

Feb. 18, 1930.

O. JUNGHANS
MEANS FOR AUTOMATICALLY REGULATING CLOCKS
BY MEANS OF ELECTROMAGNETIC WAVES
Filed Aug. 24, 1925

1,747,547

4 Sheets-Sheet 1

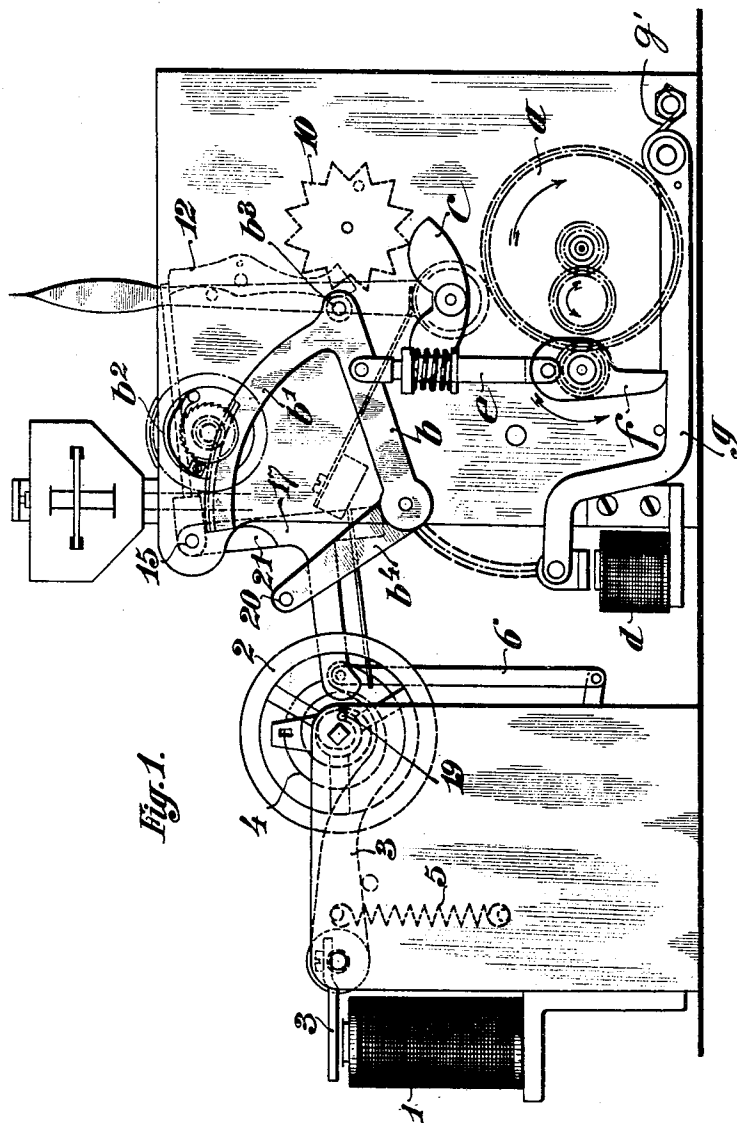


Fig. 1.

Inventor:

