(No Model.) 4 Sheets—Sheet 1.

H. J. HAIGHT

COMBINED ELECTRIC CLOCK AND THERMOSCOPE SYSTEM.

No. 460,963. Patented Oct. 13, 1891.

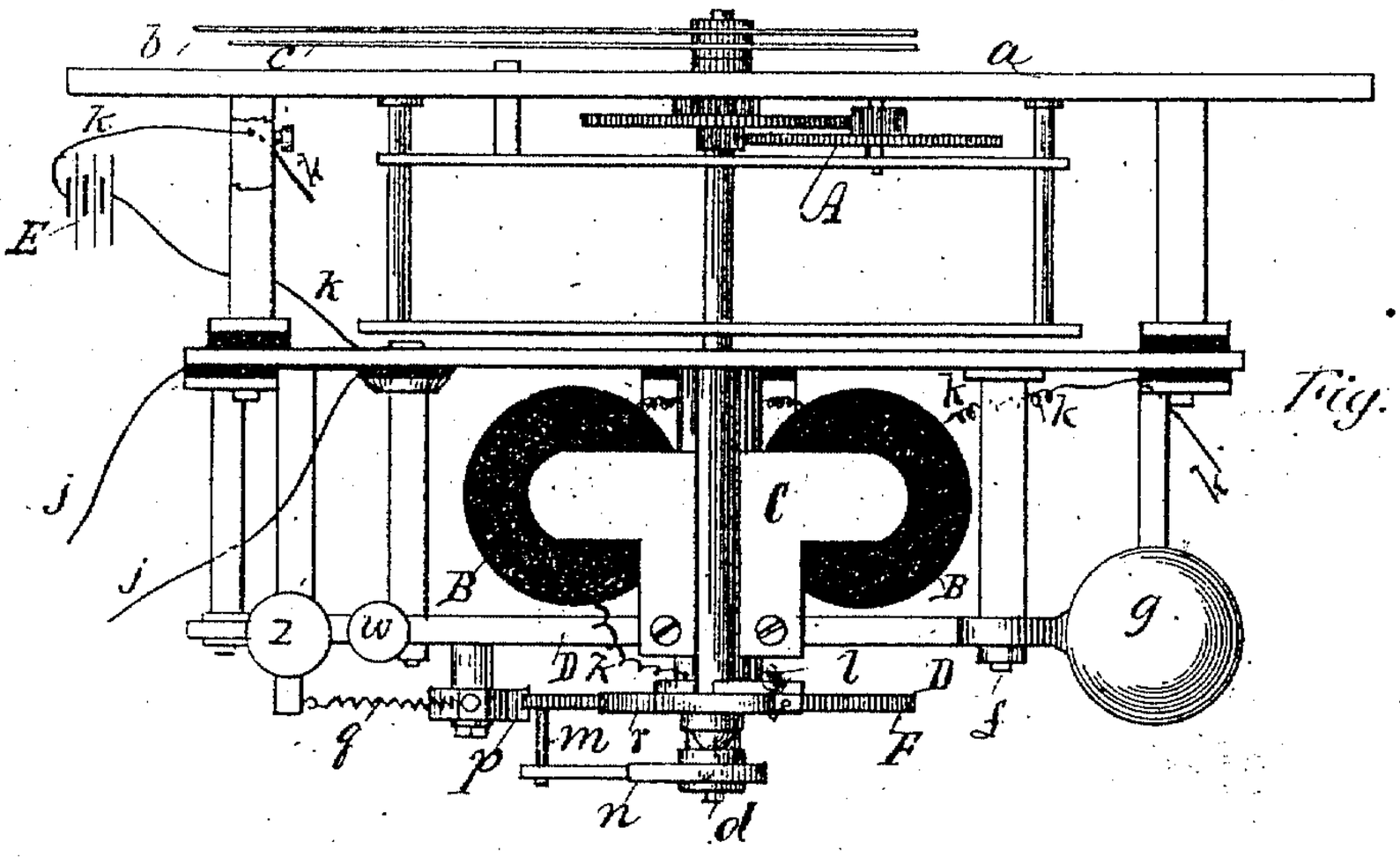
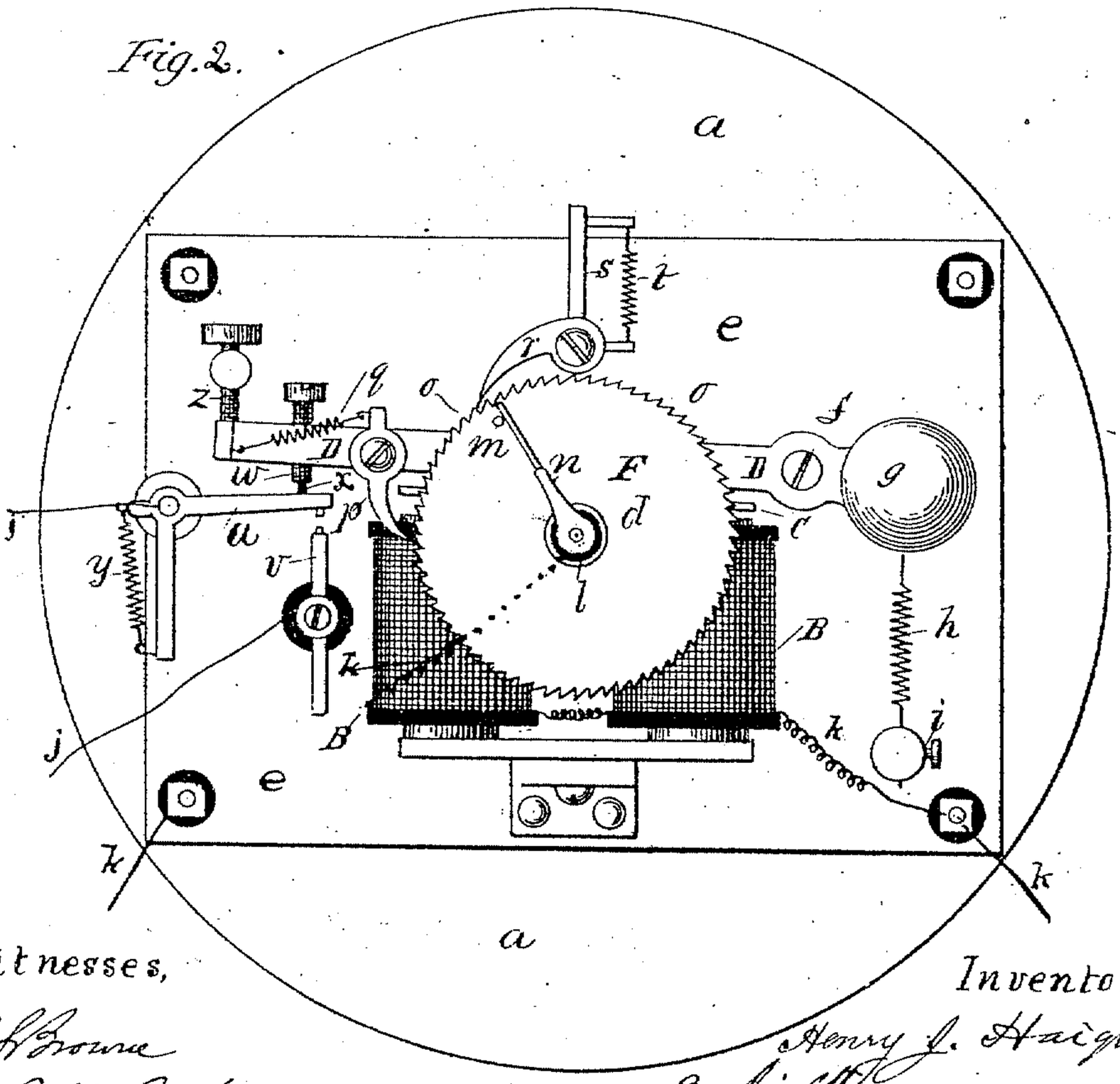


Fig. 1.

