No. 728,812. PATENTED MAY 19, 1903.

W. STANLEY.

RECTIFIER.

APPLICATION FILED OCT. 28, 1897.

NO MODEL. 2 SHEETS—SHEET 1.

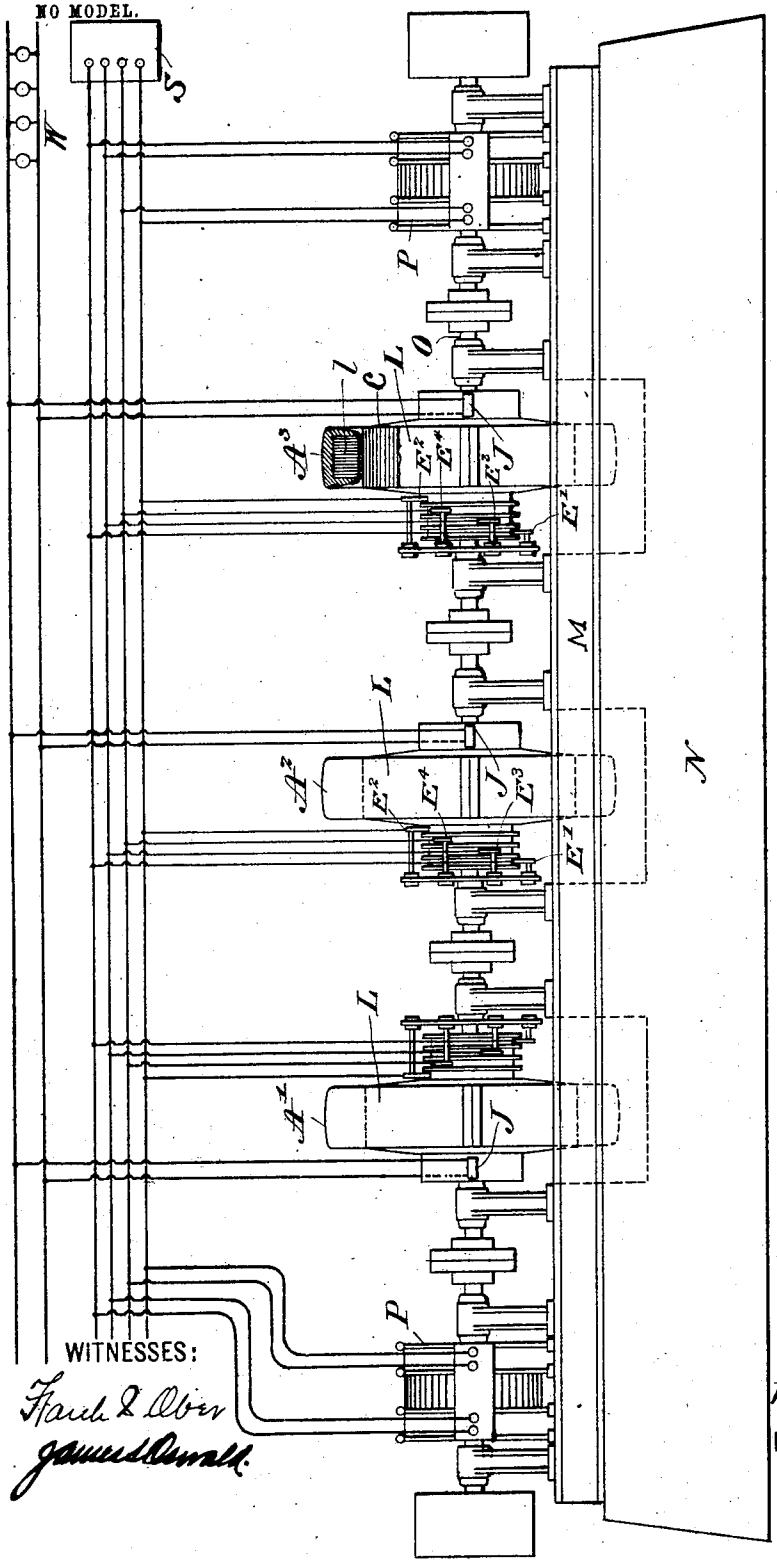

Fig. 1.

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NO MODEL. 2 SHEETS—SHEET 2.

Fig. 3.

