(No Model.) 4 Sheets—Sheet 1.

C. L. BUCKINGHAM.

PRINTING TELEGRAPH.

No. 487,981. Patented Dec. 13, 1892.

Fig. 1.

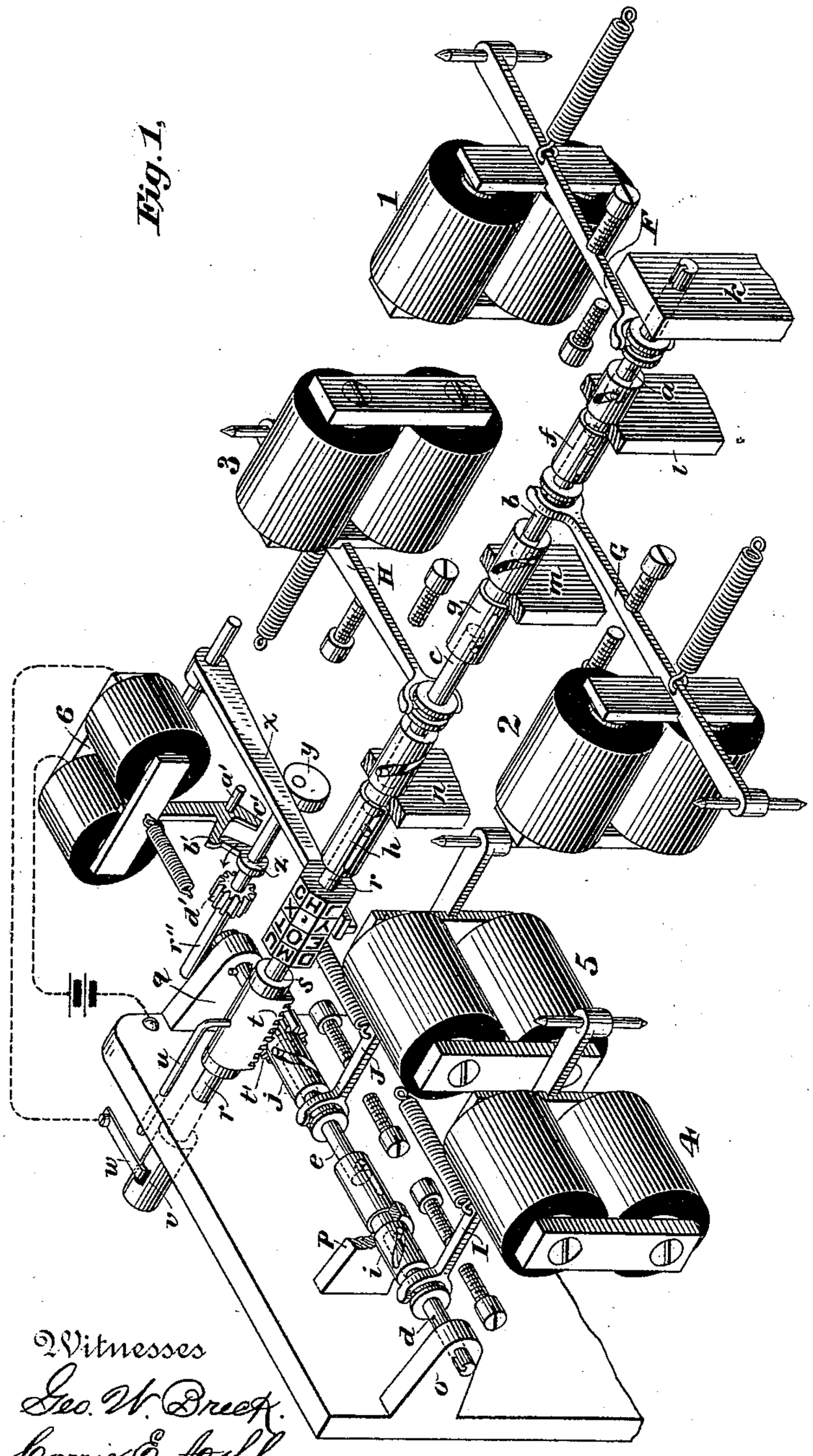

Fig. 2.

