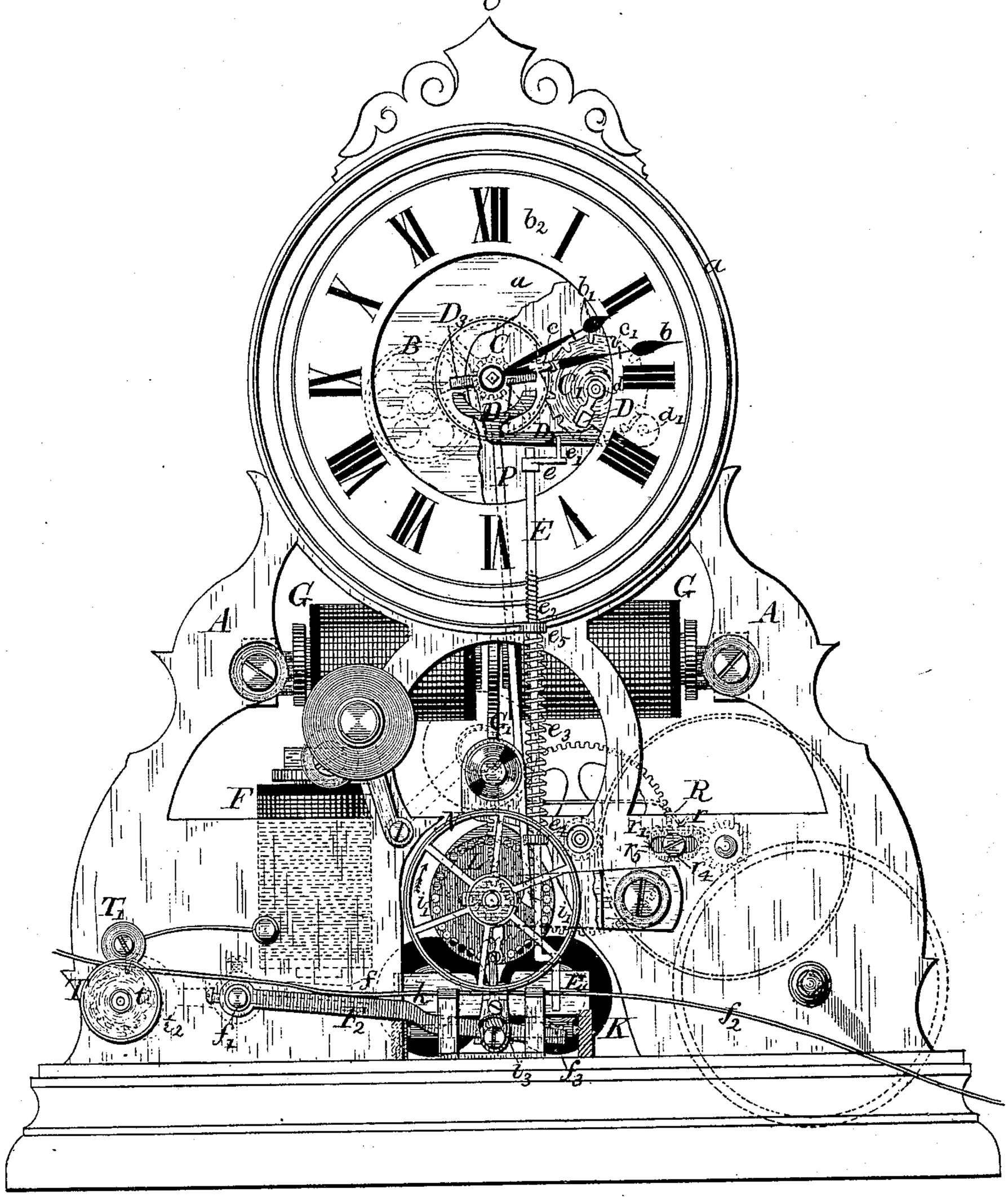
(No Model.) 3 Sheets—Sheet 1.

A. A. KNUDSON.

PRINTING TELEGRAPH.

No. 258,439. Patented May 23, 1882.

Fig: 1.



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Charles A. Terry.

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Frank L. Dyer.

N. PETERS, Photo-Lithographer, Washington, D. C.

(No Model.) 3 Sheets—Sheet 2.

A. A. KNUDSON.

PRINTING TELEGRAPH.

No. 258,439. Patented May 23, 1882.

Fig: 2.

