(Model.) 3 Sheets—Sheet 1.

F. B. WOOD & H. J. BROWER.

AUTOMATIC ELECTRIC SIGNAL PRINTING REGISTER.

No. 252,409. Patented Jan. 17, 1882.

Fig 1.

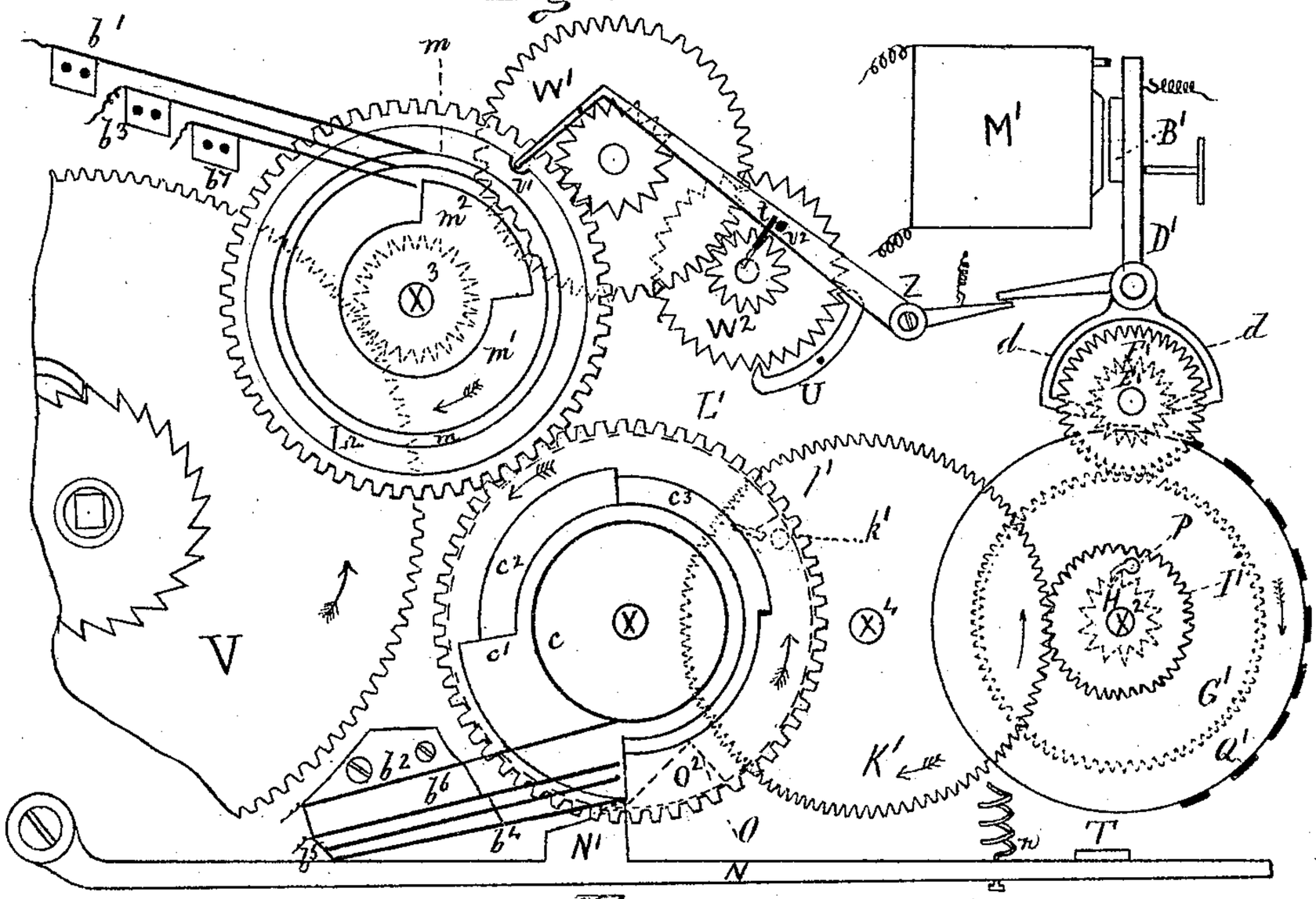

Fig 2.

