No. 610,229. Patented Sept. 6, 1898.

C. M. CROOK.

ELECTRIC CLOCK TRAIN.

(Application filed Apr. 29, 1897.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 4.

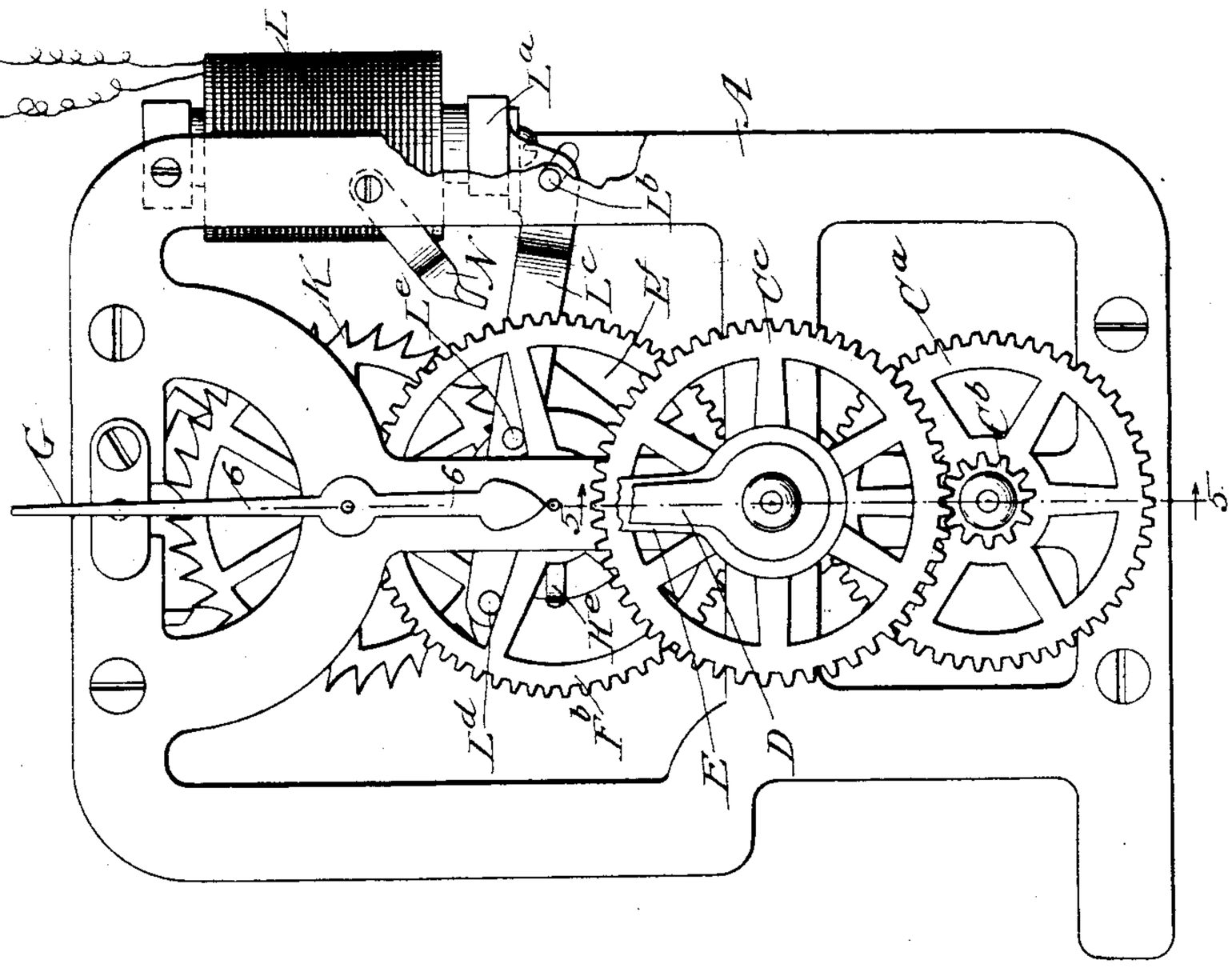

Fig. 1.

