

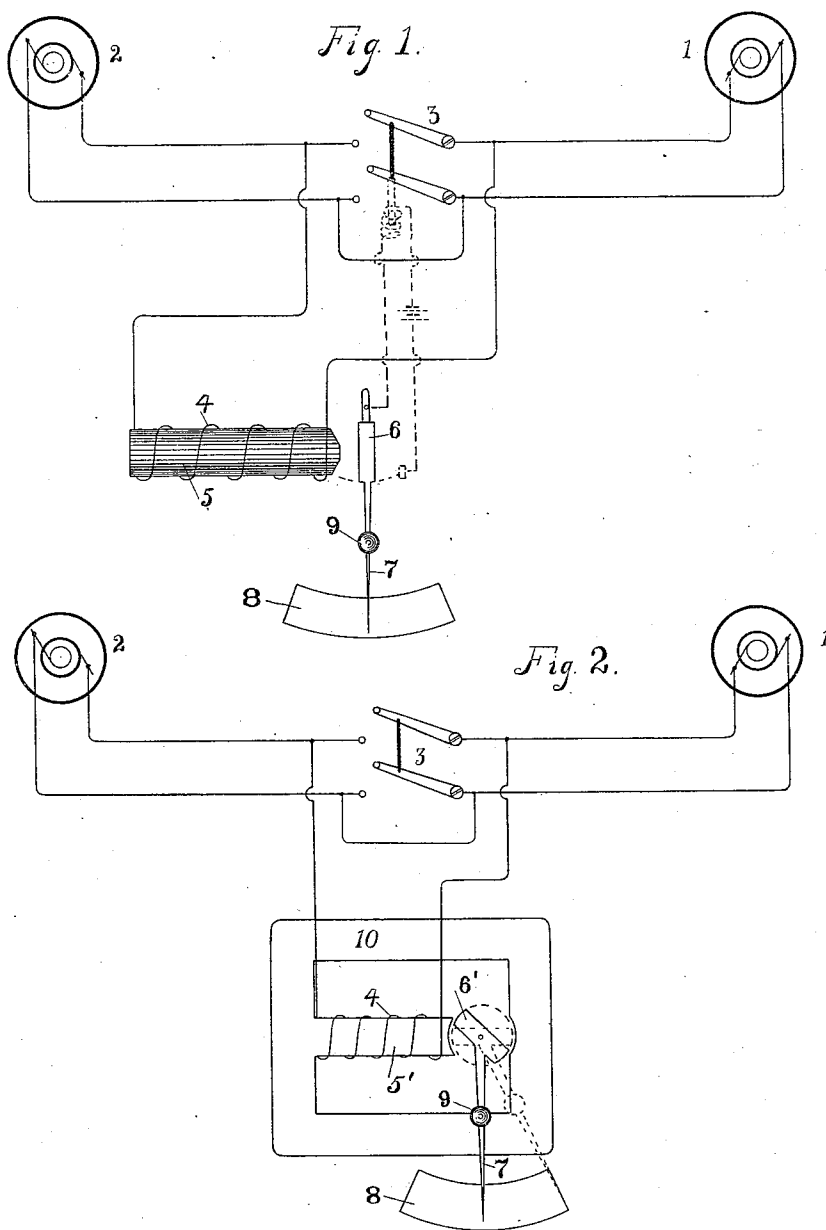
(No Model.)

2 Sheets—Sheet 1.

R. D. MERSHON.
SYNCHRONISM INDICATOR.

No. 544,365.

Patented Aug. 13, 1895.



WITNESSES:

Robert C. Tenner
James H. Smith.

INVENTOR.

Ralph D. Mershon
BY
Terry and Mackay
ATTORNEYS.

(No Model.)

