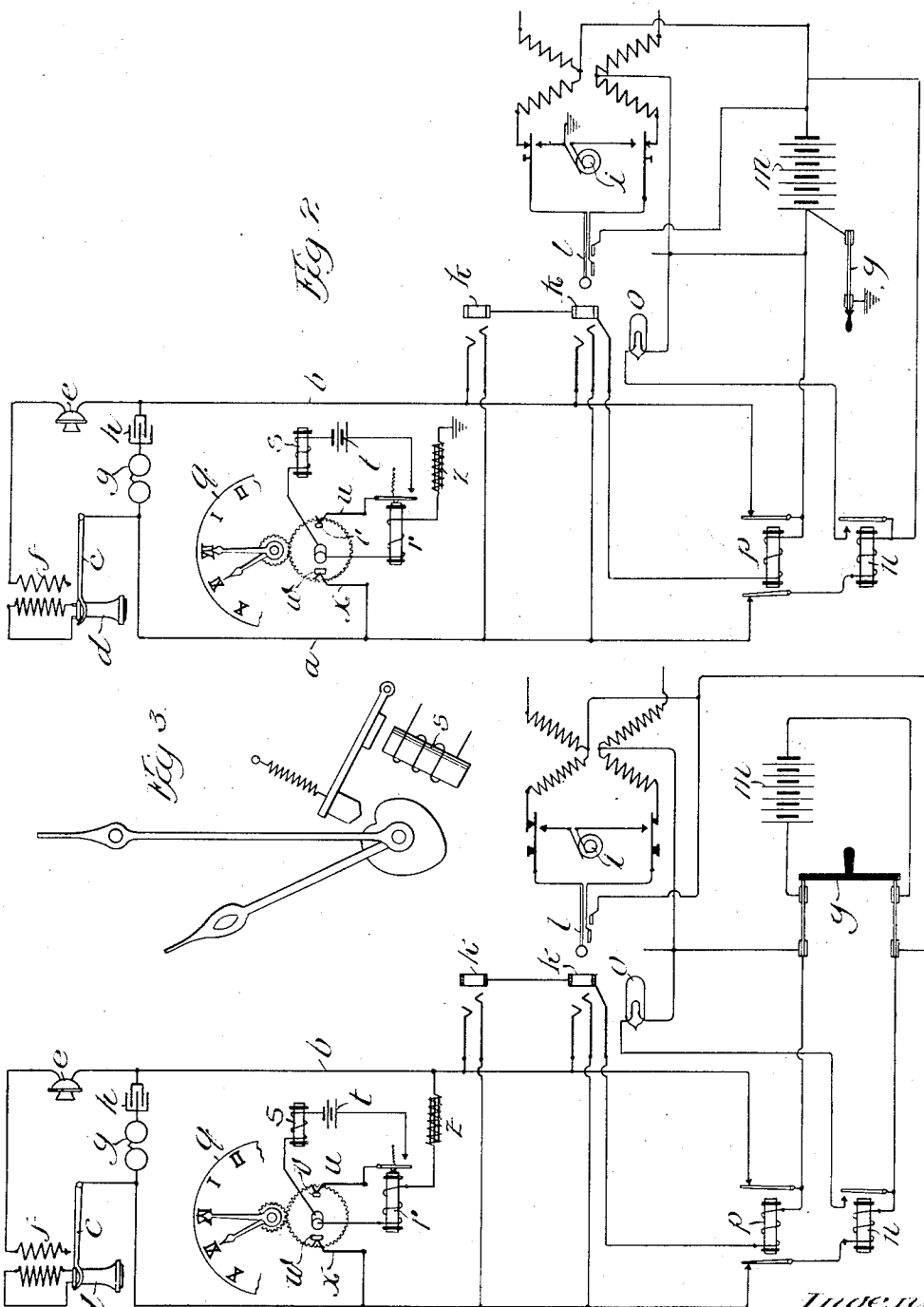


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 SYNCHRONIZING SYSTEM.
 APPLICATION FILED OCT. 17, 1910.

1,016,618.

Patented Feb. 6, 1912.



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Specification of Letters Patent.

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Application filed October 17, 1910. Serial No. 587,583.

