E. C. KETCHUM.

BRUSH HOLDER FOR DYNAMOS.

APPLICATION FILED JUNE 25, 1909.

966,839.

Patented Aug. 9, 1910.

3 SHEETS—SHEET 1.

Fig. 2.

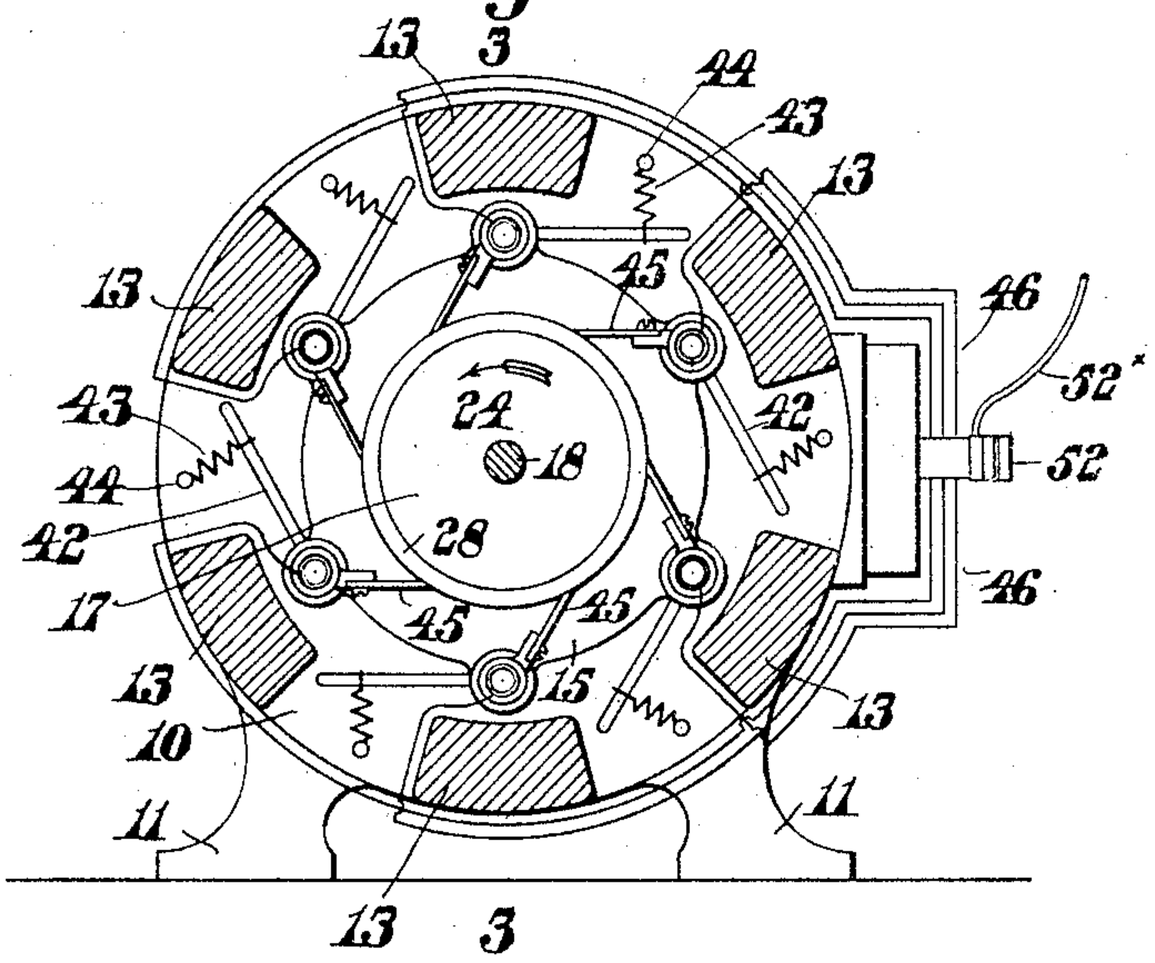
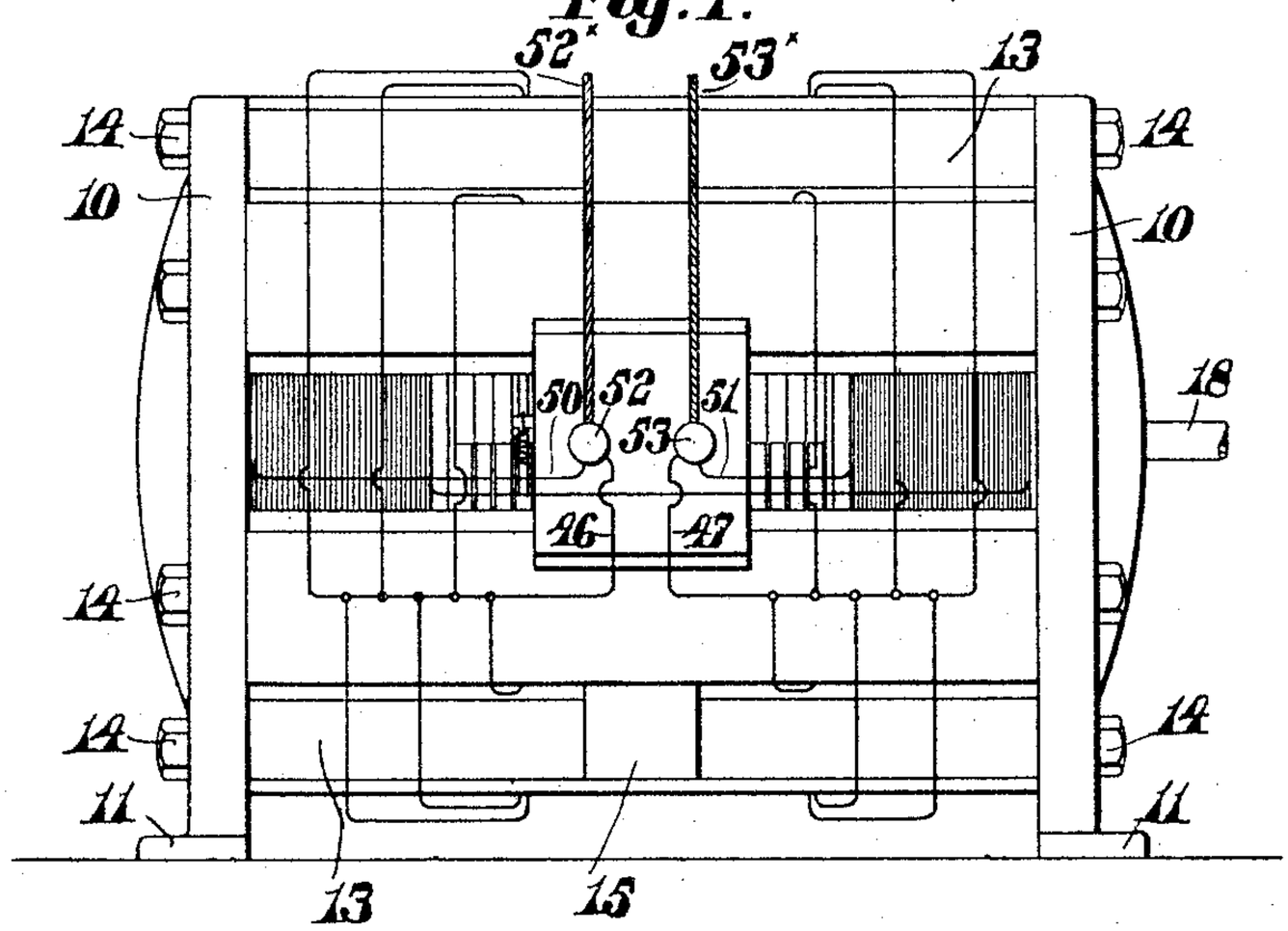