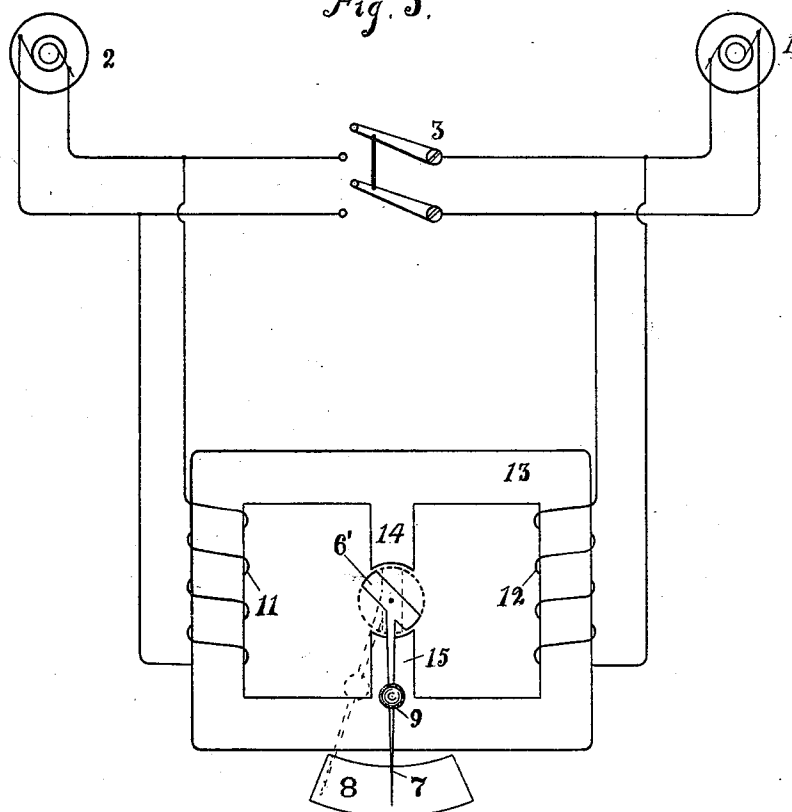
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Fig. 3.



WITNESSES:

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UNITED STATES PATENT OFFICE.

RALPH D. MERSHON, OF PITTSBURG, PENNSYLVANIA.

SYNCHRONISM-INDICATOR.

SPECIFICATION forming part of Letters Patent No. 544,365, dated August 13, 1895.

Application filed November 12, 1894. Serial No. 528,559. (No model.)

To all whom it may concern:

Be it known that I, RALPH D. MERSHON, a citizen of the United States, residing at Pittsburg, in the county of Allegheny and State of Pennsylvania, have invented a new and useful Improvement in Synchronism-Indicators, (Case No. 618,) of which the following is a specification.

My invention relates to methods and apparatus employed for determining or indicating the occurrence of synchronism between alternating-current machines, and it has for its object to provide a method and an apparatus of this character which shall be simple and durable in construction, and which shall operate to accurately indicate to the eye of the operator the moment when synchronism is reached, in order that the machines may be connected together in circuit at that moment.

In my applications, Serial Nos. 509,222 and 509,223, filed April 27, 1894, I have described and claimed methods and means for indicating the occurrence of synchronism between two alternating current machines which involve the production of acoustic vibrations, and while such methods and means are admirably adapted for use in connection with circuits carrying currents of high frequency, they fail to effect the desired result when the number of alternations per second is so low that the mechanical vibrations caused thereby will not produce a musical tone. I have accordingly devised a means and a method, illustrative examples of which are shown in the accompanying drawings, in which—

Figure 1 is a diagram showing one form of indicator and the connected circuits. Fig. 2 is a diagram of a slightly-different form of indicator embodying my invention, and Fig. 3 is a diagram showing still another modification.

Referring particularly to Fig. 1 of the drawings, 1 and 2 indicate the machines to be synchronized, and it is to be understood that such machines may be a generator and a motor or two generators.

3 is a switch for connecting the two machines in circuit when they are brought to synchronism, and 4 is a coil in series with the two machines, this coil being provided with a magnetizable core 5, preferably of laminated iron. Pivotally or otherwise mounted so that

it is free to move to and from the coil and core and in inductive relation to the latter is a closed conductor or armature 6. This armature may be a closed coil or a disk of non-magnetic metal, such as copper or aluminum, for example; or it may be of iron, and, as has already been stated, it is immaterial how it is mounted, so long as it is free to move toward and away from the coil 4. In order that the movement of this armature may be more readily noted and the moment of synchronism determined, it is preferably provided with a pointer 7, the end of which moves over a scale-plate 8. This pointer may, if desired, be provided with the weight 9 to insure its return to the zero position when not magnetically or electrically actuated. The switch 3 may be closed by hand upon the occurrence of synchronism, or the said switch may be controlled by means of a local circuit closed by the armature or the pointer, if desired, as indicated by dotted lines in Fig. 1 of the drawings. It is to be understood that the machines are to be connected in circuit at the moment when they have reached approximately the same speed and when their electromotive forces are in opposition, or, in other words, when the waves representing the electromotive forces from the two machines are of substantially the same length and the maxima of the waves from one machine are very nearly in opposition to those from the other.