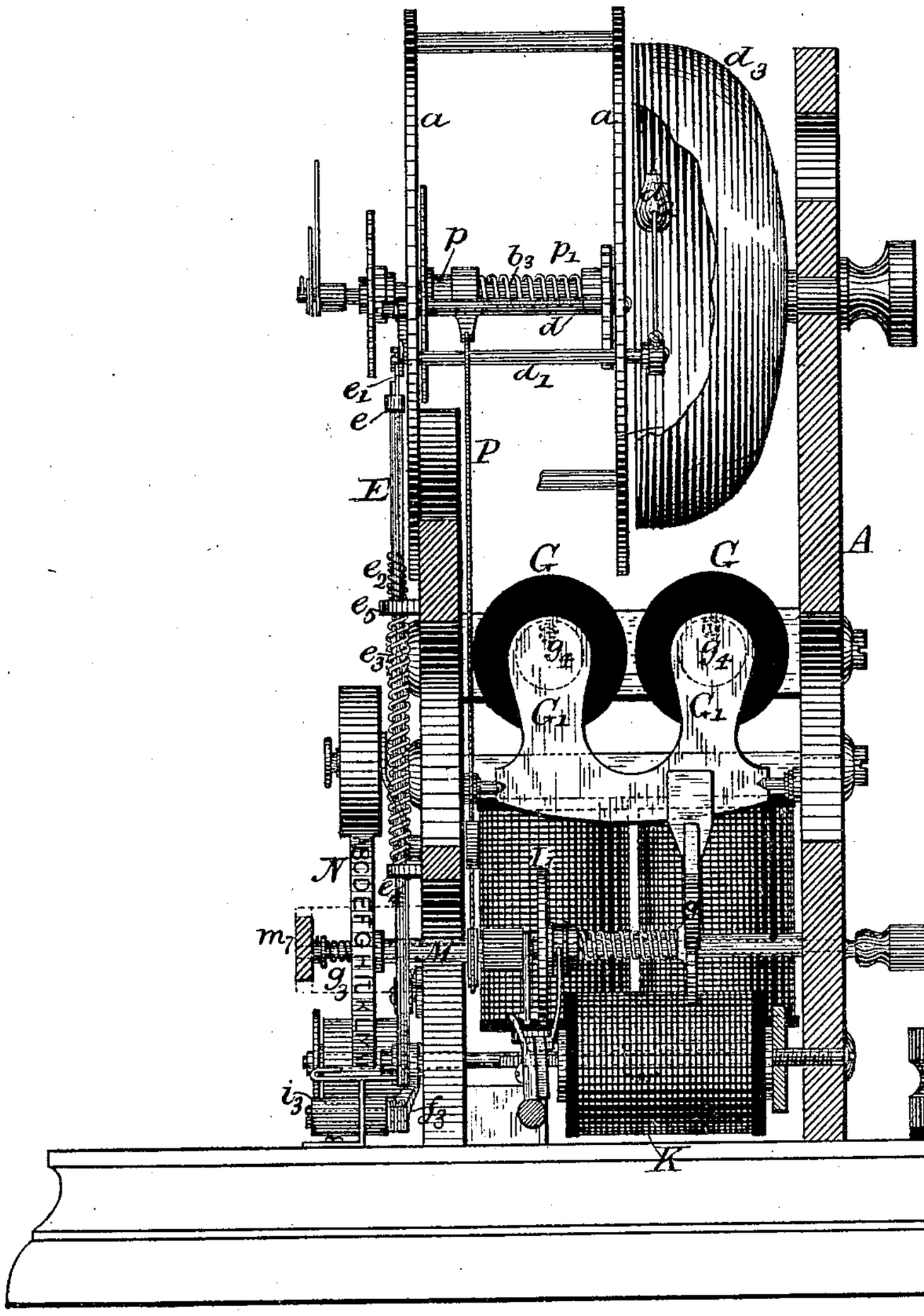
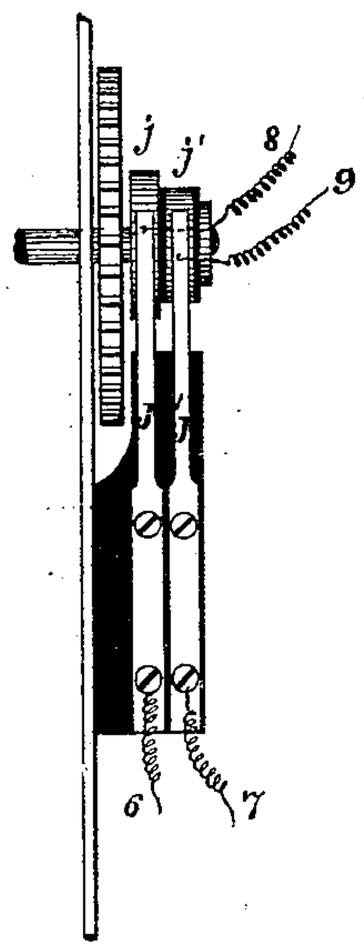


Fig. 6.



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(No Model.) 3 Sheets—Sheet 3.

A. A. KNUDSON.

PRINTING TELEGRAPH.

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Fig: 3.

