

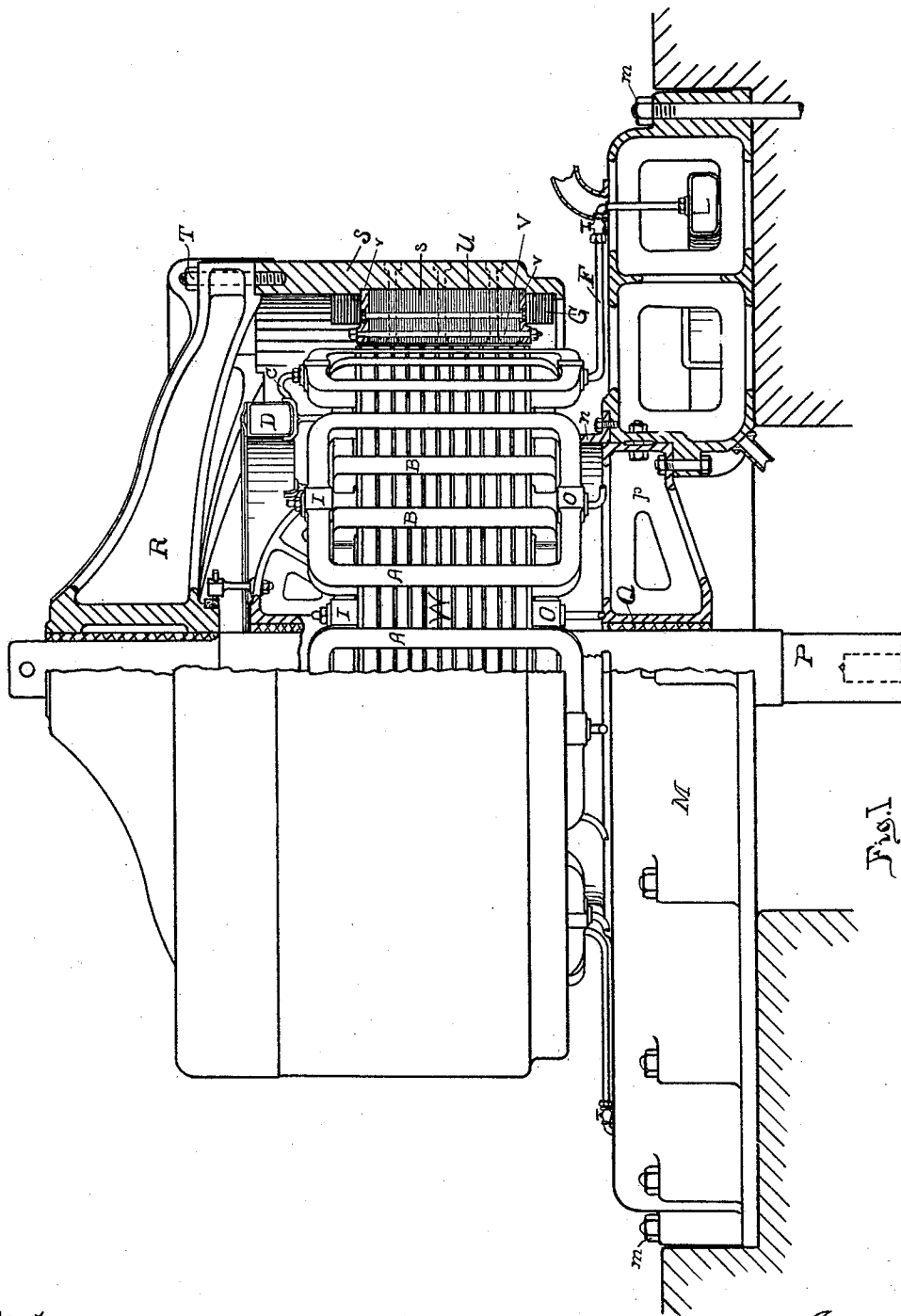
(No Model.)

2 Sheets—Sheet 1.

G. FORBES.
DYNAMO ELECTRIC MACHINE.

No. 518,944.

Patented May 1, 1894.



Witnesses.

C. W. Ricker
B. Chander
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Inventor.

per George Forbes
William Macomber
Attorney.