Fig. 1.



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Inventor:

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3 SHEETS—SHEET 2.

Fig. 3.

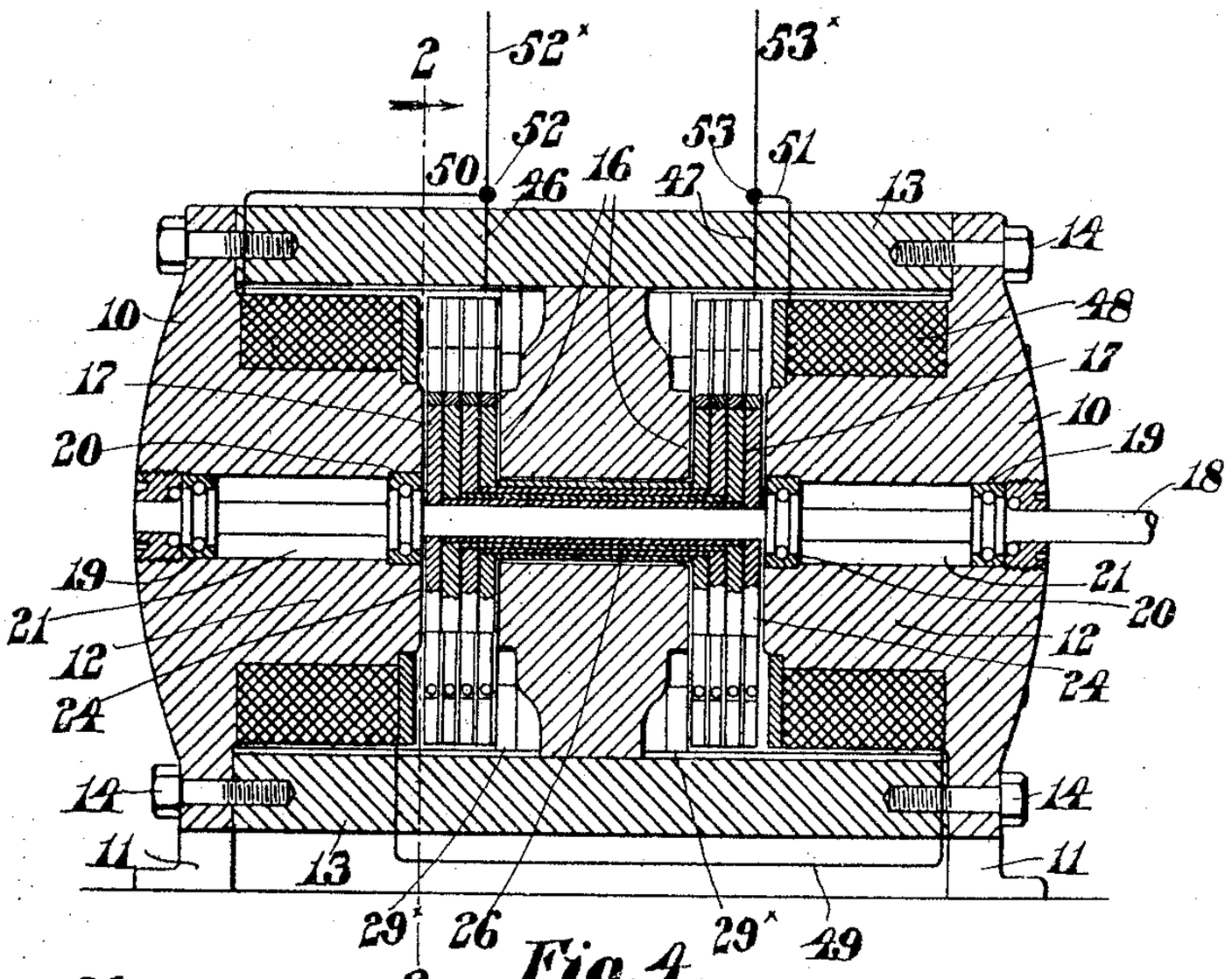


Fig. 4.

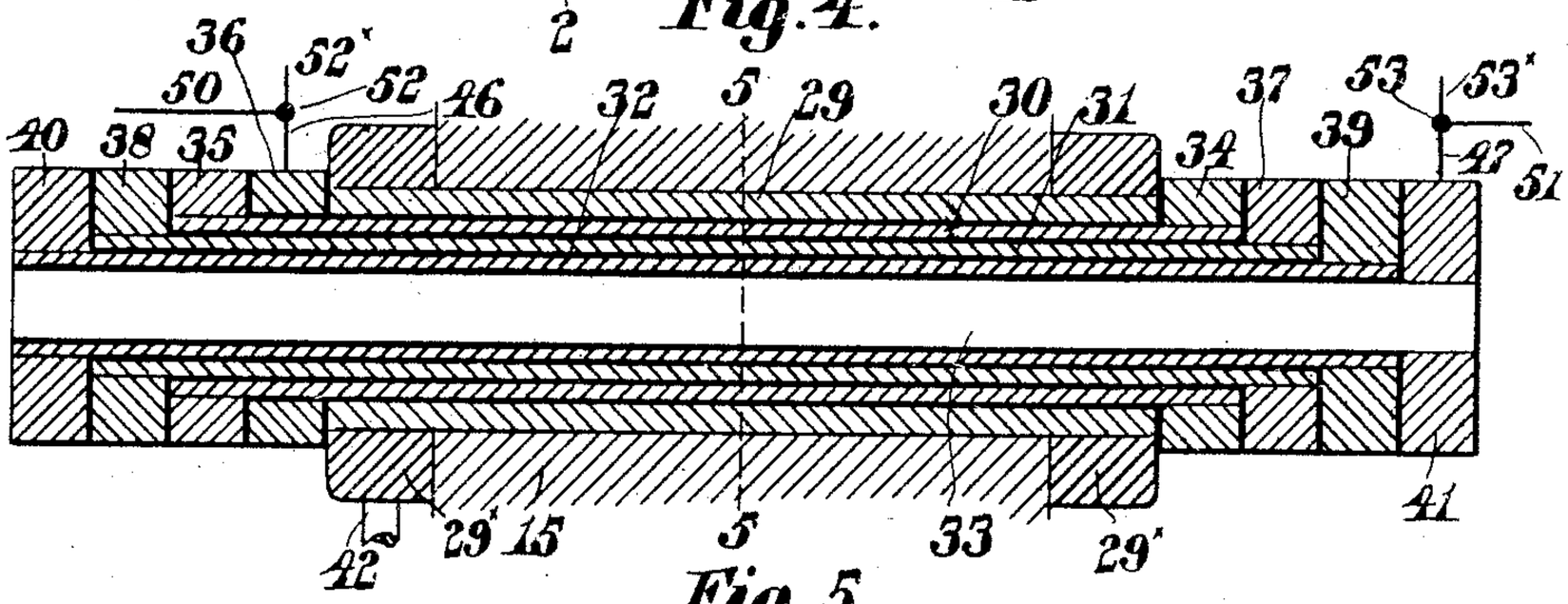
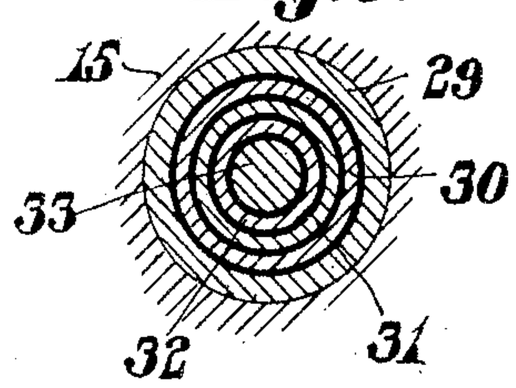


Fig. 5.