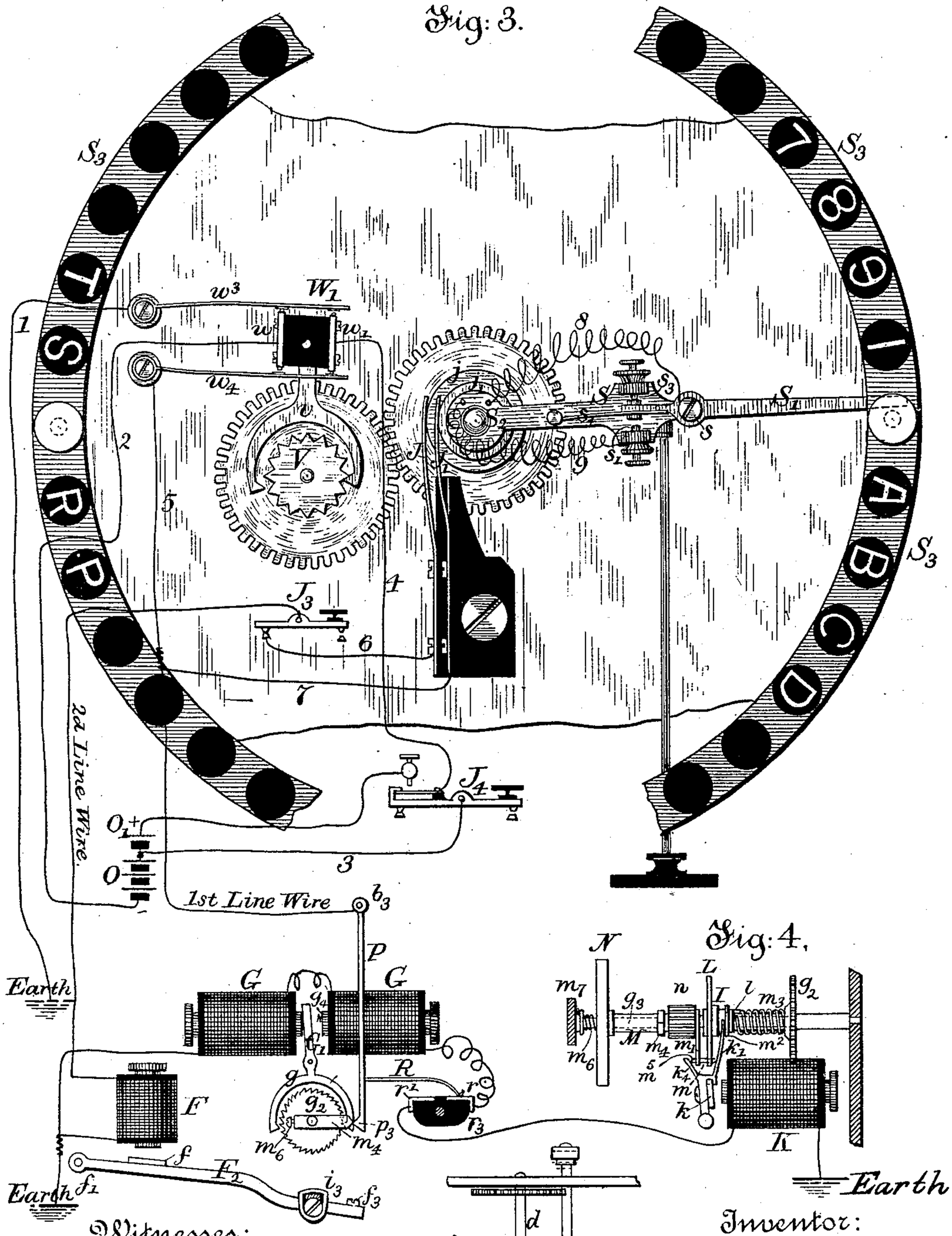

Fig: 4.

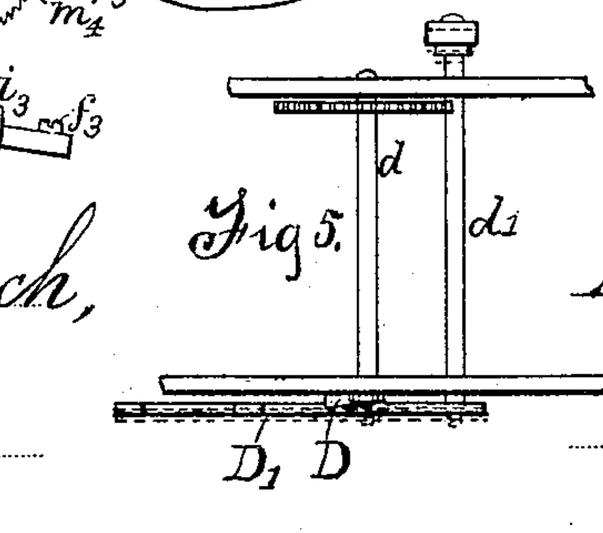

Fig 5.

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UNITED STATES PATENT OFFICE.

ADOLPHUS A. KNUDSON, OF BROOKLYN, NEW YORK.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 258,439, dated May 23, 1882.

Application filed January 26, 1882. (No model.)

To all whom it may concern:

Be it known that I, ADOLPHUS A. KNUDSON, a citizen of the United States, residing at Brooklyn, in the county of Kings and State of New York, have invented a certain new and useful Combined Electric Printing-Telegraph and Time-Regulator, of which the following is a specification.

