

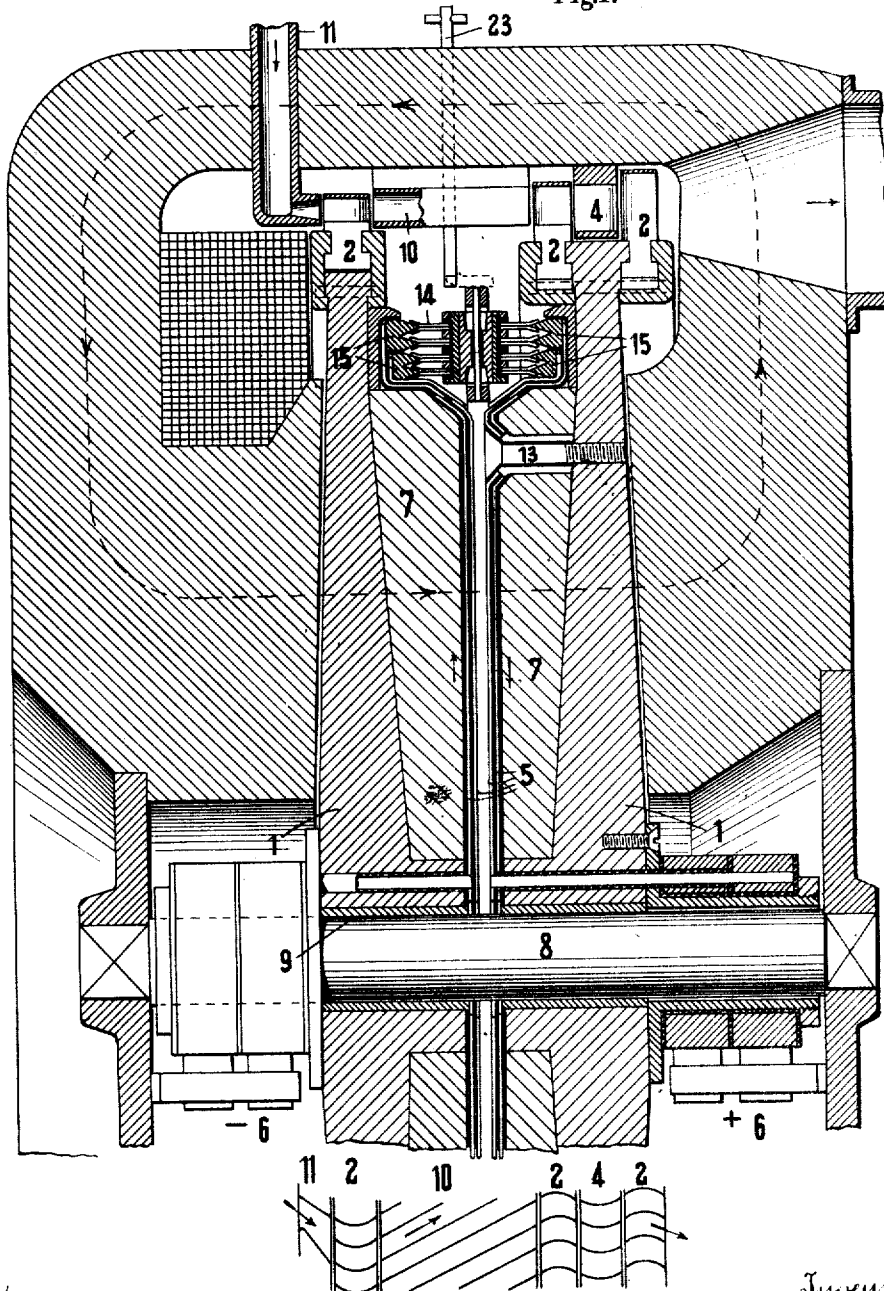
O. SCHULZ & W. H. EYERMANN.
 HOMOPOLAR, ACYCLIC, OR UNIPOLAR DYNAMO ELECTRIC MACHINE.
 APPLICATION FILED FEB. 8, 1911.

1,025,021.

Patented Apr. 30, 1912.

2 SHEETS—SHEET 1.

Fig 1.