In the apparatus just described, assuming the coil 4 to be so connected in circuit that the electromotive forces therein will be in opposition when the machines are in the proper relation for closing the switch 3, the armature 6 will, in the absence of such relation, be moved either toward or away from the coil 4 and its core 5, the direction of such movement being dependent upon whether the armature be of magnetizable or non-magnetizable metal. As the two machines approach the same speed and the electromotive forces come more nearly into opposition, the armature will tend to return to its original or zero position until the relation of the machines is such that they may properly be connected in circuit, when the armature and its pointer will be in approximately the position shown in Fig. 1 of the drawings. If, on the other hand, coil 4 be so connected in circuit that there shall be a coin-

cidence of the electromotive forces therein when the machines are in the proper relation for connecting them in circuit, the operation of the device will be the reverse of that above described—that is to say, if the armature be of magnetizable material its extreme left-hand position will indicate the time for closing the switch, and if of non-magnetizable material its extreme right-hand position will give the proper indication, the vertical or zero position, or one between that and either of the extreme positions, indicating the absence of the desired relation of the two machines. I prefer to so connect the coil 4 in circuit that there shall be an opposition of electromotive forces therein at the proper time for throwing the switch and to employ a non-magnetic armature; but the other connection and variety of armature described are entirely practical and may be employed, if desired. As already stated, it is obvious that the armature or its pointer may also serve, if desired, to close a circuit, which shall operate to effect the closing of the switch 3 automatically.

In Fig. 2 I have shown the coil 4 surrounding a core 5', which forms a portion of an iron frame 10, each core and frame being preferably laminated. Pivottally mounted between the end of the core 5' and the opposite portion of the frame is an armature 6'. Extending outward from this armature is a pointer 7, provided with a weight 9, and arranged so that the end of the pointer will move over it is a scale or indicator-plate 8, the pointer indicating thereon the position of the armature with reference to the coil 4. In this form of the device, as well as in that illustrated in Fig. 1, the armature may be either of magnetic or non-magnetic metal, and the connection of the coil 4 in circuit may be such as to secure either opposition or coincidence of the electromotive forces therein when the machines are in proper relation for closing the switch. The full-line position of the armature and pointer indicates the proper relation of the machines for closing the switch when the electromotive forces are in opposition in coil 4 at that time, and the dotted-line position of the said parts indicates such relation when there is coincidence of electromotive forces in said coil at that time.

In Fig. 3 is shown a modification in which there are two magnetic circuits, one due to the coil 11 in series with the machine 2, and the other to the coil 12 in series with the machine 1. The frame 13, on two of the arms of which the coils 11 and 12 are wound, is preferably formed of laminated iron and is provided with two opposite pole-pieces 14 and 15, between which is pivoted an armature 6', like that described in connection with the modification shown in Fig. 2. If the coils 11 and 12 are so connected in circuit with their

respective machines that their electromotive forces are in opposition when the machines are in the proper relation for throwing the switch, the magnetic lines of forces produced by the two coils and tending to pass between poles 14 and 15 will be in opposition and will therefore neutralize each other. Under these circumstances the armature will, of course, not be actuated, and it and the pointer will occupy approximately the position indicated by full lines in the drawings. If, on the other hand, the connections are such that there is agreement of the electromotive forces in the two coils, and consequently of the magnetisms produced thereby at the proper time for throwing the switch, the two sets of lines of force will reinforce each other between the poles 14 and 15, and the armature and pointer will be moved to the dotted-line position indicated in the drawings.

I do not wish to be understood as limiting my invention to the forms of apparatus shown, or to the form or location of the individual parts, since it is obvious that many changes in form and arrangement of such parts, which would be within the spirit and scope of my invention, might be made by those skilled in the art.

What I claim is—

1. A synchronism indicator for two alternating current electromotive forces comprising means for producing a varying magnetic field through the joint action of such electromotive forces, and a movable armature in said field the position of which indicates the relation of said electromotive forces, substantially as described.
2. A synchronism indicator comprising a coil in series with the two machines to be synchronized and a movable armature in inductive relation to said coil, the position of which indicates the relation of said machines, substantially as described.
3. The combination with two alternating current electric machines, of a coil in series with said machines and a pivoted armature in inductive relation to said coil, the position of said armature serving to indicate the relation of said machines, substantially as described.
4. The combination with two alternating current machines, of a coil in series with said machines, a pivoted armature in proximity to said coil and an indicating device carried by said armature, substantially as described.

In testimony whereof I have hereunto subscribed my name this 7th day of November, A. D. 1894.

RALPH D. MERSON.

Witnesses:

CHARLES IRA YOUNG,
JAS. WM. SMITH.