Oskar Jungmans

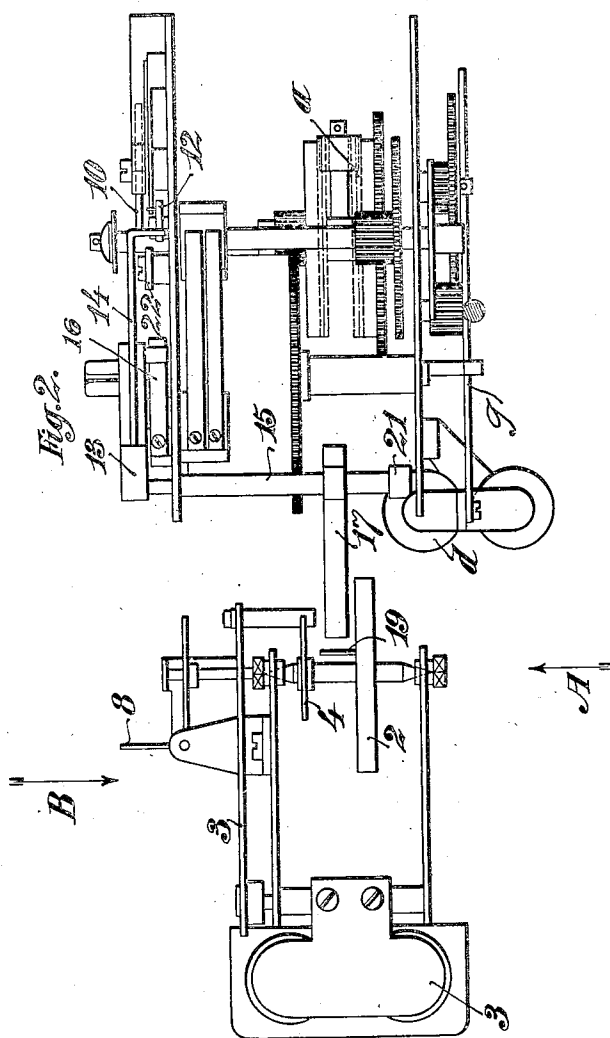
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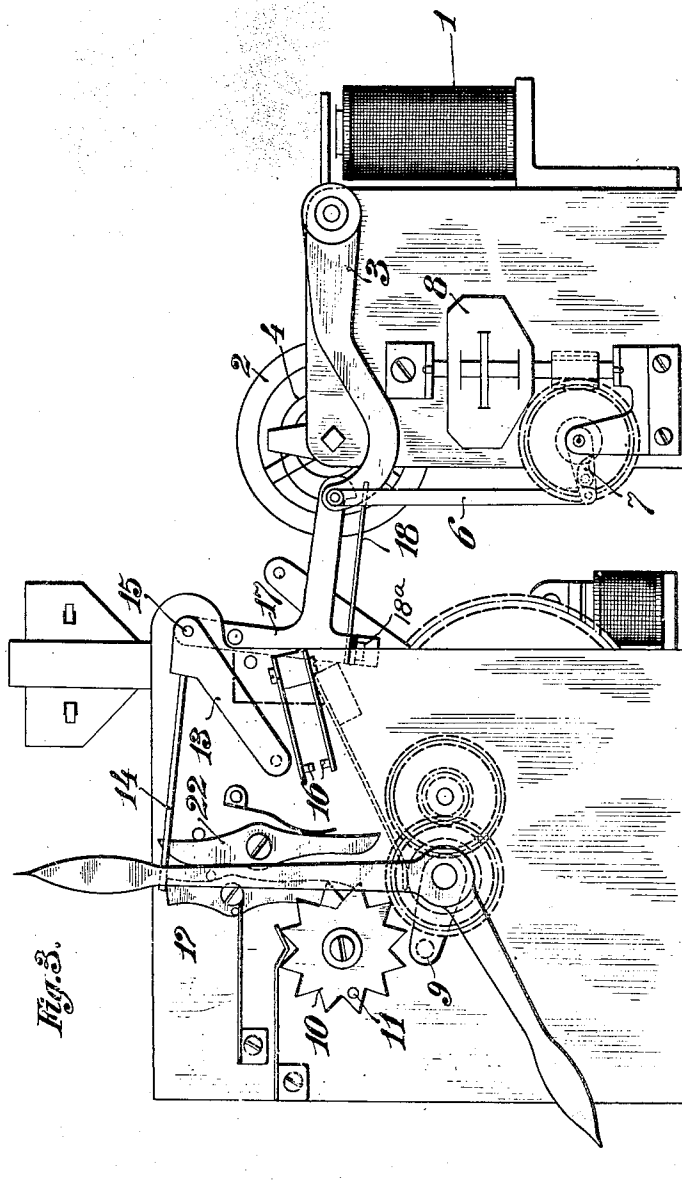


Fig. 3.

