

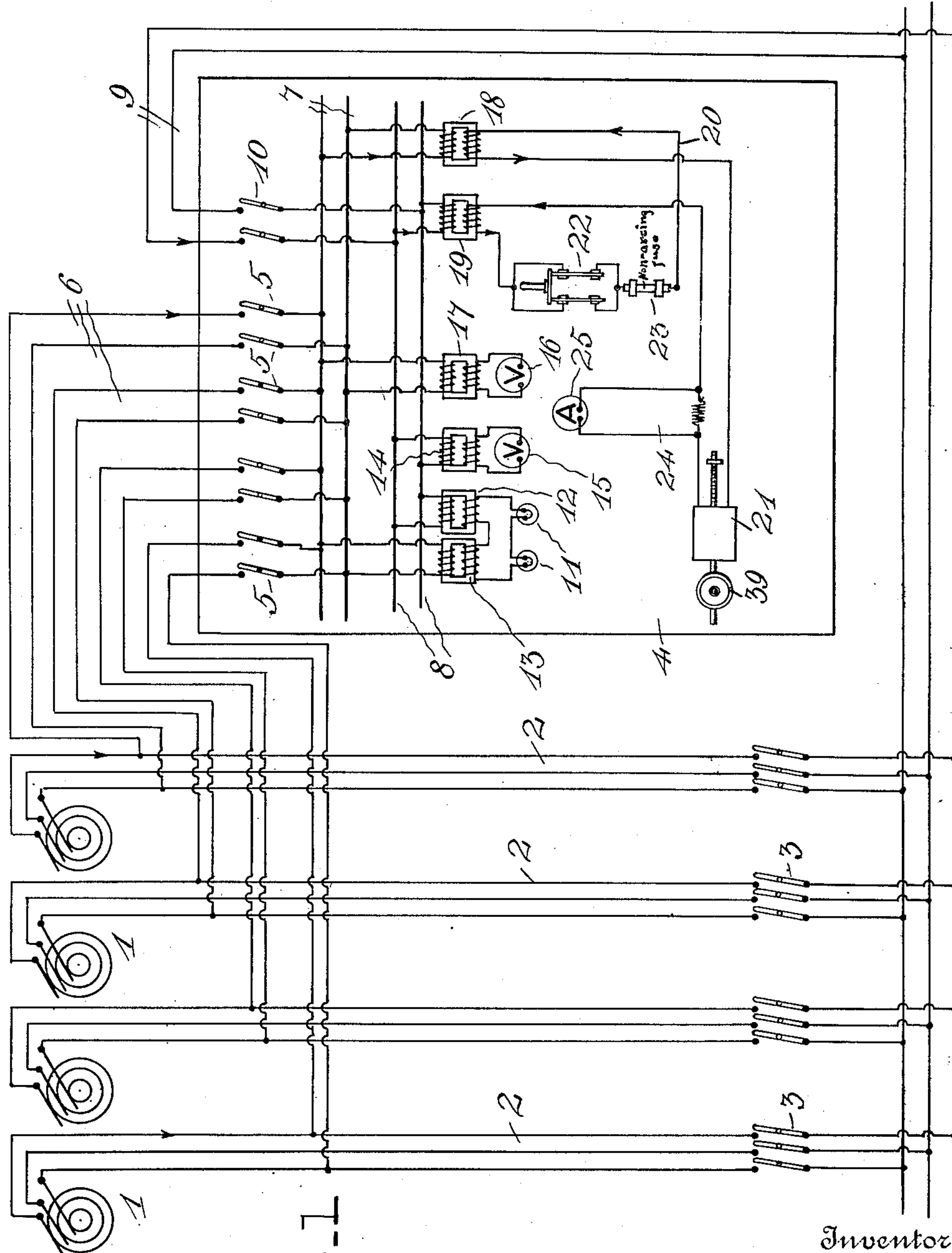
No. 821,151.

PATENTED MAY 22, 1906.

M. L. BALLARD.
SYNCHRONIZER.

APPLICATION FILED AUG. 10, 1905.