Fig. 2.



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(No Model.) 4 Sheets—Sheet 2.

H. J. HAIGHT.

COMBINED ELECTRIC CLOCK AND THERMOSCOPE SYSTEM.

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Fig. 3.

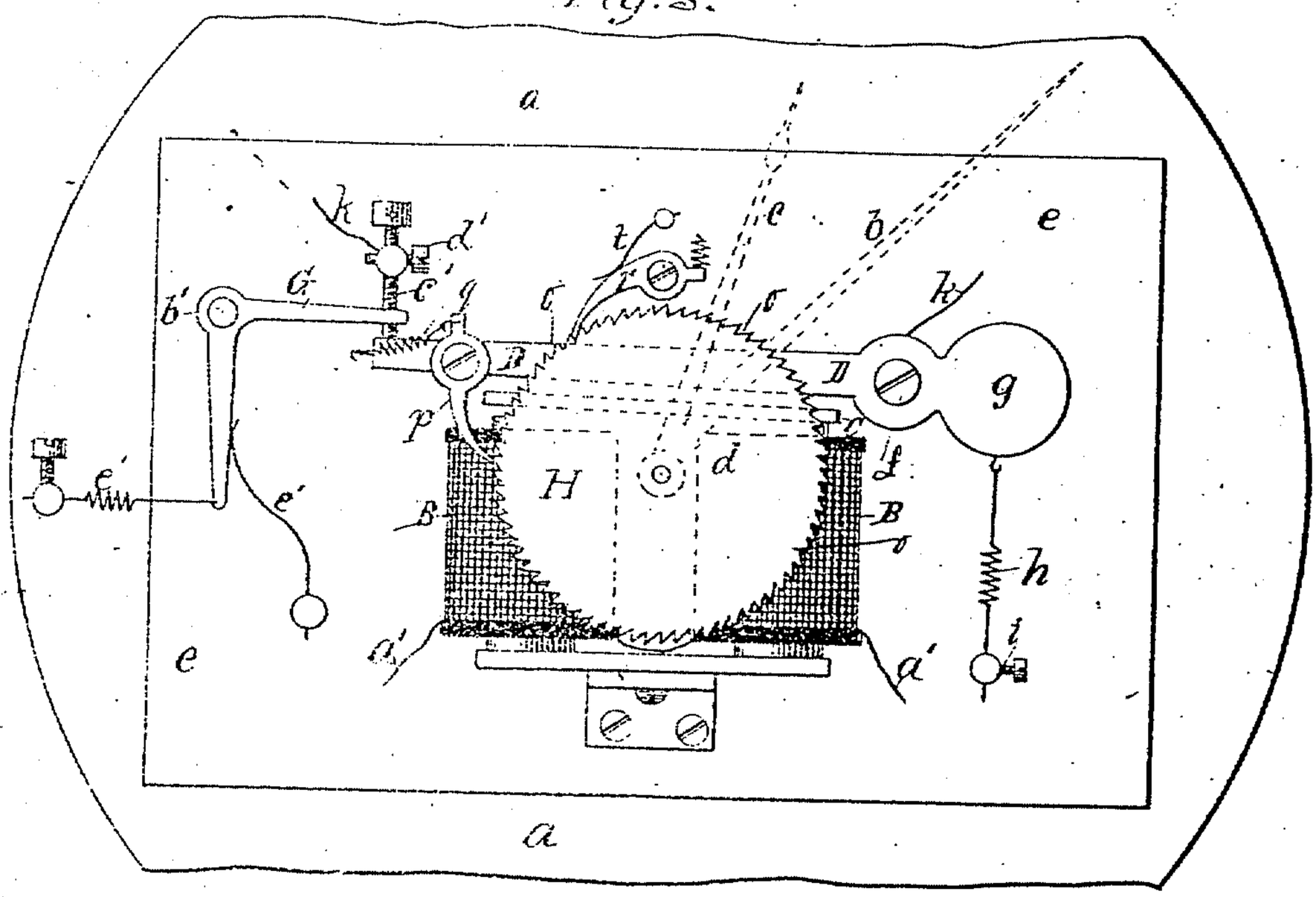
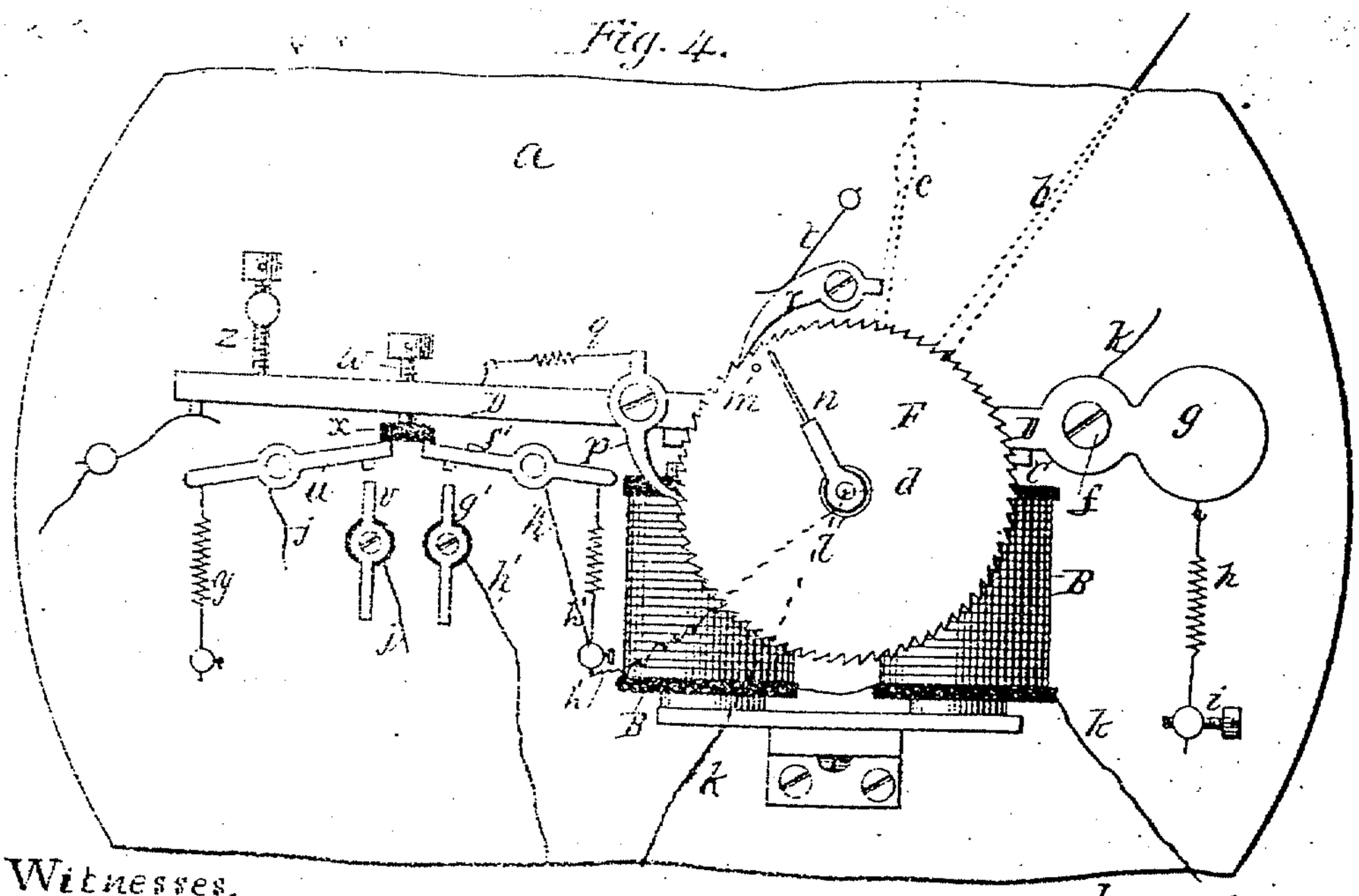