My invention relates to a telegraphic system in which a large number of type printing-instruments, situated at different points, are automatically and simultaneously actuated from a single transmitter at a principal or central station. Telegraphic systems of this character are in extensive use for the purpose of communicating the prices of stocks, bonds, and other marketable securities and the distribution generally of information useful to bankers, brokers, and dealers in securities.

My invention consists, generally, in the combination, with a telegraphic system of the hereinbefore-mentioned character, of a system of controlled time-pieces, one of which time-pieces forms an essential portion of each of the automatic receiving or printing instruments, the apparatus being so organized that irregularities and variations in the rate of the time-piece may be automatically corrected from the central office at stated intervals through the intervention of the telegraphic mechanism.

My invention further consists in an apparatus for automatically adjusting errors of synchronism in the telegraphic receiving-instrument through the intervention of the time mechanism. In this manner I am enabled to combine in a single system the advantages of a telegraphic printing-instrument and of a standard time-piece, all the telegraphic instruments and all the time-pieces throughout the entire system being kept in unison and otherwise controlled from the central station.

In my invention the type-wheel of each receiving-instrument is controlled by an escapement of the usual construction, which is caused to vibrate to and fro by a succession of rapid electric impulses of alternate polarity, transmitted through one or more electro-magnets and over one wire from the central station. As each successive letter to be printed is brought into the proper position by the revolution of the type-wheel, the impression is given by an independent electro-magnet included in a second line-wire. This electro-magnet is actuated by an electrical pulsation from the transmitting-station, which pulsation may be of either polarity. The unison device for bringing the type-wheel of each receiving-instrument into correspondence with the transmitter is actuated by mechanism receiving its motion from the time-piece connected with the instrument. An independent transmitter is provided at the central station for sending a special electric pulsation at the proper instant for simultaneously controlling, regulating, or adjusting the hands of the time-piece at each receiving-station, and devices are employed whereby this automatic adjustment is effected at the receiving-instrument through the action of the impression mechanism of the telegraphic apparatus.

In the accompanying drawings, Figure 1 is a front elevation of the printing mechanism and time-indicating mechanism at a receiving-station. Fig. 2 is a side elevation of the same, partly in section, showing certain details of construction. Fig. 3 is a plan view of the transmitting apparatus in connection with a diagram exhibiting the connection of the same with the receiving, printing, and time-regulating mechanism. Fig. 4 shows certain details of the unison mechanism, and Fig. 5 shows certain details of the mechanism for automatically adjusting the time-piece. Fig. 6 shows certain details in the construction of the transmitting mechanism.

The transmitting mechanism which I prefer to employ is shown in Fig. 3, and consists essentially of a pole-changing device driven by a suitable train of clock-work, which pole-changer, when in action, transmits alternate positive and negative pulsations over the main line. This apparatus is controlled by a series of keys manipulated by the transmitting-operator.

The pole-changing mechanism consists of two metallic contact-plates, *w* and *w'*, which are mounted upon a rectangular block, W', of non-conducting material, and are made to oscillate between two contact-springs, w^3 and w^4. The spring w^3 is connected directly with the earth by means of the wire 1, and spring w^4 is connected with the first line-wire by the wire 5.

The contact-piece *w'* is connected with the positive pole of the main battery O by wires 4 and 3, and the remaining contact-piece, *w*, is connected with the negative pole of the same battery by the wire 2.

When the apparatus is in the position shown in Fig. 3, the circuit may be traced from the earth through the wire 1 to the spring w^3, thence by the contact-piece *w* and wire 2 to the negative pole of the battery O, and from the positive pole of said battery by wires 3 and 4 to contact-piece *w'*, and thence through the spring w^4 and first line-wire, 5, to the receiving-instrument. By the oscillation of the pole-changing apparatus the poles of the main battery O are interchanged with respect to the line and earth wires, thus reversing the direction of the line-current in a well-known manner. The pole-changer is preferably oscillated by means of a star-wheel, V, which acts upon a common anchor-escapement, *v*, the arrangement being such that each revolution of the wheel V causes a number of successive pulsations to be transmitted alternately of positive and negative polarity, which, taken together, are equal in number to twice the number of teeth upon its peripbery. The rotation of the star-wheel V is controlled by an arm, S, mounted upon a shaft, S^2, geared to the shaft of the star-wheel, which rotates synchronously therewith, receiving its motion from the same source of power. This rotating arm S is rigidly secured to the shaft S^2, but carries an extension, S', which is pivoted to its extremity, as shown at *s*, and is movable upon its fulcrum in a horizontal direction, this movement being limited by adjustable stops s^3 and s^4 upon the arm S^2. The extension S' of the arm S revolves in a horizontal plane beneath a circular range of vertical keys, S^3, which are normally held up and out of its path by spiral springs placed beneath them in a manner well understood. The pivoted extension S' is held in its normal position against a stop, s^3, by a spring, s^6, and if permitted to revolve freely will perform a complete revolution in the same time as the star-wheel V.