2 SHEETS—SHEET 1.



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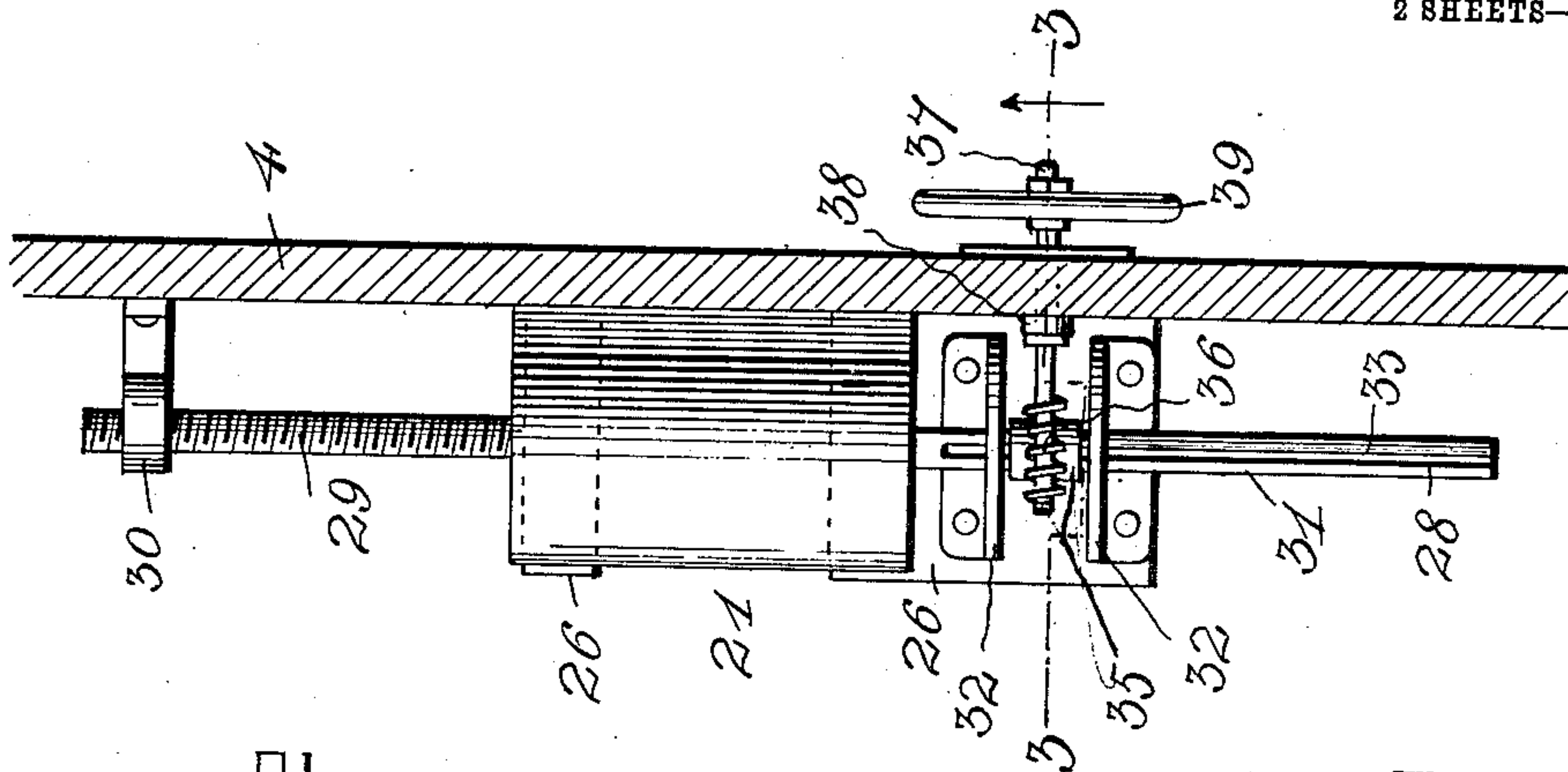


