

No. 702,453.

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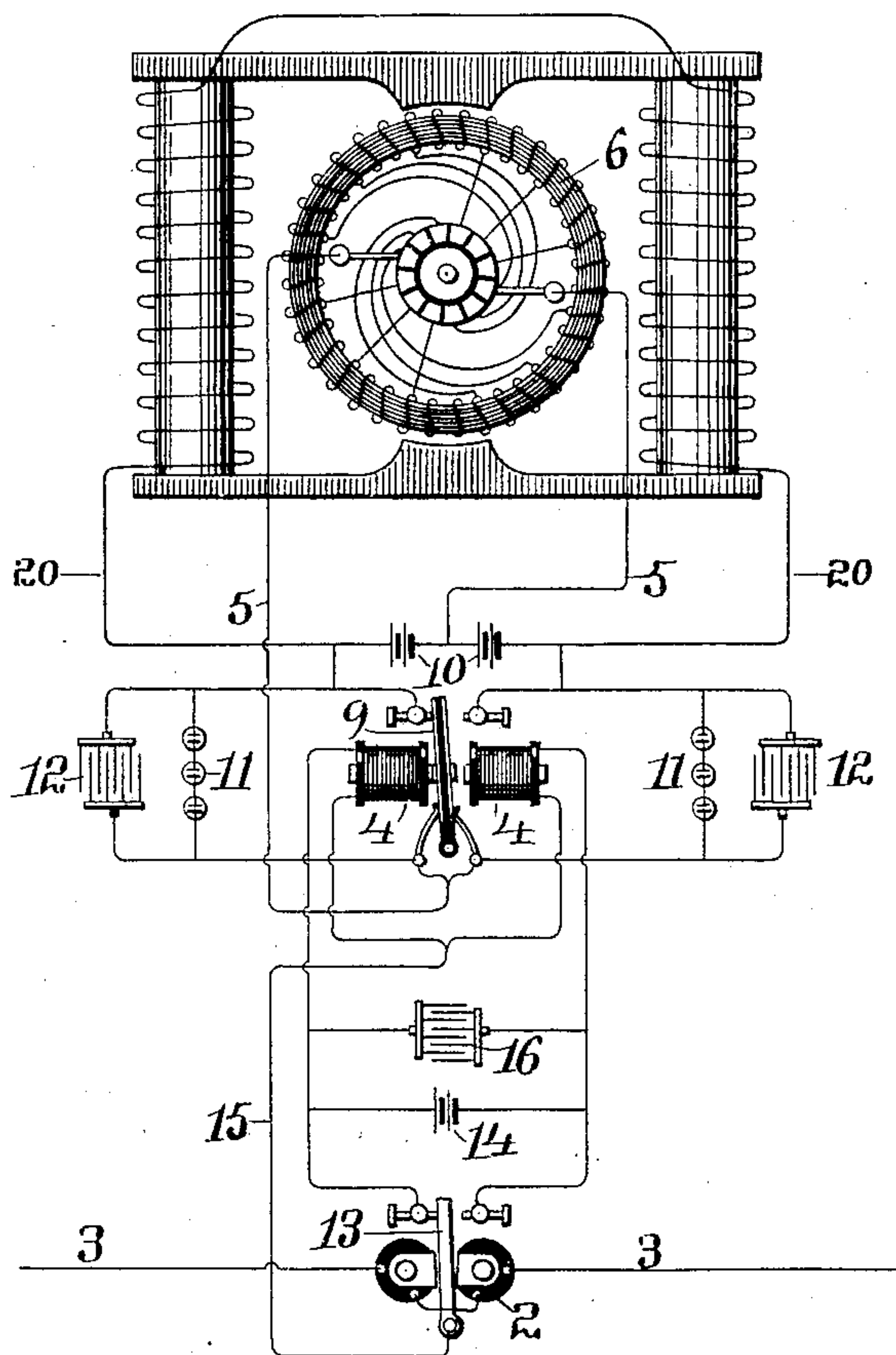
W. M. MINER.  
ELECTRIC SYNCHRONOUS APPARATUS.

(Application filed July 25, 1901.)

(No Model.)