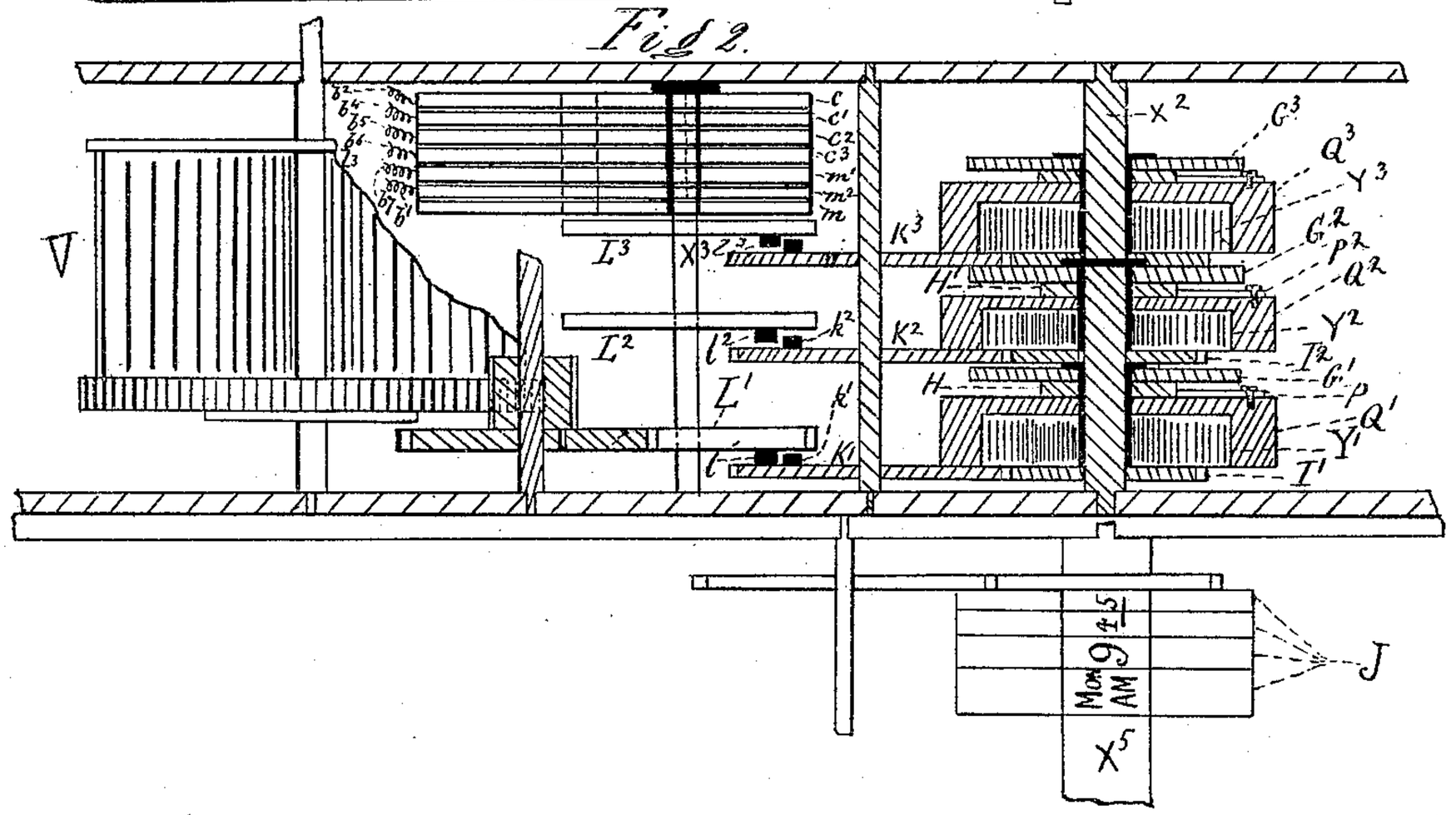

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Fig. 3.

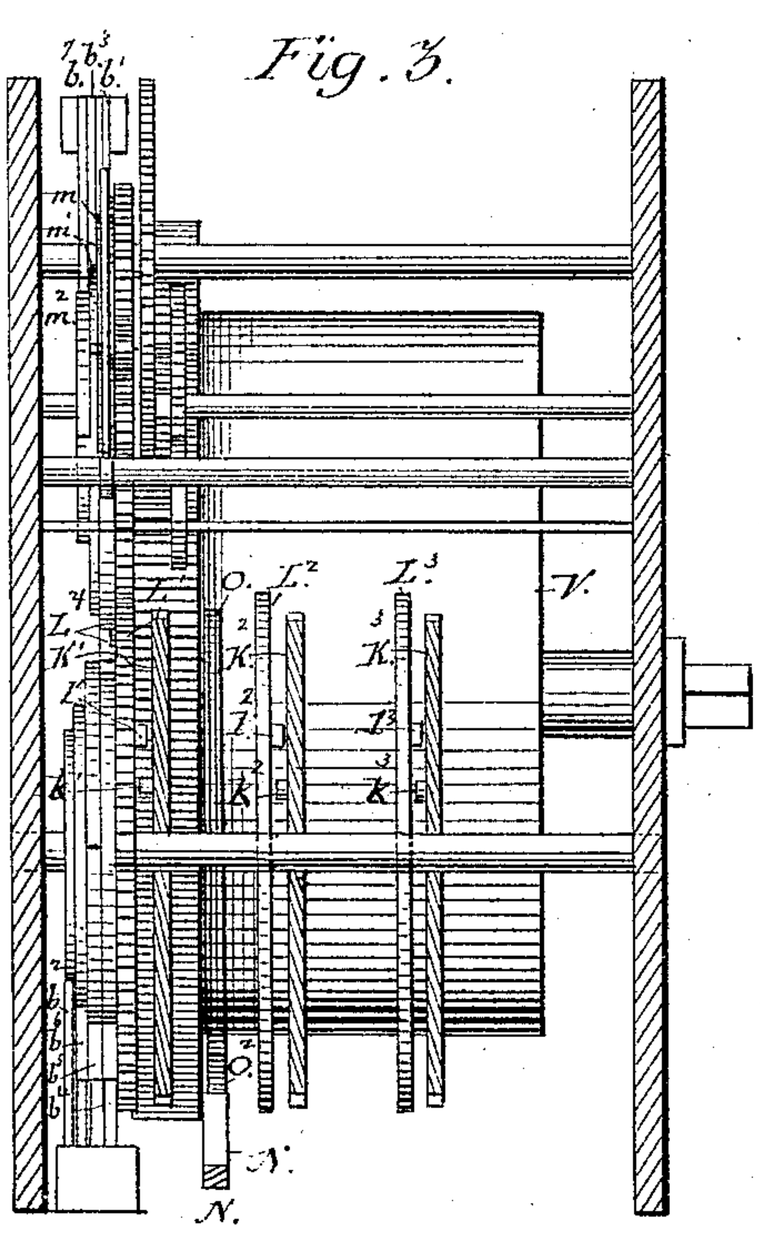
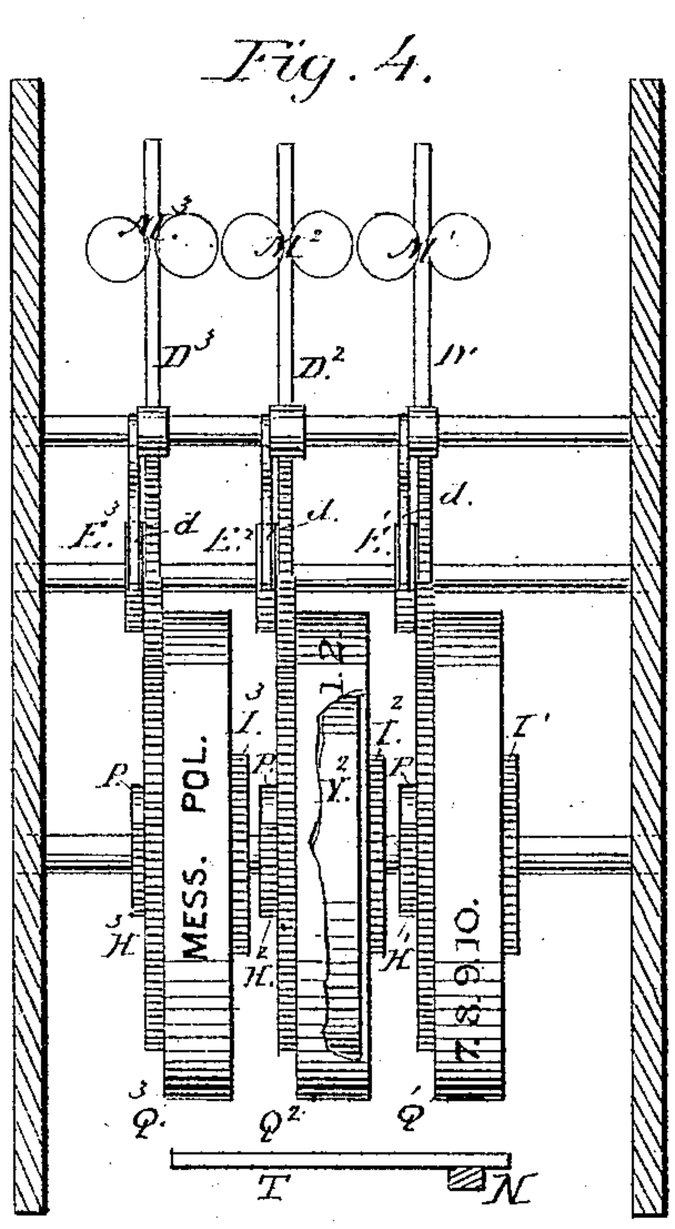