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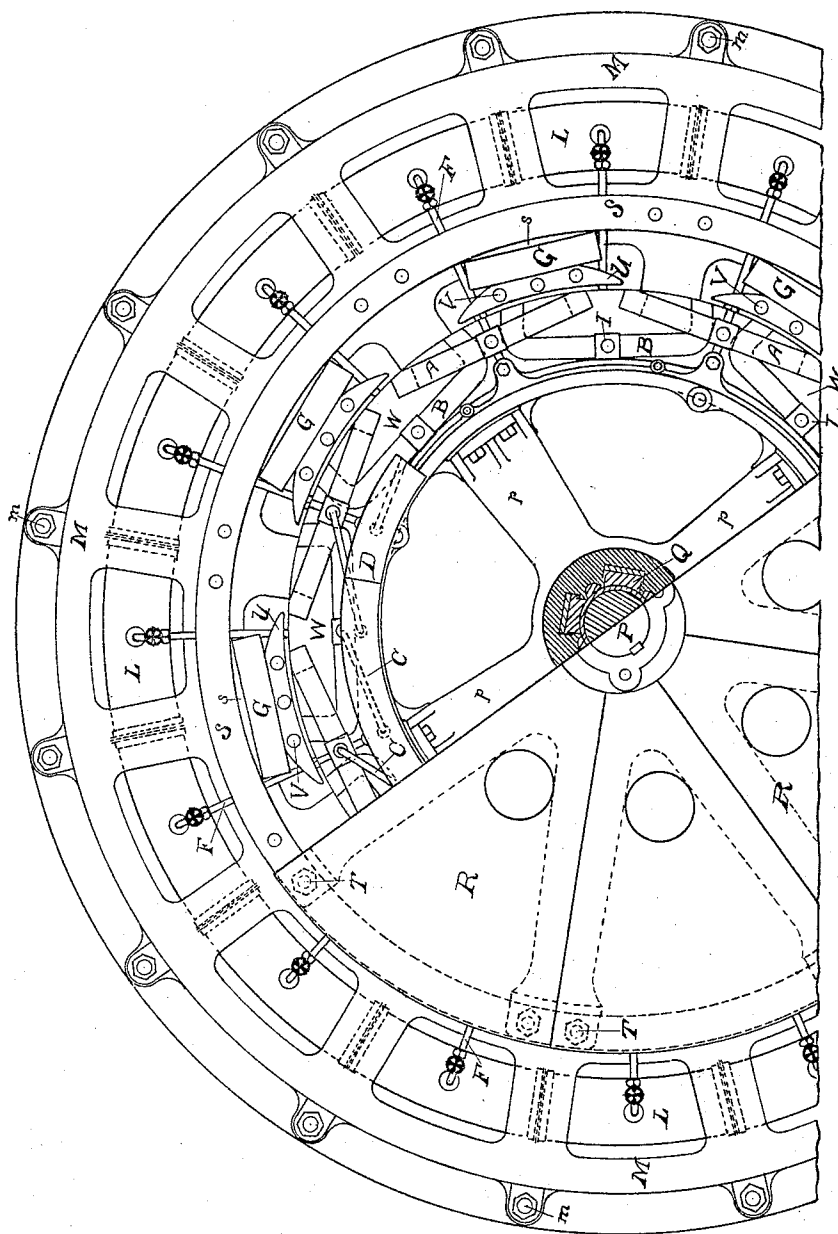


Fig. II

Witnesses.

C. W. Ricker

R. B. Anderson

Inventor.

George Forbes

per William Macomber
Attorney.

UNITED STATES PATENT OFFICE.

GEORGE FORBES, OF NIAGARA FALLS, NEW YORK.

DYNAMO-ELECTRIC MACHINE.

SPECIFICATION forming part of Letters Patent No. 518,944, dated May 1, 1894.

Application filed August 17, 1893. Serial No. 483,356. (No model.)

To all whom it may concern:

Be it known that I, GEORGE FORBES, a subject of the Queen of Great Britain, residing at Niagara Falls, in the county of Niagara and State of New York, have invented certain new and useful Improvements in Dynamo-Electric Machinery; and I do hereby declare the following to be a full, clear, and exact description of the invention, such as will enable others skilled in the art to which it appertains to make and use the same.

The object of my invention is to overcome the difficulties met with in designing large dynamos, especially when driven by water power. In large dynamo machines, especially those driven by water power, it is desirable to have a powerful fly-wheel effect to assist the governor, and this mechanical momentum is of special utility in assisting a number of alternating current dynamos to run in parallel on a single set of conductors. But this fly-wheel effect cannot be attained on the design of any dynamo as generally constructed without increasing the weight of the revolving part to an inordinate extent. Moreover, since in dynamos of ordinary construction the rotating part is the center of the machine and is surrounded by a fixed part, and since there is a magnetic attraction between the fixed and the revolving parts, which in large machines is very large in amount, it follows that the great centrifugal force and the magnetic attraction both tend to destroy the rotating part. And this is a matter of great importance because the output of a machine is increased by using the highest speed consistent with safety. If it is desired to generate a very high potential directly in the dynamo, it is essential that the armature in which the high potential is generated, should be the fixed part; and in the usual designs on this principle, the central revolving part is the field magnets. The magnetizing coils on the poles of these magnets are usually held in by the pole faces which are bolted or keyed on to the pole pieces; and this becomes a source of weakness when we have to deal with great centrifugal force and a powerful magnetic attraction.