2 Sheets—Sheet 1.

FIG 1



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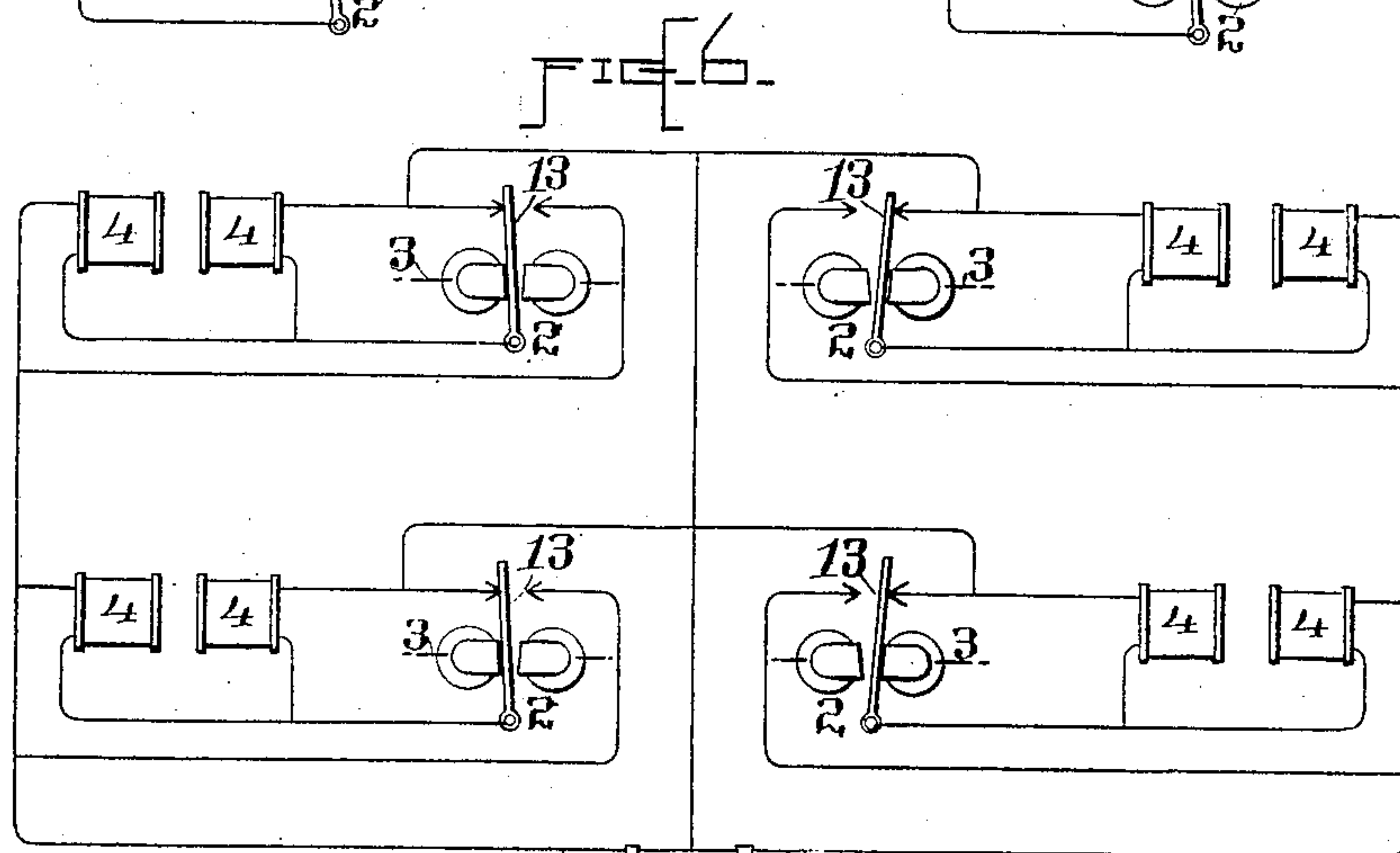
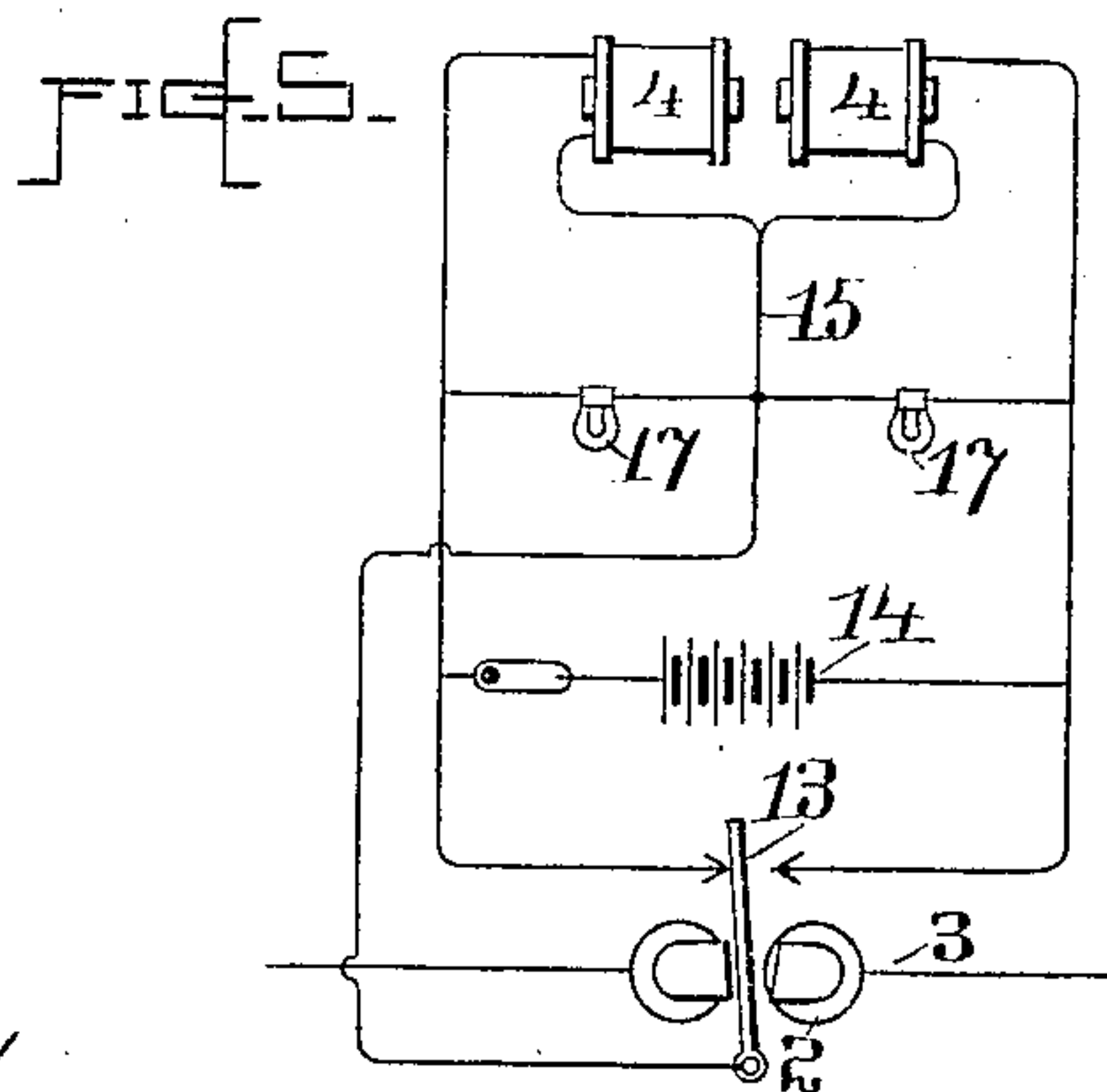