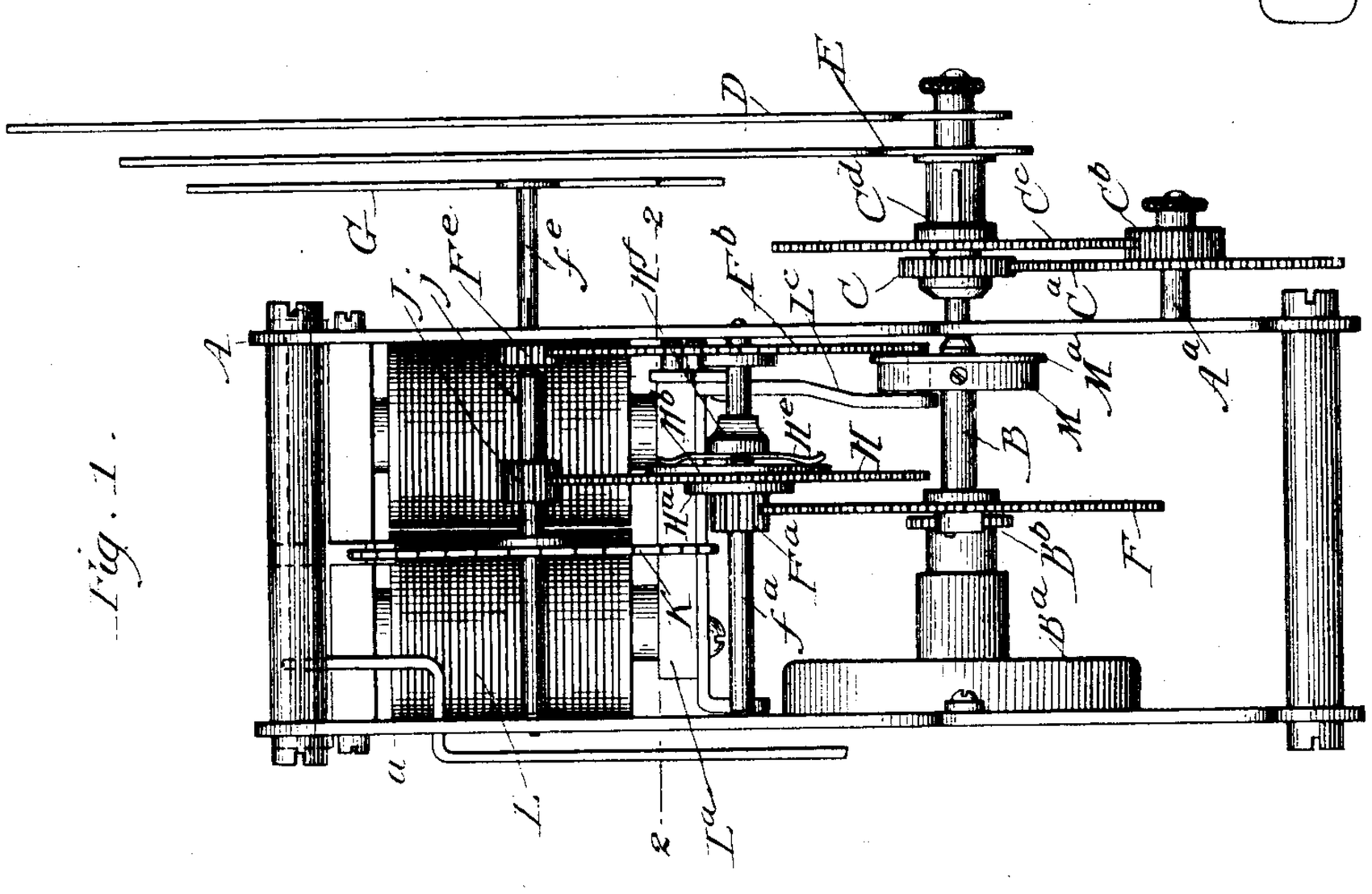

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Fig. 3.

