N. W. STORER.

DYNAMO ELECTRIC MACHINE.

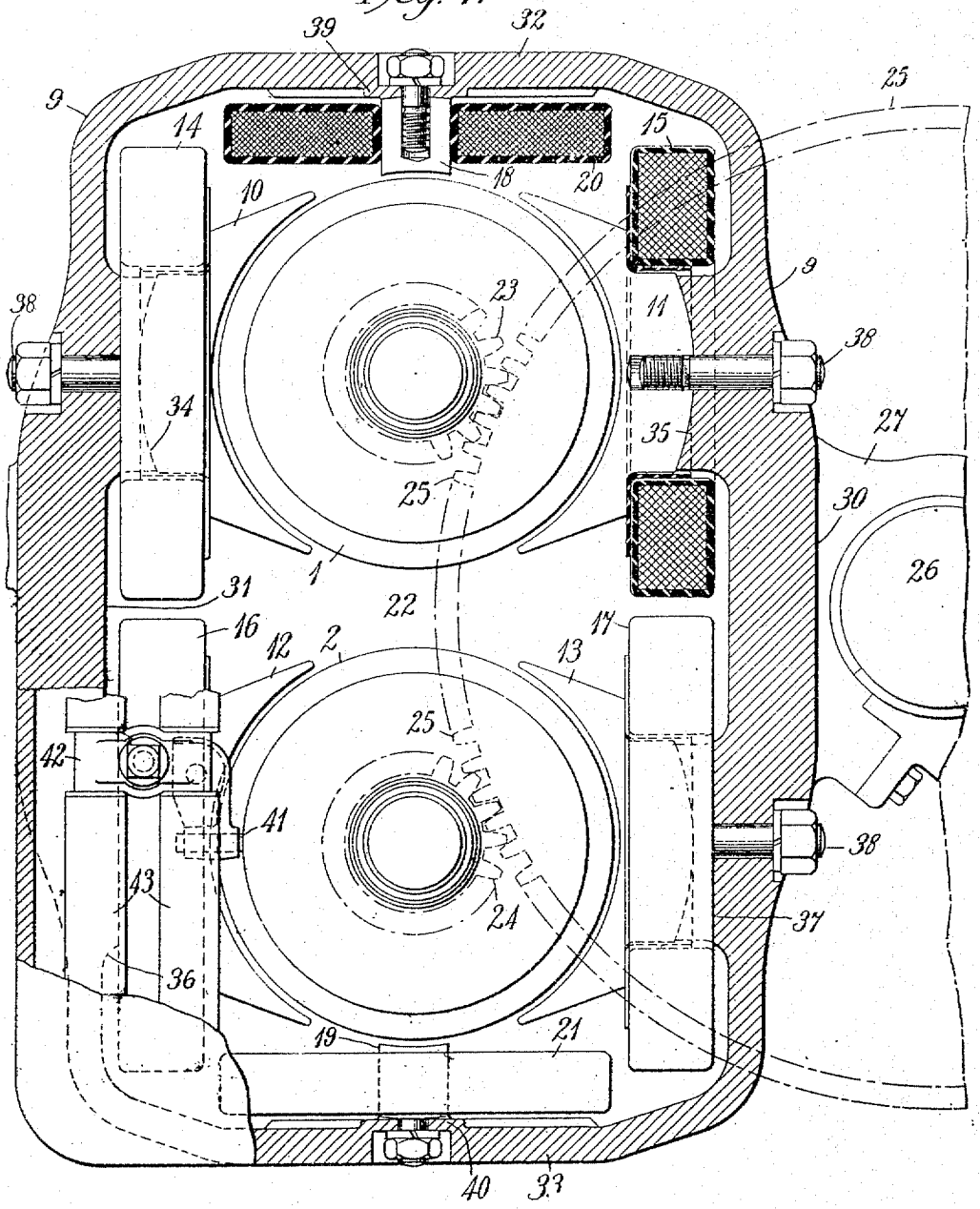
APPLICATION FILED MAY 22, 1913.

1,255,486.

Patented Feb. 5, 1918.

2 SHEETS—SHEET 1.

Fig. 1.