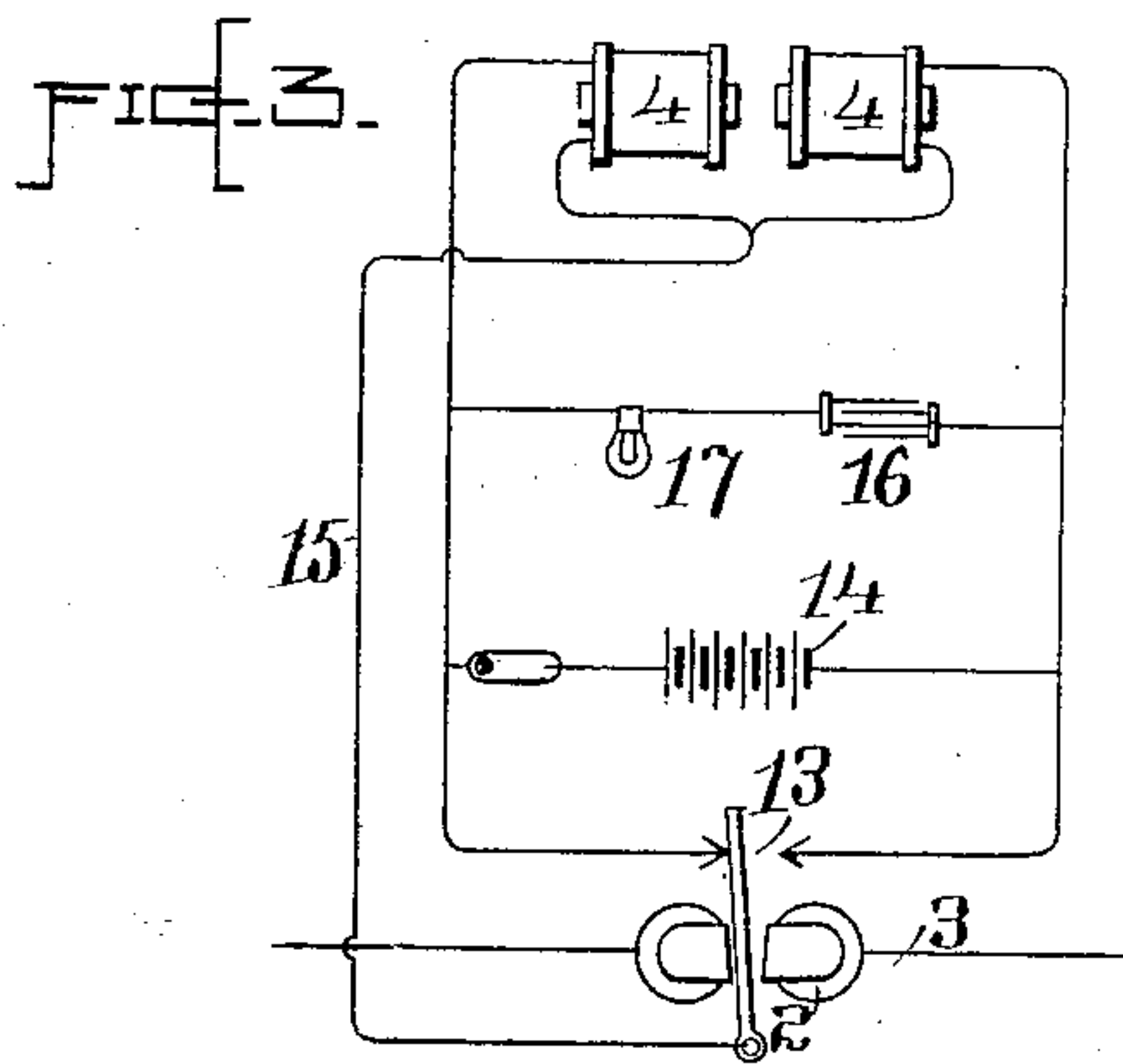
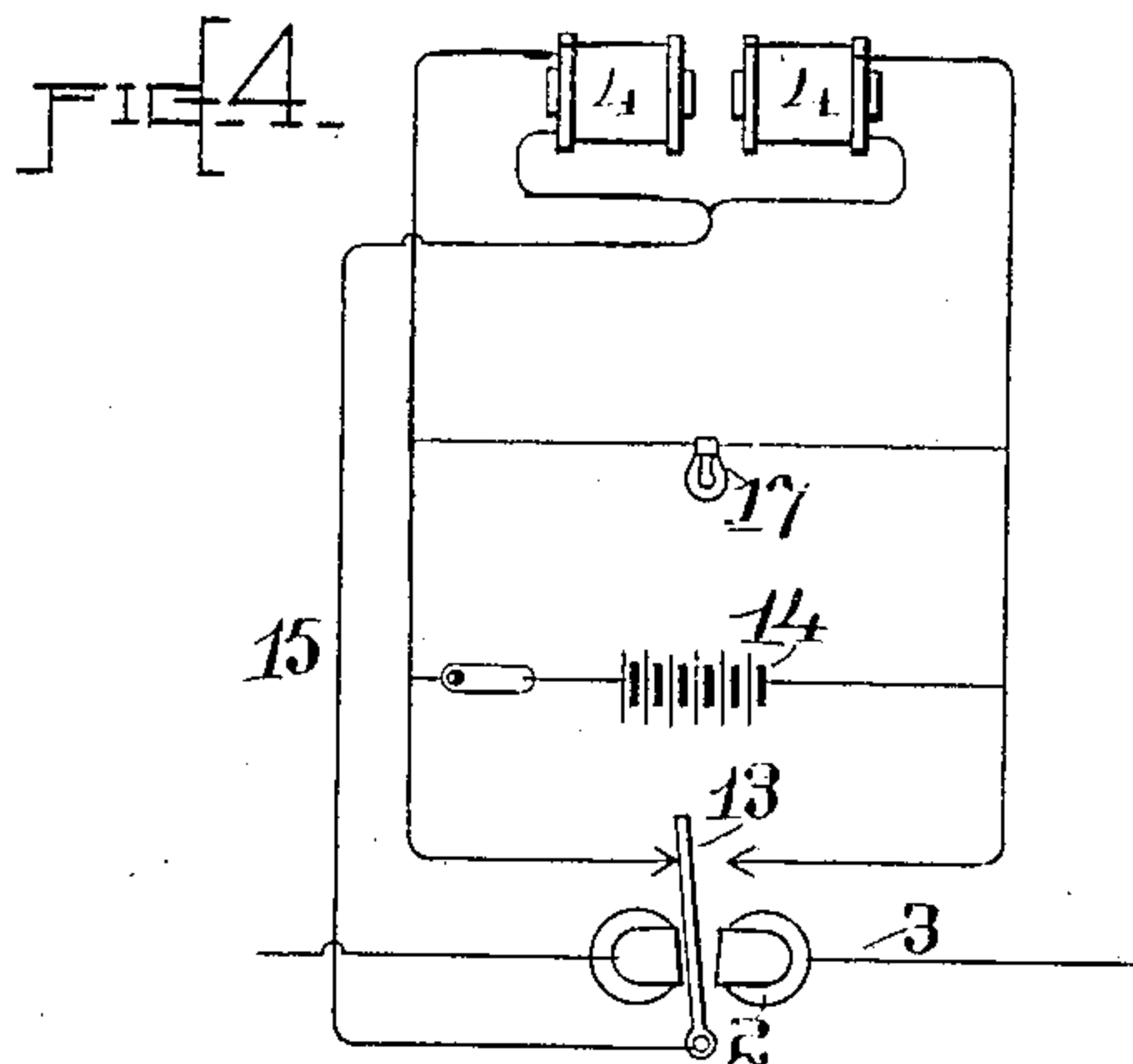
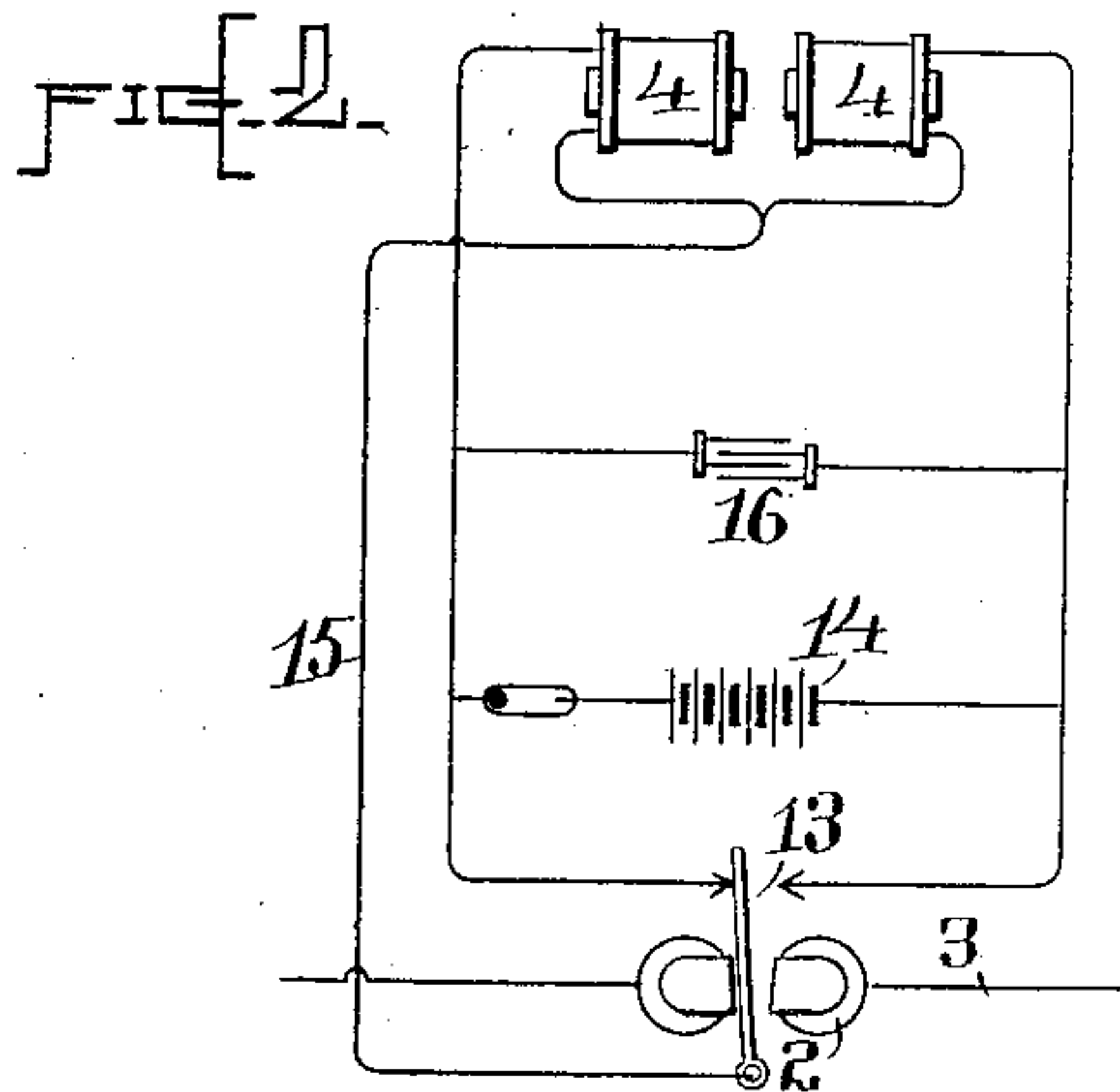
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2 Sheets—Sheet 2.