The number of keys with which the instrument is provided should be equal to the number of the teeth and spaces taken together upon the star-wheel V, and this number may be varied in different instruments designed for different classes of business, as required. Hence it is evident that if the arm S is permitted to make one complete revolution beneath the key-board as many electric pulsations will be transmitted over the line as there are keys, and these will be alternately of positive and negative polarity. These pulsations serve to control the position of the type-wheel upon a receiving-instrument in the same circuit in a manner well understood, which will be hereinafter more fully explained.

The printing of a particular letter upon the type-wheel at the receiving-station, after the same has been brought into position, is effected by means of an electric pulsation transmitted from the battery O over an independent line-wire, herein termed the "second" line-wire. The transmission of this pulsation takes place almost instantly whenever the rotary movement of the arm S is arrested by the depression of a key. If any key be depressed, it is thrust into the path of the extension S' upon the rotating arm S, which is not instantly arrested, but travels forward a short distance, bending the spring s^6 until the inner end of the pivoted extension S' comes in contact with the stop *s'*. The latter stop is insulated from the arm S^2, and serves to close the circuit of the second line-wire. This is effected in the following manner: The second line-wire, 6, is connected to an insulated metallic spring, J, and another similar insulated spring, J', is united with the line-wire 5 by a wire, 7, at or near the point where it leaves the transmitting-instrument. The springs J and J' press upon and make contact with insulated rings *j* and *j'* upon the shaft S^2, and these are connected by wires 8 and 9 with the extension S' of the arm S^2, and with the insulated contact-point *s'*. Thus it will be understood that whenever the rotating arm of the transmitter is arrested by the depression of a key a current is transmitted from the main battery O over the second line-wire without interrupting the current already traversing the first line-wire from the same battery. The pulsation thus transmitted over the second wire will be positive or negative according to the position of the pole-changing device; but this will not affect its action at the receiving-station. This pulsation may be repeated by means of a repeating-key, J^3, included in the second wire, in a manner well understood.

The pulsation for adjusting the time mechanism is transmitted by a suitable key or other circuit-closer, as shown in diagram at J^4, which, when actuated, throws an additional section of battery O' (of the same polarity as the main battery O) into the same circuit, thus increasing the strength of current therein. The key J^4 may be manipulated by hand; but it is preferred to connect it with a standard clock or regulator in such a manner that it is automatically actuated by the said clock at a predetermined hour, minute, and second of time, according to the requirements of the service.

The apparatus at the receiving-station consists of the printing mechanism, the unison mechanism, the time-piece, and the device for adjusting or regulating the time-piece.

Referring to Figs. 1 and 2, A represents the frame-work for supporting the various parts of the printing mechanism, together with the time-piece. The printing mechanism comprises a type-wheel, N, which, together with a driving-pinion, *n*, is mounted upon a sleeve or hollow axis, M, which turns upon a fixed shaft, g^3, (best seen in Fig. 4.) The type-wheel tends to revolve by the action of a train of wheel-work and mainspring, (shown in dotted lines in Fig. 1,) which engages with the pinion *n;* but the movements of the type-wheel are

controlled (except as hereinafter set forth) by means of an anchor-escapement mechanism, of well-known construction, consisting of a scape-wheel, g^2, (see Figs. 1 and 3,) and an anchor, g, having a vibrating armature, G′, attached thereto. The armature G′ is permanently polarized, and vibrates to and fro, under the influence of alternate currents, between electro-magnets G G, which are mounted so that their respective poles face each other. This organization of apparatus for producing or controlling the movement of a type-wheel by alternating currents is well known, and therefore requires no further explanation. The scape-wheel g^2 is normally coupled to the type-wheel by devices hereinafter to be described.

To secure a more rapid vibration of the armature-lever G′, I prefer to insert a small coil-spring, g^4, into a recess in the face of each of the cores of the electro-magnets G, projecting slightly beyond the end of the cores.

The printing mechanism consists of an electro-magnet, F, included in the circuit of the second line-wire, which acts upon the armature f, affixed to the press-lever F^2, which turns upon a suitable fulcrum, f'. A platen, i^3, is mounted upon the press-lever beneath the type-wheel, and a ribbon or tape of paper, f^2, is fed between the platen and the type-wheel by means of the feed-rollers T and T′, which are caused to advance the proper distance after each impression by means of a scape-wheel, t', and pallets t^2, affixed to and actuated by the press-lever F′, as indicated in dotted lines in Fig. 1.