WITNESSES:

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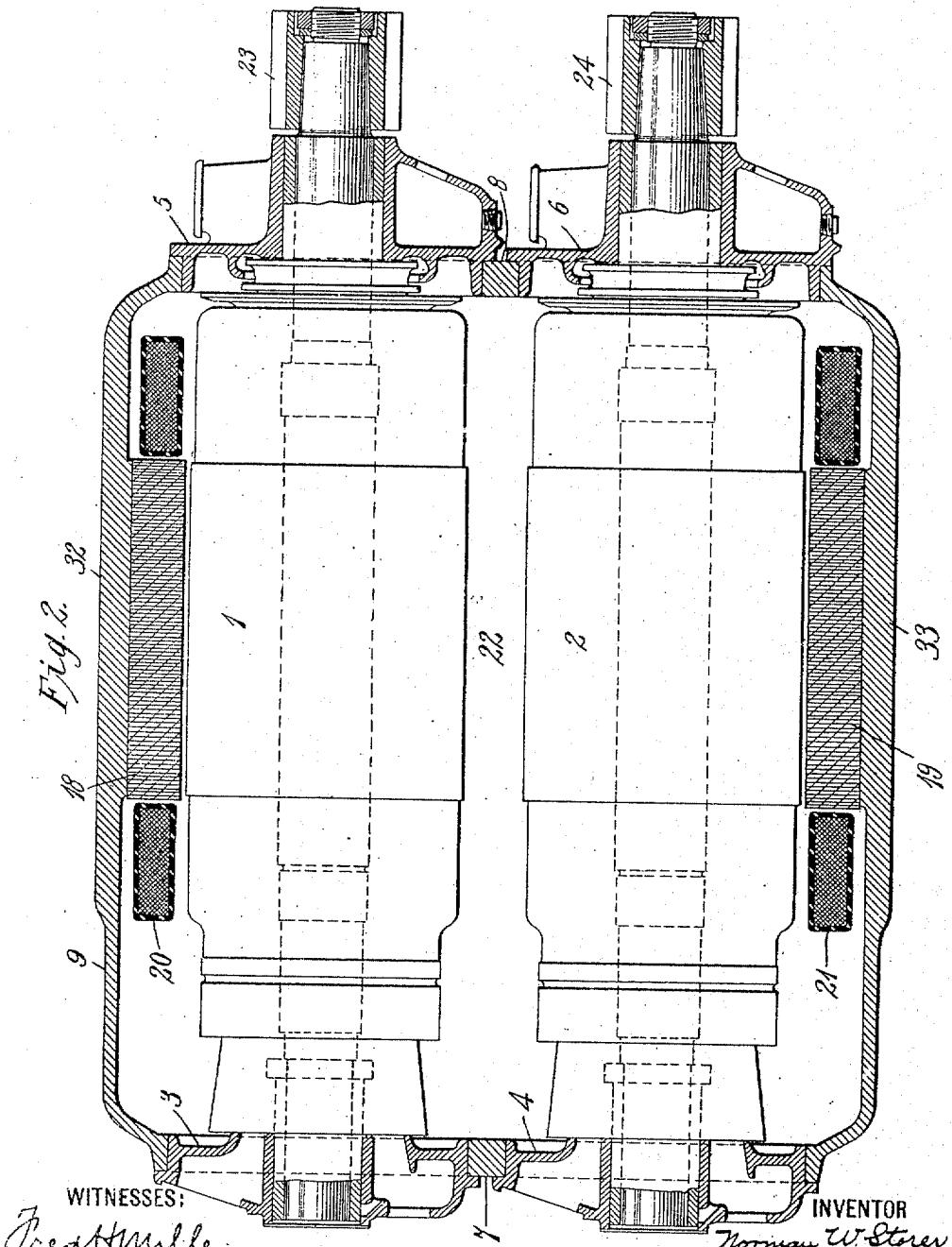


Fig. 2.

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DYNAMO-ELECTRIC MACHINE.

1,255,486. Specification of Letters Patent. Patented Feb. 5, 1918.

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To all whom it may concern:

Be it known that I, NORMAN W. STORER, a citizen of the United States, and a resident of Pittsburgh, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Dynamo-Electric Machines, of which the following is a specification.

My invention relates to dynamo-electric machines, and it has special reference to railway motors of the twin-armature type such as are specially adapted for use upon electric locomotives and motor cars to be operated by high-voltage direct-currents.

One object of my invention is to provide a machine of the above-indicated character which shall be light in weight, compact and durable in construction, and, by reason of the peculiar arrangement of its component parts, shall be of relatively high efficiency.

Another object of my invention is to provide an inclosed, self-contained unitary structure of the bi-polar type which shall comprise twin armatures and a single magnetic circuit to serve for both armatures in common, the armatures being connected in series-circuit relation with each other and with the several field coil windings, and adapted to be controlled as a single driving unit to deliver energy in common to a single driving axle.