Fig. 4.



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(Model.) 3 Sheets—Sheet 3.

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AUTOMATIC ELECTRIC SIGNAL PRINTING REGISTER.

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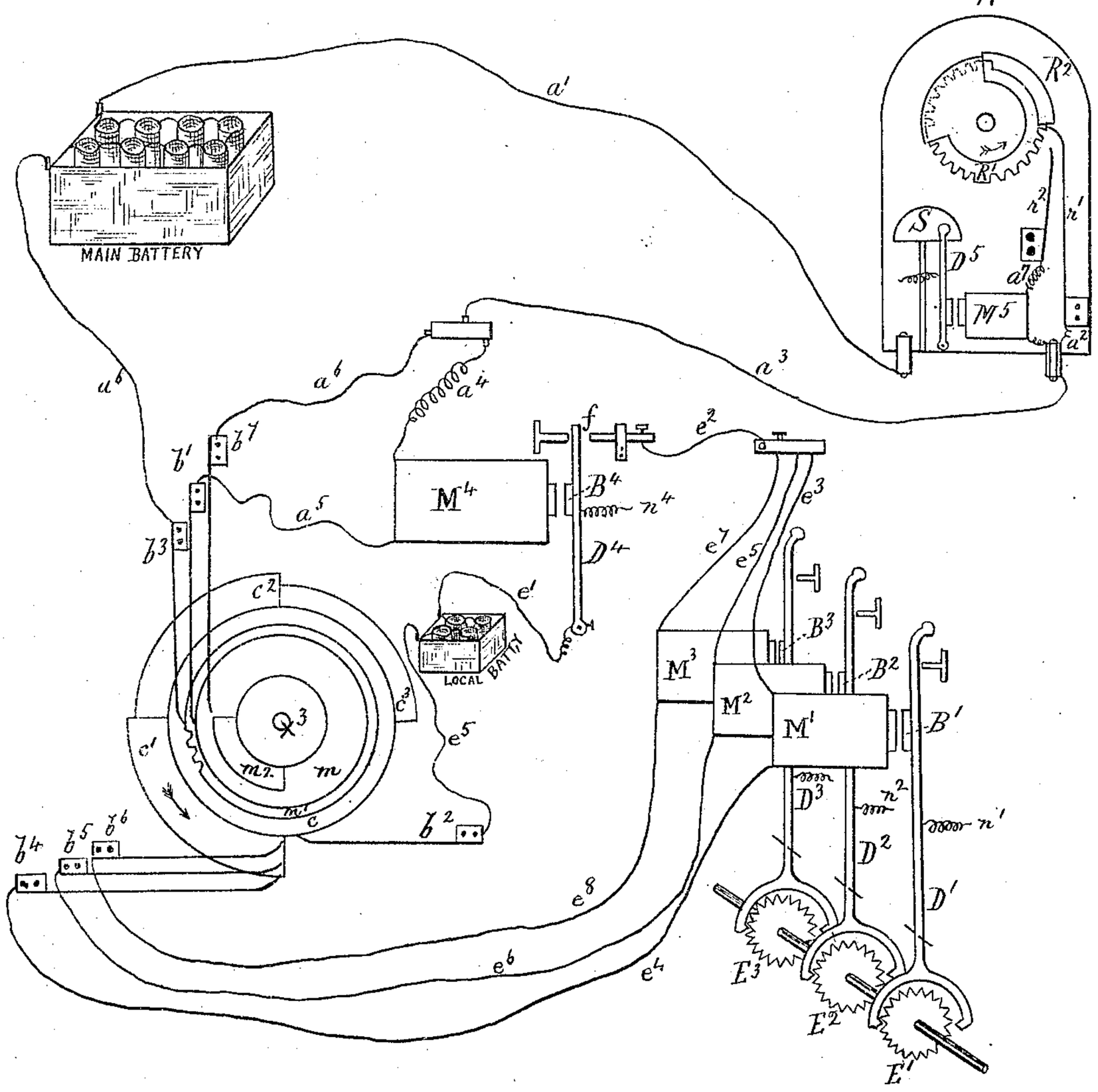
Fig. 5.



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UNITED STATES PATENT OFFICE.

FRANK B. WOOD, OF NEW YORK, AND HENRY J. BROWER, OF BROOKLYN, ASSIGNORS OF ONE-FOURTH TO BENJAMIN E. VALENTINE, OF BROOKLYN, N. Y.

AUTOMATIC ELECTRIC-SIGNAL-PRINTING REGISTER.

SPECIFICATION forming part of Letters Patent No. 252,409, dated January 17, 1882.