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# UNITED STATES PATENT OFFICE.

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## ELECTRIC SYNCHRONOUS APPARATUS.

SPECIFICATION forming part of Letters Patent No. 702,453, dated June 17, 1902.

Application filed July 25, 1901. Serial No. 69,643. (No model.)

*To all whom it may concern:*

Be it known that I, WILLARD M. MINER, a citizen of the United States, and a resident of Plainfield, in the county of Union and State  
5 of New Jersey, have invented certain new and useful Improvements in Electric Synchronous Apparatus, of which the following is a specification.

My invention relates to a synchronizing apparatus for telephonic, telegraphic, and other purposes, and more particularly to that class of apparatus wherein the flow of synchronizing-current on a local circuit through the apparatus or part of the apparatus to be controlled is governed by the action of a vibrating or oscillating lever or other device kept in vibration or oscillation synchronously with pulsations or reversals of current on a main-line circuit by means of a relay which controls the circuits of the actuating magnet or magnets for the vibrator.

In apparatus of this character difficulty is frequently experienced from the sticking of the relay-contacts, by reason of which and  
25 other conditions well understood in the art the apparatus has heretofore been unreliable and uncertain in its operation.

The object of my invention is to remove the difficulties heretofore experienced in the use of appliances of this nature, to which end my invention consists in a peculiar manner of combining the synchronizing-relay with the circuit or circuits for the actuating-magnets of the vibrator, whereby sparking at the contacts of the relay and the tendency of the same to stick are entirely obviated.

My invention consists, further, in the novel application of an electric lamp as a shunting, resistance to the vibrator-magnets for the  
40 purpose of taking up and preventing the sparking at the contacts of the relay.

Briefly stated, my invention consists in the combination, with the actuating magnet or magnets for the vibrator, of a synchronizing-relay controlling over its contacts suitable connections whereby a short circuit for a suitable source of energy may be closed and opened around said magnets alternately, as hereinafter more particularly set forth.

50 My invention consists, further, in the combination, with the aforesaid circuits for the vibrator-magnets and the relay-contacts, of a

non-sparking device placed in shunt across the terminals of one or both magnets for the vibrator, whereby sparking and sticking are  
55 still more effectually prevented.

The invention consists also in the novel manner of maintaining the field for the motor to be synchronized, as more particularly hereinafter described and claimed. 60

My invention consists also in the novel manner of furnishing the operating-current for the vibrator-magnets from a circuit having a potential higher than that required for operating the magnets themselves, while at  
65 the same time providing a shunting-resistance or non-sparking device for the contacts of the synchronizing-relay, as will be hereinafter more particularly set forth and then specified in the claims. 70

I have in the accompanying drawings illustrated my invention as applied to the controlling of the flow of current on a local synchronizing-circuit wherein a mechanism or device is maintained in synchronism by reversals of current on the circuit for the armature of an electric motor connected to the apparatus whose movements are to be made synchronous with those of some distant device connected with the line-circuit. Thus  
80 I have shown the vibrator as controlling the circuit of the armature for an electric motor, as shown in the patent of F. J. Patten, No. 428,222; but, as will be readily understood, the vibrator might operate upon a circuit and  
85 devices of any desired nature suitable for securing a synchronous control of a moving device.

Figure 1 is a general diagrammatic representation of an arrangement of apparatus  
90 embodying my invention. Fig. 2 is a simplified diagram of the synchronizing-relay and vibrator-magnet connections. Fig. 3 illustrates diagrammatically a modification in the nature of the antisparking devices employed  
95 as a shunt to the vibrator-actuating magnets. Figs. 4 and 5 illustrate other modifications. Fig. 6 illustrates the manner of operating one or more sets of vibrator-magnets from a circuit of higher voltage or potential than is required for said magnets—as, for instance, a  
100 one-hundred-and-ten-volt circuit.

Referring to Fig. 1, 2 indicates a polarized relay kept in vibration by reversals of cur-



rent over a main line 3 in any desired manner—as, for instance, as described in Patent No. 428,222, granted to F. J. Patten. 4 indicates the actuating-magnets of the vibrator which controls the flow of current on a local circuit 5, passing, as herein shown, through the armature 6 of an electric motor in the manner described in said patent for the purpose of maintaining a synchronous movement of said motor and the device or devices connected with the apparatus which produces reversal of current on the line 3.

The reversals of current upon the circuit 5 keep the motor-armature in synchronism through the connection of the armature-coils with the commutator in the special manner described in said patent.

The reversals of current on the circuit are secured through the action of the vibrator-lever 9, which controls the flow of the local batteries 10, having opposite poles connected to the contacts of the vibrator-lever and a common connection to one pole of the circuit 5, as clearly indicated. When the two sides or halves of the vibrator-lever are connected to the other pole of the circuit 5 through suitable contact-springs, as shown, then the action is obviously to cause currents of reversed polarity to flow over the circuit 5 from the batteries 10 in synchronism with the movements of the vibrator-lever.

In shunt around the contacts of the vibrator-lever are placed spark-preventing devices, such as liquid condensers 11 and plate-condenser 12.

For a fuller understanding of the action of the apparatus so far described reference may be had to the Patent No. 428,222.