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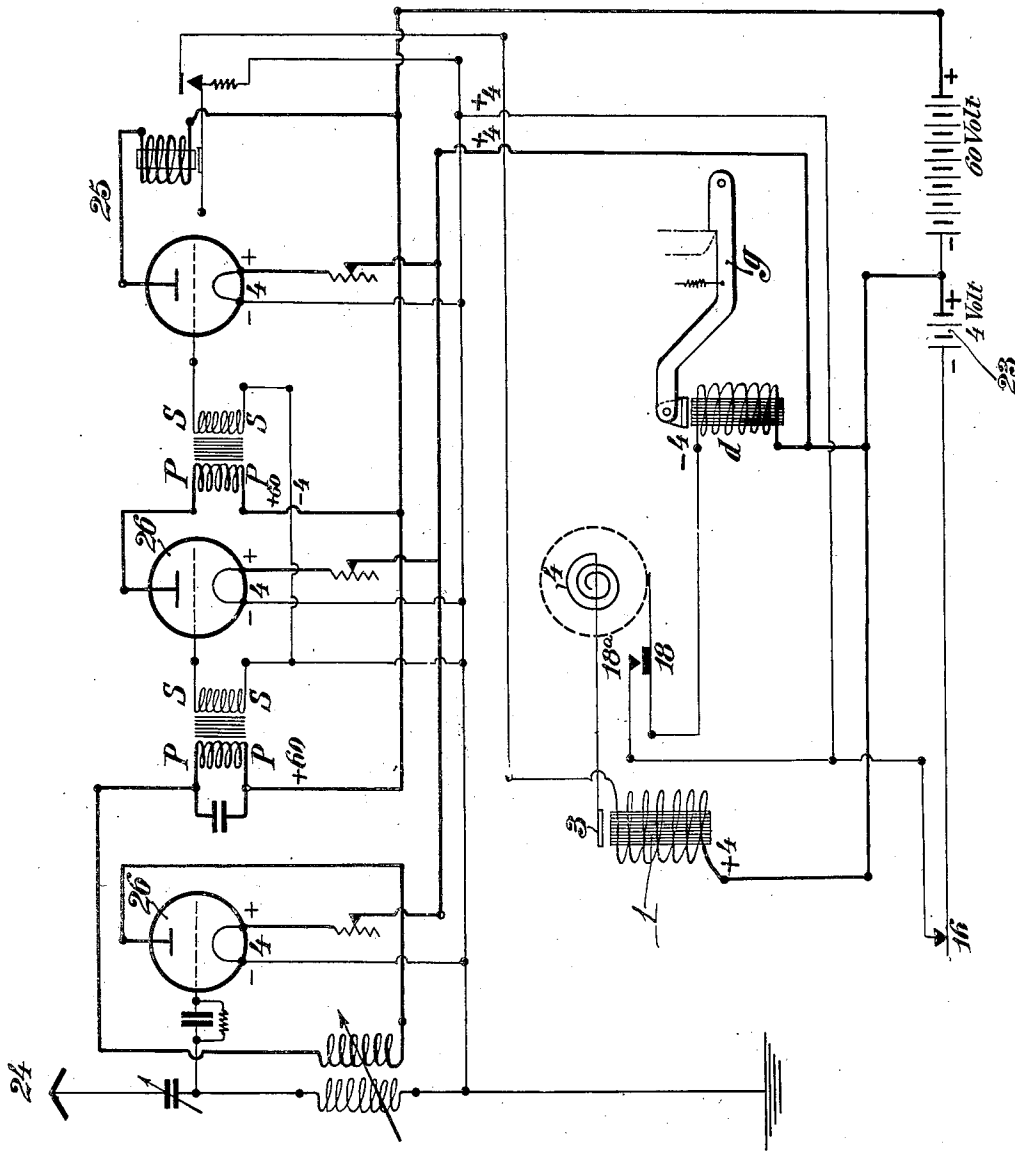


Fig. 4.

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UNITED STATES PATENT OFFICE

OSKAR JUNGHANS, OF SCHRAMBERG, GERMANY; SIEGFRIED JUNGHANS ADMINISTRATOR OF SAID OSKAR JUNGHANS, DECEASED

MEANS FOR AUTOMATICALLY REGULATING CLOCKS BY MEANS OF ELECTROMAGNETIC WAVES

Application filed August 24, 1925, Serial No. 52,023, and in Germany May 12, 1925.