Fig. 4.



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(No Model.) 4 Sheets—Sheet 3.

H. J. HAIGHT.

COMBINED ELECTRIC CLOCK AND THERMOSCOPE SYSTEM.

No. 460,963. Patented Oct. 13, 1891.

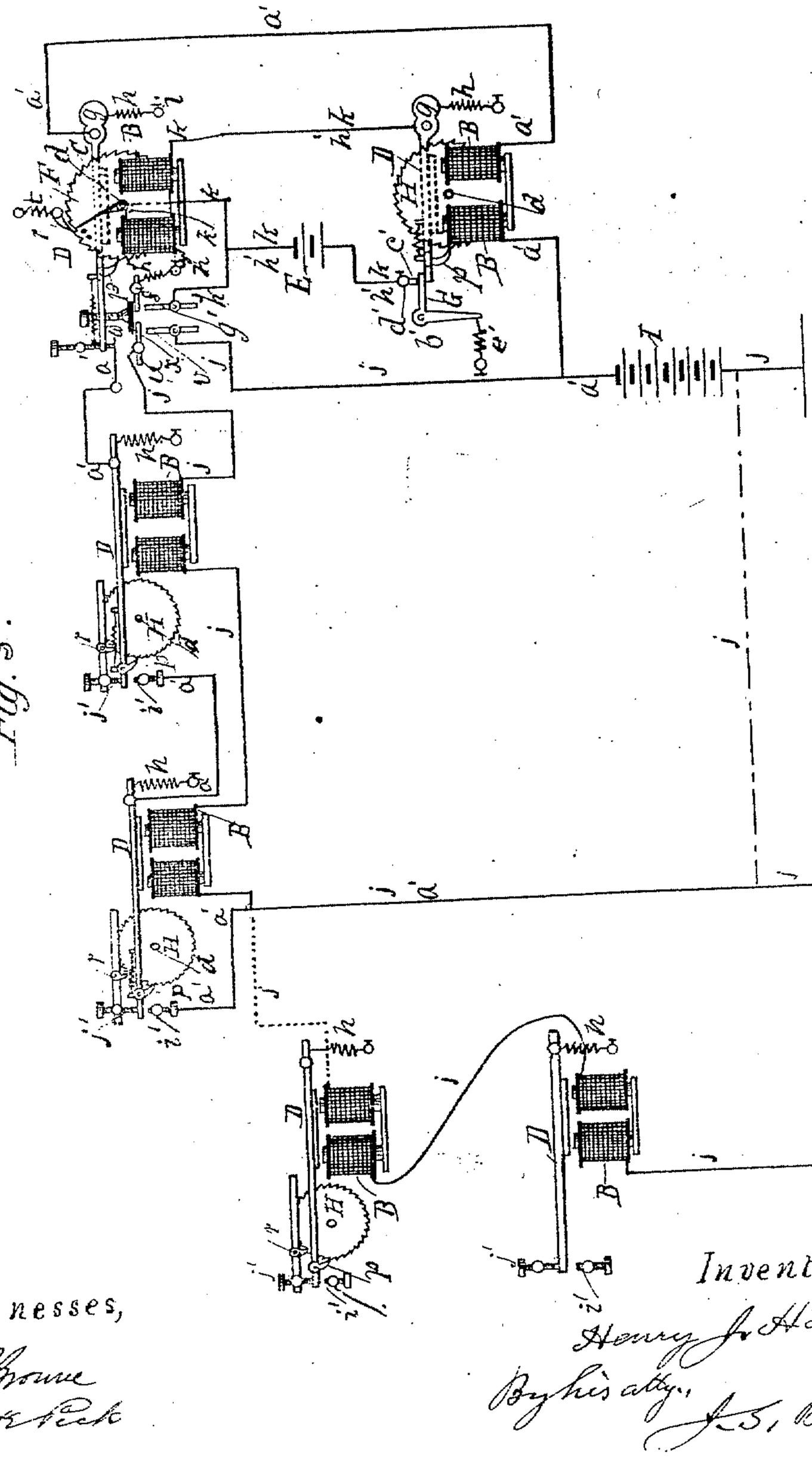

Fig. 5.

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(No Model.) 4 Sheets—Sheet 4.

H. J. HAIGHT.

COMBINED ELECTRIC CLOCK AND THERMOSCOPE SYSTEM.

No. 460,963. Patented Oct. 13, 1891.

Fig. 6.