Application filed June 13, 1881. (Model.)

To all whom it may concern:

Be it known that we, FRANK B. WOOD, of the city of New York, and HENRY J. BROWER, of the city of Brooklyn, both of the State of New York, have invented an Automatic Electric-Signal-Printing Register, of which the following specification, taken in connection with the drawings annexed to and forming part thereof, furnishes a full and clear description, sufficient to enable those skilled in the art to which it is related to make and operate the same.

In the drawings, Figure 1 is a side elevation of the register used for receiving, recording, and printing the signals and the time when they are received. Fig. 2 is a horizontal sectional view from the top of the said register. Fig. 3 is a section taken through the machine on line *x x*, Fig. 1, looking toward the main drum. Fig. 4 is a similar section, looking toward the register-wheels, with the axle X^4 and the wheels thereon taken away. Fig. 5 is a plan, showing the various electric connections in the system, both of the main circuit and the local circuits, by which the signals are communicated, from the signal-box and recorded at the register and the various changes of electric circuits from the control of one type-wheel to another in the register.

Our invention has relation to the different systems of signaling and telegraphing now in use—such as fire-alarms, district-telegraph calls, hotel-annunciators, &c. In most of these systems the electric signal is sent by a signal-box of ordinary construction, such as is adapted for sending divers calls, and an example of which is shown at A in Fig. 5, the revolution of a notched wheel, R′, breaking the electric circuit and causing the signals occasioned by the breaks to be recorded at the register. At the terminus or central office of the system the signals have (prior to our invention) been usually recorded or announced on a register by the dotting of a paper tape, such as is used in telegraph-offices, or by the stroke of a bell. The ringing of a bell of course leaves no permanent record of the signal, and its use is primarily to attract the attention of the person in charge of the register. The marks usually made upon the tape also are but for temporary purposes, and require a permanent record to be made by hand if the message or signal is to be preserved.

In signal-boxes now in use in the district-telegraph systems it is customary to have divers signals, each one denoting a different purpose or object of the call—*e. g.*, one signal to call a messenger, another to call police, a third for fire, &c.—the several calls being distinguished by the number of breaks in the circuit caused by notches in the signal-wheel.

The object of our invention is to furnish mechanism which shall automatically record and print in type legible to all, at a single impression of printing mechanism, the nature of the call and the source from whence it came by means of the words—*e. g.*, "Messenger, 65," &c.

The printing devices.—In the drawings, Figs. 1 and 2, is shown a system of movable type-wheels having upon their edges or peripheries type adapted for printing, this feature of the mechanism being substantially like the type-wheels used in the canceling and dating stamps well known to the public. The impression is to be made and printed on a strip of paper, which is pressed in the usual manner upon the type-wheels at the point T, an inking ribbon or roller being used to furnish the ink. N is the printing-lever, or means by which the pressure is given which produces the imprint. This lever N is pivoted at one end, while at the point *n* a spring furnishes the force which causes the imprint. N′ is a beveled projection upon the upper part of the printing-lever N, which, bearing against the periphery of the wheel O on the shaft X, keeps the lever N away from the type-wheels during the revolution of the wheel O at all times except when the portion O^2 comes opposite to N′, at which point the projection N′ falls suddenly into the notch O^2, causing an imprint on the paper and inking-ribbon at T, and then by the continuing revolution of the wheel O the projection N′, operating on the beveled side of the notch O^2, causes the printing-lever to resume its original position away from the type.

The register.—The type-wheels Q′, Q^2, and Q^3 are placed upon the shaft X^2, which is sta-

tionary, the type-wheels revolving around it. On the peripheries of the wheels Q′, Q², and Q³ are placed the type denoting the numbers of the signal-stations and the nature of the calls, wheel Q′ having the numerals from 1 to 9, inclusive, wheel Q² the numerals 0 to 9 inclusive, while Q³ has upon it the words "Mess'r," "Police," "Fire," "Cab," &c., in number according to the number of wants the signal-boxes are adapted for. The three wheels Q′, Q², and Q³ being similar in their construction and in their attendant wheels, &c., one of them, Q′, may be taken for description as a sample of the three. Said wheel Q′ is actuated by a spring, Y′, which we prefer to have coiled up within the wheel like the spring in the barrel of a watch. The inner end of this spring is firmly fixed to the shaft *o* X², or to a sleeve interposed between the shaft and the wheel Q′, while the outer end of the spring is fastened to the inner periphery of the wheel Q′. After placing the wheel Q′ on the shaft the spring is wound up by turning the wheel, and is held by the pawl and ratchet H, which allows a movement of the wheel in one direction independent of the other wheels. The spring Y′ is wound up, as aforesaid, sufficiently tight to cause one or more revolutions of the wheel Q′, if permitted to move the same, though in practice it is not intended to move the type-wheels more than a part of a revolution to bring any of the types to the printing-point T. The spring Y′ is allowed to partially unwind and move the wheel Q′ by means of an escape-wheel, E′, hereinafter mentioned, and the spring Y′ is wound up and restored to its original tension by the reversing of the wheel Q′, caused by the movement of the wheel K′, which is geared into the toothed wheel I′, connected therewith. Attached to the wheel Q′, and on the same shaft, is a second wheel, G′, which is geared into the cogs of a smaller wheel, F′, affixed to which is an escape-wheel, E′. In the teeth of the wheel E′ play the pallets *d d* of the double lever D′.

M′ is an electro-magnet used in connection with an armature, B′, moving to and from the magnet M′. This armature, moving the lever D′, will at each semi-vibration allow a single tooth of the escape-wheel E′ to escape, producing a consequent movement of the type-wheel Q′. In practice, for convenience and facility of operation, we prefer to have twenty teeth on the escape-wheel E′ and eighty teeth on each of the other wheels, F′ and G′.