My invention relates to the automatic regulation of clocks by means of electromagnetic waves from a distant wireless station or more particularly to means in connection with clocks for automatically controlling or setting the hands of a clock in case that the latter is too fast or behind the time.

I am aware of the fact that means of the stated kind and for the stated purpose have been suggested heretofore but as far as my knowledge goes, none of the suggested devices has found its way into the trade mainly for the reason that they are too complicated and not adapted for use with modern electro-radiant energy and broadcasting systems. For the chief point does not reside in controlling or setting a hand through electro-radiant energy, but especially and mainly lies in the requirement of receiving said energy from a certain transmitting place only and of dismissing the same immediately upon its utilization for the setting purpose. To this end the particular device employed for the purpose in connection with a clock must be adapted to respond to the time signals issued by the said transmitting place or station, exclusively and to not respond to impulses issued by other stations and having the same wave length.

The object of my invention is to provide an improved device, in connection with a clock, adapted to operate in the manner indicated, that is to say, to respond to time signals of a certain wave length issued by a certain transmitting station only, and with the above recited and other objects in view, reference is had to the following specification and drawings in which there is exhibited one example or embodiment of the invention which is in no way intended as a limitation upon the scope of the appended claims as it is to be clearly understood that variations and modifications which properly fall within the scope of said claims may be resorted to when found expedient.

In the drawing forming a part of this specification Figure 1 is a rear elevation of the device or mechanism embodying the invention, viewed in the direction of the arrow A shown in Figure 2 which is a plan view thereof; Figure 3 is a front elevation of the mechanism

viewed in the direction of the arrow B in Figure 2, and Figure 4 is a circuit diagram.

Parts which are repeated in the several views bear the same reference characters in each case.

The mechanism shown in the drawings is constructed and arranged in order to control a clock in accordance with the time signals transmitted by a central wireless station at a predetermined wave length, say of 18 km., which is also used by the said station for sending messages of any other kind.

The device I employ for directly operating or moving the minute-hand of a clock for the regulating or setting purpose is mounted in or adjacent to the casing of the clockwork and comprises in the example shown a lever *b* pivotally mounted in the frame and shaped to form a segmental rack *b'* co-operating with the gearing *b²* of a wind or flying regulator, a roller *b³* being provided at the end of the lever *b* from which the segmental rack *b'* projects, and adapted to co-act with or engage a cam *c* having a heart-shaped curve and firmly mounted on the horizontal arbor of the minute-hand, as will be clearly seen in Figure 1.

At a point intermediate between the roller *b³* and the pivot of the lever *b* a spring-controlled rod *e* is pivotally connected to the latter and the depending end of the rod is pivotally attached to a detent or pawl *f* having a gear in engagement with a differential *a* adapted to be actuated by the main spring of the clock, but normally locked by the pawl *f* which in turn is locked by a lever *g*, the free-end of which is shaped either to form or to carry the armature of an electromagnet or solenoid *d*.

As regards the operation of the above described device, the lever *g* will be lowered when the solenoid *d* is energized, so that the pawl *f* will be disengaged from the lever *g* and caused to rotate in the direction of the arrow shown in Figure 1, due to the action of the differential *a*, and to draw the lever *b* downwards through the agency of the rod *e*, whereby the roller *b³* of the lever *b* will be brought into engagement with the heart-shaped cam *c* and the hand thus will be

moved or regulated to indicate the correct time.

As soon as the pawl *f* has moved about its pivot a full revolution the lever *g* which in the meantime is released from the solenoid *d* and returned by means of a spring *g'* into its upper or normal condition, will be locked again so that the co-operating parts again will adopt the positions shown in Figure 1.

In order to prevent the pawl *f* from completing the revolution before the lever *g* has been released and returned to its normal position, the second half or 180° of such revolution, corresponding to the upward movement of the roller *b*³, are damped and retarded by the flying regulator or the gearing *b*² thereof.

The solenoid *d* is energized by means of the current of the electric battery 23 by the assistance of a suitable arrangement adapted to respond to energy impulses of a predetermined wave length and a predetermined chronological order only.