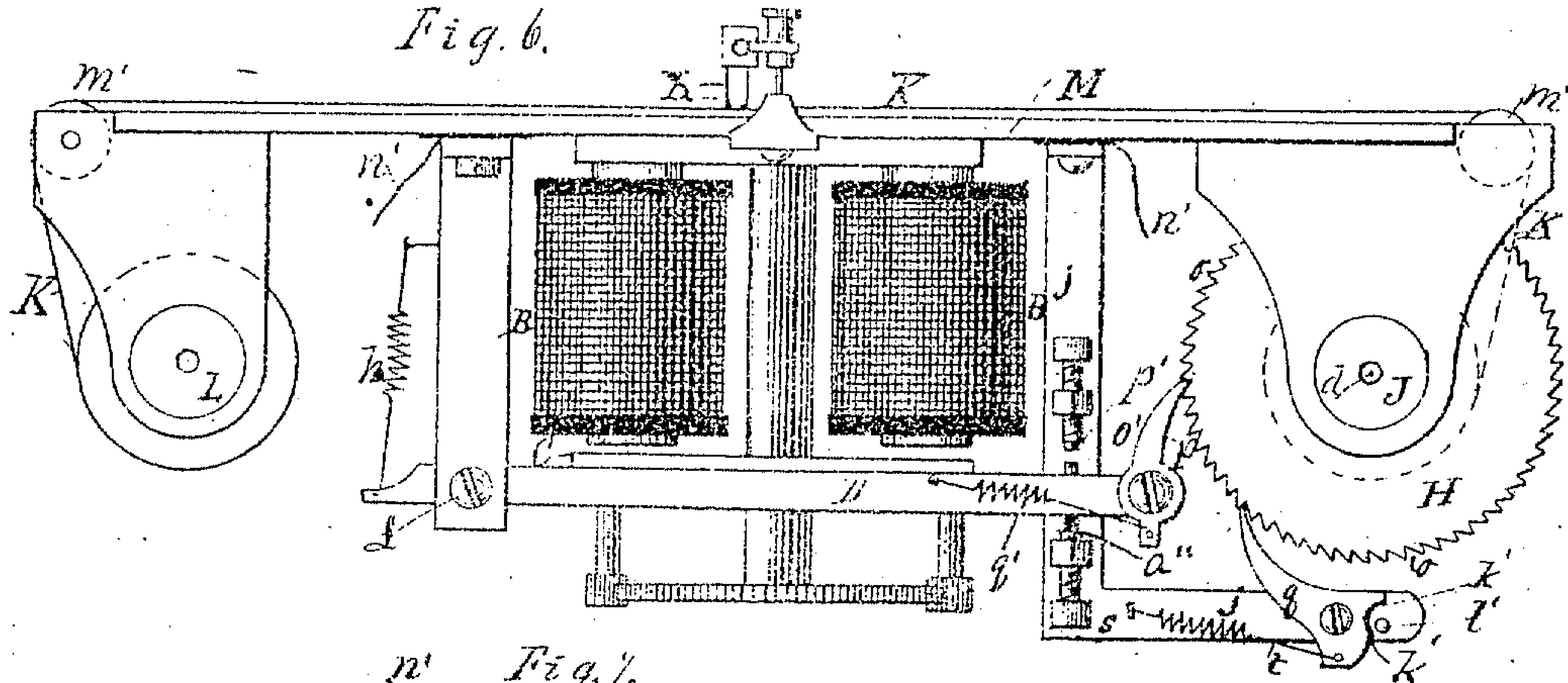


Fig. 7.

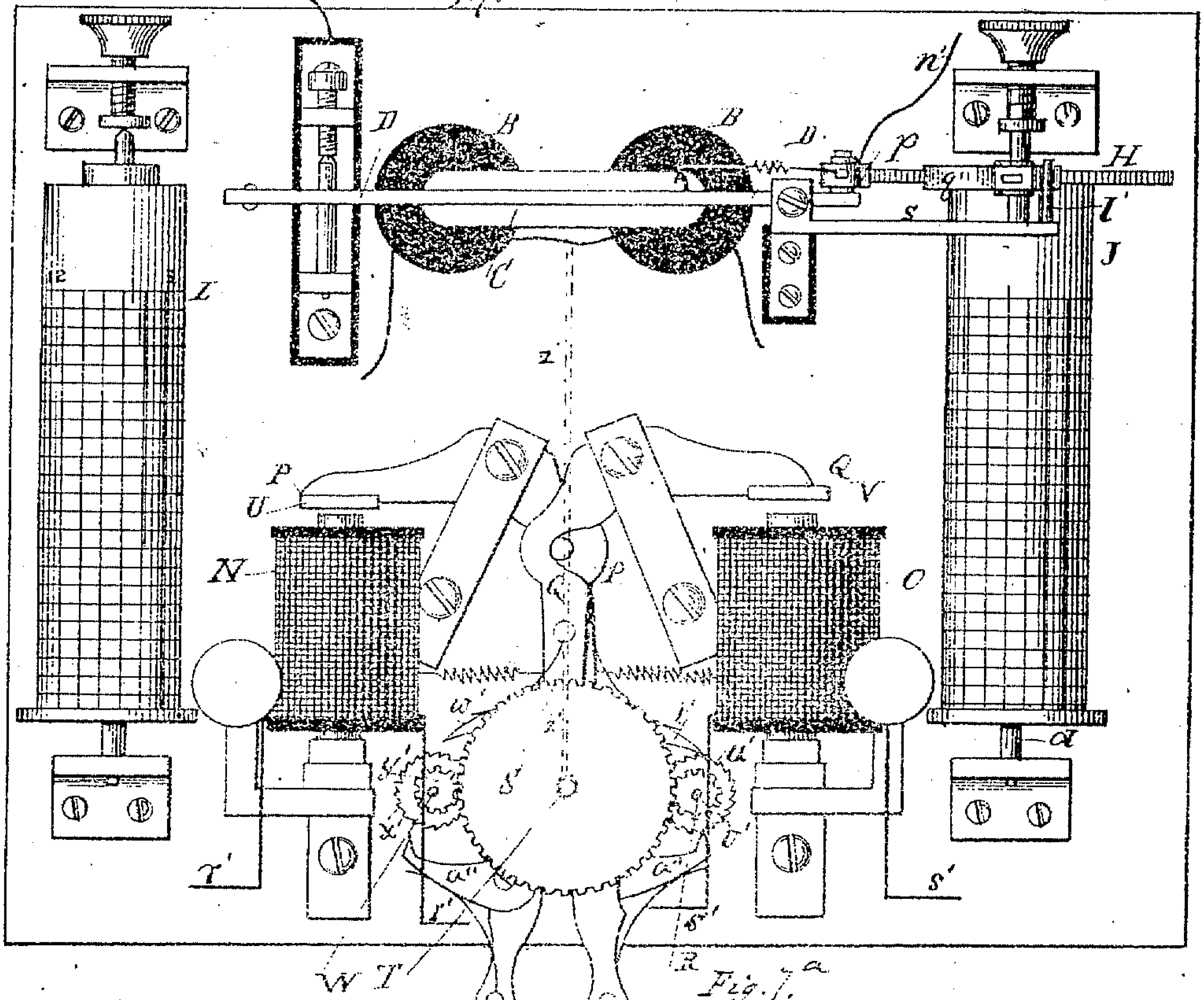
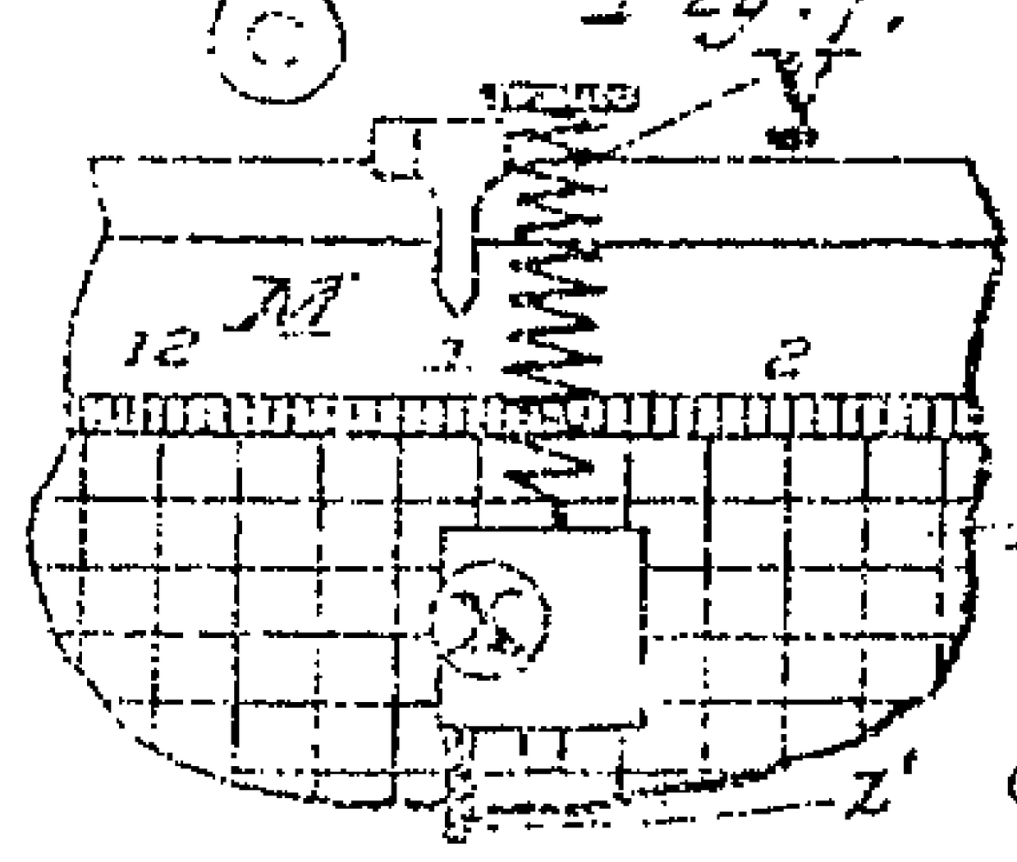