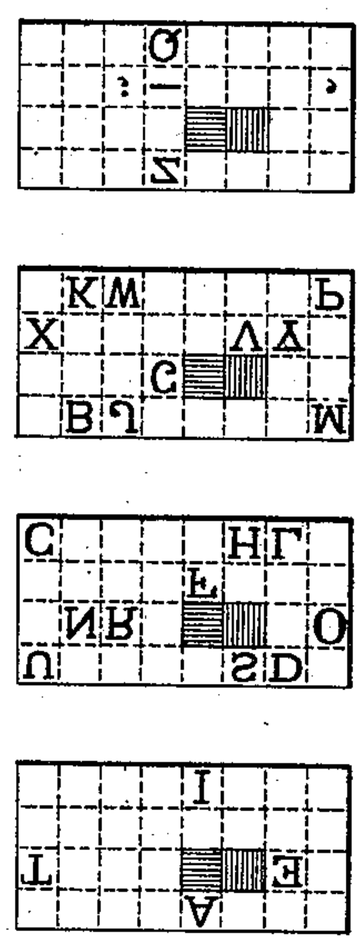

Fig. 3.

Witnesses
Geo. W. Breck.
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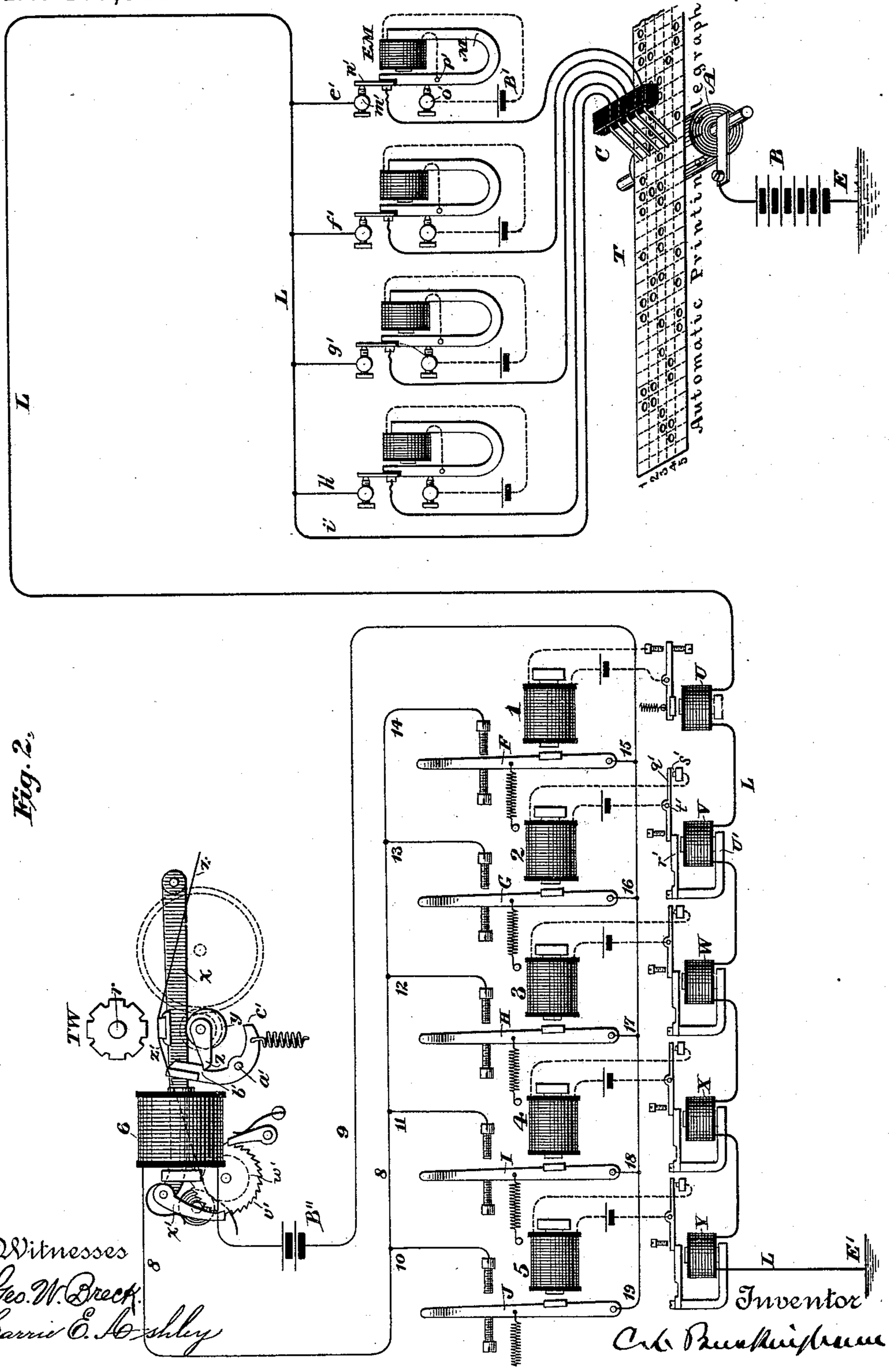

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4 Sheets—Sheet 3.

