(No Model.) 2 Sheets—Sheet 1.

H. S. PRENTISS.

ELECTRIC SYNCHRONIZER FOR CLOCKS.

No. 547,358. Patented Oct. 1, 1895.

Fig. 3.

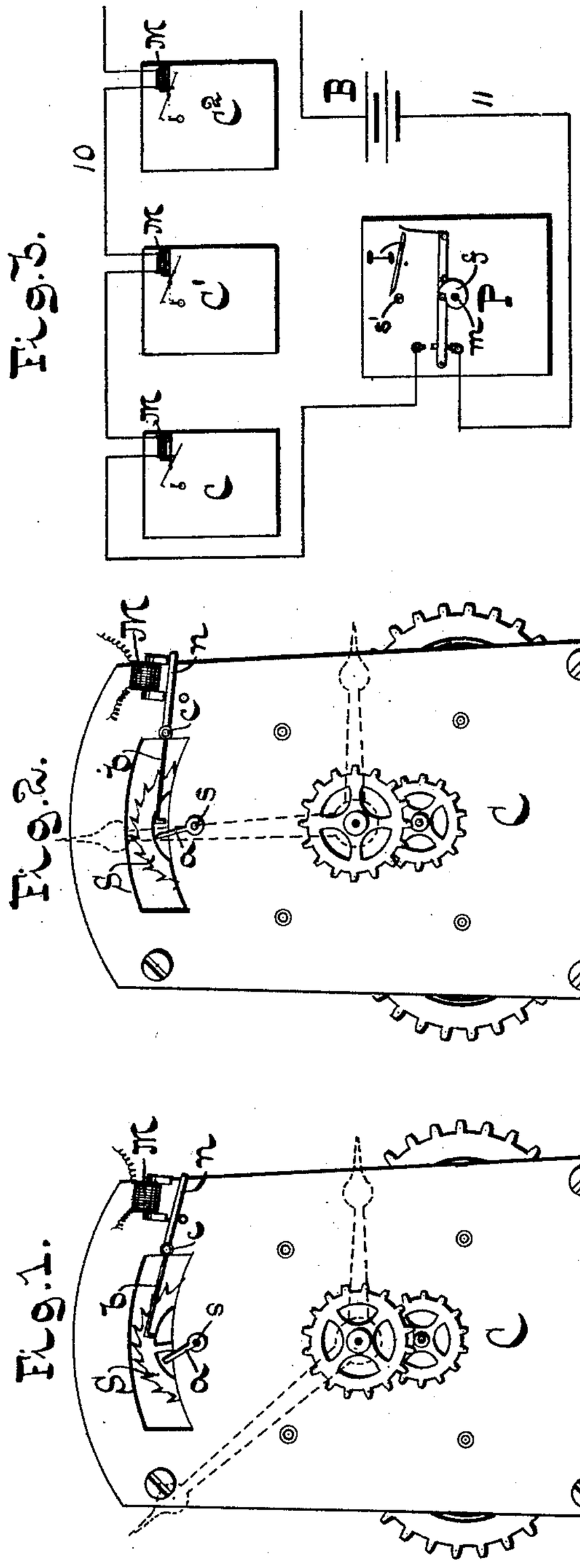

Fig. 2.

Fig. 5.

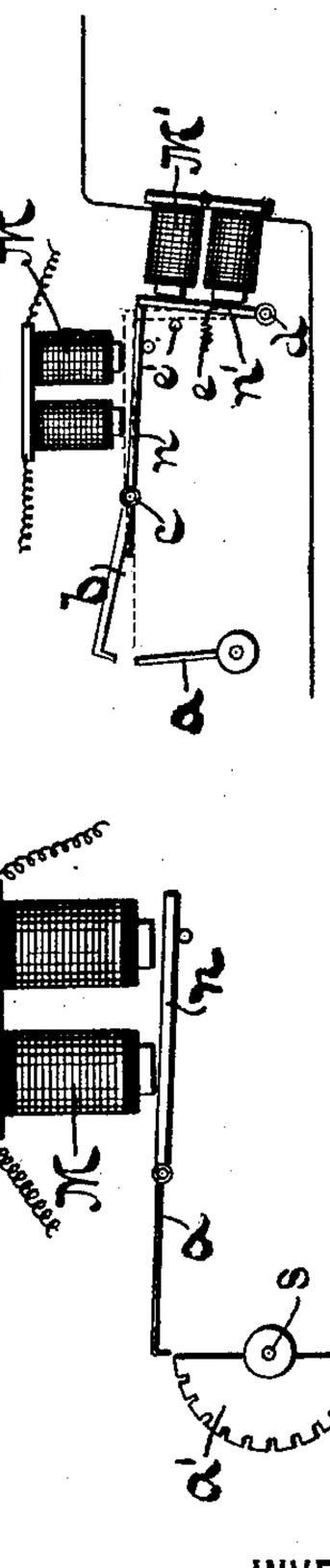

Fig. 1.