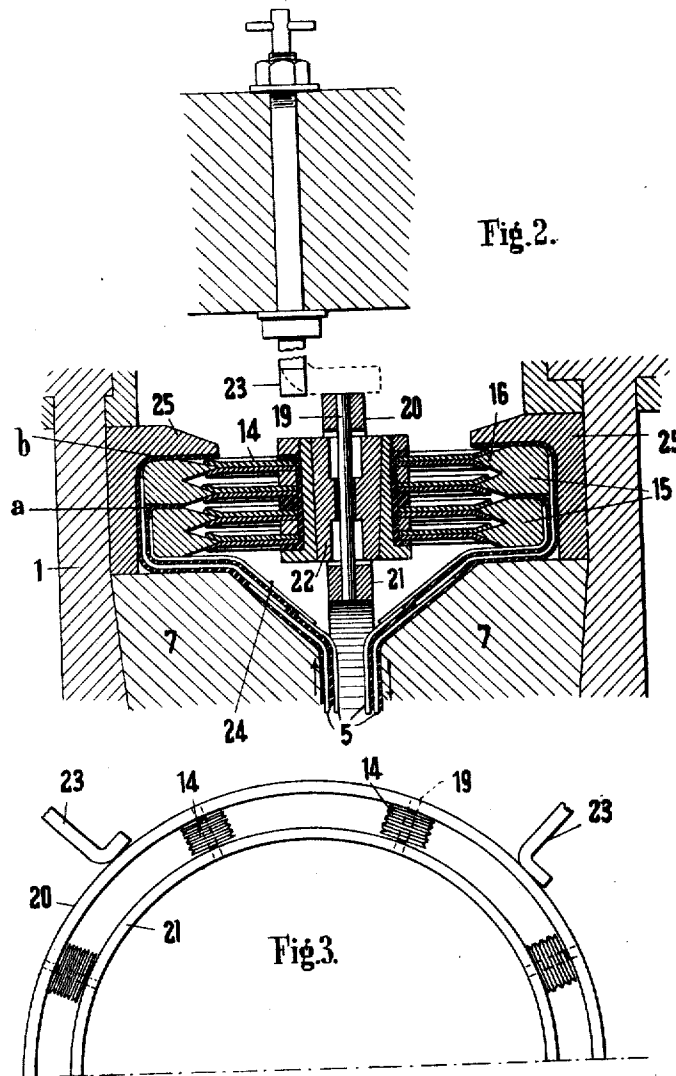
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UNITED STATES PATENT OFFICE.

OTTO SCHULZ, OF CHARLOTTENBURG, AND WILHELM HEINRICH EYERMANN, OF
FRIEDENAU, NEAR BERLIN, GERMANY.

HOMOPOLAR, ACYCLIC, OR UNIPOLAR DYNAMO-ELECTRIC MACHINE.

1,025,021.

Specification of Letters Patent.

Patented Apr. 30, 1912.

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To all whom it may concern:

Be it known that we, OTTO SCHULZ, of 15
Uhlandstrasse, in Charlottenburg, Germany,
and WILHELM HEINRICH EYERMANN, of 18
5 Menzelstrasse in Friedenau, near Berlin,
Germany, both subjects of the German Em-
peror, and residents of Charlottenburg and
Friedenau, respectively, have invented new
and useful Improvements in and Relating
10 to Homopolar, Acyclic, or Unipolar Dyna-
mo-Electric Machines, of which the follow-
ing is a specification.

This invention relates to homopolar, acy-
clic or unipolar dynamo-electric machines,
15 more particularly to a so-called "opposite-
running" unipolar machine, that is to say,
a dynamo in which the cylindrical or disk-
shaped armature conductors rotate within a
magnetic field in directions opposite to each
20 other, the armature conductors preferably
forming at the same time the rotors of steam
turbines.

In constructions hitherto known, the ar-
mature conductors were themselves used as
25 supports or carriers for the turbine buckets
or blades. According to this invention, the
armature conductors are secured to separate
supporting disks which, in their turn, in so
far as it is a question of driving the con-
30 ductors by means of turbines, can at the
same time support the turbine buckets or
blades. In this way it is possible to make
the supporting disks of materials of great
strength, and to give them the most suit-
35 able shape from the point of view of
strength. In order to obtain the least possi-
ble magnetic resistance when giving this
shape, separate filling members 7 adapted to
the carrying disks and made of magnetic ma-
40 terial, are provided. The conductors them-
selves can then be made of a material which
need be selected merely with regard to its
electrical properties, that is to say, which
45 has a high specific conductivity, but need
not have very great strength. Thus it is
possible to secure the armature conductors
in a large number of superposed layers, on
one and the same supporting disk, to in-
50 sulate them properly, to make them thin and
thus to reduce the magnetic resistance and
to neutralize the magnetic reaction on the
magnetic field of the electric currents in the
conductors. It is also possible to mount the
55 portions of the conductors, used for collect-
ing the current, independently of the said

conductors, and separately on the support-
ing disks, to center them on the same and to
collect the currents generated, by means of
separate roller current-collectors between
the moving conductors.