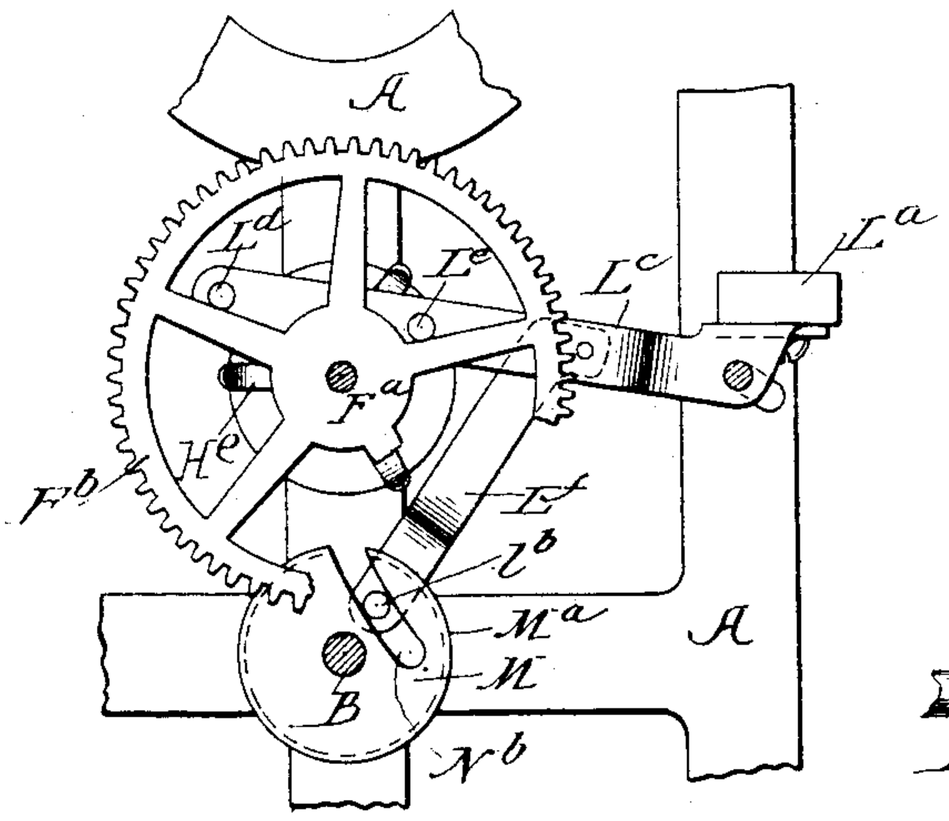


Fig. 5.

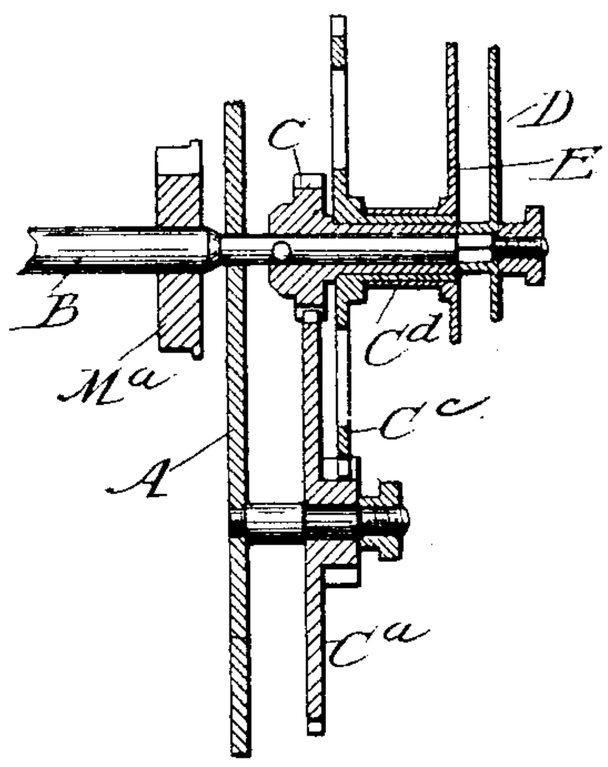


Fig. 2.