To all whom it may concern:

Be it known that I, WILLIAM A. FRICKE, citizen of the United States, residing at Chicago, in the county of Cook and State of Illinois, have invented a certain new and useful Improvement in Synchronizing Systems, of which the following is a full, clear, concise, and exact description, reference being had to the accompanying drawings, forming a part of this specification.

My invention relates to systems and apparatus for synchronizing indicating devices, such for example, as clocks.

My invention, generally speaking, comprises an equipment which includes the clock or other indicating device, and mechanism for synchronizing the clock which is jointly controlled by the clock and an instrumentality which is brought into operation when the synchronism is to be effected.

My invention is of particular service in connection with those synchronizing systems in which telephone lines are employed as synchronizing circuits, though I do not wish to be limited to an organization that includes telephone lines, since other circuits than telephone line circuits may be employed to advantage in practicing my invention.

Generally speaking, the system made in accordance with my invention may be described as including a synchronizing circuit, such as a telephone line circuit, a switching device periodically operated by the clock, or other indicating device, to close or change said synchronizing circuit, and electromagnetic apparatus for directly causing the synchronizing function which is jointly controlled by the clock and the master synchronizing element that is brought into play each time synchronism is to take place.

I will explain my invention more fully by reference to the accompanying drawing showing the preferred embodiment thereof, and in which—

Figure 1 is a diagrammatic view of so much of a telephone exchange system as is necessary to understand the operation of the synchronizing mechanism that is shown in connection therewith. Fig. 2 is a view generally similar to Fig. 1, the circuit being slightly modified. Fig. 3 is a diagrammatic view showing one of many types of electro-mechanical synchronizing devices that may enter into the equipment.

Like parts are indicated by similar characters of reference throughout the different figures.

I have shown in each of Figs. 1 and 2, one of many types of telephone lines, each telephone line illustrated being shown as including two metallic sides *a b* that extend from a substation to an exchange, each substation including a well recognized telephonic equipment comprising a telephone switch hook *c*, a telephone receiver *d* included in a closed local secondary circuit, a telephone transmitter *e* and a primary coil *f* that is connected, together with the telephone transmitter, in circuit between the sides *a b* of the line, when the receiver is removed from its switch hook. A signal receiver *g* is shown in circuit with a condenser *h*, the signal receiver and condenser being included in bridge of the associate line to enable the signal receiver to respond to ringing currents impressed upon the line from a generator *i* at the exchange, all as is well understood by those skilled in the art. The telephone exchange equipment illustrated in each of Figs. 1 and 2, also includes well recognized spring jack structures *k*. Portions of well recognized cord connecting outfits *l* are also shown. A common battery *m* is shown in each of the two equipments illustrated, which serves to energize the line relay *m* and to cause the operation of a line signal *o* whenever a call is initiated over the telephone line associated with said elements *n* and *o* and which battery *m* serves to energize the cut off relay *p*, thereby to open the circuit of the line signal device *o* when the operator responds to the signal conveyed by said signal device and which battery *m* serves to supply talking current to the telephone lines, and also to cause the operation of supervisory signals (not illustrated), all as is well understood by those skilled in the art.

I have not deemed it necessary to illustrate more of a telephone exchange equipment in Figs. 1 and 2, and while I have illustrated portions of a well recognized telephone exchange system, I do not wish to be limited thereto in all embodiments of my invention.

In each of the telephone exchange equipments illustrated the battery *m* is normally constantly connected with the telephone lines so that when the sides of any tele-