Fig. 4.

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Fig. 1.

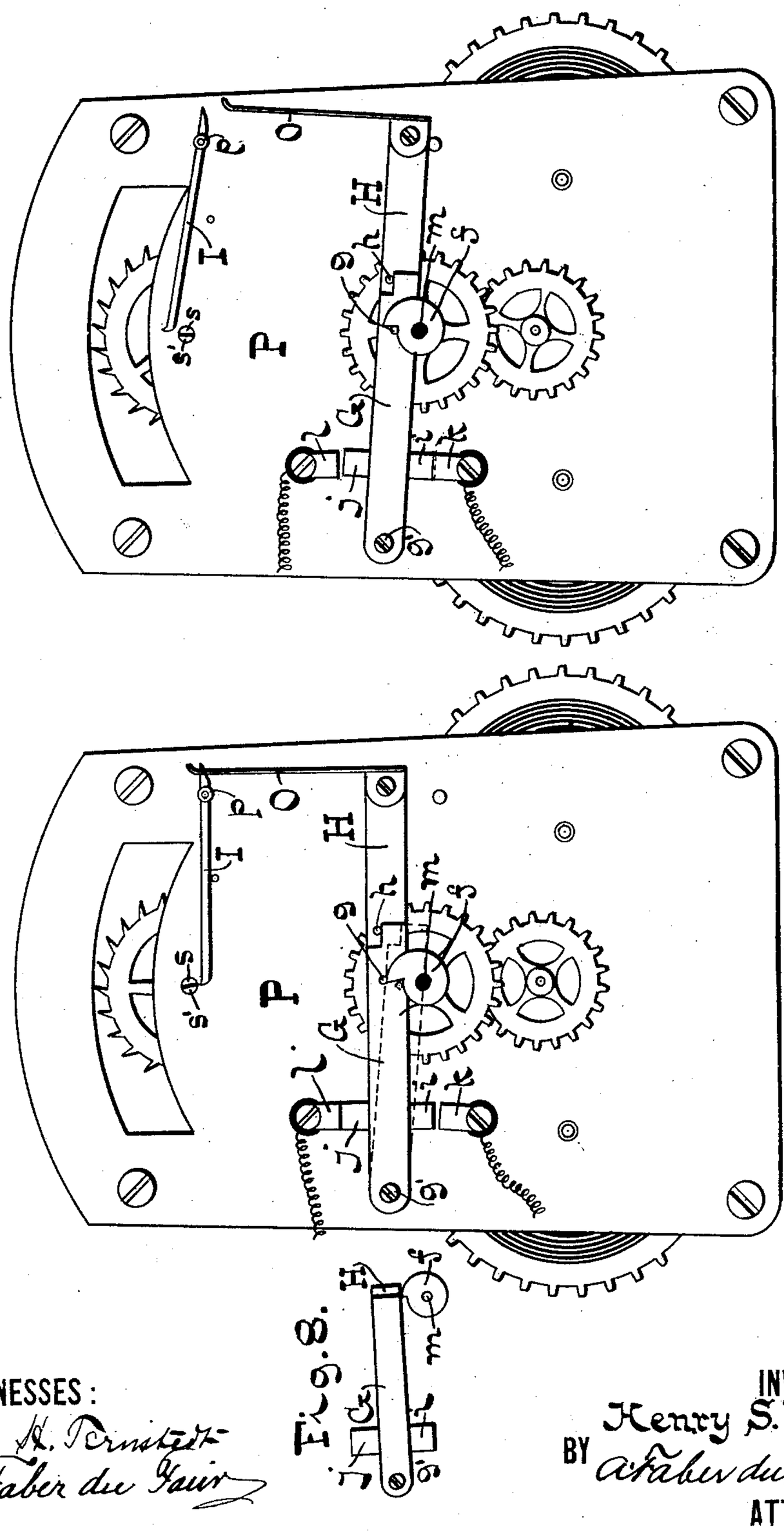

Fig. 2.

Fig. 3.

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UNITED STATES PATENT OFFICE.