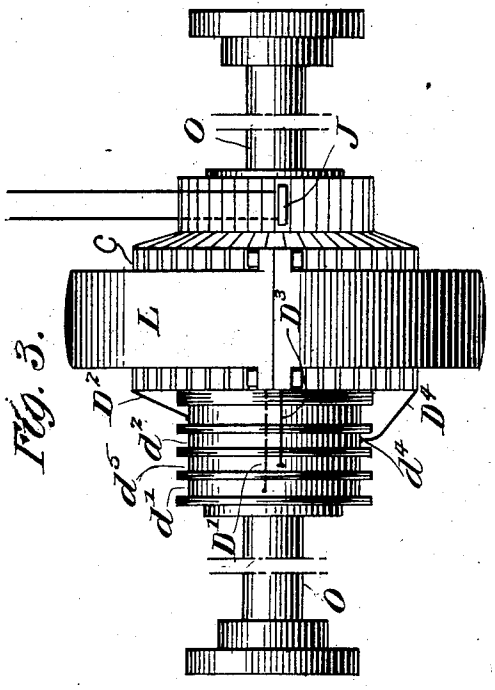


Fig. 2.

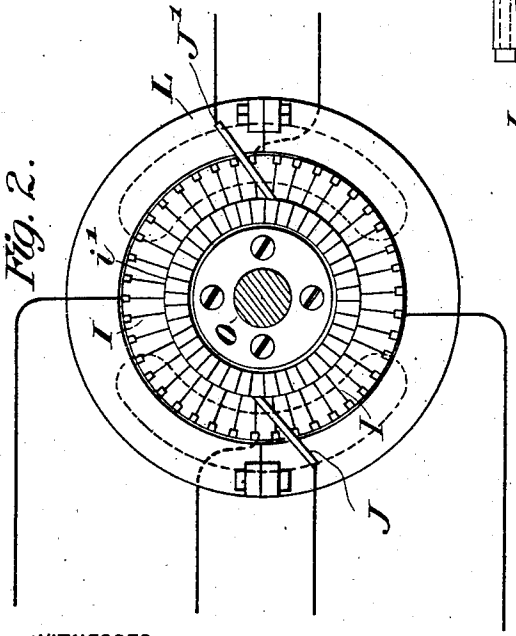
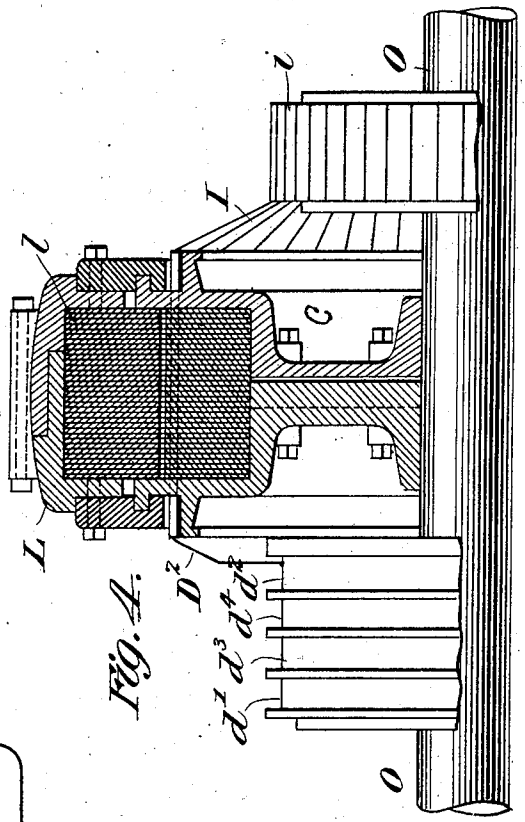


Fig. 4.



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No. 728,812. Patented May 19, 1903.

UNITED STATES PATENT OFFICE.

WILLIAM STANLEY, OF PITTSFIELD, MASSACHUSETTS, ASSIGNOR TO THE GENERAL ELECTRIC COMPANY, A CORPORATION OF NEW YORK.

RECTIFIER.

SPECIFICATION forming part of Letters Patent No. 728,812, dated May 19, 1903.

Original application filed March 10, 1897, Serial No. 626,728. Divided and this application filed October 28, 1897. Serial No. 656,643. (No model.)

To all whom it may concern:

Be it known that I, WILLIAM STANLEY, a citizen of the United States, residing at Pittsfield, Berkshire county, Massachusetts, have invented certain new and useful Improvements in Rectifiers, of which the following is a full, clear, and exact description.

My invention relates to improvements in apparatus for converting phase-differing alternating currents into continuous currents; and the object of my invention is to simplify the apparatus by which alternating currents are rectified and improve upon the construction and method of operation of such apparatus.

My present application is a division of my application filed March 10, 1897, Serial No. 626,728.

The following is a description of an apparatus embodying my invention, reference being had to the accompanying drawings, in which—

Figure 1 is a side elevation of the system embodying my invention. Fig. 2 is an end view of one of the rectifiers, the shaft of which, which is mounted, being in section. Fig. 3 is a side elevation of the same. Fig. 4 is a sectional view showing details.