FIG. 1

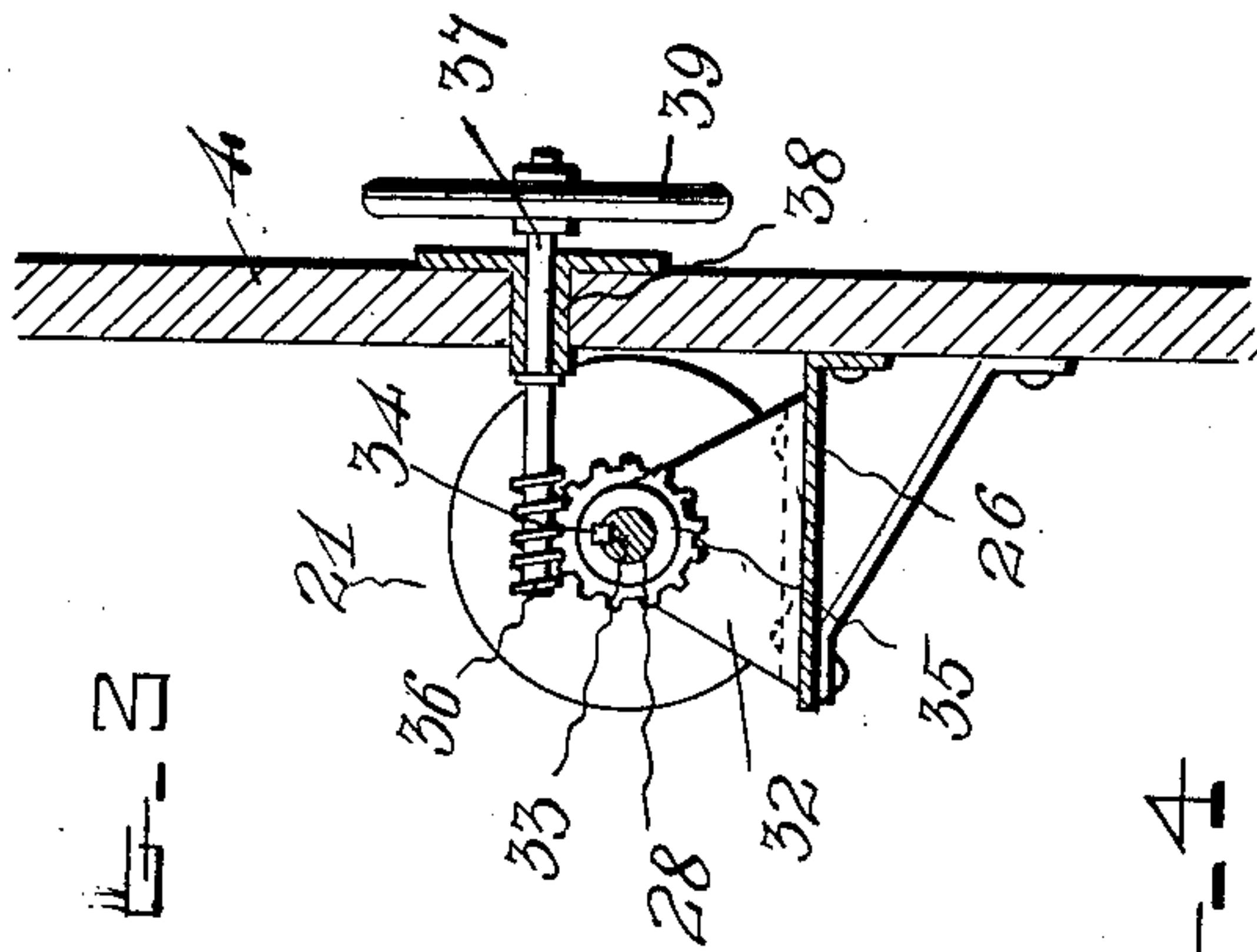