A unipolar dynamo machine according to
this invention with armature conductors
formed into disks and built as a so-called
"opposite-running" dynamo machine is
60 illustrated in the accompanying drawing.

Figure 1 is a cross-section through the
upper half of the machine. Fig. 2 shows on
an enlarged scale a section through a por-
tion of the supporting disks, together with
the corresponding current-collecting rings 70
and rollers. Fig. 3 is a side elevation of a
portion of the rings carrying the current-
collecting rollers, and Fig. 4 is a spring disk
from which the current-collecting rollers are
5 built up.

The machine has two rotating supporting
disks 1 carrying on their circumference the
moving blades 2 of a turbine. In order to
obtain as uniform working of the support-
ing disks as possible, one supporting disk 80
can be provided with a large number of con-
secutively arranged turbine blades. Thus,
in the construction illustrated, it has been
assumed, as shown diagrammatically at the
bottom in Fig. 1, that steam is admitted 85
through the nozzle 11, then passes through
the turbine blades 2 arranged on the left-
hand supporting disk, and thence is guided
by the guide plates 10 toward the first series
of the blades 2 of the right-hand supporting 90
disk 1, and then passes through the station-
ary guide blades 4 to the second group of
turbine blades 2 secured to the same sup-
porting disk.

The armature conductors consist of simple 95
sheet metal disks 5 connected to the support-
ing disks through interposed filling mem-
bers 7 by means of screws 13 and electrically
insulated from each other in a suitable man-
ner. In the construction illustrated, to each 100
supporting disk are secured two conductors
5. As the two supporting disks rotate in the
opposite directions as long as steam passes
through the turbines, the currents generated
in the conductors must have opposite direc- 105
tions indicated in the drawing by the ar-
rows.

The conductors 5, as shown in Fig. 2, are
connected by intermediate conductors 24 to
current-collector rings 15 and, between the 110

rings 15, facing each other, there are arranged springy current-collector rollers 14 in such manner that all armature conductors of both armatures rotating in opposite directions are connected in series or in some other suitable manner. The supporting disks rotate freely on the stationary or fixed spindle 8. To that end, bearing bushes or brasses 9 which can be easily lubricated through perforations in the fixed spindle are preferably arranged between the supporting disks and the spindles 8.

Next to the spindle, each conductor 5 is connected by suitably insulated conductors to slip rings and to brushes +6 or -6.

The current-collector rings and the current conductors 24 electrically connected to the same are preferably secured by slightly heating the outer ring so that it is slightly larger than the inner ring which remains cold so that, on cooling, it will press hard against the latter. The supporting ring 25 is thereupon also heated and pushed over the outer current collector ring, so that all the rings, after cooling, are firmly secured to each other. This method can be still further improved by making the rings at the surface *a* and *b* of slightly conical shape, which at the same time has for its result that the current-collector rings 15 are pressed against the supporting ring 25. In that way, it is possible to manufacture, to center and to remove the current-collector rings independently of the supporting disks.

The current collector rings are provided on the faces arranged opposite each other, with circular grooves or teeth 16.

Each roller 14 consists preferably of a number of circular springy sheet metal disks 18, such as that shown separately in Fig. 4. These disks, placed on each other in any desired number, can form a roller. In the same way, the group of disks forming a roller can be combined with one or more other groups to form one and the same roller. Each roller must be, of course, electrically insulated from the others. In the construction illustrated, where there are four armature conductors 5, and therefore also four current-collector rings 15, the four lower metal plates 18 (Fig. 2) form the element which conveys the current from the left-hand inner current-collector ring 15 to the right-hand inner current collector ring 15, while the next four upper plates form the roller electrically connecting together the outer collector rings 15.