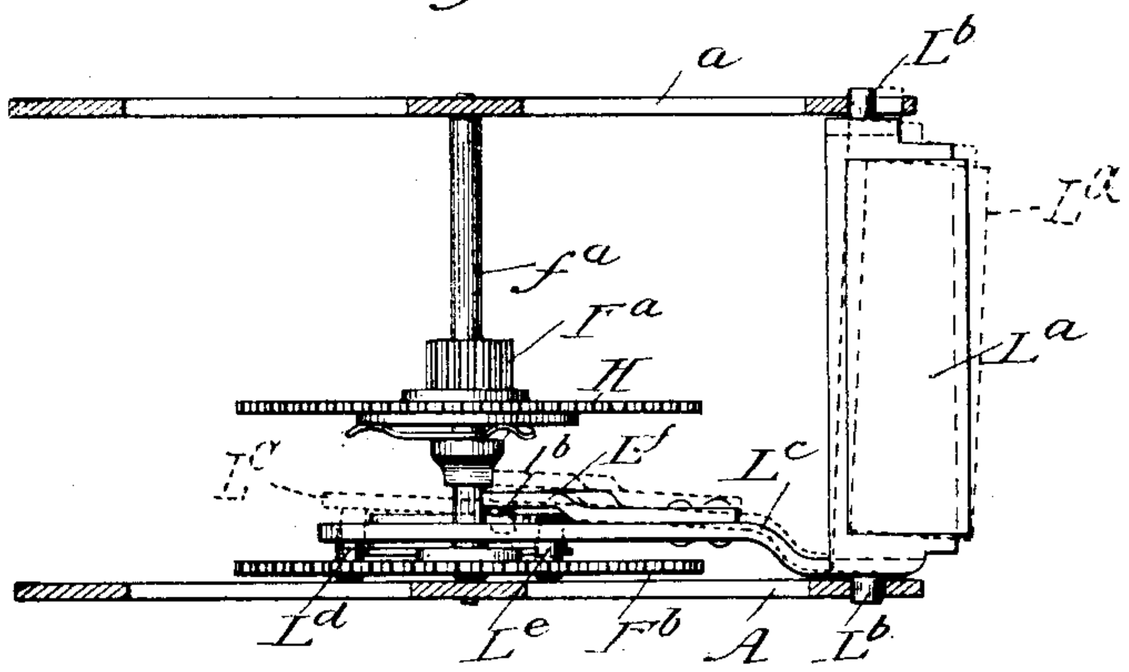


Fig. 7.

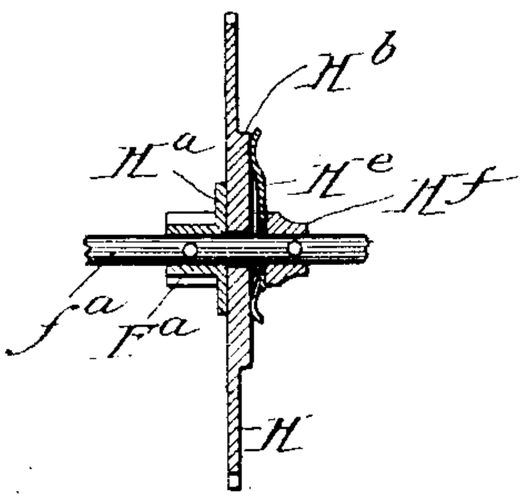
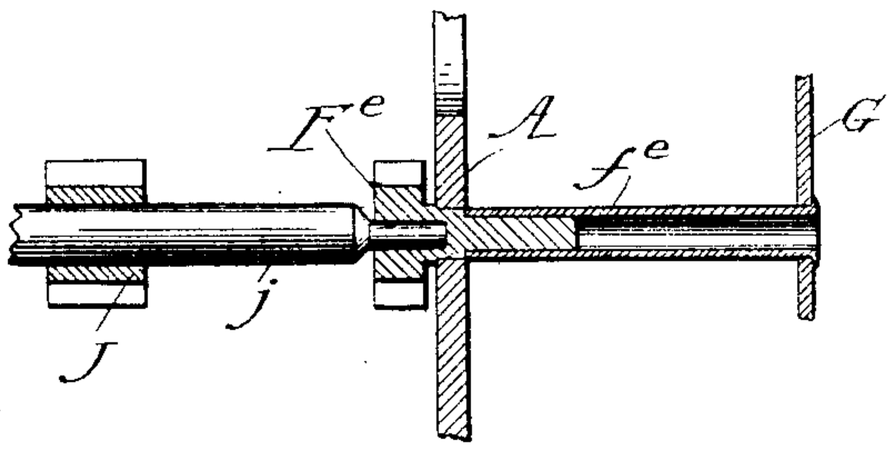