Heretofore rectifiers for phase-differing alternating currents have been used in which two or more currents differing in phase have been fed into an armature having a gram-winding or its equivalent at points separated from each other by an angular difference corresponding with the difference of current-phase. The windings have been tapped at numerous points, each such point being connected to one of a number of commutating-plates, upon which a pair of brushes bear in the ordinary manner. This armature has been free to revolve in a separately-excited magnetic field, and the alternating currents have been fed to it by means of collecting-rings. The field in which the armature revolves has been either excited from an independent source or excited by the current-rectifier. In such an apparatus the supplied alternating currents acting successively upon the separately-excited field produce a torque, causing the armature to revolve. The coils of the armature as it is revolved cut through the lines of force of the separately-excited field, and there is thereby generated in them an electromotive force tending to oppose the electromotive force of the supply-alternating currents. This electromotive force (the electromotive force due to rotation in the separately-excited field) can equal and oppose the impressed electromotive force only at one critical value of the field strength, which necessitates adjustment of the exciting field-current for varying impressed electromotive forces. Such apparatus has the ponderous field-magnets of the motor and is the equivalent of a motor and generator combined therewith and operated thereby and lacks the advantages of my improved apparatus, which dispenses with the separately-excited field, and on that account is much more simple in its method of operating and also in its construction and produces better results.

Referring to the drawings, A' A^2 A^3 represent three of my rectifying devices, each consisting of a revolving armature, upon which is clamped a laminated ring or keeper L, the laminations I being in planes at right angles to the shaft O, which is a revolving shaft, carrying the said armatures, together with the rings or keepers clamped thereon. Each of these armatures has a gram-winding or its equivalent, which is connected by the conductors D' D^2 D^3 D^4 at four points or, according to the number of phase-differing alternating currents, to the collecting-rings d' d^2 d^3 d^4. At regular intervals each of the windings is connected by conductors I to contact-plates i upon the collectors upon which the brushes J J' bear, to which are connected the terminals of the work-circuit W. Upon connecting the contact-rings d' d^2 d^3 d^4 to the source of currents in quadrature S by brushes E' E^2 E^3 E^4 a magnetic field is established, rotating relatively to the armature C and the keeper L, which field as it cuts the conductors of the armature produces by induction electromotiv eforces which coincide in phase with and oppose the alternating impressed electromotive forces—that is to say, the magnetizing components of the supplied currents lag ninety degrees behind their re-

spective impressed electromotive forces and cause a resultant magnetization which induces in the armature-winding electromotive forces counter to the phase-differing electromotive forces impressed whose maximum points coincide with the points of maximum electromotive force due to the combined action of the currents in different phase. These points of maximum electromotive force are maintained in communication with the terminals of the work-circuit, as hereinafter described.

The collecting-brushes $E' E^2 E^3 E^4$ are mounted upon stationary supports rising from the base M, as are also the brushes J J', bearing upon the commutator and constituting the terminals of the work-circuit W.

To the shaft O one or more synchronously-running motors P are attached. The synchronous motors P operate so as to revolve the armature, with its keeper L, in the opposite direction from that in which the shifting magnetic field progresses in the armature and ring or keeper of the rectifier and at the same rate of speed, with the result that the polar line in the rectifier remains stationary in space and also stationary relatively to the brushes upon the commutator. The points of maximum potential therefore are also relatively stationary. The brushes J J' are adjusted so as to make contact with the commutator at these points, and consequently the maximum points and the points of brush-contact remain the same so long as the synchronous speed is maintained. In such a construction the magnetic field due to the phase-differing currents supplied from the main operating the motor, though stationary in space, revolves relatively to both the armature and its surrounding ring, producing the electrical action heretofore described.

The apparatus which I have described as embodying my invention is designed to be operated by currents in quadrature. I do not, however, intend to imply that it could not equally well be used with currents of other phase differences.

The number of rectifying devices connected to the shaft O may be one or as many as the motors can drive.

What I claim is—

1. In a rectifier for alternating currents of different phase, the combination of a revoluble core, a winding thereon, said core having an external laminated portion or keeper clamped thereon, surrounding said winding and in close inductive relation thereto, a commutator having its segments connected with the winding on said core, all of said parts being mounted upon a rotatable shaft, conductors carrying currents of different phase, means for connecting said winding with said conductors, and a synchronous motor coupled to said shaft.

2. The combination of a core, a winding thereon, a keeper secured over said winding, a commutator having its segments connected to said winding, collecting-rings also connected to said winding, and a synchronous motor for revolving said core and the winding thereon.

Signed at Pittsfield, in the county of Berkshire and State of Massachusetts, this 26th day of October, 1897.

WILLIAM STANLEY.

Witnesses:
H. M. PLATT,
C. A. BURGHARDT.