Time signals are usually transmitted from a central wireless station at a certain time, say at noon, for a period of five minutes, that is from 12 o'clock to five minutes past 12, and as a signal is emitted each second or five times sixty, 300 signals are emitted totally each time. In accordance therewith a balance 2 making one oscillation each second may be mounted in the clockwork, and a spring-controlled lever or arm 3 adapted to be actuated by an electromagnet 1, is provided to act on the spiral spring 4 of the balance 2. This electromagnet 1 is the receiving magnet, properly speaking and is connected in parallel with the solenoid *d* in the circuit of the battery 23. The lever 3 has a pin to engage the spiral spring 4 and is pivotally connected, by means of a rod 6, to a pawl and ratchet mechanism 7 adapted to move, by means of suitable transmitting means, a governor 8 in one direction only. If the central wireless station is sending any messages of the predetermined wave length and if the device is set ready for reception, the waves received by the antenna 24 influence the relay 25 and close it at each rush of current. By means of the relay 25 the circuit of the electro-magnet is closed which energizes the magnet 1. A certain motion, therefore, will be imparted to the lever 3, but the single movements the lever receives, will not occur in units of time equal to exactly a second each, so that due to the lack of resonance, a slight oscillation of the balance only can occur, which cannot have any disturbing effect on the solenoid *d* and consequently cannot influence the position of the hand.

As soon, however, as a time signal is transmitted, that is to say, current impulses one in each second arrive at the clock, the arm or lever 3 will be moved each second and, therefore, the oscillatory amplitude of the

balance will be increased owing to the existing resonance. The fact that the arm or lever 3 is connected to the damping or retarding device comprising the governor 8, by means of the rod 6, results in retarding the return movement of the lever 3 and consequently also the traction exercised on the spiral spring 4 of the balance 2, so that the latter is capable of starting to swing or oscillate upon the extraordinarily short current impulses. Thus the balance attains its full amplitude of oscillation already after a few oscillations and at the same time a pin 19 of the balance moves downward beyond a contact spring 18 so as to be below the latter and move the same upwards towards a contact piece 18^a at the subsequent return movement, whereby the circuit of the electromagnet *d* will be closed and the lever *g* be attracted and the clock corrected in the above described manner, see Figure 1.

For the purpose of limiting the time of receiving wireless current impulses through the clock, to a least possible period, I provide an arrangement which operates in a manner that only for a period of five minutes before the time signal of the central wireless station, the solenoid *d* will be capable of energization for correcting or regulating the clock.

The said arrangement comprises a lever or arm 9 rigidly connected with the minute-hand or the arbor thereof and adapted to engage in a star-wheel 10. The latter has twelve circumferential teeth and a pin 11. Upon each full revolution of the minute-hand the star-wheel is moved forward for the peripheral length of one tooth by the arm 9 engaging in the wheel so that the pin 11, after a certain number of hours, will adopt a certain position in which to engage the tapered end of a lever 12 pivotally mounted in the frame of the clockwork. In the example shown this engagement will occur exactly at four minutes before noon. The lever 12 then moves or oscillates, in the counter-clockwise direction in Figure 3, in order to release the arm 14 of a lever 13 which is firmly connected to an arbor 15 duly journaled in the two walls constituting the frame of the clock-work. The lever 13, when thus released, moves downward through the action of a spring, not shown, until the same abuts against a stop and at the same time acts to close a contact 16 by pressing against the upper contact spring of the same, as will be readily understood on inspection of Figure 3. By closing the contact 16 the battery 23 is inserted in the circuit, so that the amplifying tubes 26 are heated and the electromagnets 1 and *d* might be energized, if the current is closed by means of the relay 25 so that from this moment the reception of wireless impulses can take place and the solenoid *d* can work

to synchronize the position of the hands of the clock.

As above described, the pin 19 attached to the balance will adopt, upon a certain amplitude of oscillation of the spiral spring 4, a position below the contact spring 18 to close the contact. Obviously the pin 19 must be returned as soon as the minute-hand has been set or corrected, to its original position over and above the contact spring 18. I attain this by causing the contact spring to be actuated simultaneously with the means for inserting the amplifying tubes into the circuit, so that the former will not lie in the oscillating path of the pin 19 until the amplifying tubes are inserted into the circuit, and will be removed therefrom upon the tubes being cut out. To this end a lever 17 carrying the spring 18 is firmly mounted on the arbor 15, carrying the lever 13, 14. When the lever 13, 14 is released by the receding lever 12 and allowed to turn about the axis of the arbor 15 so that the latter will also revolve, the lever 17 necessarily must rotate at the same time so that the contact spring 18 of the latter will be placed into the oscillating path of the pin 19.