Another object of my invention is to provide a twin motor structure having its armatures disposed close together in side-by-side relation and spaced apart only by a slight air gap, whereby the longitudinal dimension and the length of the magnetic circuit are reduced to a minimum and the weight and bulk are reduced accordingly.

A still further object of my invention is to embody, in such a structure, a single commutating pole for each armature, which poles are associated with the respective end portions of the inclosing frame.

A still further object is to provide a structure of this general type having relatively few parts which may be readily and cheaply made and finished with little machine work and labor and which may be assembled and taken apart with facility. Another object of my invention is to adapt the structure for commercial manufacture upon a large scale and to employ parts of standard form which may be carried in stock for use when desired.

In the prior art, it has been suggested to employ motors of the twin bi-polar type for railway work but they have never proved satisfactory from an operating and commercial point of view because all of such machines have been unduly large and of excessive weight. Moreover, the design thereof has been inferior, as regards mechanical structure and electrical characteristics, by reason of the arrangement of parts which permitted large magnetic losses by reason of leakage and excessive length of the magnetic circuit. The operation of the structures heretofore employed has been unsatisfactory because they were not, and could not, be provided with effective commutating poles. Furthermore, in the past, the armatures have been operated independently, whereas I propose to combine the twin armatures both electrically and mechanically and to control them as a single unit, in combination with other similar units, whereby direct current energy in the neighborhood of 3600 or 4800 volts may be utilized for electric railway service.

My invention will therefore obviate the difficulties heretofore encountered and will provide a motor structure which may be manufactured and will operate to advantage and will therefore open up the field of high-voltage direct current railway service.

In the accompanying drawing, Figure 1 is a view, partially in section and partially in end elevation, of a portion of a dynamo electric machine constructed in accordance with my invention, and Fig. 2 is a view, partially in section and partially in side elevation, of the unitary driving structure shown in Fig. 1.

Referring to the drawings, the structure shown comprises essentially a pair of armatures 1 and 2 that are disposed one above the other in parallel relationship and are rotatably supported by a plurality of bearing housings 3, 4, 5 and 6 having their seats in openings in end portions 7 and 8 of a hollow substantially rectangular inclosing frame or casing 9 which surrounds the armatures 1 and 2. The frame 9 is provided with detachable main polar projections 10, 11, 12 and 13 having field coil windings 14, 15, 16 and 17, and with commutating polar projections 18 and 19 that are respectively provided with commutating field coil windings 20 and 21.

The armatures 1 and 2 are of like con-

struction and may embody any suitable structural details that are commonly used in the art. The armatures are disposed close together, being separated only by a comparatively small air gap 22, and are severally provided with pinions 23 and 24 in the usual manner, to coöperate with a suitable gear wheel 25 which is fixed to a driving axle 26. The axle 26 is provided with driving wheels (not shown) and is adapted to partially support the entire structure by means of axle caps 27 which form parts of the frame 9. Obviously, the total energy is transmitted to the driving wheels through the pair of pinions 23 and 24 which may be of relatively short length, thereby permitting driving units of large capacity by reason of the increased amount of transverse space that may be utilized for them.

The frame 9 is provided with side portions 30 and 31 which are relatively large in cross sectional area in comparison with the end portions 32 and 33 for a reason to be hereinafter pointed out. The several main polar projections 10 to 13, inclusive, are disposed in pairs on the opposite sides of each of the armatures 1 and 2 and are respectively secured to inwardly projecting base portions or seats 34, 35, 36 and 37 which constitute integral parts of the frame 9. Suitable bolts 38 may be employed for this purpose or any other means for accomplishing the same result.

The polar projections 18 and 19 are respectively disposed intermediate the main polar members of the upper and the lower armatures and are respectively detachably secured to the base portions or seats 39 and 40 of the end portions 32 and 33 of the frame 9 in a suitable manner.

By reason of the arrangement and location of parts, the seats 34, 35 and 39 may be finished by a single boring operation as they constitute elements of a single cylinder. Similarly, the seats 36, 37 and 40 may be readily made at comparatively small expense.

The several bolt holes may also be drilled in a single operation, by a multi-spindle drill, so that the expense and labor of finishing the several parts is reduced to a minimum, which particularly adapts the structure for commercial manufacture upon a large scale.