Fig. 7a.



Witnesses,
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Inventor,
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By his atty,
A. S. Brown.

UNITED STATES PATENT OFFICE.

HENRY JANSEN HAIGHT, OF NEW YORK, N. Y.

COMBINED ELECTRIC CLOCK AND THERMOSCOPE SYSTEM.

SPECIFICATION forming part of Letters Patent No. 460,963, dated October 13, 1891.

Application filed March 7, 1887. Serial No. 229,937. (No model.) Patented in England March 10, 1887, No. 4,135.

To all whom it may concern:

Be it known that I, HENRY JANSEN HAIGHT, a citizen of the United States, residing in the city of New York, in the county of New York and State of New York, have invented a new and Improved Electro-Magnetic Clock System and Recording Thermoscope Combined Therewith; and I do hereby declare that the following is a full and exact description of the same, reference being had to the accompanying drawings, making part of the specification.

This invention is the subject-matter of Letters Patent in Great Britain granted to me, dated March 10, 1887, No. 4,135[A].

My invention consists, first, in a new and improved means of transmitting by electro-magnetic power to one or more distant stations or localities the time-indications of a standard or other clock and of showing the same time on the clock-faces at the stations or localities without requiring clock-work at the said stations or localities, and thereby avoiding the necessity of any winding of clocks or other attention thereto; second, in the combination, with the said clock-time transmitter, of a comparer or verifier located in the vicinity of the transmitting-clock, whereby the correctness of the transmission of the time to the distant stations or localities is verified; third, in the combination, with the aforesaid time transmitting and exhibiting devices, of an electro-magnetic receiving and recording thermoscope for the said distant stations or localities.

In the accompanying drawings, Figure 1 represents a top view of so much of a standard or other clock as is necessary for the present purpose and of the electro-magnetic time-transmitting mechanism combined with the clock; Fig. 2, a rear view of the same; Fig. 3, a rear view of the time-verifier employed in connection with the clock and transmitter; Fig. 4, a rear view of the time-transmitting mechanism, showing the additional circuit-closing mechanism for connecting it with the verifier; Fig. 5, a diagram exhibiting the electric-circuit connections between the clock-transmitter, the distant stations or localities, and the verifier; Fig. 6, a top view of the thermoscopic recording mechanism employed in connection with the time-transmitter; Fig. 7, a rear view of the same; Fig. 7[a], a fractional face view of the tablet-roll, with the worker and other parts connected therewith.

Like letters designate corresponding parts in all of the figures.

Referring to Figs. 1 and 2, I first describe the clock-time transmitter without other parts.

Let A represent a clock-movement, or so much thereof as is necessary to show its connection with the electro-magnetic time-transmitter, *a* indicating the face, *b c* the minute and hour hands, respectively, and *d* the central or minute-hand shaft. Upon the rear side of the back plate *e* of the clock is mounted the electro-magnetic time-transmitting mechanism, the essential parts of which will now be specified. First, an electro-magnet B, of the ordinary or any other suitable construction, is properly attached to the clock. Its armature C is mounted on a lever D, which is pivoted on a pivot *f*, projecting from the said clock-plate. The counterbalancing end of this lever is preferably weighted, as at *g*, so that the position of its pivot *f* may be as far from the electro-magnet as practicable. I also prefer to employ a light counter-spring *h*, adjustable in tension, although it is evident that either an adjustable counter weight or spring may be made to serve the whole purpose. This armature-lever actuated by the electro-magnet and counter weight or spring serves to close and open the electric circuit (represented in the figures) by the broken wires *j j*, which transmits the time-indications of the clock to distant clocks or clock-hands. The lever also serves to turn a circuit-closing repeater, as follows: The clock work and frame are insulated from the electro-magnet, its armature-lever, &c., by interposing insulating material at their respective attachments to the back plate *e*, as indicated by heavy black lines in Fig. 1. The central minute-hand shaft or spindle *d* of the clock is of sufficient length to extend to the rear side of the electro-magnetic mechanism, but does not come in metallic connection with the same, except at the proper times for closing the circuit of a local battery E, the circuit-wires *k k* of which connect at one end with the clock-frame and at the other end

with the electro-magnetic mechanism, including the wires of the electro-magnet, also in the circuit, as indicated in the figures by wires and dotted-line connections. A part of this circuit is a circuit-closing repeater F, which ordinarily consists of a disk or wheel mounted to turn freely on a tubular pivot *l*, attached to the plate *e* and surrounding the clock-shaft *d*, but not being in metallic contact or connection with it. On the face of the repeater is a projecting contact-pin *m*, and projecting radially from the clock-shaft *d* is an arm *n*, just back of the circuit-closing repeater, but not in contact therewith, and so located that it may strike the pin *m* as it moves forward impelled by the clock-work. It has a suitable platinum or equivalent contact-tip, so as to make good electrical connection with the pin when it strikes the same to close the local circuit. The circuit-closing repeater F has ratchet-teeth *o o* on its circular edge of sufficient fineness or distance apart to correspond with any prescribed portion of an hour, provided for by a complete revolution of the minute-hand, before the face of the clock. Thus if the repeater-disk is constructed to make just one revolution each hour, and there are sixty ratchet-teeth on the same, it will be moved every minute. If there are one hundred and twenty ratchet-notches, the circuit-closing repeater will be moved every half-minute, and so in proportion with any desired number of ratchet-teeth. The circuit-closing repeater is turned one notch at a time by a pawl *p*, pivoted upon the armature-lever D, a light spring *q* serving to hold it to the teeth of the circuit-closing repeater. A detent *r*, pivoted on a bracket *s*, takes into the ratchet-teeth of the repeater-disk to prevent any backward motion of the circuit-closing repeater. The detent is held to the ratchet-teeth by a suitable spring *t*.