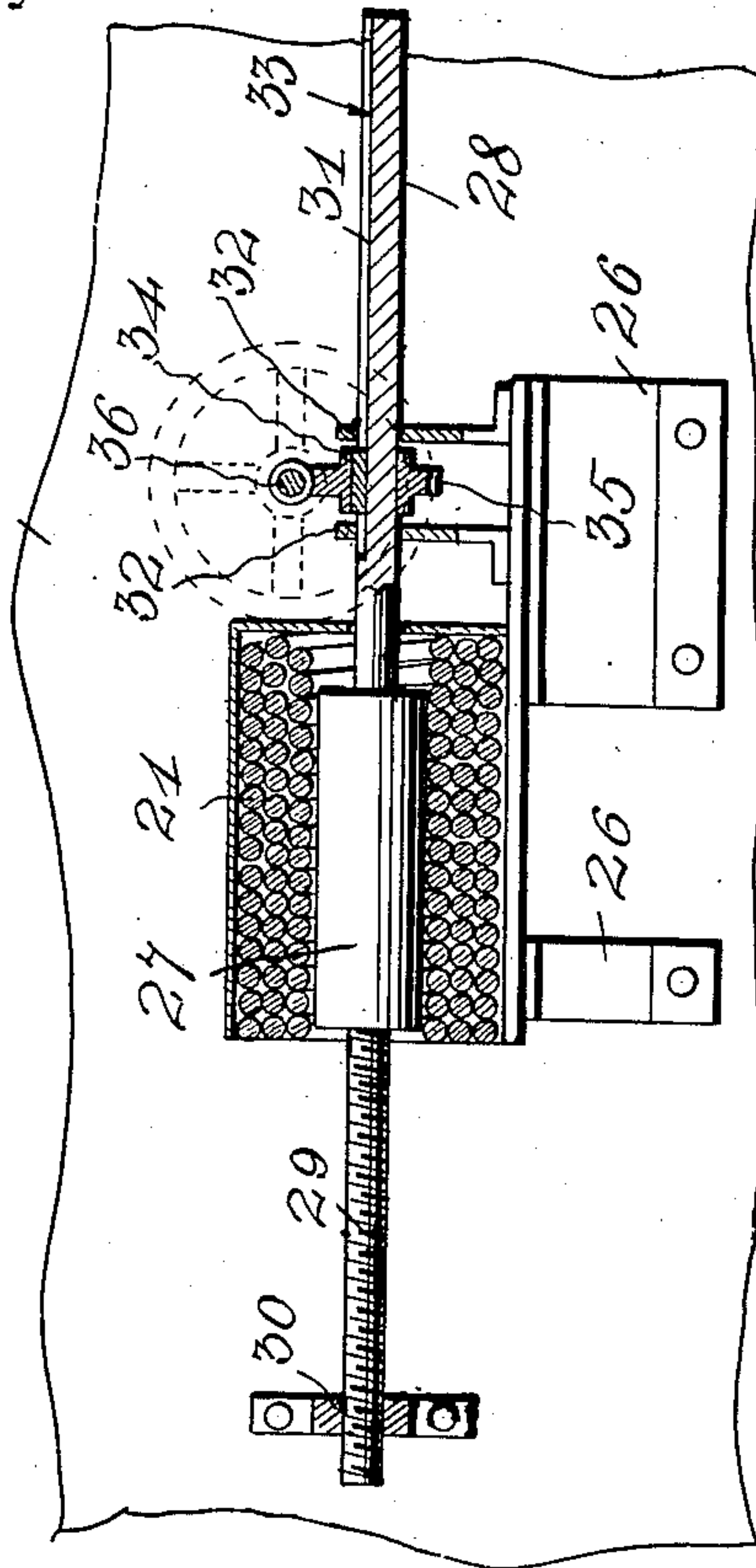