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3 SHEETS—SHEET 3.

Fig. 6.

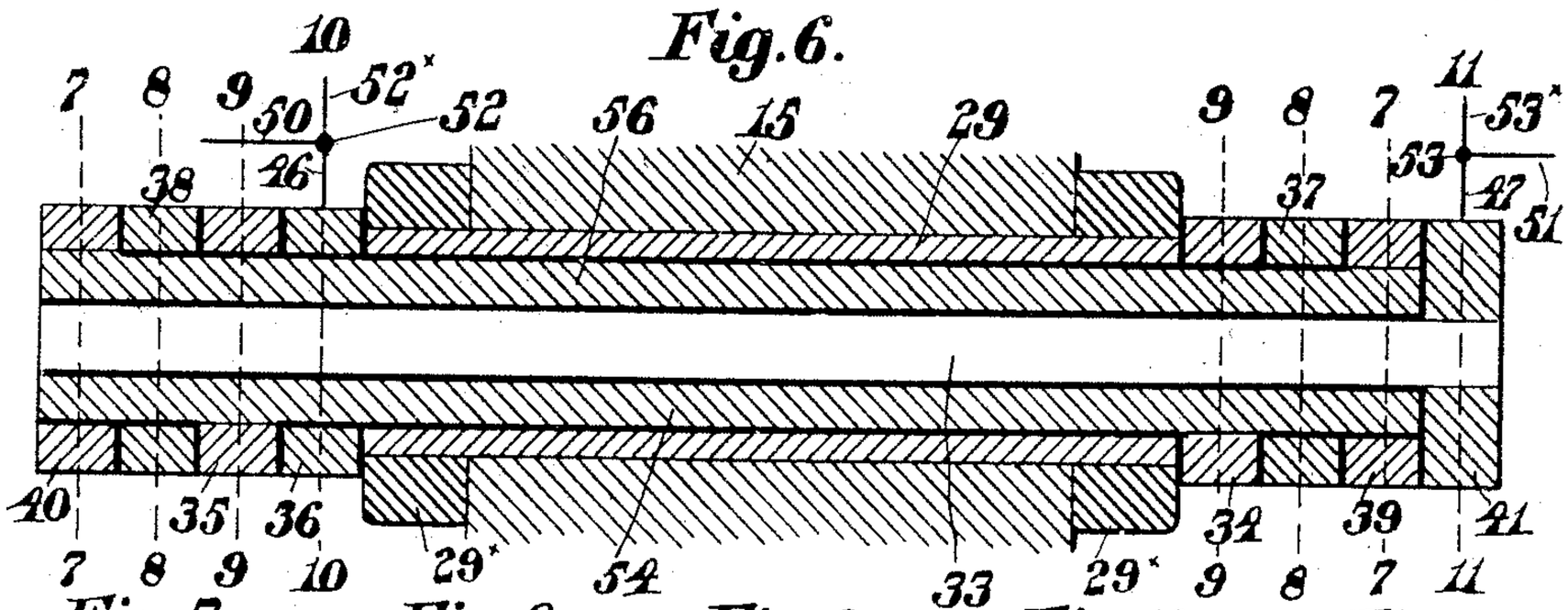


Fig. 7.

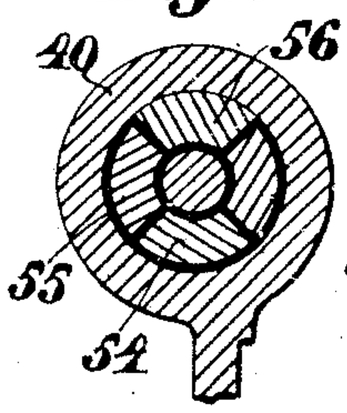


Fig. 8.

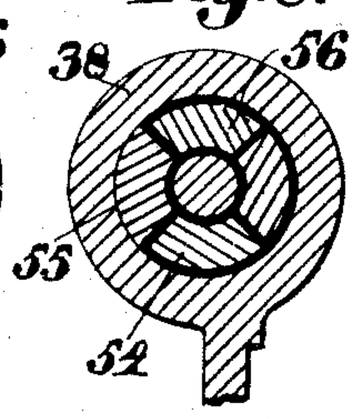


Fig. 9.

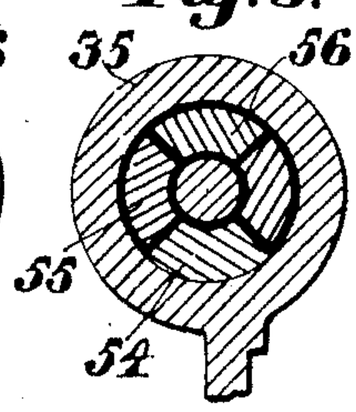


Fig. 10.

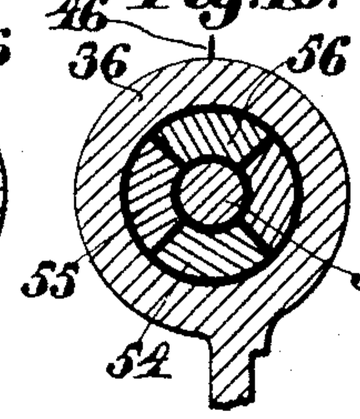


Fig. 11.