It is obvious from the foregoing that the type on the wheel Q′ may be caused successively to pass (by the revolution of the wheel) to the proper place opposite T for printing their characters, and that to cause any particular type or word to pass down opposite the point, T, it is only necessary to operate the lever D′ a sufficient number of times to allow the requisite escapement. The lever D′, as before stated, has attached at B′ an armature for a corresponding electro-magnet, M′. These are shown in Fig. 5, and the method of vibrating the lever D′ to allow the escapement is performed by opening and closing at the signal-box A of an electric circuit, in which the magnet M⁴ is situated, the said relay closing up and putting in operation, by means of its armature B⁴, to which the lever D⁴ is attached, the local circuit of which the magnet M′ and armature B′ form a part, in the manner hereinafter described.

Upon the shaft X² we place the other wheels, Q² and Q³, constructed and operated in a similar manner to the wheel Q′—that is to say, by inclosed springs Y² Y³ and geared wheels G² G³, with corresponding escapements, E² E³, armatures B² B³, and levers D² D³.

V is a barrel containing a powerful spring, provided with the ordinary ratchet mechanism for winding the same, and having a cog-wheel for gearing into others of the train. This wheel V is geared into a pinion on the shaft X³, thereby causing it to revolve the geared wheel L². It is obvious that a weight on a cord wound on the axle of V can be substituted for the spring inside the barrel V, where a perfectly even power is desired. The revolution of the wheel L² is governed as to speed by the ordinary and well-known escape mechanism, consisting of a train of wheels and a lever or fly-wheel governor, as shown at W′, W², and U. In this connection it should be observed that the wheels L² L′ on the register and the signal-wheel in the signal-box should have their governors so adjusted that they will revolve at the same rate of speed and complete their revolutions simultaneously when started together.

On the pinion of the wheel W² is a shoulder-stop, *t*, which, revolving with the pinion, engages on the pin v^2 on the lever Z and stops the running of the train. At *v′* on the wheel L² is a notch, which allows one end of the lever Z to drop into it and bring the pin v^2 down to engage with the stop on the pinion of W². The other end of the lever Z engages with the escapement-lever D′, as shown in Fig. 1, so that as soon as the armature B′ is moved by its magnet on the closing of the local circuit the lever Z is tripped and the wheels of the train commence to revolve. At the end of one revolution of the wheel L⁴ the end of the lever drops into the notch *v′*, allowing the stop on W² to check the movement of the train until the lever Z is again tripped at a subsequent signal. The relative position of the stop *t* on the wheel W² and the pin v^2 on the lever Z is such that whenever the end of the lever is raised out of the notch *v′* the engagement between said stop and pin will be broken, and the train W′ W² U will move if impelled, but when the point of the lever Z drops into the notch *v′* the pin v^2 will be brought into the line of rotation of the stop *t*, and the engagement of the stop and pin again made and the train brought to rest.

L′ is a wheel of the same diameter and number of cogs as the wheel L⁴, and is designed to revolve simultaneously with L⁴. This may be accomplished by having the teeth of one geared into the teeth of the other, as shown in Fig. 1,

or by affixing them both firmly to the same shaft or axle X^3. There should be, however, a perfect insulation between these two wheels, (or the system of cam-wheels attached to them,) as one of them is a part of the main circuit and the other is a part of the local circuit. Their office is, by means of the said cam-wheels, which they carry with them, to switch off the circuits to and from the relay and to and from the type-wheel levers, respectively.

The return to unison.—K′ is a cog-wheel upon a separate axle, X^4, and geared with the wheel I′, which moves on the same shaft as and with a corresponding movement with the type-wheel Q′, to which it is affixed. It is obvious that as the type-wheel Q′ moves around in the direction of the arrow (under the vibrations of the lever D′ and escapement E′) the wheel K′ will be carried around in the opposite direction by the same force—viz., the spring Y′.

k′ is a pin projecting from the face of the wheel K′ at a point between the axle and the periphery of the wheel, overlapped by the wheel L′. The movement of the type-wheel Q′, carrying the geared wheel K′ in correspondence with it, will carry down the pin *k′* to a point nearer the bottom of the register. The type-wheels Q^2 Q^3 are also worked back to unison by means of the wheels K^2 k^2 L^2 l^2 and K^3 k^3 L^3 l^3. The axles X and X^4 are so placed relatively to each other that the movements of the pin *k′* shall always be within a space covered by a segment of the wheel L′ when the latter is placed in a plane parallel with that of K′. The wheel K′ is so geared that it makes only about one-fifth of a revolution during the greatest contemplated movement of the wheel Q′ and a less distance in proportion to a smaller movement of Q′.

On the wheel L′ is a shoulder or beveled projection, *l′*, which, as the wheel L′ revolves in obedience to the power exerted at V, will during the last part of its revolution engage upon the projection *k′* (at whatever point it may have been carried to by the partial revolution of the wheel K′) and restore it to its original position. The spring or other power at V being so much more powerful than the spring Y′ in the wheel Q′, as soon as the projection *l′* comes in contact with the pin *k′* it reverses the movement of the wheel K′, and, in consequence of the gearing of the latter, will reverse also the movements of the wheels I′ and Q′, thereby winding up the spring Y′ and carrying the type on the wheel back to their original position or to unison, ready to receive and record another signal. The ratchet-wheel H, with its pawl connected with the wheel G′, prevents the wheels G′, H′, F′, and E′ from reversing with the other wheels, I′ and Q′, in consequence of the movement of the wheel K′, and allowing only a forward movement in one direction by said wheels in obedience to the escape mechanism.