In order to have the amplifying tubes automatically cut out after each correcting or regulating proceeding so as to render the device incapable of receiving signals, in order to prevent the balance from being influenced by only subsequent current impulses, I provide a lever b^4 , see Figure 1, in connection with the lever b and a pin 20 in the lever b^4 . As hereinbefore stated, the lever b with its roller b^3 is moved downward during or at the correcting proceeding. At the same time the lever b^4 is caused to swing, in the right-hand direction in Figure 1, in order to turn the lever 21 fixed to the arbor 15 whereby the levers 13 and 17 also fixed to the arbor 15, are returned to their raised positions shown in the drawings, and at the same time the contact spring 18, as hereinbefore described, is removed from the oscillating path of the balance pin 19. In the meantime the pin 11 of the starwheel 10 disengaged from the lever 12, due to the normal running of the clock, so that the lever 12 is returned to the position shown in Figures 1 and 3 to support and lock the lever 13, 14, and the mechanism again is in the position of rest illustrated in the drawings.

A safety device may be provided for preventing the contact 16 from being constantly closed in case that the regulating or correcting device b , b^2 , properly operating, should fail to work, or in other words, the mechanism is not cut out by the arm b^4 . In the embodiment shown the safety device consists of a lever 22 acting to raise the lever 13, 14, after the minute-hand has rotated for ten minutes from the moment of the commencement of the actuation of the correcting or regulating

mechanism, so that the lever 13, 14 will be supported and locked by the lever 12 which in the mean time has returned into its supporting position.

While I have shown my invention embodied in one form of construction only, it is not to be inferred that such embodiment represents the only form in which my invention may be embodied, but is illustrated and described only illustrative of a form now preferred by me, and to make clear the principles and methods of specification of my invention.

What I claim is:—

1. An automatic device for synchronizing clocks by means of radio time-signals, comprising a clockwork, a hand-setting mechanism adapted to be operated by said clockwork and including a heart-shaped cam, a lever carrying a roller to engage the said cam, a pawl pivotally connected with the said lever by means of a spring-controlled rod, and a differential mechanism adapted to be actuated by the said clockwork in order to correct the position of the hand and locked by the said pawl until the latter is released upon the reception of the time signal.

2. An automatic device for synchronizing clocks by means of electromagnetic waves, comprising a receiver including a balance having a spiral spring adapted to make one oscillation during each second, a receiving magnet, and a lever actuated by the said magnet and operable to bring the said spring to the full oscillatory amplitude during the reception of current impulses only in a sequence of one during each second.

3. An automatic device for synchronizing clocks by means of radio time signals, comprising a clock work, a minute-hand, a switch closing lever periodically released by the minute-hand, and a safety lever adapted to raise the first stated lever after the said minute-hand has been moved for a certain time upon the arrival of the time signal.

4. An automatic device for synchronizing clocks by means of radio time signals, comprising a clockwork, a minute-hand, a mechanism for setting the said hand and adapted to be operated by said clockwork, a receiving magnet, a balance having a pin, a lever actuated by the said magnet and adapted to bring the balance to the full amplitude of oscillation in case of current impulses only which arrive in a sequence of one in each second, a damping device for retarding the return movement of the said lever, an arm connected with the said minute-hand, a star-wheel co-operating with the said arm, a circuit closing device operated by said star-wheel to render the entire device ready for reception at a certain time prior to the arrival of the time signal, a spring-controlled lever mounted on an arbor supporting a lever which in turn supports a contact cooperating with said pin of

the balance, and an arm firmly attached to said arbor and controlled by an arm of the setting mechanism, so that during the operation of synchronizing the clock the said arbor will be rotated and at the same time the contact will be disconnected.

In testimony whereof I affix my signature.
OSKAR JUNGHANS.

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