The unison mechanism whereby the position of the type-wheel of the receiving-instrument is brought into correspondence with the transmitter is constructed as follows:

Upon the same shaft g^3 which carries the escapement-wheel is mounted a clutch-wheel, L, laterally movable along a feather, l, on the shaft. This clutch-wheel is provided with a collar, m^2, (see Fig. 4,) encircled by a groove, i, into which fits a forked clutch, k', attached to the armature k of the unison electro-magnet K. Near the periphery of the clutch-wheel L is a series of perforations, i', adapted to receive a pin, m, mounted upon the end of an arm, m', and carried upon the sleeve M of type-wheel N. The clutch-wheel L is normally pressed toward the arm m' by means of a spring, m^3, and engages with the pin m, thus locking the parts together, so that the type-wheel N can revolve only in correspondence with the movement of the scape-wheel g^2. Whenever a current of electricity is sent through the unison-magnet K, the armature k, carrying the clutch-arm k', will be attracted thereto, thus disengaging the wheel L from the pin m. The type-wheel and pin on being thus released from the scape-wheel g^2 will revolve, by the action of the clock-work exerted through the pinion n, in the direction indicated by the arrow until arrested at the zero-point by reason of the stop m^5, carried upon the arm m', striking against the projection k^4, carried upon the armature k, when that armature is attracted toward its magnet. Thus, whenever an electrical current traverses the unison-magnet K, the type-wheel will be automatically brought to the zero-point, and when this current is interrupted the armature k will be thrown backward from the poles of the magnet by the pressure of the spring m^3 against the collar m^2, and the type-wheel sleeve again locked to the scape-wheel by the pin m entering one of the holes in the periphery of the clutch-wheel L. A friction-spring, m^6, is provided to press against the sleeve of the type-wheel and the binding-screw m^7 at the end of the shaft g^3 to prevent the recoil of the type-wheel when suddenly arrested.

The device which I employ for sending an electrical impulse at frequent intervals through the unison-magnet K, in order to correct the position of the type-wheel, consists of a shunt or switch, operated by the movement of the time-piece, whereby the current of the main line, which controls the type-wheel, is shunted through the unison-magnet (in case the instrument should not be at unison) whenever the escapement mechanism is inactive during a few seconds. The mechanism whereby this result is effected consists of an arm, P, suspended from the axis b^3 of the minute-hand of the clock, and carrying at its lower end a frictional contact-spring, R, provided with two contact-points, r and r'. The upper end of the arm P is loose upon the shaft, and is pressed against a shoulder, p, thereon by means of a spring, p', constituting a frictional connection. The motion of the minute-hand will cause the arm P, when unobstructed, to be gradually moved in a direction corresponding with the motion of the hand b, thus carrying the contact-spring R from the contact-point r to the contact-point r'. One of these contact-points, r, is connected with one extremity of the coils of the type-wheel magnets G and the other contact-point, r', is connected with one terminal of the coil of the unison-magnet K. When the arm P is in its normal position, the circuit will be formed through the binding-post W, the metallic frame-work, the clock mechanism, the arm P, contact-point r, and the electro-magnets G to the binding-post X. The movement of the shaft b^3 will cause the arm P to be gradually moved forward, carrying the contact-spring R from the point r to the point r', thus transferring the circuit from the escapement-magnets to the unison-magnets and operating the unison device in the manner before described.

The method of placing the contact-spring R in contact with the contact-point r, and thus closing the circuit through the magnets G, consists in causing the stop m^4, mounted upon the sleeve M, to be brought into contact (when the type-wheel reaches its zero-point) with a projection or tooth, p^3, carried at the lower extremity of the arm P, thus throwing the arm P backward by means of the beveled ends of said stop and extension. The stop m^4 blocks the arm P as long as the type-wheel remains at its unison-point, and maintains a closed cir-

cuit through the contact-point *r* and the type-wheel magnets until the type-wheel is again operated. Whenever a momentary pause occurs in the operation of the escapement mechanism and the type-wheel is left in any position other than zero, the contact-spring R will be carried from the contact-point *r* to the contact-point *r'* by the time-movement, thus operating the unison mechanism. The contact-points *r* and *r'* are preferably mounted upon a piece of insulated substance—such as hard rubber or ivory—r^3, which is secured to the frame A by means of a screw, r^4, passing through a slot, r^5, which allows of its adjustment with reference to the contact-spring R. The stop m^4, mounted upon the sleeve which carries the type-wheel, is also adjustable with reference to the extension p^3 upon the end of the arm P by means of the screw m^6. The end of the stop m^4 and the corresponding extension p^3 are preferably wedge-shaped, and the former is so adjusted that it will block the path of the latter only when the type-wheel is exactly at the unison-point.

The time-regulating mechanism consists of a suitable train of clock-work, B, driven by any convenient motor, and supported in a frame, *a*, the function of which is to move the hands *b* and *b'* over the dial b^2 of the time-piece to indicate mean solar time in the well-known manner.

Connected with the ordinary mechanism of the time-piece, and driven by the same motive power, are two additional wheels, C and C', constituting what is technically known as a "Geneva stop-movement." The wheel C revolves synchronously with the minute-hand *b* of the clock, thus performing one complete revolution per hour. Upon the periphery of this wheel is formed a single tooth, *c*, which, at a particular point in each revolution, enters one of the twelve equidistant recesses *c'* in the periphery of the wheel C' and moves it a distance of one-twelfth of its circumference, thus causing it to complete a revolution once in every twelve hours. The periphery of the wheel C fits into the concavities between the successive recesses in the periphery of the wheel C', and thus prevents the latter from moving except when driven by the tooth *c*. Upon the end of the arbor *d*, which carries the wheel C', is rigidly affixed a cam, D. The end of this cam engages, once in every revolution, a horizontal arm, D', which is mounted upon the end of an arbor, *d'*. The arm D' is supported in the frame-work *a* by the arbor in such a manner as to permit a slight horizontal movement. (See Fig. 5.) The arm D is normally forced backward against the plate *a* by the torsion of a spiral spring, e^2, upon a vertical rod or spindle, E, which is provided at its upper extremity with a crank-arm, *e*, and pin *e'*, the latter bearing against the arm D'.