The field of the motor is maintained by exciting it from the same batteries 10 which are controlled by the vibrator. This is done by taking off a shunt connection 20 from the outside terminals of the double or split battery 10, as shown. In this arrangement it will be observed that the batteries supply an intermittent current through the contacts of the vibrator and a continuous current for the field of the machine, whereas the practice in this art has heretofore been to use independent sets of batteries or generators for the vibrator-circuit and for the field-circuit of the machine, respectively. By my arrangement not only is the number of cells which it is necessary to care for greatly diminished, but there is also a positive advantage in that the field-magnet coils act to assist in absorbing the spark at the contacts of the vibrator and further operate to take up any discharge-current of the static condensers which may then discharge through the field-magnet coils instead of over the contacts of the vibrator, in which latter case the spark might start an arc which would then be maintained from the local generator and would result finally in a welding of the contacts together. The presence of the field-magnet in the shunt-circuit tends, however, to do away with this frequent

source of trouble in synchronizing apparatus of the general character heretofore employed.

The vibrator-lever 13 of the polarized relay operates between two contacts connected directly to the poles of a suitable generator 14, and the poles of the same generator also connect directly with terminals of the coils of the actuating-magnets 4 for the vibrator, while the coils themselves are connected together, as shown, so that there is in the absence of other connections a continuous circuit through the two coils 4 from the battery 14. At the junction of the coils, however, a connection 15 is made with the lever 13 of the polarized line-relay, so that as said lever vibrates it will operate to short-circuit first one coil 4 and then the other coil 4 of the vibrator; but when in position to short-circuit one of said coils the short circuit of the other coil is opened, so that the current from the battery or generator 14 will flow through the latter coil and energize the magnet so as to actuate the vibrator-lever. In the position in which the parts are shown with the lever 13 against the left-hand contact current will be shunted from the left-hand coil 4, and the current from the battery or generator 14 will flow from one pole through the right-hand coil 4 and by way of connection 15 back to the opposite pole of the battery. When the lever 13 reverses its position, the short circuit formed around the left-hand coil 4 will be broken and short circuit established around the right-hand coil 4, as may be readily traced on the diagram. By this means the vibrator-lever is caused to follow the oscillations of the relay-lever 13.

By following connections it will be seen that there is a closed circuit for the coils of each magnet, although one only of them is in action at a time. This may be more readily seen by reference to the simplified diagram, Fig. 2, from which it will appear that at the instant of breaking the short circuit of the right-hand magnet 4, for instance, a discharge-path for the extra current from said coil will exist through the other coil and through the generator or through any spark-preventing device, such as plate-condenser 16, which may be employed across the terminals of the coil, as indicated. It will also be seen that there is always a path provided for the current from the generator 14 independently of the controlling-contacts governed by the relay-lever 13, and that hence there is no opportunity for the flow of the current from said battery across the contacts, so as to produce sticking. Any tendency that may exist, however, to the formation of a spark or welding current at the contacts is effectually removed through the presence of the spark-preventing device 16, which is placed, as shown, across the circuit or in shunt to the coils of the actuating-magnets. In Fig. 2 this spark-preventer is shown as a plate-condenser. In Fig. 3 it consists of an ordinary incandescent lamp 17, together with the plate-condenser 16, said lamp



and condenser being placed in series. In Fig. 4 the spark-preventer consists simply of an incandescent lamp 17, placed in shunt to both coils of the vibrator in a similar manner to the spark-preventer illustrated in Figs. 2 and 3.

Instead of placing the lamp or lamps in shunt to both coils a lamp may be placed in shunt to each coil, as illustrated in Fig. 5, where two lamps 17 are shown both connected to the circuit joining the coils 4 with the vibrator-lever 13 and each connected to the wire joining the coil with the contact for the lever 13.

I find in practice that by the use of an ordinary incandescent lamp arranged in any of the ways shown a very effectual non-sparking action may be secured and one far superior to that hitherto secured in devices of this general nature by the use of plate-condensers, resistances, &c., as set forth in the United States Patents 428,222 and 428,221.

I am aware that incandescent lamps have been used as an artificial resistance, but I am not aware that they have been employed in the relation to the contacts of the vibrator, as herein set forth. Their practical effect in absorbing the extra currents generated through the operation of the vibrator is a very decided improvement, as I have found in actual practice, over the results obtained heretofore by the use of resistance-coils and condensers, which, while theoretically well suited to the purpose, do not act with uniformity in the relation described, so that the contacts of the vibrator will be welded together sometimes by the effect of the discharge from the condenser.