The several field coils 14 to 17, inclusive, and 20 and 21 are rectangular and standard in form and may be economically wound in large quantities. The specific structure of the field coils pertains only indirectly to my invention and no detailed description thereof is deemed necessary, as any suitable type of construction may be employed.

The armatures 1 and 2, as well as the main field coils 14, 15, 16 and 17 and the commutating field coils 20 and 21 are connected in series-circuit relation and are operated and controlled as a single unit, it being understood that, with this arrangement of circuit connections, each of the armatures has impressed upon it substantially half of the total motor voltage.

The cross sectional area of the side portions 30 and 31 of the frame 9 is chosen to give the desired flux density in the magnetic circuit which comprises the armatures 1 and 2, main polar projections 10, 11, 12, and 13 and the side portions 30 and 31. The magnetic circuit, just referred to, serves in common for both of the armatures 1 and 2, and is magnetized in accordance with well-known principles by the main field coils 14 to 17, inclusive. Inasmuch as the armatures 1 and 2 are spaced so closely together, the total length of the magnetic circuit is reduced to a minimum.

Under certain conditions, it may be found desirable to effect even greater economy in weight and space than is possible with the particular structure illustrated, in which case, the armatures may be located extremely close together with only sufficient clearance for safety. Obviously, the adjacent sides of the armatures are of the same polarity and would exert a neutralizing action upon each other, thus preventing any cross magnetization.

The relative proportions of the end portions 32 and 33 may be chosen to accommodate any desired amount of flux from the main poles, although it is only necessary to make them of sufficient thickness to carry the flux that is to be passed through the commutating polar projections 18 and 19 and consistent with mechanical strength. It is obvious that a certain amount of flux which passes through the armatures 1 and 2 is forced through the end portions 32 and 33 of the frame in shunt thereto, according to the amount of current traversing the armatures and field circuits and the degree of saturation in the several parts.

The armatures are respectively provided with a plurality of diametrically disposed brushes 41, each of which is carried in an arm or supporting bracket 42, the latter being clamped or otherwise suitably secured to a plurality of insulated rods 43 which project vertically within the frame 9 and are fastened thereto.

While I have illustrated and described a preferred embodiment of my invention, it is manifest that many other devices of a similar type which differ to a greater or less extent in specific structural features, may be made without departing from the spirit and scope of my invention, and all such modifications are intended to be covered in the appended claims.

I claim as my invention:—

1. In a twin bi-polar dynamo-electric ma-

chine, the combination with a pair of armatures having their axes in different parallel lines and separated only by an air gap, a pair of polar members for each armature and a rectangular magnetizable frame associated with said polar members and inclosing said armatures and polar members, of magnetizing coils disposed upon said polar members adjacent to the respective armatures and adapted to force the main body of flux through a single magnetic circuit including both armatures, the polar members and side portions of said frame and the remaining flux in multiple magnetic circuits including the respective armatures, their associated polar members and the end portions of said frame.

2. In a twin bi-polar dynamo-electric machine, the combination with a pair of armatures having their axes in different parallel lines and separated only by an air gap, a unitary rectangular magnetizable frame inclosing said armatures and having end portions of small sectional area and side portions of relatively large sectional area, and a pair of main polar projections for each armature associated with the side portions, of magnetizing coils disposed upon the respective polar projections adjacent to the armatures, auxiliary commutating polar projections associated with the end portions, and magnetizing coils therefor.

3. A duplex bi-polar dynamo-electric machine comprising an oblong substantially rectangular field magnet frame having two side-by-side pairs of main polar projections extending inwardly from the longer sides of the frame, the adjacent poles of the different pairs being of opposite polarity and the intervening portions of the frame being of larger cross section than the remaining portions, and having a commutating polar projection extending inwardly from each of the shorter sides of the frame, a coil upon each of said polar projections, and two armatures having substantially parallel axes located between the polar projections of said pairs and respectively adjacent to said commutating polar projections.

4. In a twin bi-polar dynamo-electric machine, the combination with a pair of armatures having their axes in different parallel lines and separated only by an air gap, a pair of polar members for each armature, and a rectangular magnetizable frame associated with said polar members and inclosing said armatures and polar members, of magnetizing coils disposed upon said polar members adjacent to the respective armatures and adapted to force the main body of flux through a single magnetic circuit including both armatures, the polar members, and side portions of said frame.

In testimony whereof, I have hereunto subscribed my name this 15th day of May, 1913.

NORMAN W. STORER.

Witnesses:
JACOB STAIR, Jr.,
B. B. HINES.