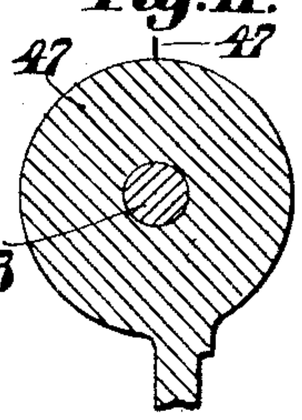


Fig. 12.

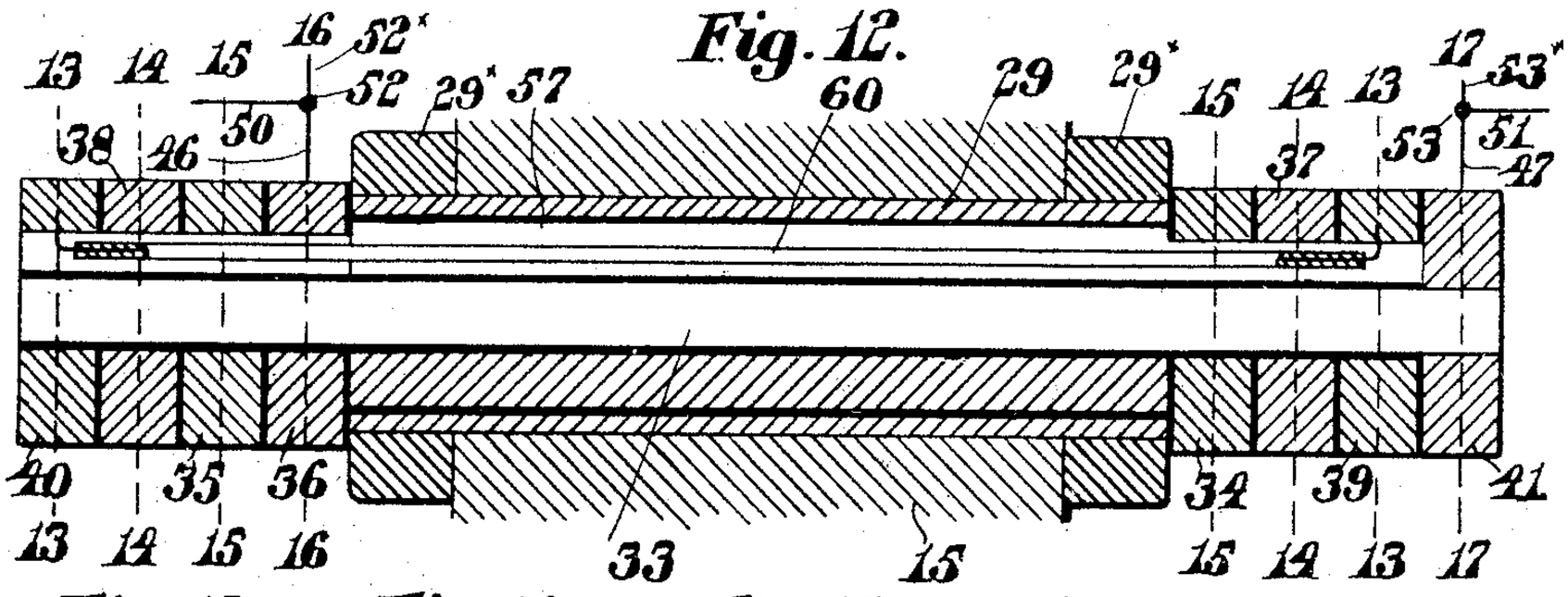


Fig. 13.

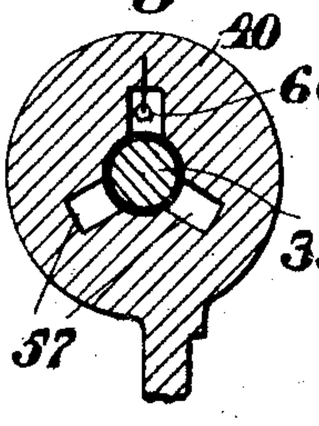


Fig. 14.

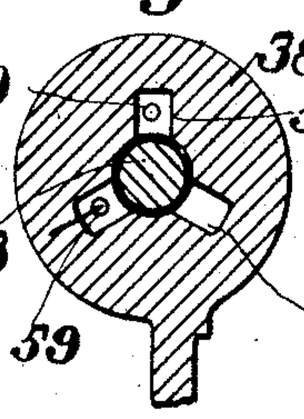


Fig. 15.

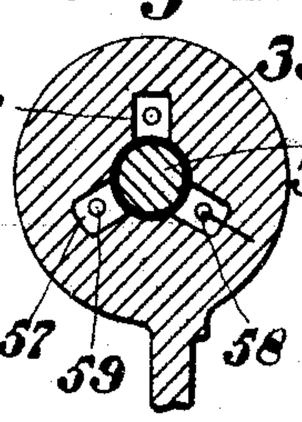


Fig. 16.