Fig. 6.



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UNITED STATES PATENT OFFICE.

CHARLES M. CROOK, OF ELGIN, ILLINOIS, ASSIGNOR TO CHARLES S. BURTON, TRUSTEE, OF OAK PARK, ILLINOIS.

ELECTRIC CLOCK-TRAIN.

SPECIFICATION forming part of Letters Patent No. 610,229, dated September 6, 1898.

Application filed April 29, 1897. Serial No. 634,313. (No model.)

To all whom it may concern:

Be it known that I, CHARLES M. CROOK, a citizen of the United States, residing at Elgin, in the county of Kane and State of Illinois, have invented certain new and useful Improvements in Synchronizing Clock-Movements, which are fully set forth in the following specification, reference being had to the accompanying drawings, forming a part thereof.

In the drawings, Figure 1 is a side elevation of a clock-movement embodying my invention. Fig. 2 is a section at the line 2 2 of Fig. 1. Fig. 3 is a detail forward side elevation of a portion of the train upon which the synchronizing-lever acts. Fig. 4 is a front elevation of the movement. Fig. 5 is a detail section at the line 5 5 on Fig. 4. Fig. 6 is a detail section at the line 6 6 on Fig. 4. Fig. 7 is a detail section.

A distinguishing feature of my invention is that the train from the motor-shaft to the seconds-hand, including the train which drives the hour and minute hands, may be positive—that is, without slip-joint or frictional connection such as is usually provided to permit setting the hands—and that the escape-wheel or other governing device is not actuated positively in such train, but in a branch or offshoot train from the hands-train, which has a frictional or slip connection with the latter. Most conveniently and therefore preferably the branch train leading to the escape-wheel is as a whole frictionally driven from the principal hands-train; but it will be obvious upon consideration of the structure that frictional or slip connection at any point in such branch train anterior to the escape-wheel would yield substantially the same result. This feature of my invention is illustrated associated with a specific synchronizing-lever action, which is the subject of an application filed by me in the United States Patent Office on the 11th day of January, 1897, Serial No. 618,805, and the specific features of said action are herein illustrated only for the purpose of completely exhibiting an entire operative structure and will not be claimed herein.

Other detail features of my improvements in the movement are set forth in the claims.

A a are respectively the front and rear plates of a clock-movement.

B is the main shaft, actuated in any way. As illustrated, B^a is the spring-housing, and B^b a pawl-and-ratchet structure by means of which the spring when properly coiled reacts to rotate the shaft B.

My invention is not concerned with the specific means of communicating motion to the principal shaft, and therefore these features are only illustrated conventionally and without detail. The shaft B extends through the front plate and constitutes the staff of the minute-hand D.