By reference to Figs. 1 and 2 it will be seen that the position of the shoulder *l′* on the wheel L′ with reference to the pin *k′* on the wheel K′, when the lever Z is dropped into the notch *v′* on the wheel L^2, is just immediately above or past said pin, and that the wheel L′ will make almost an entire revolution before the shoulder *l′* is brought to travel over the arc of the wheel K′, within which the pin *k′* moves with the wheel. It will be remembered that the widest range of movement in the wheel K′ does not take the pin *k′* out of the arc over which the shoulder *l′* travels. It will also be remembered that the wheels L′ L^2 have unison-gear. Now, when the lever Z is tripped by the action of the escape-lever D′, (which is done at the first movement of the armature B′,) the wheel L^2 is released, and, impelled by the spring in the barrel V, is turned with a velocity regulated by the train W′ W^2 U. The wheel L^2 is moved with equal speed, and its revolution brings the shoulder *l′* around beneath the axis X and on until it begins to move over the arc of the wheel K′, in which the pin *k′* moves. During the time the wheel L′ is making the portion of its revolution just described—*i. e.*, bringing the shoulder *l′* from a point above the pin *k′* around to a point beneath it—the register-wheel Q′ has been set to the proper number by the vibrations of the armature B′ working the escape mechanism D′ *d* E′, and the printing-lever N T has been sprung and made the required impression, and, as a consequence the wheel K′ has been turned more or less in the direction of the unbarbed arrow and the pin *k′* brought farther down the arc covered by the shoulder *l′*. The shoulder *l′* starts over the arc of the wheel K′, which it covers, and comes in contact with the pin *k′* sooner or later, according to the distance backward the pin *k′* has been carried, which will be in accordance with the distance the register-wheel Q′ is turned. When the shoulder *l′* meets the pin *k′* the superiority in strength of the impelling-force furnished by the large spring in the barrel V overcomes the force of the spring Y′ in the wheel Q, which has thus far moved the wheel K′, and the motion of the wheel K′ is reversed. The shoulder *l′*, acting against the pin *k′*, drives the wheel K′ in the direction of the barbed arrow until the pin *k′* is past the arc over which the shoulder *l′* moves, when the register-wheel will be found to be brought back to zero. The same operation has taken place with reference to the register-wheels Q^2 Q^3, and this connected gear and all of the wheels will be back to unison. The wheels L^2 L′ are now brought to rest by the lever Z dropping into the notch *v′*, and the train W′ W^2 U is caught by the stop *t* and pin v^2. When another signal is given the lever Z will be again tripped, the printing-wheels started, and the operation repeated.

O, as heretofore stated, is a wheel on the same shaft X as the wheel L′, and has the features, already described, which trip the printing-lever N.

The consecutive movements of the register.—From the foregoing it will be seen that if by proper instrumentalities the type-wheel Q′ is

moved to any desired position before the notch o^2 on the wheel O arrives opposite the projection N, when the last-mentioned event takes place there will occur, through the instrumentalities of the wheels O and L′, respectively, as they revolve on the same axle, first, an impression by the printing-lever N, and subsequently the restoration of the type-wheels to their original position, winding up again to their original tension the inclosed springs Y′, &c. The projections l' and k' are so placed on their wheels I′ and K′—viz., by having l' on that part of L′ which in the beginning of its revolution is most remote from contact with k'—that they do not engage with each other until after the act of printing has been accomplished.

It is obvious that the number of printing-wheels which may be placed on the shaft X^2 may be increased to suit the demand; but in practice two wheels, Q′ and Q^2, to print the numbers to indicate the station whence the signal is sent, and one, Q^3, to print nature of the call, will be found sufficient. Each of the type-wheels Q^2 Q^3 moves on the fixed axle X^2 by means of springs Y^2 Y^3, as in the case of Q′, and are provided with similar wheels, escapements, levers, armatures, magnets, &c., as are provided for Q′ in G′, H′, I′, E′, F′, D′, B′, and M′, and are respectively returned to unison by wheels K^2 K^3, fixed on the shaft X^4, which actuates them all simultaneously with the movements of K′.

The circuit-switching wheels, &c.—m, m', and m^2, and c c' c^2 c^3 are a series of wheels on the shafts X^3 and X, respectively, used for forming contacts with springs or "scraping-connections," to open and close electric circuits, as hereinafter described. These contact-wheels are shown in Fig. 1 on the two shafts X^3 and X, alongside of the wheels L^2 and L′ respectively; but inasmuch as, as before stated, L^4 and L′ may be placed upon the same axle X^3, the contact-wheels in that case are all more conveniently placed side by side on the same axle, as shown in Figs. 2 and 5. Of these contact-wheels c, c', c^2, and c^3 are in the local circuits—*i. e.*, the circuits which operate the magnets M′, M^2, and M^3. The other wheels, m, m', and m^2, are in the main circuit, or circuit on which the signal-boxes are stationed. Circuits are formed through these wheels by contact of their surfaces with circuit-breakers or flexible springs affording a scraping-connection, (shown in the drawings by b' b^2 b^3 b^4 b^5 b^6 b^7.) Each of the wheels c', c^2, c^3, and m^2 has a cam or projecting segment on about one-fourth of its periphery, so that during one-fourth of a revolution a circuit will be formed through it by means of its connecting-spring or circuit-breaker, and thrown off again during the balance of the revolution. Of these contact-wheels, m of the main circuit and c of the local circuit are always in contact with the scraping-connections b' and b^2, respectively, and m' of the main circuit is always in contact with the contact-spring b^3, except at the notches shown on its periphery, which are on the last quarter of its revolution, and are used for breaking the circuit to send a return signal to the signal box A, as hereinafter described. The cam-wheels m^2 of the main circuit and c', c^2, and c^3 of the local circuits are so arranged on their shaft that their operating-cams shall come in contact with and leave their respective contact-springs or circuit-breakers as follows: c', during the first quarter of revolution; c^2, during the second quarter of revolution; c^3, during the third quarter of revolution, and m^2 during the last quarter of revolution.

The operation of the different circuits.—The system by which the divers local circuits are operated and the type-wheels moved and controlled is shown in Fig. 5, where A represents the signal-box on the main line (at a point remote from the register,) from which a signal is to be sent.

M^4 is a relay-magnet at the central station where the register is placed.

As the construction of the register has been explained, and is shown in detail in Figs. 1 and 2, we show in Fig. 5 only so much or such parts of the register in their relative positions as is necessary to illustrate the workings of the electric circuits—viz., the escapement-wheels E′ E^2 E^3, used in connection with the type-wheels Q′ Q^2 Q^3 and their respective levers D′, &c., and magnets M′, &c.; also, the circuit-breakers and the contact-wheels, hereinbefore referred to, which are all placed on the shaft X.