FIG. 2

FIG. 3



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UNITED STATES PATENT OFFICE.

MELZAR L. BALLARD, OF DURANGO, COLORADO.

SYNCHRONIZER.

No. 821,151.

Specification of Letters Patent.

Patented May 22, 1906.

Application filed August 10, 1905. Serial No. 273,637.

To all whom it may concern:

Be it known that I, MELZAR L. BALLARD, a citizen of the United States, residing at Durango, in the county of La Plata and State of Colorado, have invented certain new and useful Improvements in Synchronizers; and I do 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.

My invention relates to improvements in synchronizers for coupling into parallel alternating-current generators.

The object of the invention is to provide a simple, durable, and quickly-acting synchronizing apparatus which will permit of the paralleling of alternating-current generators without the danger and damage caused by the closing of the main switches when the generators are out of step and also one which will enable an attendant to quickly synchronize generators on a changeable load on the feeders or power-lines.

With the above and other objects in view the invention consists of certain novel features of construction, combination, and arrangement of parts, as will be hereinafter described and claimed.

In the accompanying drawings, Figure 1 is a diagrammatic view showing the application of my improved synchronizing apparatus to a system. Fig. 2 is a detail sectional view through the switchboard, showing the impedance-coil and its operating mechanism in top plan. Fig. 3 is a detail vertical sectional view taken on the plane indicated by the line 3 3 in Fig. 2, and Fig. 4 is a detail longitudinal sectional view through the coil.

Referring to the drawings by numerals, 1 denotes a series of alternating-current generators which are connected to the leads by circuits 2, in which are provided main switches 3. On a switchboard 4 are mounted machine-switches 5 for the synchronizer, said switches 5 being included in circuits 6, which lead from the generators 1 to bus-bars 7, provided upon the switchboard parallel with the main bus-bars 8. The latter are connected to the leads by a circuit 9, in which is included the main bus-bar switch 10 for the synchronizer. Synchronizing-lamps 11 are provided upon the switchboard in circuit with the secondary coils of two transformers 12 13, the primary coils of which are respectively connected to the main bus-bars 8 and

the secondary or synchronizer bus-bars 7, as shown in Fig. 1 of the drawings. To the main bus-bars 8 is connected the primary of a transformer 14, which has its secondary in circuit with the bus-bar voltmeter 15. A synchronizer-voltmeter 16, also provided upon the switchboard, is in circuit with the secondary coil of a transformer 17, the primary of which is connected to the bus-bars 7.

The numerals 18 and 19 denote two main synchronizing-transformers which have their primary coils connected, respectively, to the bus-bars 7 and 8 and their secondary coils included in a circuit 20, which also includes an impedance-coil 21, a synchronizer-switch 22, and a non-arcing fuse 23. Leading from the circuit 20 is a shunt 24, in which is provided an ammeter 25 for the purpose of indicating the load on the transformers 18 19 caused by the impedance of coil 21.

The impedance-coil 21 (shown in Figs. 2, 3, and 4 of the drawings) is mounted upon a shelf or support 26, provided upon the back of the switchboard 4, and comprises a laminated iron core 27, which is secured upon a shaft 28 and slides in the winding or coil, as shown. The shaft 28 has one of its ends 29 screw-threaded and engaged with a similarly-threaded opening in a stationary lug or nut 30. The opposite end 31 of said shaft slides in bearings 32 and is formed with a longitudinally-extending groove or keyway 33. Projecting into the latter is a key 34, carried by a worm gear-wheel 35, which is disposed on the shaft between the bearings 32. This construction permits the shaft to slide freely through the wheel 35, which is held against longitudinal movement by the bearings 32, but causes said shaft to turn with said wheel when the latter is rotated. Said wheel 35 meshes with a worm-wheel 36, secured upon a right-angularly-disposed shaft 37, which projects through the switchboard, and a bearing 38 provided thereon. Upon the outer or front end of the shaft 37 is secured a hand-wheel 39, by means of which the core 27 is adjusted in the coil. It will be seen that when the hand-wheel is turned the shaft 28 will be rotated and will move longitudinally, owing to the engagement of its threaded end 29 with the stationary nut or lug 30.

The operation of the synchronizer is as follows: Assuming that the appropriate switch 10 has been closed, the left-hand generator 1 to be feeding onto the main bus-bars 8, and it

is desired to start the right-hand generator 1 to running in parallel with the left-hand one on the same bus-bars, the right-hand machine is first run as nearly as possible at the same speed as the left-hand one. The right-hand switch 5 is then closed, the switch 22 being in its open position. When this is done, the lamps 11 will flicker with gradually-decreasing rapidity as the machines come into synchronism until they go entirely out, whereupon the generators will be in synchronism, the connections being such as to cause the secondary currents to oppose each other. When the lamps flicker very slowly, and thereby indicate that the speeds of the machines are nearly the same, the switch 22 is closed regardless of whether the machines are in or out of synchronism. When the machines are in synchronism, as indicated by the arrows in Fig. 1, they are paralleled through the transformers 18 19 by both feeding into the same circuit through the said transformers, the circuit being through the secondary of transformer 19, switch 22, fuse 23, secondary of transformer 18, and coil 21. The action of this circuit is as a load to which both machines are furnishing current. When the machines come into synchronism after the closing of the switch 22, they will be held in synchronism by the transformers 18 19 and the coil 21, and when in this condition they will work in parallel through the action of the coil on the secondaries of the transformers. The operation of the coil 21 is as follows: When the currents are in synchronism, as indicated by the arrows, the electromotive force from the transformers 18 19 combine, and a current will flow through said coil, the amount depending on the adjustment of its core. This adjustment is effected by means of the hand-wheel 39 and facilitated by the ammeter 25. It will be understood that the coil 21 is adjusted so as to allow the synchronizer to be used on different sizes of machines and also to vary the load on the secondaries of transformers 18 19. The voltmeters are used to show when the voltage of the generators is close enough to permit of paralleling them.