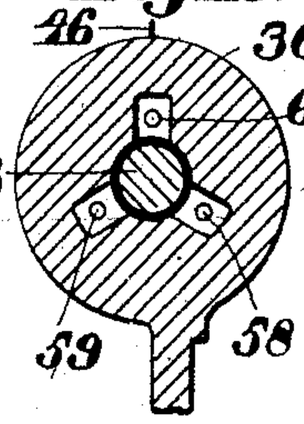
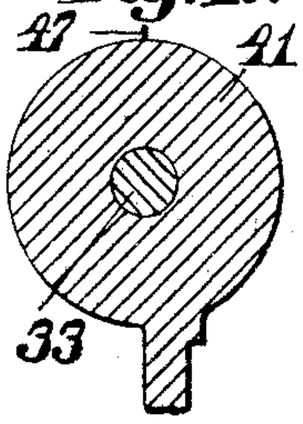


Fig. 17.



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BRUSH-HOLDER FOR DYNAMOS.

966,839. Specification of Letters Patent. **Patented Aug. 9, 1910.**

Application filed June 25, 1909. Serial No. 504,935.

To all whom it may concern:

Be it known that I, ERNEST C. KETCHUM, a citizen of the United States of America, and a resident of Boston, in the county of Suffolk and State of Massachusetts, have invented certain new and useful Improvements in Brush-Holders for Dynamos, of which the following is a specification.

This invention relates to dynamo electrical machines and has for its object the production of such a machine in which the armature may be driven direct at a great velocity from high-speed motors, such as turbine engines, without endangering the displacement of any of the elements of said armature.

The particular object of the invention is to provide a means of supporting the various brushes co-acting with the armature disks and connecting them in series through the brush-supporting members, thus obviating the necessity of making external wire connections, as has been the previous practice.

The invention consists in certain novel features of construction and arrangement of parts which will be readily understood by reference to the description of the drawings and to the claims hereinafter given.

Of the drawings: Figure 1 represents a front elevation of a machine embodying the features of this invention. Fig. 2 represents a transverse vertical section of the same, the cutting plane being on line 2—2 on Fig. 3. Fig. 3 represents a longitudinal vertical section of the same, the cutting plane being on line 3—3 on Fig. 2. Fig. 4 represents a longitudinal section through the brush holders and a portion of the intermediate members in which they are supported. Fig. 5 represents a transverse section of the same, the cutting plane being on line 5—5 on Fig. 4. Fig. 6 represents a similar view to Fig. 4, showing a modified form of brush holder. Figs. 7 to 11 inclusive represent transverse sections of the same, the cutting planes being, respectively, on lines 7—7, 8—8, 9—9, 10—10, and 11—11, on Fig. 6. Fig. 12 represents a longitudinal section of another modified form of brush holder similar to Figs. 4 and 6, and Figs. 13 to 17 inclusive, represent transverse sections of the same, the cutting planes being, respectively, on lines 13—13, 14—14, 15—15, 16—16, and 17—17 on Fig. 12.

Similar characters designate like parts throughout the several figures of the drawings.

In the drawings, 10 represents end pieces supported by suitable legs 11 and provided with inwardly extending cylindrical hubs 12 which form cores or poles for the field. Interposed between and connecting said end pieces 10 are a plurality of members 13 united thereto by means of the bolts 14. Located centrally of said members 13 is the member 15 either face of which is provided with a pole 16 in alinement with each other and with the poles 12 of the end pieces 10. Interposed between the poles 12 and 16 and separated therefrom by suitable air spaces is an armature 17, said armature being driven by a shaft 18 revoluble in anti-friction bearings 19 and 20, located within the chamber 21 in the end pieces 10.

The bearing 20 is placed at the extreme inner face of the pole 12 to insure support for said armature 17 near either end thereof. The shaft 18 is driven direct by means of any suitable high-speed motor. Screwed into the outer ends of the chamber 21 and surrounding the shaft 18 are thrust bearings 23 which prevent any end movement of said shaft. The armature 17 is composed of a plurality of disks 24 of high magnetic permeability separated from each other by suitable insulating plates.

The disks 24 are connected together in pairs by means of suitable tubular members 26, said tubular members being insulated from each other and from the shaft 18 upon which they are mounted, all as shown and described in Letters Patent No. 826,668, issued to me July 24, 1906. The disks are of steel and provided with an annular peripheral band 28 of copper which serves to conduct the current of electricity quickly to and from all portions of the periphery of said disk from which it moves in radial lines to and from the center where it flows through a tube 26.

The member 15 has extending through a bearing therein a tube 29 capable of oscillation in said bearing. Within this tube 29 are a plurality of tubular members 30, 31, and 32 insulated from each other and from the tube 29, the inner tubular member 32 having extending therethrough and in axial line therewith a rod 33 from which it is insulated in any suitable manner. One end of the tube 30 has mounted thereon and electrically connected thereto a brush holder

34 while the opposite end of said tube has mounted thereon and electrically connected thereto a brush holder 35 between which and one end of the tube 29 is interposed a brush holder 36 insulated from said tubular member 30 and the tube 29 and brush holder 35.

The tubular member 31 has mounted on one end and electrically connected thereto a brush holder 37 insulated by any suitable material from the brush holder 34 while the opposite end of the tubular member 31 has mounted thereon and electrically connected thereto the brush holder 38 which is insulated from the brush holder 35.