phone line thus normally constantly connected with said battery are brought together the circuit will be closed through said battery for operating purposes. In the system of Fig. 1, the mechanism of the clock *q*, or other indicating device, serves periodically to connect the limbs *a b* of the associate telephone line with the battery *m*, in order to close what I term the main synchronizing circuit through a relay *r* periodically. The main synchronizing circuit is traceable from the left hand pole of the battery *m* through the upper blade of the switch *y*, the right hand armature switch of relay *p* when normal, the side *b* of the telephone line, the impedance *z*, relay *r*, the contacts *w* and *x* when engaged, the limb *a* of the telephone line, the left hand armature switch of relay *p* when normal, the line relay *n*, the lower blade of switch *y* to the right hand terminal of battery *m*. The clock whose mechanism is to be synchronized periodically closes the main synchronizing circuit at *w x*, the contacts *w* and *x* being engaged preferably once a day, say at midnight. Obviously the frequency with which the clock mechanism performs its circuit controlling function may be varied to suit requirements. The relay *r* is made of high resistance in order to prevent the operation of the line relay and line signal when the circuit is established through the relay *r*, though I do not wish to be limited to this characteristic. The relay *r*, when energized once in twenty-four hours or at other intervals, attracts its armature to effect an opening in a local circuit that includes a synchronizing magnet *s* and a battery *t*. This local circuit preferably includes another switch, in addition to the armature switch governed by the relay *r*, this second switch including a spring brush *u* and a contact *v* that is presented thereto and engaged therewith as frequently as the circuit is established through the relay *r*, this engagement terminating before circuit through said relay is opened. The clock mechanism which actuates the contact *v* also actuates the contact *w* included in circuit with the relay *r* in such a manner as to enable the contact *w* to engage a contact spring brush *z*, so as to enable the closure of the circuit through the relay *r* to occur before the parts *u v* of the local circuit switch are engaged and to cause the opening of the circuit through the relay *r* after the switch elements *u v* have become separated. In this way the local circuit for the synchronizing magnet *s* is positively maintained open at the armature of relay *r* before, during, and after the main synchronizing circuit through the relay *r* is closed, that is, during the entire time the contacts *w x* are in engagement, except at that precise interval when the master synchronizing ele-

ment, which is to be described, is operated for the purpose of opening or otherwise changing the main circuit through the relay *r* in order that the armature switch of said relay may be released during the time the elements *u* and *v* of the local circuit switch are in engagement, whereby the battery *t* is permitted, at the instant the master synchronizing device is operated, to energize a synchronizing magnet *s*, to bring the clock into synchronism. I need not describe any of the mechanism of the synchronizing device which is illustrated in Fig. 3, as the type of synchronizing device there shown is very familiar to those skilled in the art, nor do I limit myself to the said synchronizing mechanism.

The master synchronizing device which I have illustrated comprises a circuit opening and closing switch *y*, in this instance a manually operated switch to which I do not wish to be limited, which is operated to open the main synchronizing circuit that includes battery *m* to prevent current from flowing therefrom over the telephone line at that instant when the clock is to be synchronized, at which instant the contacts *w* and *x* are in engagement, as are also the contacts *u* and *v* whereby, at which instant, the armature switch of relay *r* is released to bring about the energization of the magnet *s* with results which have been specified. By causing the engagement of the contacts *w* and *x* before contacts *u* and *v* are engaged and breaking the engagement of the contacts *u* and *v* before engagement between the contacts *w* and *x* is broken the closure of the circuit through the magnet *s* is absolutely prevented except through the operation of the master synchronizing device *y*. I believe it to be broadly new with me to control the closure and separation of the switches *w x* and *u v* by the clock, or other indicating device which is to be synchronized, and to cause these switches to cooperate with the balance of the equipment with results which have been set forth. When the device is in no need of synchronism, its timing being correct, ineffective synchronizing action will arise when the contacts *u* and *x* engage the middles of the contacts *v* and *w* respectively providing the master synchronizing device *y* is at that time operated. The contact *w* is elongated upon each side of its middle sufficiently to enable it to engage the contact *x* when the time indicating device is late within a predetermined period or is fast within a predetermined period. The contact *v* is of such a length as to enable the synchronizer to work during any of the time that it engages the contact *u* which should be predetermined. The contact *v* is shorter than the contact *w* so that synchronism cannot occur when the contacts *w* and *x* are first engaged and so that the synchronizing

action must cease before the contacts w and x separate. The contact v is adapted for engagement with the contact u throughout a predetermined interval of lesser duration than the contacts w and x as has been made clear, the lesser interval being comprised within the greater interval whereby the main synchronizing circuit may be automatically adjusted preparatory to the operation of the master synchronizing device y and whereby the time at which the master synchronizing device is to be operated may be timed exactly. If the contact w did not engage the contact x before the contact v engaged the contact u , the mere closure of the contacts v and u would effect synchronism, upon the deenergized condition of the magnet u , which might be false. If the contact w did not leave the contact x after the contact v left the contact u , then another synchronizing action, which would positively be an incorrect action, would occur. By means of my invention the time indicating device is not permitted automatically to take part in its false synchronism. By the arrangement set forth, the common battery may be in normal circuit relation with the line so that the same line may be used for a common battery telephone system that is also used for the synchronizing system. As I have shown my invention embodied in connection with telephone exchange equipment, I have included an impedance coil z in circuit with the relay r for the purpose of sufficiently obstructing current from the ringing generator i to prevent false operation of the relay r when it is included in circuit with the battery m .