C is a pinion thereon which meshes with the gear-wheel C^a, which meshes with and drives gear C^c, whose shaft is the sleeve C^d, journaled outside the minute-hand staff and carrying the hour-hand E. On the shaft B and rigid therewith there is also a gear-wheel F, which meshes with the pinion F^a on the shaft f^a, which has rigid with it at the forward end a gear-wheel F^b, which meshes with pinion F^e, whose shaft f^e is journaled on the front plate A and extends therethrough and constitutes the shaft of the seconds-hand G. On the shaft f^a is a gear-wheel H, which is frictionally held and driven between two friction-disks H^a, which is formed as a flange on the pinion F^a, and H^b, which is mounted on the shaft at the opposite side of the gear H from the disk H^a and is pressed against said gear by the spring-tripod H^e, which in turn is stopped by the collar H^f, which is rigid with the shaft f^a. The gear H meshes with a pinion J on the shaft j, rigid with which is the escape-wheel K. The shaft j obtains bearing at the rear end in the plate a. At the forward end it is reduced in diameter and extends into the hollow shaft f^e of the pinion F^e, and thereby in addition to obtaining bearing supported on the plate A it affords a steadying-bearing for said hollow shaft f^e. The gears F^b and H are equal in size and in the number of their teeth, and the pinions F^e and J are also equal, so that the two shafts j and f^e move together and so without friction one upon the other in the ordinary running of the clock, but are capable of entirely independent movement.

It will be seen upon consideration of this

structure that the train from the motor-shaft B of the hands is positive and that any setting movement wherever initiated in the train will set all the hands and communicate movement back to the motor-shaft, so that the hands being rigidly set and secured on their respective shafts in position to harmonize in their indications on the dial will continue so related through all settings, and that in such setting or synchronizing action the escape-wheel or other governing-wheel is not actuated and does not interfere with the synchronizing action, because such governing-wheel is driven only frictionally by the train which is actuated to synchronize. It may be understood that this feature of my invention—making the connection between the governing-wheel and motor-train frictional and not positive—is practicable only when the action is such that the motor-shaft is driven with comparatively light force, so light that it is inadequate to slip the frictional connection with the escape-wheel or other governing device; and I design this invention to be used primarily, and perhaps it may be found useful only, in connection with self-winding clocks in which the rewinding by electrical impulse or otherwise occurs so frequently as to require only a light spring or other form of storage-motor. It will be understood from the nature of the result aimed at in this part of my invention that in describing the connection of the principal or hand-actuating train with the motor-shaft as "positive" it is not necessary to require (since it is not necessary to provide) that the connection should be absolutely unyielding, but only that it should be sufficiently so to insure transmission of the movement both ways—that is, from the motor-shaft to the hands in the ordinary running of the clock and from the hand-shafts or an intermediate point back to the motor-shaft in the setting movement—and that such connection, styled "positive," should be less yielding—that is, more nearly positive—than the connection between the governing-wheel and the motor-train, which is termed "frictional"—that is to say, the terms "positive" and "frictional" as applied to these two connections are relative, the connection called "frictional" being comparatively easily yielding and the connection called "positive" not being so easily yielding—and the description in these respects is not to be construed as inconsistent with or excluding a structure adapted to permit the hour and minute hands to be set by hand at any point in the dial regardless of the train. In connection with this movement I have employed a synchronizing or setting mechanism which, except as to certain details, is similar to my application, Serial No. 618,805, above mentioned, and which will now be described sufficiently for the purpose of pointing out in detail certain improvements relating thereto.