The tubular member 32 has mounted upon one end and electrically connected thereto a brush holder 39 while the opposite end of the tubular member 39 has mounted thereon and electrically connected thereto a brush holder 40 insulated from the brush holder 38 by any suitable material and on the projecting end of the rod 33 mounted within and insulated from the tubular member 39 is a brush holder 41.

A collar 29* at each end of the tube 29 is provided with an arm 42 to the opposite end of which is secured a spring 43 the opposite end of which is secured to a fixed pin 44. The tension of the spring 43 serves to move all of the brush holders within the tube 29 about its axis to retain the brushes 45, one of which is secured to each of the holders 34 to 41 inclusive, in contact with the disks 24 of the armature. By moving the arm 42 inwardly toward the armature the brushes on the various holders mounted within the tube 29 may be moved simultaneously away from the periphery of the disks 24 of the armature for the purpose of either cleaning the brush or the periphery of the armature.

It is obvious that all of the disks 24 are insulated from each other and all of the tubular members 26 are in like manner insulated from each other so that the disks 24 are connected together in pairs and a current of electricity may pass from one end disk to the opposite end disk and the second disk from the end in a like manner is connected with the second disk from the opposite end.

The brush holders 34 to 41 inclusive are insulated from each other and the tube 29 and the tubular members 30, 31, and 32 and the rod 33 are all insulated from each other in such a manner that the current of electricity passing from the brush holder 41 to one of the outer disks 24 will pass through the interior tubular member 26 to the opposite disk and thence through the brush 45 to the brush holder 40. The current will then pass through the tubular member 32 to the brush holder 39 and from its brush 45 to the disk 24 next to the one at the outer end of the armature, from which it will pass through the next to the smallest tubular member 26 to the second disk from the opposite end then through the brush 45 of the brush holder 39 and so on, connecting the various brush holders in series until the current finally passes through the brush 45 of the brush holder 36.

A wire 46 extends from the brush holder 36 to a terminal 52 while a wire 47 leading from the brush holder 41 leads to a terminal 53. From the terminals 52 and 53 extend main conducting wires 52* and 53* from an electric circuit. Each of the poles 12 is surrounded by coils 48 which are connected together by a wire 49 and are connected, respectively, by wires 50 and 51 with terminals 52 and 53 to which are connected the main conducting wires 52* and 53*.

As the shaft 18 is revolved by means of any suitable high-speed motor an electric current will be generated thereby in the field coil which will build up the field and cause the lines of force to be materially increased as they move inwardly from the positive poles 12 to the negative poles 16, a complete circuit of these lines of force being made through the intermediate member 15 and the yokes 13 back to said poles 12. It will be seen that as the poles are all in alinement and the armature is in alinement therewith the working parts of the armature when in operation always move in a plane at right angles to the lines of force and are constantly cutting the same without producing a reversal of the current and a change of polarity in the armature. By this arrangement whereby the movement of the armature is always at right angles to the lines of force in the field the eddy currents and other losses which are frequent in other types of dynamos are entirely eliminated in a machine of this construction.

By providing an armature in which wires are entirely dispensed with the armature is permitted to revolve at a high velocity without endangering the displacement of any of the elements which form the same. It is intended that the shaft 18 should be in perfect alinement and that the periphery of the disks forming the armature thereon should be concentric with the axis thereof. This mounting of the brush holders on a common support so that they may be oscillated in unison by means of a suitable spring 43 interposed between a fixed member 44 and an arm 42 projecting from one of said brush holders provides a desirable means for yieldingly retaining the brushes in contact with the armature disks and insures a perfect contact under all conditions.

The preferred manner of mounting the brush holders in the tube 29 is as shown in Figs. 4 and 5 and as previously described. It is obvious, however, that these brush holders may be connected in series in other

ways while still confined in the oscillating tube 29. For instance, as shown in Figs. 6 to 11 inclusive, a plurality of segments 54, 55, and 56 may be used as connectors in lieu of the tubular members 30, 31, and 32, the segment 54 connecting the brush holders 34 and 35, the segment 55 connecting the brush holders 37 and 38, the segment 56 connecting the brush holders 39 and 40, while the brush holders 36 and 31 are insulated from the other brush holders and from the various segments and connected by the wires 46 and 47 to the terminals 52 and 53 and through the wires 50 and 51 to the field magnets 48. In a similar manner the tube 29 may be provided with a core insulated therefrom and from the supporting member 33 through which extend grooves 57 in which are mounted the insulated wires 58, 59, and 60 connecting the various disks in series in the same manner as these disks are connected by means of the segments 54, 55, and 56, shown in Figs. 6 to 11 inclusive.

By supporting the brushes 45 in the manner described and connecting them by members confined within an oscillating tube, all of the brushes may be moved in unison into contact with the armature disks and retained there by means of a single yielding member, while by making the connections through said tube the exterior wire connections for this purpose are entirely dispensed with which is an obvious advantage.

It is believed that the operation and many advantages of the invention will be fully understood from the foregoing.

Having thus described my invention, I claim:

1. In a dynamo electrical machine, the combination of a field magnet; a shaft mounted in bearings in the poles thereof; two sets of separated metal disks mounted thereon parallel with the faces of said poles; members connecting the disks in pairs; a plurality of supported members insulated from each other and grouped about a common center outside the peripheries of said disks; and a brush holder secured to each end of each member and each bearing on one of said disks to connect said disks in series.