The sheet metal disks are capable of spring movement relatively to each other in such manner that the teeth 16 must force the sheet metal disks apart. In that way, each tooth 16 is touched in a laterally springy and yielding manner by one sheet metal plate 18, so that current is collected in a thoroughly reliable manner in every

respect. To this must be added that, under the action of centrifugal force, the circumference of the disks 18 which, under the action of centrifugal force, has the tendency to become straightened, will be pressed against the lateral sides of the teeth 16. The teeth prevent the rollers from moving radially.

For each armature conductor there is provided a large number of current-collecting rollers 14 arranged in a circle. In the construction illustrated there are eight rollers, as shown in Fig. 3. Each of the rollers is mounted on a thin spindle, and the spindles 19 are mounted in two concentric light rings 20 and 21. In case of unequal speed or of different diameters of the single roller rings, the whole roller system can therefore rotate with half the difference of speed. The rollers run on spindles 19 by means of bushes 22 provided with a comparatively large bore so that the rollers can automatically take up the proper position. The bushes are preferably made of hard insulating material, such as porcelain, glass or quartz, or even hard carbon.

In order to bring the rollers 14 with their supporting rings 20, 21 during erection into the proper central position, bolts 23 provided with hooks are rotatably mounted in the machine frame. The bolts are turned in such a manner that their hook shaped ends keep the outer ring 20 in the central position relatively to the spindle 8, as shown dotted in Figs. 1 and 2.

When the machine is completely erected, the bolts 23 are turned so that they are no longer in the path of the rotating parts, as shown in full lines in Figs. 1 and 2 and in Fig. 3.

Claims.

1. In a homopolar dynamo, the combination of oppositely rotating supporting disks, a collector ring fixed to the inner side of each disk, rollers in engagement with the collector rings, conductors connected to said collector rings, and conductor disks carried by the supporting disks and in engagement with said conductors, substantially as described.

2. In a homopolar dynamo, the combination of oppositely rotating supporting disks, collector rings fixed to the inner side of each disk, a frame arranged between said disks, rollers carried by said frame and in engagement with the collector rings, conductors connected to said collector rings, and conductor disks carried by the supporting disks and in engagement with said conductors, substantially as described.

3. In a homopolar dynamo, the combination of oppositely rotating supporting disks, collector rings fixed to the inner side of each supporting disk and having inwardly projecting teeth, a frame composed of concentric

- tric rings, rollers carried by the frame and arranged between the rings thereof, each roller comprising a plurality of sheet disks arranged in pairs and having their peripheries oppositely beveled to form grooves for engagement with the teeth of the collector rings, and conductors carried by the supporting disks and connected with the collector rings, substantially as described.
- 10 4. In a homopolar dynamo, the combination of oppositely rotating supporting disks, supporting rings carried by the inner side of each supporting disk, collector rings carried by the supporting disks and having inwardly projecting teeth, a frame composed of concentric rings arranged between the supporting disks, spindles carried by the concentric rings of the frame, a bushing loosely mounted on each spindle, disks formed of sheet metal fixed to the bushing in pairs and having their peripheries oppositely beveled forming grooves for engagement with the teeth of the collector rings, conductors connected to the collector rings, conductor disks carried by the supporting disks and in engagement with the conductor disks, and brushes connected with the conductor disks, substantially as described.
- 30 5. In a homopolar dynamo, the combination of supporting disks, turbine blades carried by each disk and being oppositely ar-

ranged to rotate the disks in opposite directions, a casing inclosing the blades and having an inlet and an outlet, a supporting ring carried by the inner side of each supporting disk, collector rings carried by the supporting disks and having inwardly projecting teeth, a frame formed of concentric rings arranged between the supporting disks, spindles carried by the concentric rings of the frame, a bushing loosely mounted on each spindle between the concentric rings, disks of sheet metal fixed to the bushing in pairs and having their peripheries oppositely beveled forming grooves for engagement with the teeth of the collector rings, conductors connected to the collector rings, filling members secured to the supporting disks, conductor disks fixed to the filling members and having connection with the conductor rings, and brushes for taking off electric current from the conductor disks, substantially as described.

In testimony, that we claim the foregoing as our invention, we have signed our names in presence of two witnesses, this 25th day of January 1911.

OTTO SCHULZ.
WILHELM HEINRICH EYERMANN.

Witnesses:
WOLDEMAR HAUPT,
HENRY HASPER.