I preferably place upon the front of the switchboard 4 the following parts, 5, 10, 11, 15, 16, 25, 22, 23, and 39, and upon the rear of said board the remaining parts, with the exception of the transformers 18 19, which, owing to their size, must be placed at some other convenient point.

While I have shown and described the preferred embodiment of my invention, it will be understood that I do not wish to be limited to the precise showing herein set forth, since various modifications and changes may be made within the scope of the appended claims.

Having thus described my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. The herein-described synchronizing system comprising a plurality of alternating-current generators, leads, conductors connecting the generators to the leads and each provided with a circuit-breaking switch; main bus-bars, conductors connecting them to the leads and each including a switch, synchronizer bus-bars, transformers 12, 13, having their respective primary coils connected to the main and synchronizer bus-bars and having translating devices in the circuit of their secondary coils; conductors 6 connecting the first-named generator-conductors to the synchronizer bus-bars and each having a switch, and synchronizing-transformers 18, 19, having their primary coils connected respectively to the synchronizer and main bus-bars and their secondary coils included in a circuit 20, which also includes an impedance-coil, a synchronizer-switch and a fuse, substantially as specified.

2. The herein-described synchronizing system comprising a plurality of alternating-current generators, leads, conductors connecting the generators to the leads and each provided with a circuit-breaking switch, main bus-bars, conductors connecting them to the leads and each including a switch, synchronizer bus-bars, transformers 12, 13, having their respective primary coils connected to the main and synchronizer bus-bars and having translating devices in the circuit of their secondary coils, transformers 14, 17, having their respective primary coils connected to the main and synchronizer bus-bars and each having a voltmeter in the circuit of its secondary coil, conductors 6 connecting the first-named generator-conductors to the synchronizer bus-bars and each having a switch; and synchronizing-transformers 18, 19, having their primary coils connected respectively to the synchronizer and main bus-bars and their secondary coils included in a circuit 20, which also includes an impedance-coil, a synchronizer-switch and a fuse, substantially as specified.

3. The herein-described synchronizing system comprising a plurality of alternating-current generators, leads, conductors connecting the generators to the leads and each provided with a circuit-breaking switch; main bus-bars, conductors connecting them to the leads and each including a switch, synchronizer bus-bars, transformers 12, 13, having their respective primary coils connected to the main and synchronizer bus-bars and having translating devices in the circuit of their secondary coils; conductors 6 connecting the first-mentioned generator-conductors to the synchronizer bus-bars and each having a switch; and synchronizing-transformers 18, 19, having their primary coils connected respectively to the synchronizer and main bus-bars and their secondary coils included in a circuit 20, which also includes an impedance-coil, a synchronizer-switch and a fuse, substantially as specified.

dance-coil, a synchronizer-switch and a fuse, said circuit 20 having a shunt including an ammeter, substantially as specified.

5 4. The combination of a coil, a shaft slidable therethrough, a core upon said shaft within said coil, a stationary nut, screw-threads upon said end engaged with said nut, a gear keyed to rotate with said shaft but
10 slidable longitudinally thereon, an operating-shaft, and a gear upon the latter in mesh with

said gear upon the first-mentioned shaft, substantially as described.

In testimony whereof I have hereunto set my hand in presence of two subscribing witnesses.

MELZAR L. BALLARD.

Witnesses:

JOHN W. REDMAN,
J. L. PARSONS.