Thus organized, whenever the minute-hand of the clock advances a prearranged part of an hour, as a minute or half-minute, for instance, its shaft *d*, carrying the circuit-closing arm *n*, moves the said arm forward into contact with the pin *m* on the repeater-disk, thereby closing the local circuit and causing the electro-magnet B to be magnetized, whereby the armature-lever D is brought down and the pawl *p* thereon is made to move the repeater-disk one notch forward, thus moving the contact-pin *m* forward again away from the contact-arm *n* and breaking the local circuit, so that the armature-lever is again raised by its counter-spring. Again, as the minute-hand moves forward another division the circuit-closing arm *n* comes once more into contact with the pin *m* and closes the local circuit, whereby the pawl *p* moves forward the repeater-disk another notch and breaks the circuit again. Thus the repeater-disk is continually moved forward one notch at a time as fast as the minute-hand of the clock moves round an equal part of a circle and closes the circuit, so that the repeater-disk makes a revolution each hour; or it might turn only a part of a revolution, or more than one revolution each hour, provided that the instrument is so arranged that a certain number of notches on the disk will correspond with a complete revolution of the minute-hand shaft, indicating an hour of time. It is only necessary, then, that the main circuit extending to the distant clocks to be moved or regulated by the transmitting-clock shall be closed and broken simultaneously with the local circuit, as above set forth, in order to make all of the distant clocks in the main circuit to synchronize with the said transmitting-clock. For this purpose the armature-lever D is made to close the main circuit as it descends, and a counter-spring or its equivalent breaks the circuit as the said armature-lever again rises.

In the drawings I show a main circuit-closer, constructed and arranged as follows: A pivoted lever *u*, of bell-crank or other form, is connected with one wire *j* of the main circuit and an adjustable contact-pin *v* is connected with the other wire *j* of the main circuit, as clearly shown in Fig. 2. An adjustable presser-finger *w* is attached to the armature-lever, consisting, as represented, of a screw passed down through the lever and provided with an insulated tip *x*, to press on the top of the circuit-closing lever *u*. Suitable platinum or equivalent tips are attached, respectively, to the lever *u* and pin *v* to produce good electrical connection. Thus when the local circuit is closed, as above specified, and the armature-lever is drawn its presser-finger *w* depresses the lever *u* and causes it to make contact with the pin *v*, and thereby close the main circuit. A counter-spring *y* again raises the lever *u* as soon as the armature-lever is raised, and so breaks the main circuit, thus accomplishing the purpose above specified. The lever *u* and stud in which the pin *v* is mounted are properly secured to the clock-plate *e*, but are insulated therefrom. An adjustable stop *z* is located above the armature-lever D to limit its upward movement and regulate the distance through which it vibrates as the local battery-circuit is closed and opened.

Any construction of time secondary clock or clock-hand movement with a clock-face in which the minute-hand shaft or spindle may be turned by a ratchet-wheel thereon and a pawl actuated by an electro-magnet in the main circuit of the clock-transmitter may be employed.

The general construction of the verifier, Fig. 3, may be the same as or substantially similar to that of the clock-transmitter above described, but without a clock-movement, since this verifier is a time-receiver and the minute-hand shaft is turned by the electro-magnetic impulses. I have indicated by corresponding letters of reference on the drawings such parts as correspond in function with similar parts on the transmitter, includ-

ing the electro-magnet B, armature-lever D, clock-face *a*, minute and hour hand shafts *b c*, minute-hand shaft *d*, and back plate *e*. Two battery-circuits are also connected with this verifier, but differently arranged from those of the transmitter. Thus the wires *a' a'*, which connect with the wires of the electro-magnet B, are connected with the main circuit, while the wires *k k* are in the local circuit of the transmitter and are marked by the same letters. The armature-lever D in this instrument is insulated and forms part of the local circuit. The end of the lever also presses upward against the key-lever G, which also is insulated, and in the local circuit and turns on a pivot *b'*. The end of the key-lever in turn presses upward against an adjustable contact-pin *c'* in a binding-post *d'*, to which one end of the local circuit-wire *k* is attached. The key-lever has a suitable spring *e'*, by which it is kept pressed down upon the armature-lever D, while the retracting-spring *h* of the armature-lever is of sufficient strength to raise the lever and also press up the key-lever to the contact-pin *c'* against the force of the spring *e'* of the said key-lever; but when the armature-lever is depressed by the action of the electro-magnet B, when its circuit is closed, the spring *e'* holds the key-lever G down upon the armature, thereby separating it from the contact-pin *c'* and breaking the local circuit. As soon as the circuit connected with the main circuit and passing through the electro-magnet B is again broken the armature-lever is again raised and closes the local circuit. A pawl *p* on this armature-lever takes into ratchet-notches *o o* on the periphery of a disk or wheel H. This ratchet-wheel has a connection with the armature-lever D, similar to that of the repeater-disk in the transmitter; but its function is different, since it is mounted directly upon the center shaft *d* of the minute-hand, and is thereby made to move the minute-hand by the closing and breaking of the circuit passing through the electro-magnet B. The detent *r* fulfills a function corresponding with that of the detent *q* of the transmitter.

In connection with this verifier the transmitter has an additional feature of construction, as shown in Fig. 4, besides what is shown in Figs. 1 and 2. This consists in an additional circuit closer and breaker operated by the armature-lever for a second local circuit. All the other parts of the transmitting-instrument remain the same, as indicated by like letters of reference; but the insulated tip *x* of the presser-finger *w* may be enlarged, so as to depress the additional circuit-closer upon its adjustable contact-pin *g'*, instead of using a separate presser-finger, which, however, might be employed. The wire *h'* for this local circuit is connected at one end with the contact-pin *g'*. Thus it will be seen that when the armature-lever D is depressed by the closing of the local battery-circuit, as before set forth, the said lever will depress both circuit-closers *a'* and *f'*, and thereby simultaneously close the main circuit and the additional local circuit provided for by this construction of the transmitting instrument.