2. In a dynamo electrical machine, the combination of a field magnet; a shaft mounted in bearings in the poles thereof; two sets of separated metal disks mounted thereon parallel with the faces of said poles; members connecting the disks in pairs; a plurality of supported tubular members insulated from each other and grouped about a common center outside the peripheries of said disks; and a brush holder secured to each end of each member and each bearing on one of said disks to connect said disks in series.

3. In a dynamo electrical machine, the combination of a field magnet; a shaft mounted in bearings in the poles thereof; two sets of separated metal disks mounted thereon parallel with the faces of said poles; members connecting the disks in pairs; a supporting tube the center of which is outside the peripheries of said disks; a plurality of supported members within said tube insulated from said tube and from each other; and a brush holder secured to each end of each member and each bearing on one of said disks to connect said disks in series.

4. In a dynamo electrical machine, the combination of a field magnet; a shaft mounted in bearings in the poles thereof; two sets of separated metal disks mounted thereon parallel with the faces of said poles; members connecting the disks in pairs; a supporting rod; a brush holder electrically connected to one end of said rod; a brush holder mounted upon but insulated from the opposite end of said rod; other brush holders between the end holders and insulated from them and each other; and electric connections extending lengthwise of said rod and insulated therefrom adapted to connect said disks and brush holders in series.

5. In a dynamo electrical machine, the combination of a field magnet; a shaft mounted in bearings in the poles thereof; two sets of separated metal disks mounted thereon parallel with the faces of said poles; members connecting the disks in pairs; a supported rod; a plurality of members thereon each extending nearer to the end of said rod at one end than at the other and insulated from said rod and each other; and a brush holder on each end of said rod and each member each provided with a disk contacting brush adapted to connect said disks in series.

6. In a dynamo electrical machine having a disk armature, the combination of a tube adapted to be oscillated in its bearing; a plurality of brush holders supported at each end thereof and adapted to be oscillated therewith; and a spring acting on said tube to cause movement thereof about its axis to retain all of said brushes in contact with said armature.

7. In a dynamo electrical machine having a disk armature, the combination of a tube adapted to be oscillated in its bearing; a plurality of brush holders at each end thereof each provided with a disk contacting brush; supporting means for said brush holders extending through said tube; an arm radiating from said tube; and a spring acting on said arm to retain all of said brushes in contact with said armature.

8. In a dynamo electrical machine having an armature comprising a plurality of disks, the combination of a tube adapted to be oscillated; a plurality of members extending through said tube all insulated therefrom

and from each other; a brush holder electrically connected to each end of each member with its brush contacting with one of the armature disks so that said disks are thereby connected in series; and a spring adapted to retain all the brushes of said holders in contact with the disks of said armature.

9. In a dynamo electrical machine having an armature comprising a plurality of disks, the combination of a tube adapted to be oscillated; a plurality of tubular members extending through said tube all insulated therefrom and from each other; a brush holder electrically connected to each end of each tubular member with its brush contacting with one of the armature disks so that said disks are thereby connected in series; and a spring adapted to retain all the brushes of said holders in contact with the disks of said armature.

10. In a dynamo electrical machine, the combination of a field magnet provided with two poles in alinement; an intermediate pole alined therewith; armature disks revoluble between said poles; a tubular member supported by said intermediate pole; members extending through said tubular member and insulated from each other and from said supporting member; and a brush holder on each end of each member insulated from the brush holders adjacent thereto and from said intermediate pole, the brushes of which contact with the disks of said armatures and connect them in series.

11. In a dynamo electrical machine having an armature comprising a plurality of disks, the combination of a supporting member; a composite member supported thereby and confined therein composed of a plurality of parts insulated from each other, said parts extending beyond each end of said supporting member in echelon; a brush holder opposite one end of said supporting member on an end of one part and insulated from all other parts and the adjacent brush holder; a brush holder on each end of all the other parts insulated from the brush holders adjacent thereto; and a brush holder opposite the other end of said supporting member and insulated therefrom and from the part on which it is supported and from the adjacent brush holder, the brushes of all of said brush holders being adapted to contact with the disks of said armature and connect them in series.

12. In a dynamo electrical machine having an armature comprising a plurality of disks, the combination of a supporting member adapted to be oscillated in its supporting bearing; a composite member supported thereby and confined therein composed of a plurality of parts insulated from each other, said parts extending beyond each end of said supporting member in echelon; a brush holder opposite one end of said supporting member on an end of one part and insulated from all other parts and the adjacent brush holder; a brush holder on each end of all the other parts insulated from the brush holders adjacent thereto; a brush holder opposite the other end of said supporting member and insulated therefrom and from the part on which it is supported and from the adjacent brush holder, the brushes of all of said brush holders being adapted to contact with the disks of said armature and connect them in series; and means for oscillating said supporting member and the composite member confined therein in its bearing to retain said brushes in yielding contact with said disks.

Signed by me at 4 Post Office Sq., Boston, Mass., this 14th day of April, 1909.

ERNEST C. KETCHUM.

Witnesses:

WALTER E. LOMBARD,

NATHAN C. LOMBARD.