As shown and described, the contacts v and u close the local or secondary synchronizing circuit that includes the synchronizing magnet s after the normally open break in the main synchronizing circuit has been closed at $w x$. As will also be understood from the previous description, the secondary or local synchronizing circuit is opened by the separation of the contacts $v u$ before the main synchronizing circuit is opened at the contacts $w x$. In this way the armature switch of the relay r is operated, due to the closure of the main synchronizing circuit including said relay before there is opportunity to close the local synchronizing circuit at $v u$ and the closure of such local synchronizing circuit is prevented, as a mere consequence of the engagement of the contacts w and x at any time the contacts v and u are engaged, owing to the attraction of the armature switch of relay r during all of that time that the contacts v and u are engaged. The only way in which synchronism can be effected is by such manipulation or operation of the master synchronizing switching device y as will cause the opening of the

main synchronizing circuit during the time the contacts u and v are in engagement, whereupon the local synchronizing circuit that includes the synchronizing magnet s will be closed owing to the release of the armature of relay r . By providing the combination of two sets of contacts $w x$ and $u v$ and associating with the contacts $u v$ the armature switch of relay r , I am enabled to use non-polarized electro-magnetic mechanism r and am able to exclude said electro-magnetic mechanism from the influence of the common battery except at the time when such common battery needs to be included in the main synchronizing circuit. In the example which has been chosen the electromagnet r is included in circuit with the common battery m for a short interval of time in each period of twenty-four hours.

The equipment shown in Fig. 2 is in all essential respects similar to that shown in Fig. 1. There is a slight modification however, in the location of the master synchronizing element y and the circuit which it governs. While in Fig. 1 the main synchronizing circuit governed by the device y is metallic, in Fig. 2, said circuit is grounded, only one limb of the telephone line, namely, limb a , being employed for establishing a main synchronizing circuit through the relay r . The system of Fig. 2 possesses an advantage over the system of Fig. 1 in that, with the first system, conversation is not interrupted when the master synchronizing device y is operated, whereas, in the second system, such conversation is interrupted. While the relay r is preferably non-polarized, I do not wish to be limited to a non-polarized relay.

Having shown and particularly described two embodiments of my invention to which I do not wish to be limited, I claim as new and desire to secure by Letters Patent:

A synchronizing system including an indicating device that is to be synchronized; a main synchronizing circuit including a source of current normally connected between its sides; a switch located at the station of the indicating device and included in the main synchronizing circuit, the closure and separation of the contacts of this switch being governed by the indicating device; a magnet or relay included in the main synchronizing circuit at the station of the indicating device; a master synchronizing device for changing the condition of the main synchronizing circuit to effect the operation of said magnet when the contacts of the aforesaid switch are in engagement; a synchronizing mechanism at the station of the indicating device, this synchronizing mechanism including an electro-magnet for operating it, this second magnet having a local synchronizing circuit; and switching mechanism for governing said local syn-

chronizing circuit and governed in turn by
the indicating device and the first aforesaid
magnet, the switch which is operated by the
indicating device to take part in governing
5 the main synchronizing circuit and the por-
tion of the switching mechanism operated
by the indicating device for taking part in
the control of the local synchronizing cir-
cuit having individual contacts that are so
10 related that the contacts of the switch that
takes part in governing the main synchro-
nizing circuit are engaged and separated

respectively before and after the engage-
ment and separation of the contacts of the
said switching mechanism portion that 15
takes part in controlling the local synchro-
nizing circuit.

In witness whereof, I hereunto subscribe
my name this 11th day of October A. D.,
1910.

WILLIAM A. FRICKE.

Witnesses:

G. L. CRAGG,

ETTA L. WHITE.
