposed between these parts, all of the parts of the field-carrier being bound or firmly clamped together by the tie-bolts 43, which are suitably attached to the head and the base-ring. This field-carrier sustains a series of laminated sheets 45, which constitute the iron core for the starting and field coils 46 of the induction-motor. The core-sheets and the coils of this induction-motor are arranged between the head and the base-ring of the field-carrier, so as to be confined rigidly within the latter. The field and starting coils are surrounded by the laminated sheet 45, as shown by Figs. 2 and 3, and said coils and laminated core on the adjustable field-carrier envelop or surround the copper bars 22 of the armature-spider. The field-coils and their cores are thus mounted within the annular carrier 18 for the purpose of being movable therewith on the endwise adjustment of said carrier upon the fixed spindle 30, whereby the area of the coils and the core exposed to the copper bars on the armature-spider may be varied by an adjustment of the field-carrier substantially in the way indicated by dotted lines in Fig. 2. The upper head 41 of the field-carrier is provided with a central threaded opening 41^a, into which is screwed the upper threaded length of the spindle 30, and this threaded connection between the spindle and the field-carrier head causes the carrier to assume a stationary position with relation to the armature-spider. The field-carrier is held firmly in its adjusted position on the spindle by a jam-nut 47, the latter being screwed on the spindle and binding against the carrier-head 41. Said field-carrier also supports the binding-posts 48, to which are fastened the insulated conductors 49, and in order to compactly dispose these conductors I prefer to carry or extend them through the tubular spindle 30.

In Fig. 1 of the drawings the improved motor is shown in operative relation to a centrifugal governor mechanism which forms an element of the dynamo regulator system disclosed in my prior application. The weighted lever-arms 51 of this governor mechanism are fulcrumed at 52 to the depending lugs 24 of the motor-armature. The levers of the governor have the pivotal links 53 pivoted thereto near the weights thereof, and these links are also connected with a revoluble and slidable collar 61 of said governor mechanism. It is to be understood that the induction-motor of my invention is not restricted in its adaptation to a governor mechanism, because I am aware that said motor may be used in the arts generally.

The improvements which I have made in the induction-motor are not directed to the operating elements of a motor *per se;* nor do they relate to the theory or principle upon which the motor becomes operative through the inductive effects of the alternating current. My improvements relate more particularly to the means for supporting the rotative motor element, (the armature,) by which the latter may rotate with minimum friction, to the means by which the motor is regulated as to rotative strength and speed by enveloping more or less of the armature within the field of the coils, which adjustment is due to the movement of the relatively-stationary carrier by the agency of the threaded spindle and the nuts thereof, and, finally, to the provision of the means by which the parts can be adjusted to compensate for wear.

The operation of my motor is as follows: The field-magnet and armature are capable of relative lateral movement, whereby the area of the armature within the magnetic field is varied, and these being combined with a centrifugal governor, which automatically regulates the relative positions of the field-magnet and armature, the speed of the motor is thereby controlled and regulated by the governor, as will be readily understood, the descent of the governor-weights increasing the areas of the armature within the magnetic field, and the ascent of the weights, due to centrifugal force generated by higher speed of the motor, tending to withdraw the armature from the magnetic field.

It follows from the foregoing that an essential feature of my invention is a motor in which the field-magnet and armature are relatively laterally movable and combined with a governor mechanism for automatically varying the coacting areas thereof, and I would have it therefore understood that I do not desire to limit myself to the form of motor herein shown and specifically described, as modifications may be made therein without departing from the spirit of my invention.

It is evident that the field-coils of the motor can be interchanged with other coils readily to suit the different potentials without disturbing the motor-armature.

Changes may be made in the form and proportion of some of the parts while their essential features are retained and the spirit of the invention embodied. Hence I do not desire to be limited to the precise form of all the parts as shown, reserving the right to vary therefrom.

Having thus described the invention, what I claim is—

1. In an induction-motor, the combination of a spindle, an armature-spider revoluble freely on the spindle, and a carrier mounted on said spindle concentric with the armature and supporting field-coils and their cores, said carrier being adjustably connected to the spindle for movement with the field-coils, substantially as described, for the purpose set forth.

2. In an induction-motor, the combination with a spindle, of an armature-spider fitted revolubly to the spindle and provided on its external surface with a series of short-circuited copper bars, a carrier fixed to said spindle for adjustment thereon and arranged concentric with the armature-spider and its short-circuited secondary element, and the field-coils supported within the said carrier and surrounding the short-circuited copper bars of the armature, said coils adjustable with the carrier relatively to the armature, substantially as described.

3. In an electric motor, an armature, a stationary spindle on which the same is idly mounted, a field-carrier adjustable on said spindle, and a centrifugal governor, revoluble with and connected to the armature, all combined and adapted to operate for the purpose set forth, substantially as described.

4. An induction-motor comprising an armature-spider having a sleeve-like hub and an outer shell, said sleeve-hub provided at one end with an external conical bearing-face and enlarged at its other end to form an internal conical bearing-surface, a spindle on which the sleeve-like hub of the spider is revolubly fitted, the bearing-cone and the cup in operative relation to the conical bearing-faces of said sleeve-hub, a field-carrier supported on the spindle, and field-coils supported by the carrier and enveloping the armature, substantially as described.

5. An induction-motor comprising a supporting means having a lubricant-reservoir, a fixed spindle carrying a bearing-cup and a bearing-cone, an armature-spider having an external shell and a sleeve-like hub, the latter fitting loosely on the spindle and entering the reservoir, said hub being also provided at its lower end with a conical bearing-face and with an enlarged upper end forming an internal conical bearing-face, bearing-balls confined between the armature-spider, the cup and the cone, a field-carrier supported by the spindle, and field-coils on said carrier and enveloping the armature-spider, substantially as described.

6. In an induction-motor, the combination of a central spindle, a lubricant-reservoir, an armature-spider having its sleeve-hub loosely fitted on the spindle within said reservoir and provided with a shell which is arranged externally to the reservoir and carries a series of short-circuited copper bars, ball-bearings fitted to the spindle for engagement with the sleeve-hub of the spider and situated within the reservoir to be constantly supplied with lubricant therefrom, an annular carrier supported on the spindle, and field-coils mounted on said annular carrier and enveloping the bars of said armature, substantially as described.

7. In an induction-motor, an armature-spider provided with a sleeve-hub having conical bearing-faces on its inner and outer surfaces and facing in a common direction, a cup contiguous to the external face, a cone opposite the internal face, and bearing-balls between the opposing faces of the parts, in combination with a spindle, a field-carrier, and coils mounted on the field-coils and enveloping the armature-spider, substantially as described.

8. In an induction-motor, an armature-spider having a sleeve-like hub enlarged at one end forming an internal conical bearing-face, a spindle fitted loosely in said hub, a bearing-cone adjustable on the spindle with relation to said internal face of the hub, and ball-bearings for said hub, in combination with a field-carrier mounted adjustably on the spindle, and field-coils supported by the carrier and enveloping the armature-spider, substantially as described.

In testimony that I claim the foregoing as my own I have hereto affixed my signature in the presence of two witnesses.

GEORGE S. NEELEY.

Witnesses:
CHAS. J. JAMESON,
RICHARD MILES.