Upon the free end of the arm D' is carried a yoke, D^2, extending beneath the arbor b^3, which carries the minute-hand of the clock. Mounted upon this arbor is a time-correcting bar, D^3, which is rigidly affixed thereto. So long as the arm D' is in its normal position the correcting-arm D^3 revolves in front of the yoke D^2 without touching it. When the cam D revolves in the direction indicated by the arrow, it passes behind the beveled rear face of the arm D', as seen in Fig. 5, thus pressing it outward and throwing the pin *e'* forward. This movement causes the spindle E to be turned against the tension of the spring e^2 a sufficient distance to bring another right-angled arm or extension, E', upon its lower extremity above and into the path of the adjustable hammer-screw f^3, carried at the end of the press-lever F^2. The arm D' is by the same movement placed above and in the path of the upper extremity of the spindle E, while the yoke D^2 is brought beneath the correcting-bar D^3. While the lever D' remains in this position, if an upward motion be communicated to the printing-lever F^2, the spindle E will be raised and its upper extremity pressed against the lever D', by which means the yoke D^2 will be caused to engage the correcting-bar D^3 and force the latter to assume a position parallel to the ends of the yoke which is in contact with it. This operation turns the arbor b^3 and minute-hand of the time-piece either backward or forward, the direction depending upon which end of the correcting-bar D^3 is first engaged by the yoke D^2. A spiral spring, e^3, surrounds the spindle E, the lower end of which is engaged by a shoulder, e^4, upon the shaft, while the upper end bears against a stationary support, e^5, thus exerting a downward pressure, which normally maintains the spindle in the position shown in the figures. It will be thus understood that at a predetermined moment, once in every twelve hours, the arm D' will be thrown forward in the manner described, and into a position to move the minute-hand of the clock, provided an upward force be exerted by the lever F^2. The position of the correcting-bar and the arm D with reference to the minute-hand of the time-piece will determine the moment at which the arm D' will be thus placed in position to move that hand. It should, moreover, be observed that the relative positions of the cam D and the correcting-bar D^3 should be such that the former shall engage with the arm D' only at a time when the correcting-bar D^3 is in a nearly horizontal position; otherwise the yoke D^2 will be pressed outward against one end of the correcting-bar D^3, and not in a position to engage therewith.

The distance which the correcting-bar D^3 may vary from a position parallel to the yoke D^2 and still permit the lever D^2 to be pressed outward will depend upon the distance the yoke is allowed to drop below the arbor b^3, which carries the minute-hand. In practice it is found desirable to so adjust these positions that the correcting-bar D^3 may deviate from the horizontal line a distance sufficient to allow the minute-hand of the clock to indicate a time two or three minutes fast or slow of the correct time. If, now, at a prearranged moment—

say once in each twelve hours—the arm D′ be brought into the proper position for adjusting the correcting-bar D^3, and an upward blow be given by the printing-lever F, the yoke D^2 will force the correcting-bar D^3 into a position parallel to itself, thereby causing the minute-hand of the clock to indicate the correct time. If the clock has lost or gained an amount not exceeding two or three minutes during the intervening period, it will be thus automatically corrected for that error.

Upon the end of the arbor *d′* opposite that which carries the arm D′ is mounted a hammer, D^2, which receives an upward impulse whenever the forked arm D^2 is thrown upward by the shaft E, and strikes a bell, d^3, thus indicating, by an audible signal, that the clock has been adjusted to the correct time.

The operation of the printer is as follows: A series of electric pulsations of alternating polarity are sent from the transmitter over the first line-wire to the binding-post W, which pass from thence through the metallic frame A and clock-work mechanism to the arm P, contact-spring R, and contact-point *r* to the electro-magnets G G, which control the movements of the type-wheel, and from thence to the ground through the binding-post X. In this manner the type-wheel is allowed to rotate step by step until the required character which is to be printed is in position above the paper tape. An electrical impulse is thereupon sent from the transmitter, as hereinbefore described, through the second line-wire connecting with the binding-post Y, the press-magnet F, and the binding-post Z, causing the armature *f* to be actuated and the press-lever thrown upward. The movement of the armature-lever F^2 by the same operation allows the rollers T and T′ to rotate, carrying the paper ribbon a sufficient distance for the next character to be printed. This operation is of course repeated for each character printed.