HENRY S. PRENTISS, OF ELIZABETH, NEW JERSEY, ASSIGNOR TO THE PRENTISS CLOCK IMPROVEMENT COMPANY, OF NEW YORK, N. Y., AND JERSEY CITY, NEW JERSEY.

ELECTRIC SYNCHRONIZER FOR CLOCKS.

SPECIFICATION forming part of Letters Patent No. 547,358, dated October 1, 1895.

Application filed August 10, 1892. Serial No. 442,694. (No model.)

To all whom it may concern:

Be it known that I, HENRY S. PRENTISS, a citizen of the United States, and a resident of Elizabeth, in the county of Union and State of New Jersey, have invented certain new and useful Improvements in Synchronizers for Clocks, of which the following is a specification.

My invention has reference to improvements in apparatus for synchronizing timepieces; and it consists, essentially, in regulating the several secondary clocks of a system to run fast, and providing each of the same with a detent thrown across the path of part of the train before the hour, as indicated by the respective secondary clock, and withdrawn at the exact hour, as indicated by the master-clock, all of which, together with certain novel features in the construction of the circuit-closing devices at the master-clock, is more fully pointed out in the following specification and claims, and illustrated in the accompanying drawings, in which—

Figure 1 represents a face view of a secondary clock constructed according to my invention, showing the detent withdrawn. Fig. 2 is a similar view showing the detent thrown across the path of an arm affixed to a part of the train. Fig. 3 is a diagram illustrating the clocks arranged in a system. Figs. 4 and 5 illustrate detail views, on a larger scale, of modifications of the synchronizing devices. Figs. 6 and 7 are face views of a master-clock, showing the circuit-closing devices in different positions. Fig. 8 is a detail view of a modified form of circuit-closer.

Similar letters and figures indicate corresponding parts throughout the several views.

In the drawings, referring at present to Figs. 1 and 2, the letter C designates one of the secondary clocks, which may embody any suitable well-known movement—such, for instance, as a pendulum or lever movement or an electric or electromechanical movement. In the drawings I have shown a pendulum movement, in which *s* is the arbor of the scape-wheel S. On said arbor is secured to turn therewith an arm *a*. M is an electromagnet secured in any suitable manner to the frame of the clockwork or other support. The armature *n* of this magnet has secured thereto or engages with one arm of a detent *b*, pivoted at *c*. The free end of the detent is turned down or otherwise formed into an abutment and is arranged in the same vertical plane with the arm *a*. Normally the detent *b* is out of the path of the arm *a*; but when the electromagnet is vitalized to attract its armature the detent is thrown across the path of the said arm. In the operation of the system all the secondary clocks are arranged to run a trifle fast—say from one-tenth to five seconds per hour, or for the synchronizing period. The circuit is closed through the electromagnets of the secondary clocks by the master-clock at such a time before the hour as to throw the detents *b* across the paths of the arms *a* at a period which will insure that the detents shall be in their lower positions before the arms have reached a radial position to be engaged by said detents. As each individual secondary clock reaches the hour as indicated by the same, its arm engages with the detent and the normal motion of the train is arrested thereby. At the exact hour as indicated by the master-clock the circuit is broken at the same, all the detents are withdrawn, and the clocks resume their normal motion. Of course it must be understood that the secondary clocks should not be regulated to run so fast as to remain idle a sufficient time to permit their pendulums to come to rest unless starting devices for the latter are employed.

Referring to Fig. 3, in which the clocks are arranged in a system, P designates the master-clock, and C C′ C², &c., the several secondary clocks; B, the battery, and 10 and 11 the wires including the electromagnets M.

It is evident that many modifications can be made in the construction of the synchronizing devices as applied to the secondary clocks. In Fig. 4 I have replaced the arm by a toothed segment *a*′, so that in case the clock should for some reason have run so fast as to exceed the limit allowed by the master-clock the detent, when thrown downward, would ultimately engage with one of the notches in the segment and arrest the motion of the train, thereby lessening the error of the timepiece. Again, as shown in Fig. 5, I make use of two magnets M M′, the one M acting on the arma-

ture n of the detent b and the other having an independent armature n', set at right angles to the armature n and pivoted at d to a suitable support. Normally the parts are in the position shown by full lines in Fig. 5. At the commencement of the synchronizing period the circuit is closed for an instant through electromagnet M and the detent is thrown across the path of arm a, while the armature n' is drawn against stop e' by its spring e, so as to come beneath armature n to support it in the position shown by broken lines. At the exact hour the circuit is closed through M', whereby armature n' releases armature n and the detent resumes its normal position. By this means a closed circuit of several seconds can be avoided. It is evident that the same result can be obtained by the use of a polarized relay for actuating the detent.