L is an electromagnet in circuit with a controlling-clock, the circuit being closed at the time for synchronizing or setting all the clocks which are so connected, and such setting being effected by the movements of the armature L^a when it is attracted to the magnet-poles upon the energizing of the circuit of the latter. The armature L^a is mounted on and rigid with the rock-shaft L^b, journaled in the front and rear plates A and *a* and having a lever-arm L^c, which extends across behind the wheel F^b of the train. The rear bearing of the rock-shaft L^b in plate *a* is elongated obliquely, as seen in Fig. 4, so that in addition to the ordinary rocking movement of the shaft in its bearings it has capacity for an oscillating movement at the rear end, the direction of oscillation being determined by the direction of elongation of the rear bearing, such elongation having the effect of swinging the lever-arm L^c toward and away from the gear F^b, while it oscillates also up and down past or adjacent to said plate on account of the rocking movement of the rock-shaft. From this structure it results that when the armature is free from the attraction of the magnet the rock-shaft drops to the lower outer limit of the rear bearing and the arm L^c stands in the position shown in dotted lines in Fig. 2, its free end being more remote from the wheel F^b than the end at the rock-shaft, and when the armature is attracted to the magnet the rear end rising also moves inward, following the elongated bearing, and the arm L^c swings forward toward the heel F^b while it moves downward. The lever-arm L^c has two abutments or studs L^d L^e projecting forward. When the arm is in the position shown in dotted lines in Fig. 2, these studs are wholly at the rear of the plane of the wheel F^b; but when the lever-arm is thrown downward and forward and when the armature is actuated toward the magnet these studs or abutments penetrate the plane of the wheel F^b and as the lever-arm descends are adapted to collide with the spokes of the wheel at opposite sides of the vertical plane through the axis, and so colliding they force the wheel to a definite position, rotating it one way or the other, according to the variance of the positions of the two spokes before collision from the position to which the movement of the lever with its studs colliding with and acting upon the spokes will bring the latter—that is, if, for example, the wheel is too far advanced the spoke at the right-hand side or nearest the rock-shaft will be struck by the stud L^d and the wheel will be actuated to set back the hands, this movement being arrested, however, and ending when as a result of it the other stud L^e meets the opposite spoke of the wheel. If the clock is slow and requires to be set forward, the stud L^e will be the first to collide with the spoke on that side, and the movement thus caused will be arrested by the collision of the other stud with the opposite spoke.

In respect to the synchronizing features as

thus far described the structure is identical with that illustrated in my above-mentioned application, Serial No. 618,805.

When clocks of a system designed to be synchronized together are used together in such situation as to permit the employment of a telegraph-line to be used as the connecting-circuit—for example, in case of clocks located at several stations of a railroad—it is desirable to avoid the necessity of constructing an independent circuit, and for this purpose it is customary to connect the clocks by proper switches with the telegraph-line for a very short time about the hour of synchronizing, the line being for that time held out of other use. When this method prevails, if after the synchronizing action has occurred the operator at any station neglects to disconnect the clock an impulse will be experienced by the armature at every opening and closing of a telegraph-key in the ordinary use of the line in sending messages, and in the absence of any device to prevent such result the clock would in that event be reset at every such impulse back to twelve o'clock, that being the synchronizing hour. This would evidently defeat the synchronizing action which was performed at the proper time, because it would set the clock slow by as many minutes as had elapsed after twelve o'clock before such resetting occurred. To avoid such a result, I provide the lever-arm L^c with a branch L^f, which extends down in a direction to avoid interference with the shaft f^a to a point directly above the shaft B, and on said shaft there is secured a drum M, having a flange M^a. A stud l^b, projecting from the branch L^f of the lever L^c, overhangs the periphery of the drum resting thereon when the armature is free from the influence of the magnet, and at a corresponding position of the lever L^c the latter is stopped in the opposite direction by the finger N, which projects from the frame-plate A. The flange M^a of the drum is designed to stop the lateral movement of the branch L^f when the lever is swung laterally toward the plane of the wheel F^b. The drum M has a slot or channel N^b extending from its periphery through the body or across the face, such slot or channel being wider than the diameter of the pin l^b by an amount corresponding to the maximum allowance for synchronizing—that is to say, the slot having its opening at the periphery of the drum in a position to coincide with the pin at the synchronizing hour, say twelve o'clock. Said slot is wider than the diameter of the pin an amount sufficient to permit it to be under the pin, so that the latter can enter it for a length of time before and after the synchronizing hour equal to the maximum error which the synchronizing action is calculated to correct. The maximum correction, it will be understood, is the maximum movement which the hands can receive from the collision of the studs L^d and L^e with the spokes of the wheel F^b, and in practice it is not necessary that the clock be adapted for a maximum correction of more than one minute each way.