The signal-box being in a normal position with its signal-wheel R at rest, the electric circuit throughout the main line will be as follows: Commencing at the main battery, by the wire a' to the signal-box, and from the signal-wheel R′, through the contact-spring or circuit-breaker r', out of the signal-box, along the wires a^2 a^3, through the relay M^4, along the wires a^4 a^5, through the contact-spring b', the wheels m m', and by the contact-spring b^3, along the wire a^6 to the main battery again. As soon as the signal-wheel R′ commences to revolve and break the circuit by the notches on its periphery and circuit-breaker r' the armature B^4 is drawn by the spring n^4 away from the relay-magnet M^4. The lever D^4, on which is the armature B^4, leaving the relay-magnet M^4, is drawn by the spring n^4 to the point f, where by its contact it closes and puts in operation a local electric current on the register as follows: Commencing at the local battery, along the wire e' and lever D^4, the wires e^2 and e^3, the electro-magnet M′, wire e^4, contact-spring b^4, into the cam-wheel c', out through the wheel c, along the contact-spring b^2 and wire e^5, back to the local battery. At each opening and closing of this local circuit by means of the lever D^4, operated by the main line and relay, the magnet M′ will operate on the armature B′ and vibrate the lever D′, permitting the movement of the escape-wheel E′, whereby the type-wheel Q′ will be stepped forward,

one space for each break of the signal-wheel R′, until the number of notches shown on the first quarter of the signal-wheel (being in the case shown by the drawings six in number) have progressed the type-wheel Q′ a corresponding number of stages, thereby bringing the figure 6 opposite the impress-point T of the printing-lever N.

It will be borne in mind that the axle X^3 (and also X if the contact-wheels are placed on two axles) is so adjusted as to revolve at the same time and same rate of speed as the axle of the signal-wheel R′. By the time therefore that the signal-wheel R′ has by its revolution announced the number of breaks on its first quarter the revolution of the axle on which the wheel c' is placed will have carried the cam of c' away from contact with the spring b^4 and will have brought the second contact wheel or cam of c^2 in contact with the spring b^5, the effect of which is to put the magnet M′ out of the local circuit (stopping the vibration of the lever D′ and the movement of the escape-wheel E′) and throwing the local circuit through the magnet M^2, which thereupon brings into play its own armature and the lever D^2. During the second quarter of revolution of the signal-wheel R′ the breaks on its periphery (in this case five in number) operate the second type-wheel, Q^2, so as to bring the corresponding figure to the point of impact of the printing-lever N, thus setting the type to print the number of the signal-station. The revolution of the signal-wheel R′ having been advanced to the end of its second quarter, the wheels on the axle X^3 will have been advanced in their revolution to the ends of their second quarters, respectively. The contact between the cam c^2 and the spring b^5 will have terminated, and a new local circuit formed through the cam-wheel c^3, the spring b^6, and third magnet, M^3, over the intervening wires e^7 e^8. This third local circuit operates the lever D^3 by means of its armature attached, and permits the escapement of the wheel E^3 and consequent advancement of the third type-wheel, Q^3, on the periphery of which are placed the type for printing the nature of the signal—such as "Mess'r," "Police," &c. The number of spaces which the third type-wheel, Q^3, is stepped forward is controlled by the number of notches left uncovered on the third quarter of revolution of the signal-wheel R′. At the end of the third quarter of revolution of the signal-wheel R′, and the consequent setting in position desired of the type-wheels Q′, Q^2, and Q^3, the notch o^2 will be brought to its proper position, as hereinbefore described, to cause the printing-lever N to take an imprint from the type, while during the completion of the fourth quarter of revolution of the axle X^3, the type-wheels Q′, &c., are restored to unison, or their original position by the wheels K′, &c.

The return signal.—During this fourth or last quarter of revolution a return signal is transmitted from the register to the signal-box A, automatically, for the purpose of announcing to the sender of the signal the fact that his message has been duly received and registered at the central station. To accomplish this return signal our system automatically forms a new circuit on the main line during the fourth quarter of revolution of the axle X^3 and the signal-wheel R′. The normal circuit on the main line is, as already stated, so far as the signal-box A forms a part of it, from the signal-wheel R′, through the contact-spring or circuit-breaker r', directly out of the box at a^2. The new circuit on the main line is formed by having on the last quarter of revolution of the signal-wheel R′ the periphery of the wheel cut away, so that no contact will take place between the surface of the wheel R′ and the circuit-breaker r' during that portion of the revolution. At the side of the signal-wheel R′, however, at that portion—viz., the last quarter of revolution—is affixed a cam, R^2, which, during the last quarter of revolution of the wheel R′, forms a contact with the spring or circuit-breaker r^2, opening a circuit, through intervening wires a^7, into the magnet M^5 and out of the box, onto the main line at the same point where the original circuit left the box. S is a bell, operated by a lever, to which is affixed the armature of the magnet M^5. The lever D^5 is drawn by the armature toward the magnet M^5 when the circuit is formed through the magnet, and is thrown by a spring against the bell when the armature is released from the magnet by the breaking of the circuit. By the new circuit inside the signal-box the bell S will be rung whenever during the existence of this new circuit it is broken. This is accomplished by the wheel m', which revolves with the axle X^3 on the register. This wheel m' has been in contact with the spring at all times during the first three quarters of its revolution, but has on the last quarter of its periphery one or more notches to break the contact with the spring b^3, thereby opening the circuit and ringing the bell S in the signal-box. This "cutting in" of the circuit through the magnet M^5 in the signal-box and ringing of the bell by the notched wheel m' of the register will take place during the last quarter of revolution of the signal-wheel R′ and of the axle X^3, after the original signal has been received and printed at the register and while the type-wheels Q′, &c., are being restored to unison.

The return signal, forming the subject of another application for patent, we lay no claim to here.