My present invention has for its object to overcome all these difficulties. I use a fixed central armature, and the revolving fields are

outside with the pole pieces projecting radially inward, and these are attached to, or may form a part of, the external revolving mass of iron, which resembles the rim of a massive fly-wheel. This rim, with pole pieces attached, is supported by a spider rigidly secured to the shaft at one end of the armature.

This invention may be applied to a dynamo either with a horizontal or with a vertical shaft. The result of this is that, owing to the great peripheral speed of the external revolving part, we get the maximum momentum with the minimum weight; also that the magnetic attraction acts in opposition to the centrifugal force and tends to prevent undue strain on the revolving masses; also that there is no strain of centrifugal force on bolts or keys used to hold the parts together. The magnetizing coils and the pole pieces, if these are not in one piece with the rim, are held in direct contact with the rim by the centrifugal force. I thus obtain a machine with fixed armature in which I can generate high potentials, with a maximum of momentum with a minimum of weight in the revolving parts.

Referring to the drawings herewith, consisting of two sheets: Figure I is an elevation of my machine, having a portion of the fields removed to show the interior construction. Fig. II is a top plan view of a portion of the machine, having a portion of the spider, connecting the revoluble fields with the shaft, removed.

Like letters refer to like parts throughout the drawings.

M is the bed-plate of the machine, properly secured by bolts *m, m*. Upon the bed-plate and about the interior opening is secured the sleeve *n*, upon which the body of the armature *W, W*, is rigidly supported. There are also secured to the interior of the bed-plate *M*, the brackets *p, p*, which are united about the bearings *Q, Q*, which support the shaft *P*.

A, A, are the coils of the first type, and *B, B*, are the coils of the second type, the ends of the coils *B, B*, being bent over the end plates so that the ends of the coils *B, B*, pass within and clear of the coils *A, A*, of the first type. These coils are provided with a close-fitting oil-tight casing provided with inlet boxes *I, I*, and outlet boxes *O, O*. The inlet

boxes I, I, are connected with the tubes C, C, which in turn are connected with the pipe D; and this pipe is connected with a supply tank which furnishes oil for a forced circulation 5 about the coils. The outlet boxes O, O, are connected with the pipes F, F, which deliver the oil from the coils to the pipe L, which lies within the bed-plate M, and about which is maintained cold water or brine cooled with 10 ammonia for the purpose of cooling the oil. From this pipe L, the oil is pumped back into the supply tank; and by this means a forced circulation of cooled oil is maintained about the coils upon the armature. The coils as 15 herein shown are constructed with parallel sides, which fit into corresponding parallel notches upon the face of the armature.

Upon the end of the shaft P, is rigidly mounted the spider R, the legs of which are 20 secured to the rim S, by the bolts T. Upon the interior of this rim are inwardly projecting magnet cores s, s, to which the pole faces U, U, are secured by the bolts V, V, and the brackets v, v, which are secured directly to 25 the magnet cores s, s, and which pass underneath the ends of the coils upon the magnet cores. The winding upon the pole pieces is shown at G, G.

The spider R, may be secured to the shaft 30 P, in such manner that it can be quickly disconnected and removed with the field magnets for the purpose of the inspection of the interior of the machine; but I prefer to have the shaft, or one section of the shaft, firmly 35 attached to the spider and detachable from the driving coupling on the other end so as to be removed with the spider in such a manner as to guide the magnets as they pass the coils of the armature within the field, both 40 in taking the machine apart and in putting it together again.

I have shown the general arrangement of a dynamo for alternating currents and two 45 phases, according to the present invention; but I have shown this particular type of machine, not for the purpose of limitation, but

for the purpose of a clear explanation of my invention.

Having now stated the object and nature of my invention and the means of carrying 50 it out, I do not claim a dynamo in which the field magnet revolves, nor do I claim a dynamo with the armature revolving outside the field; nor do I claim the coil or solenoid provided with an oil-tight casing to permit of a 55 forced circulation of oil, or the combination of the same with a system of forced circulation, as that invention constitutes the subject matter of a separate application for Letters Patent by me filed August 17, 1893, Serial 60 No. 483,358; nor do I claim the construction of an armature provided with parallel notches to receive the corresponding parallel sides of the coils, or the combination of such notches, 65 coils and supports for the coils, or the combination of such notches with the coils of two types in which the coils of the second type have their ends bent over the end plates of the armature so as to pass within and clear 70 of the coils of the first type, as that invention constitutes the subject-matter of a separate application for Letters Patent by me filed August 17, 1893, Serial No. 483,357; but

What I do claim is—

1. The combination of a field magnet outside the armature rotated by means of a spider 75 attached to the shaft, the spider and field forming a bell-shaped revolving field magnet, with a stationary armature, substantially as set forth. 80

2. The combination of a shaft supported centrally within a stationary armature by brackets attached to the frame of the armature, with a spider and external revolving 85 field, substantially as described.

In testimony that I claim the invention above set forth I affix my signature in the presence of two witnesses.

GEORGE FORBES.

Witnesses:

MORRIS COHN, Jr.,
C. W. RICKER.