The telegraph-line used for the synchronizing-circuit would be held out of other use for a period somewhat longer than the maximum correction, and during that time the drum M would rotate far enough to carry the mouth of its slot away from the stud l^b, so that if after that period through failure to switch the clock out of the circuit the magnet should receive an impulse the armature could not respond to the attraction of the magnet, as it would be locked out of position by the lodgment of the stud l^f on the periphery of the drum M. It will be understood that the slot N^b extends across the face of the drum in a course which would be in the arc of a circle about the axis of the rock-shaft L^b when the drum occupies the position such that the stud l^b can enter the slot.

I claim—

1. In a clock-movement, in combination with a motor such as a mainspring, a principal train actuated thereby in the ordinary running of the clock, extending to and including the staffs of all the time-indicating hands and a governing device, the latter being actuated solely by frictional connection with the anterior portion of the train, and all the hand-staffs being actuated in such anterior portion, such frictional connection of the governing device being adapted to endure without slipping the full driving power transmitted to it by the train.

2. In a clock-movement, in combination with a motor such as a mainspring, a principal train actuated thereby in the ordinary running of the clock, extending to and including the staffs of the minute and hour hands and a governing device, the latter being actuated solely by frictional connection with the anterior portion of the train, and all the hand-staffs being actuated in such anterior portion, such frictional connection of the governing device being adapted to endure without slipping the full power transmitted thereto by the train.

3. In a clock-movement, in combination with a motor such as a mainspring; a principal train actuated thereby in the ordinary running of the clock and extending to and including the seconds-hand, and a governing device; a secondary or offshoot train actuated solely by frictional connection with a principal train and leading to and including a governing device, such frictional connection of the offshoot train being adapted to endure without slipping the full driving power transmitted thereto by the train.

4. In a clock-movement, in combination with a motor such as a mainspring, a principal train actuated thereby extending to and including the staffs of all the time-indicating hands, and a governing device, the latter being actuated solely by frictional connection with the anterior portion of the train, and all the hand-staffs being actuated and positively con-

nected in such anterior portion, such frictional connection of the governing device being adapted to endure without slipping the full driving power transmitted thereto by the train, a synchronizing device adapted to act upon one of the positively-connected wheels of such hands-train, and suitable extraneous means for operating the synchronizing device.

5. In a clock-movement, in combination with a motor such as a mainspring, a principal train actuated thereby, such train extending to and including the staffs of the minute and hour hands, and an escape-wheel, the latter being actuated solely by frictional connection with the anterior portion of the train, and the minute and hour hands being actuated and positively connected in such anterior portion, a synchronizing device to act upon one of the positively-connected hand-actuating wheels, and means for actuating such synchronizing device.

6. In a clock-movement, in a combination with a motor such as a mainspring, the principal train actuated thereby extending to and including the seconds-hand, a secondary or offshoot train actuated by frictional connection with the principal train, such offshoot leading to and comprising an escape-wheel; a synchronizing device adapted to act upon a wheel in the principal train positively connected with the seconds-hand staff, and means for operating the synchronizing device.

7. In combination with the hands-train of a clock, an electromagnet on the frames, a circuit in which it is energized, an armature for such magnet, a lever connected thereto and actuated thereby and adapted to act upon a wheel in said train when the magnet is energized, a disk on said lever having a projection adapted to encounter a wheel on the shaft of the train when the armature experiences the initial impulse of the magnet, said wheel having a path for the projection at a position on the wheel which coincides with the path of the projection in its movement with the lever at the synchronizing hour, the amplitude of said path in the wheel being in excess of the actual path of the projection by an amount corresponding to the maximum correction for which the synchronizing device is calculated.

In witness whereof I have hereunto set my hand, at Chicago, Illinois, this 24th day of April, 1897, in the presence of two witnesses.

CHARLES M. CROOK.

Witnesses:
CHAS. S. BURTON,
JEAN ELLIOTT.