Cutting out the relay.—The next feature of our invention provides a method of automatically "cutting out" the relay-magnet M^4 during the aforesaid fourth quarter of revolution while the return signal is being given. It is a fact well known to those familiar with electro-dynamics that if there are two or more electro-magnets in circuit upon the same line, in order to operate the armatures of all of them simultaneously under a given electrical current, the power of resistance of the respective mag-

nets must be similar. Thus if the magnet M^4 of the relay is of one hundred ohms, the magnet M^5, operating the bell in the signal-box, must also be of one hundred ohms, or thereabout, otherwise only one of them—viz., the stronger—would operate its armature when the current was sent through both. The magnet M^4 usually required at the relay, is of comparatively high power, and if a magnet of like number of ohms were placed in each signal-box on the main line, the expense would be unnecessarily great. A magnet of only a few ohms' resistance is sufficient to operate the bell in the signal-box if the effect of the relay-magnet M^4 can be overcome during the period when said bell is to be sounded. We overcome the effect of the relay-magnet M^4 by automatically cutting it out of the circuit during the time when the return signal is to be sent through the magnet M^5, which period, it will be remembered, is the time occupied by the last quarter of revolution of the wheel R′ and the axle X^3. The normal circuit on the main line is, as heretofore stated, from the wheel *m*, by the contact-spring *b′*, along the wire a^5, and through the relay-magnet M^4, by the wire a^4, to a^3. As the electric current always takes the shortest course between two points, if a more direct connection is made between the wheel *m* of the register and the wire a^3, running to the signal-box, the current will pass along the more direct route and obviate the effect of the relay-magnet. This short cut is provided during the last quarter of revolution of the axle X^3 by the cam-wheel m^2, which, during the last quarter of revolution, comes in contact with the spring b^7, thereby switching the current off the longer route, a^5, which runs through the relay M^4, and sending it along the shorter line a^6, which connects with a^3 at a point beyond the relay. The effect therefore of the fourth quarter of revolution of the wheel R′ will be to cut in upon the main circuit the bell and magnet M^5, while during the same period of time the effect of the fourth quarter of revolution of the axle X^3 is to cut out from the main circuit the powerful relay-magnet M^4, and during the same time to break the main circuit on the wheel *m′* of the register, so as to ring the bell in the signal-box. The completion of the revolution of the axle X^3 and the signal-wheel R′ restores the circuits and contacts to their original and normal positions, ready for any further signals.

The time-registering system.—The foregoing portion of this specification describes the means by which the nature of the signal and the station from which it is sent may be automatically printed by the register; but it is often important that the time when the signal is sent shall be also noted in connection with the registry of the signal. Our invention provides for the combination with such register of an automatic system for printing the day, hour, and minute when such signal is received. In this part of our invention we combine with our register an old invention, which, apart from the combination in which we use it, is well known to the public. It consists of an automatic time-stamp, an example of which is shown in its details in Letters Patent No. 215,195, granted to Frank B. Wood, one of the undersigned inventors, on the 6th day of May, 1879, wherein a series of type-wheels to print the day, hour, minute, &c., are moved intermittently by a spring controlled by a lever tripped once each minute by the movements of a time-piece. The revolving type-wheels for printing time, as aforesaid, are of substantially the same size, and with type of corresponding character, as the type-wheels Q′, &c., on the axle X^2. The axle X^5 on which the time-printing wheels revolve is independent of the axle X^2, on which the type-wheels Q of the register revolve, but is placed end to end with said axle X^2, so that all the type-wheels (both the signal-printing and time-printing) shall revolve in parallel planes side by side, the movements of the time-printing wheels J being controlled by a chronometer, as described in said prior patent, and the movements of the signal-printing wheels being controlled by the electric circuits, as described in this specification. Both sets of wheels, however, impress their type on the same paper simultaneously by the movement of the lever N, the printing-tablet or contact-surface of which extends across all the type-wheels of both classes.

In the drawings the position of the time-printing wheels is shown at J in Fig. 2.

Having already, as above stated, obtained a patent on the time-printing mechanism, and as we claim it herein only as a unit, not as to any of its component parts, we have not deemed it necessary to illustrate or describe it further.

Having thus described our invention, we do not limit ourselves to all the details of construction which are shown as the most convenient way of putting our invention into practice, nor do we limit ourselves to the combined working of all the features, for it is obvious that some of the features—*e. g.*, the automatic return signal, &c.—may be useful independently of the printing mechanism. On the other hand, we do not wish to be understood as claiming, broadly, the operating of type-wheels by electricity, nor, broadly, a time-printing machine; but

What we do claim as our invention, and desire to secure by Letters Patent, is—

1. In a register, constructed substantially as described, for recording electric signals, the combination of the intermittently-moving type-wheel Q′, the spring Y′, the escapement-lever D′, and its intervening mechanism for permitting an intermittent movement of Q′, the electro-magnet M′, with its armature for governing the intermittent movements of the escapement-lever, and the engaging-wheels L′ and K′, with their trains, substantially as described, for winding up the spring Y′ and returning the type-wheels to unison.

2. In a register for recording electric signals,

the combination of two or more intermittently-moving type-wheels, Q′ Q², &c., with their governing and actuating attachments Y′, &c., E′, &c., D′, &c., substantially as described, with the cam-wheels *c c′ c²*, &c., and contact-springs or circuit-breakers *b² b⁴ b⁵*, &c., and electro-magnets M′ M², &c., for changing the local circuits successively through said magnets, substantially as and for the purposes specified.

3. The combination of a signal-printing register, substantially as described, whose intermittently-moving type-wheels are controlled by the electro-magnets M′, &c., of a local electric circuit, and a time-printing register, substantially as described, whose type-wheels are controlled by a chronometer or time-piece, with the printing-lever N, automatically operating, substantially as described, to imprint by the same impress both the electric signal and the time when it is received, substantially as specified.

4. The combination of one or more signal-boxes, A, the main line of an electric circuit, a relay, and an automatic printing-register, (forming part of a local circuit,) constructed with a series of spring register-wheels having escapements operated by the electric current for moving them, and with a counter-moving mechanism which is impelled by a force superior to that of the register-wheels, and which engages with them during a part of its revolution to throw them back to unison after the printing is done, so that the electric signal and number of the station from which it is sent will be automatically recorded and printed, and then a return signal automatically sent to the signal-box, and the parts restored automatically to their original position by the mechanism herein described, or its equivalent.

5. In a signal-register having a type-wheel or series thereof, mechanism to operate the same, as described, to present the desired number or mark at a given point, and provided with a spring or springs which impel the wheel or wheels in one direction, in combination with means for reversing said register wheel or wheels and bringing them back to unison, consisting of a trip mechanism and unison-wheels impelled by a greater force than the register-wheels, having engagement with the register-wheels during only a part of their revolution, substantially as set forth.

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HENRY J. BROWER.

Witnesses:
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