I am unable to state positively to what the improved action of the incandescent lamp is due; but it may possibly be attributed to the fact that its resistance is completely non-inductive, and there is also an advantage to be attributed to the fact that its resistance decreases in a large ratio with the heating of the filament, due to the passage of current through it. It thus changes with the pressure in such a manner as to dissipate the discharge due to the interruption of the current-flow, the high pressure due to this interruption causing the resistance to decrease momentarily and allow current to pass with greater ease. By thus affording a good discharge-path for such extra-pressure current generated in any part of the apparatus and by preventing sparking at the point of interruption the device acts effectually to prevent a welding of the contacts of the vibrator together by the flow of current from one to the other.

When it is desired to supply one or more sets of synchronizing devices from a one-hundred-and-ten-volt circuit and to obviate the necessity of winding the vibrator-magnets for such high voltage, an arrangement such as indicated in Fig. 6 may be employed, wherein the desired difference of potential for the operating-circuit of the vibrator-magnets is ob-

tained by the use of incandescent lamps or other resistances, and the resistance is made to operate at the same time as the spark-preventing device in shunt across the terminals of both vibrator-magnets, as illustrated in Fig. 4.

In the diagram Fig. 6, 18 indicates supply-wires having a potential of, say, one hundred and ten volts. 17 indicates four incandescent lamps of any desired resistance suitable for the purpose and connected in series with one another across the supply-wire 18. In shunt to one or more of said lamps, depending upon the operating voltage required, is placed the operating-circuit for the vibrator-magnets controlled by the lever 13 of the polarized relay in the manner shown. As will be seen, a difference of potential, depending upon the resistance of the lamp so shunted, exists at the terminals of the supply-circuit, and the lever 13 operates to shunt such potential from the magnets 4 alternately, while at each shunting action produced for one magnet 4 the current is allowed to flow through the other. It will be seen also that the lamp 17, around which the supply-circuit forms a shunt, stands in the same relation to the apparatus as the lamp 17 in Fig. 4 and operates, in fact, as a spark-preventing device. It is also apparent that any number of actuating-circuits might be tapped off from the series of lamps 17 dependent upon the number of lamps so employed in series and upon the voltage required for operating the vibrator-magnets. It is also obvious that each shunt connection from a lamp might be used as a supply-wire or bus from which a number of operating-circuits for the vibrator-magnets may be connected in multiple, as clearly shown in Fig. 6.

What I claim as my invention is—

1. In a synchronizing apparatus for telephonic, telegraphic and other purposes, the combination substantially as described of a synchronous vibrator, a pair of actuating-magnets therefor, a synchronizing-relay and contacts and connections as described whereby said relay may close and open shunt or short circuits for a suitable source of energy, around said vibrator-magnets in turn, as and for the purpose described.

2. In a synchronizing apparatus for telephonic, telegraphic and other purposes, the combination substantially as described, of a vibrator, a local synchronizing-circuit controlled thereby, an actuating magnet or magnets for the vibrator, a synchronizing-relay responsive to pulsations or changes of electrical condition periodically produced upon a main line and contacts and connections whereby the relay-lever may alternately open and close a shunt or circuit for a suitable source of energy around the vibrator-magnets in turn, as and for the purpose described.

3. In a synchronizing apparatus for telephonic, telegraphic and other purposes, the combination substantially as described of a



vibrator controlling a local synchronizing-circuit and a main-line relay responsive to periodical reversals of current on a main line, actuating-magnets for the vibrator provided  
5 with circuits and connections to the relay-contacts and to a suitable generator whereby a short circuit for said generator may be closed around said magnets alternately, and  
10 the terminals of one or both magnets for the vibrator, as and for the purpose described.

4. In a synchronizing apparatus for telephonic, telegraphic and other purposes, the combination with the vibrator and its actuating-magnets, of the line-relay, a suitable  
15 source of electric energy and contacts and connections as described whereby a short circuit for the generator-current may be completed around said magnets alternately and  
20 synchronously with the main-line pulsations and an electric lamp placed in a shunt across terminals of the vibrator-actuating magnets.

5. In a synchronizing apparatus for telephonic, telegraphic and other purposes, the  
25 combination substantially as described with supply-wires or connections 18 leading from a source of any voltage or potential, of two or more lamps placed in series across said

wires, a vibrator having a pair of actuating-magnets, a relay controlling the flow of current through said vibrator-magnets in turn  
30 and a local supply-circuit for said magnets formed by a shunt around one or more of said lamps and including contacts of the relay, as and for the purpose described. 35

6. In a synchronizing apparatus, the combination with an electric motor of a vibrator, generators connected alternately to the armature of the motor by the action of said vibrator and a field-magnet circuit for the motor supplied by a shunt from the outside terminals of said generators. 40

7. In a synchronizing apparatus, the combination of an electric motor, a local generator, a vibrator controlling the connection of  
45 the generator and motor-armature, and a field-magnet circuit connected to said generator but in shunt to the armature and vibrator contacts.

Signed at New York, in the county of New York and State of New York, this 26th day of June, A. D. 1901. 50

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Witnesses:

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