The operation and function of the verifier, in connection with the transmitting-instrument and the main circuit leading to distant stations or localities, where secondary instruments are placed in the said main circuit, will be understood by reference to Fig. 5, which is a diagram showing the connections of the said instruments by a suitable arrangement of the main and local circuits. The diagram also illustrates the manner of multiplying the number of relay and secondary instruments to an indefinite extent. I show at the upper right-hand part of the figure the outline of the principal parts of the transmitting-instrument; under the same, corresponding parts of the verifying-instrument; to the left of the transmitting-instrument, the principal parts of the two secondary instruments in different places in the main circuit of the transmitting-instrument, and still farther to the left outlines of two other secondary instruments, with dotted-line circuit-wire connections with the other instruments. (Shown to indicate the manner of the indefinite extension of the number of the secondary instruments.) Like letters indicate parts of these instruments corresponding with like parts of the instruments described in the former figures of the drawings. I show the local battery E and how the regular local-circuit wires *k k* connect the transmitter and the verifier. I also show here how the wires *h' h'* of the second local circuit connect the transmitter and the verifier. The main-circuit wires *j j* are represented in the complete circuit through the transmitter, two secondary clocks, the main battery I, and the ground connections. Also by dotted lines there is shown an extension of the main-circuit wires to two other secondary instruments. An additional circuit (represented by the wires *a' a'*) connects the transmitter, the secondary instruments, and the verifier for the purpose of the verification. Part of this circuit may be coincident with the main circuit, as shown, and the main battery I may serve for both those circuits; also, parts of the second local circuit *h'* may coincide with parts of the regular local circuit *k*, as shown, and one local battery suffices for both.

I will now trace the successive movements of the instruments and the courses of the circuits to illustrate the operation of the instruments. When the circuit-closing arm *n* of the transmitter at any time reaches the contact-pin *m* on the repeater-disk F, the regular local circuit is closed, and thereby the electro-magnet B is magnetized and the armature-lever D is depressed. This movement of the armature-lever presses down the second local-circuit closer *f'*, Fig. 4, and closes the second local circuit *h'*, which, also passing through the electro-magnet B, keeps the arma-

ture-lever still depressed for the time being. This is the essential purpose of this second local circuit. At the same time the armature-lever closes the main circuit *j*. This circuit passing through the electro-magnets B B of the secondary instruments, the said electro-magnets are magnetized and their armature-levers D D are all simultaneously depressed, and by a suitable pawl-and-ratchet construction they turn the respective ratchet-wheels H H of these instruments, mounted on the minute-hand shafts of the same just as set forth in the description of the verifier, thereby transmitting the clock-time, as required. These simultaneous movements of the armature-levers of the secondary instruments, following instantly on the depression of the armature-lever of the transmitter, close the verifier main circuit *a'*, which passes through the several armature-levers of all the instruments except the verifier and through the electro-magnet of the verifier. Each of these armature-levers (except that of the verifier) by their depression strike upon the circuit-closing pins *i'*, as shown, which are respectively connected with the wires *a' a'* of this circuit. Upon the closing of this circuit the electro-magnet B of the verifier is magnetized, thereby depressing its armature-lever D and moving the ratchet-wheel H of the verifier and causing the minute-hand thereof to designate the corresponding progress of the time. The depression of the armature-lever D of the verifier also allows the depression of the key-lever G, as above set forth, thereby breaking the second local circuit and permitting the armature-lever of the transmitter to be raised ready for the next movement, as described. Thus as long as all the instruments are in working order these movements go on regularly and the time-indications of the verifier agree exactly with those of the standard clock of the transmitter, and so long it is known with certainty at the transmitter-station that all the secondary clocks are keeping time correctly; but in case any one of the secondary clocks is out of order or from any cause the main circuit is not closed and opened regularly by the action of the transmitter, then the verifier-circuit which is connected with or dependent on the working of the main circuit is not closed, the verifier-magnet is not magnetized, and consequently its clock-hands do not move, the key-lever G is not depressed, and the local circuit passing through it to the transmitter is not broken, so that the armature-lever of the transmitter is not raised; but the standard clock continues to go and keep time, the circuit-closing arm *n* bearing against the contact-pin *m*, and thereby moving the repeating-disk F round on its pivot. Thus, since under failure to close the verifier-circuit the verifier clock-hands do not move, it will immediately be known by its not keeping time with the standard clock that the apparatus is not in working order and must be attended to.

In the diagram I show by a dotted line *j j* that a return-wire may be used instead of a ground-return in the main circuit. Where the secondary clocks are all in the same building as, or in the immediate vicinity of, the transmitter, the whole main circuit between the several instruments may properly be through-wires.

In Figs. 6 and 7 I show a means for moving the recording tablet or paper roll of a thermoscope by a time-movement electrically transmitted, as by the transmitting-instrument above described, and also in connection therewith an electro-magnetic thermoscopic receiver. Fig. 6 is a top view of the main parts of the device, and Fig. 7 a rear view of the same. An electro-magnet B is placed in the main circuit represented by the wires *j j* of the transmitter. Its armature-lever D has a pawl *p*, taking into ratchet-teeth *o o* on the periphery of a ratchet-wheel H. The armature-lever is retracted by a suitable spring *h*, and the pawl *p* by a spring *q'*. A detent *q* also takes into the ratchet-teeth pivoted on an L-shaped or equivalent bracket *s*, attached to the plate or frame of the instrument and retracted by a spring *t*. When this pawl works upward, as shown in Fig. 6, suitable limiting-shoulders *k' k'* on the detent are employed in connection with a stud *l'* on the bracket or equivalent means to limit the motion of the detent and prevent its falling out of position. On the shaft of the ratchet-wheel H is mounted one of the rollers, the active roller J of the tablet-roll K, on which the thermoscopic indications are recorded, the tablet-roll being unwound from a passive roller L and passing in front of a plate or plane surface M. The tablet-roll is to have the proper cross markings and numberings to indicate the hours and minutes thereon as the tablet-roll is moved regularly along by the clock-time movement electrically transmitted. For the purpose of scientific observation this tablet-roll, indicating, in connection with a suitable index or pointer in the proper position, the correct time at any moment, may serve as a clock in itself; but for the purpose of showing time for ordinary use a minute-hand will or may be placed on the shaft *d* in connection with an hour-hand and a clock-face of the usual construction, as in the clock-time receiver, as above set forth. As the tablet-roll K passes from one roller to the other it passes around two guide-rollers *m' m'*, respectively placed at the two ends of the plate M and serving to bring the tablet-roll into exact position before the plate and to diminish friction. The vibration of the armature-lever D, as the main circuit is closed and broken by the clock-time transmitter, turns the active roller J regularly and moves the tablet-roll in regular time. The armature-lever D also

may serve as a circuit closer and breaker for a relay-circuit, to transmit the time-indications to another station or stations by a relay-battery, or for a verifier-circuit. Thus, one wire n' of the relay-circuit may be connected with the metallic bracket on which the said armature-lever is pivoted, and the other wire n' with the L-shaped bracket s', which is insulated from the armature-lever. A contact-point o' on the armature-lever strikes a contact-pin p' on the said bracket, so that every time the armature-lever is moved by the magnetizing of its magnet this relay-circuit is closed. A limiting-stop a'', against which the armature-lever strikes in its retracted movement, has an insulating-tip to prevent the closing of the relay-circuit in this return movement. The thermoscopic movements, in connection with this tablet-roll movement driven by the electro-magnetic time-movement, is sufficiently indicated in Figs. 6, 7, and 7ª, reference being had to my Letters Patent for an improved electro-magnetic thermoscope, dated January 10, 1888, No. 376,149, for a fuller illustration and description of the mechanical devices employed in connection with the thermoscopic electro-magnets.