Whenever the printing mechanism is for a moment inactive the motion of the shaft b^3, carrying the minute-hand *b*, will cause the contact-spring R to be moved from the contact-point *r* to the contact-point *r′*, thus transferring the circuit from the type-wheel magnets to the unison-magnet, as before described. The last-named magnet will thereupon attract its armature and release the sleeve carrying the type-wheel and pinion *n*, allowing the same to move forward to the zero-point, at which it will be arrested by the stop k^4, in the manner hereinbefore described. The stop m^4 will now press against the beveled end of the extension p^3 and throw the arm P backward, thus breaking the circuit between the contact-spring R and the contact-point *r′*, and again closing the circuit through the contact *r* to the type-wheel magnets. This circuit will remain closed so long as the stop m^4 blocks the path of the arm P.

I do not herein specifically claim the laterally and vertically moving yoke, nor the mechanism for bringing the same into the plane of the correcting-bar, nor the mechanism for forcing the yoke against the correcting-bar, as I intend to embody and claim the same in an application, to be hereafter filed by me for Letters Patent, relating to improvements in electric clocks.

I claim as my invention—

1. The combination, substantially as hereinbefore set forth, in a printing-telegraph, of a type-wheel, a platen for effecting the impression of a character upon said type-wheel, a clock or time-piece, a corrector for adjusting the minute-hand of said time-piece, and mechanism, substantially such as described, for actuating said platen and corrector.

2. The combination, substantially as hereinbefore set forth, in a printing-telegraph, of a type-wheel, a platen for effecting the impression of a character upon said type-wheel, a time-piece, a corrector for adjusting the minute-hand of said time-piece, and an electro-magnet for actuating said platen and corrector.

3. The combination, substantially as hereinbefore set forth, in a printing-telegraph, of a platen for effecting the impression of a character upon the type-wheel, a corrector for adjusting the minute-hand of a time-piece, an electro-magnet for actuating said platen and corrector, a line-wire, and two independent transmitters connected therewith, one for actuating the printing-platen and the other for actuating the time-corrector.

4. The combination, substantially as hereinbefore set forth, in a printing-telegraph, of a clock or time-piece, mechanism, substantially such as described, for correcting the position of the hands of said time-piece by the action of the printing mechanism, and means for disconnecting the printing from the correcting mechanism except at stated times or when the correction is to be effected.

5. The combination, substantially as hereinbefore set forth, in a printing-telegraph, of an intermittently-rotating shaft, a radial arm mounted thereupon, a circular range of finger-keys, each of which, when depressed, arrests the rotation of the arm at a predetermined point, a line-wire, a transmitter actuated by said shaft for sending electrical pulsations over said line-wire, a second line-wire, and a yielding contact-lever mounted upon said radial arm, which closes a circuit with said second line-wire when brought into contact with a depressed key.

6. The combination, substantially as hereinbefore set forth, in a printing-telegraph, of an intermittently-rotating shaft, a battery, a line-wire, a series of finger-keys for controlling the movement of said shaft, a pole-changer for sending electric pulsations of alternate polarity from said battery through said line-wire, a second line-wire, and a key or circuit-closer which transmits a pulsation of either polarity over the second line-wire, and is actuated whenever said shaft is arrested by the depression of a finger-key.

7. The combination, substantially as hereinbefore set forth, in a printing-telegraph, of a

type-wheel, an electro-magnet for controlling said type-wheel, a unison-stop, a device for releasing the type-wheel from the control of said electro-magnet while being brought to unison, a constantly-moving time-train, and a circuit-changer operated by said time-train to close a circuit through an independent electro-magnet for actuating said releasing device whenever an intermission occurs in the movement of the type-wheel.

8. The combination, substantially as hereinbefore set forth, of a main line, an electro-magnet included in said main line, a type-wheel controlled by said electro-magnet, a unison device, an independent electro-magnet for controlling the action of said unison device, a circuit-changer for diverting the main-line current from the type-wheel magnet to the unison-magnet during a pause in the movement of the type-wheel, and a time-train and connections, substantially such as described, for actuating said circuit-changer.

9. The combination, substantially as hereinbefore set forth, of a main line, an electro-magnet included in said main line, a type-wheel controlled by said electro-magnet, a unison device, an independent electro-magnet for controlling the action of said unison device, a circuit-changer for diverting the main-line current from the type-wheel magnet to the unison-magnet during a pause in the movement of the type-wheel, and a device moving with the type-wheel for operating said circuit-changer to close the circuit through said type-wheel magnet when the type-wheel is at the zero or unison point.

10. In a printing-telegraph, the combination, substantially as hereinbefore set forth, of the type-wheel, the electro-magnet for controlling said type-wheel, the type-wheel shaft, the escape-wheel, the clutch-wheel longitudinally movable along said shaft, the locking-pin, the spring for normally locking the clutch-wheel and pin together, the fork for disconnecting said clutch-wheel from the pin, the independent electro-magnet for actuating the fork, the circuit-changer, and the device moving with the type-wheel for operating said circuit-changer to close a circuit through the type-wheel magnet when the type-wheel is at its zero or unison point.

In testimony whereof I have hereunto subscribed my name this 25th day of January, A. D. 1882.

ADOLPHUS A. KNUDSON.

Witnesses:

CHARLES A. TERRY,

WILLIAM H. KENYON.