Since the accuracy of the secondary clock will in a great measure depend on the prompt breaking of the circuit at the exact hour by the master-clock, I make use, when great accuracy is required, of the devices shown in Figs. 6 and 7. On the arbor m of the minute-hand is secured a cam f, adapted to engage with a pin g, secured to one end of a drop-lever G, pivoted at g' to the frame of the clock. On the same pivot g' is mounted parallel to the first lever a second drop-lever H, having a pin h, that is engaged by the lever G. Each of the drop-levers is provided with a metallic contact i j, respectively, facing in opposite directions, and on the frame of the clock are arranged two split contacts k l, insulated from the frame of the movement and adapted to be engaged by the respective contacts i j. The lever H carries at its end a vertical spring arm or link O, having an opening at its end adapted to engage with one arm of a lever I, pivoted at p to the frame of the clock-movement and having its opposite end arranged to engage with a cam-shaped portion s' of the scape-wheel arbor s.

The operation of the device is as follows: A short time before the hour the cam f releases the pin g and lever G drops into the position shown by dotted lines in Fig. 6, and the circuit is now closed through i k and j l, thereby causing the detents of the several secondary clocks to be thrown across the path of the arms a. Lever H cannot fall, because it is still held suspended by the link O at the exact hour the lever p is released by cam s' on the scape-arbor, and the said lever is now free to turn. Lever H being now free to fall, it carries with it the link O and releases it from the lever p. At the instant that lever H falls the contact is broken at j l and the circuit is broken through the magnets of the secondary clocks, Fig. 7. In the continued rotation of the cam f the levers G and H are lifted and link O again engages with the lever p, and the contact is broken at i k and re-established at j l. In case great accuracy is not required, the connection with the scape-arbor may be omitted, and the lever H is made slightly longer than lever G, and the ends of both levers are arranged to bear upon the cam f, so that lever G will drop before the hour and lever H at the hour, Fig. 8.

It is evident that according to the system herein described slow-running clocks would not be synchronized. Consequently in an extensive system of clocks, where it might be difficult to keep all the clocks running fast constantly, the clocks may be regulated as usual and devices such as shown embodied, which would act in case the respective secondary clocks ran fast to set the same to the correct time, and with said devices other devices would be embodied to act in case the secondary clocks ran slow. Therefore I do not wish to restrict myself to purposely regulating the clocks to run fast.

What I claim as new, and desire to secure by Letters Patent, is—

1. In a clock system a master clock provided with a circuit closer, and a secondary clock (or clocks) provided with a detent thrown into the path of a moving part of the train by the closing of the circuit at the master clock at a constant and predetermined period before the hour as indicated by the master clock, to arrest the motion of the train of the secondary clock when it arrives at the hour, said detent being withdrawn on the hour by the breaking of the circuit at the master clock, substantially as and for the purpose set forth.

2. In a clock system, a master clock provided with a circuit closer, and a secondary clock (or clocks) provided with a detent, and an electro-magnet having its armature in operative connection with the detent, said electro-magnet being vitalized by the closing of the circuit at the master clock at a predetermined and constant period before the hour as indicated by the master clock to throw the detent into the path of a moving part of the train, to arrest the motion of said secondary clock when it arrives at the hour, said detent being withdrawn at the hour on the breaking of the circuit at the master clock, substantially as and for the purpose set forth.

3. A circuit closer consisting of two levers operated by a cam or cams constructed to permit the levers to drop in succession, one of said levers closing the circuit when elevated and breaking it when depressed, and the other the reverse, and a metallic connection between the two levers.

4. A circuit closer consisting of two levers, a cam on one arbor constructed to permit one of said levers to drop, a cam on a second arbor arranged to permit the second lever to drop, means for raising the levers, a metallic connection between the two levers and contacts, substantially as described.

5. The circuit closer herein described, consisting of two drop levers G, H, a cam on one of the arbors of the train engaging the lever G, a cam on a second arbor of the train, a lever O engaging said cam, and a link connect-

ing lever H with lever I, all operating substantially as described.

6. In combination with a secondary clock, a notched disk secured to one of the arbors of the train, and a detent adapted to engage with the same, and an electro-magnet for operating said detent, substantially as and for the purpose set forth.

In testimony that I claim the foregoing as my invention I have signed my name, in presence of two witnesses, this 29th day of July, 1892.

HENRY S. PRENTISS.

Witnesses:
A. FABER DU FAUR, Jr.,
KEAS H. TERNSTEDT.