An increasing-temperature electro-magnet N is in the increasing-temperature circuit indicated by the circuit-wires r' r', and a decreasing-temperature electro-magnet O is in the decreasing-temperature circuit indicated by the circuit-wires s' s'. The armature-lever P of the electro-magnet N carries a pawl t', which takes into a ratchet-wheel u' on a shaft r', which carries a pinion v', that gears into a cog-wheel S on the thermoscopic index-shaft T. Similarly, the armature-lever U of the electro-magnet O carries a pawl w', which takes into a ratchet-wheel x' on a shaft V, which carries a pinion y', that gears into the said cog-wheel S. Suitable detents a'' a'' also take into the ratchet-wheels w' x'. The construction of the armature-levers, pawls, ratchet-wheels, and detents here referred to is the same as fully represented in Letters Patent No. 376,149, granted to me January 10, 1888, and described in lines forty-four to one hundred and twenty-five, inclusive, of the second page of the specification of the same; and since I make no claim to the construction or any combination of the same in the present case a full view or detailed description therof is herein unnecessary.

A cord z' or its equivalent is wound at one end around the index-shaft T and at its other end is secured to a marker X, which is arranged to slide transversely in front of the tablet-roll K. When the index-shaft is turning in the direction to wind the cord z' thereon, it moves the marker in one direction over the tablet-roll, and when the index-shaft is turning in the direction to unwind the cord therefrom a counter-spring Y, Fig. 7ª, draws the marker in the opposite direction across the tablet-roll. The whole construction is so proportioned and arranged that for every turning movement of the temperature-index shaft T to the extent of one degree of temperature a corresponding movement is made on the tablet-roll by the marker to the extent of one degree of temperature, according to the scale on the said tablet-roll.

The receiving-thermoscopes, as thus described, which are adapted to record thermometric records on tablets moved by secondary clock mechanisms, are themselves arranged and operated in a well-known way—as, for example, in the manner and in accordance with the system disclosed in my above-named Letters Patent No. 376,149. In the systems described in that patent a series of electro-magnetic receiving and indicating thermoscopes at different stations are all simultaneously actuated by a transmitting-thermoscope at a transmitting-station. Now a main object of the present invention is to apply such a system to the clock-time-transmitting system set forth in the present specification, so that continuous temperature-records of the transmitting-station may be recorded at each of the receiving-stations. Accordingly at each of the receiving-stations a receiving and indicating thermoscope is arranged in connection with a secondary clock in the manner shown in Figs. 6 and 7. The several secondary clocks are actuated by the primary clock at the transmitting-station, and the several receiving-thermoscopes are actuated by a transmitting-thermoscope at the transmitting-station.

I claim as my invention—

1. A plurality of synchronously-movable clock mechanisms and an equal number of recording-tablets operated, respectively, by said clock mechanisms, in combination with a plurality of simultaneously and uniformly acting indicators corresponding in number with said clock mechanisms, and an equal number of markers, each of said markers being actuated by one of said indicators and marking upon one of said tablets, substantially as set forth.

2. A clock-time-transmitting mechanism or primary clock, one or more secondary clock mechanisms, actuating electro-magnets for each of said secondary clocks, and a main electric circuit including an electric battery and said actuating electro-magnets, said main electric circuit being controlled by said primary clock, in combination with a verifier having an actuating electro-magnet, said verifier being also a secondary clock mechanism or clock-time indicator, and a verifying electric circuit, which includes a battery and the said magnet of said verifier, said verifier-circuit extending to all of the secondary clocks in series and its continuity being controlled at each of said secondary clocks by the movements of the same, whereby said verifier is actuated only when all of said secondary clocks act in unison, and a discrepancy be-

tween the primary clock and the verifier indicates a defect in the working of the system, substantially as set forth.

3. A clock-time-transmitting mechanism or primary clock having an electro-magnet B and armature-lever D, the circuit-closing arm *n* of said primary clock, the rotating disk F, actuated by the movements of said lever D, the contact-pin *m*, with which said arm *n* operates, the verifier having also an actuating electro-magnet and armature-lever and two normally-open local electric circuits, one of said local circuits including the electro-magnet of said primary clock and having its terminals at said arm *n* and contact-pin *m*, respectively, whereby when said arm comes in contact with said pin said local circuit is closed, thus actuating said magnet and moving the armature-lever D of said primary clock, thereby moving said disk F and again separating said arm *n* and pin *m*, and the second of said local circuits including the armature-lever of said verifier and the magnet of said primary clock and having its terminals at a normal break controlled by the armature-lever D of said primary clock, whereby when said armature-lever D is attracted by the magnet of said primary clock said second local circuit is closed, thereby holding said lever D attracted until said second local circuit is broken by the movement of the armature-lever of the verifier, in combination with one or more secondary clocks, each having an actuating electro-magnet and an armature-lever therefor, a main electric circuit including said magnets of said secondary clocks, said main circuit being controlled by said primary clock, a verifying electric circuit which includes the electro-magnet of said verifier and which extends to all of said secondary clocks in series, its continuity being controlled at each of said secondary clocks by the movements of the same, whereby said verifier is actuated only when all of said secondary clocks act in unison, and electric batteries for the several electric circuits, substantially as set forth.

4. The combination of the clock-movement of a clock-time transmitter, the circuit-closing arm on its central shaft, a freely-revolving circuit breaking and closing repeating-disk having a contact-pin thereon, a time-verifier, as specified, a local-battery circuit connecting the transmitter and verifier, an electro-magnet in the local circuit and connected with the transmitter, an armature-lever actuated by the said electro-magnet adapted to turn the said repeating-disk, and a second local circuit connecting the transmitter and verifier and closed and broken by the said armature-lever, substantially as and for the purpose herein specified.

5. The combination of the clock-time transmitter, one or more secondary clocks, a clock-time verifier, a main and two local circuits, as set forth, connecting the said instruments, a main electric generator and a local electric generator, and a circuit closing and breaking key automatically actuated by the armature-lever of the verifier, as specified.

6. In a thermoscopic recording mechanism actuated by the clock-time transmitter, the combination of an active tablet-roller moved by the armature-lever of the electro-magnet in the time-transmitting circuit, the passive tablet-roller, the tablet-roll, and the loose anti-friction rollers around which the tablet-roll passes between the tablet-rollers, as specified.

In witness whereof I have hereunto signed my name in the presence of two subscribing witnesses.

HENRY JANSEN HAIGHT.

Witnesses:
C. S. NEWELL,
MANLEY A. RAYMOND.