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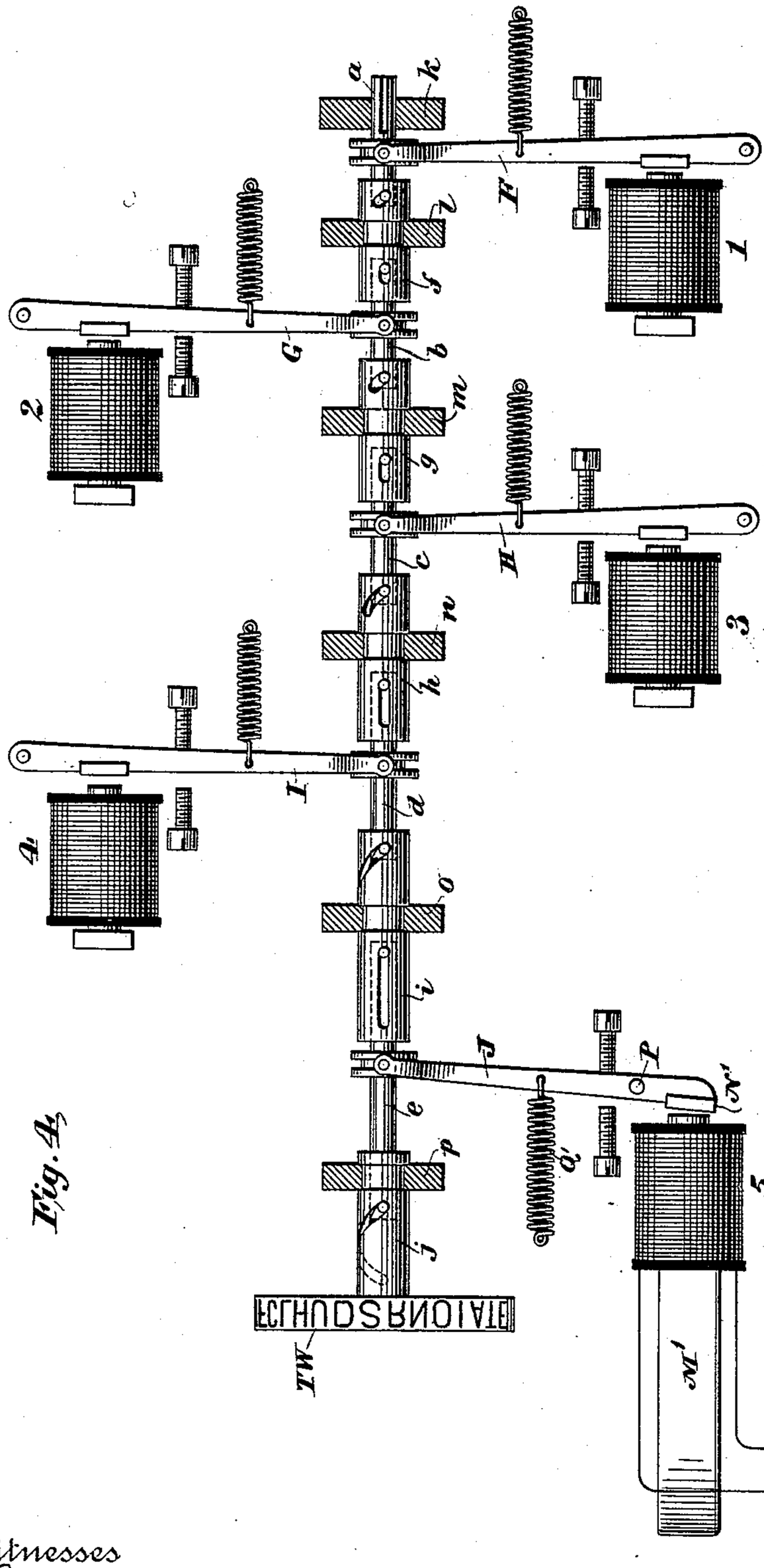

Fig. 4.

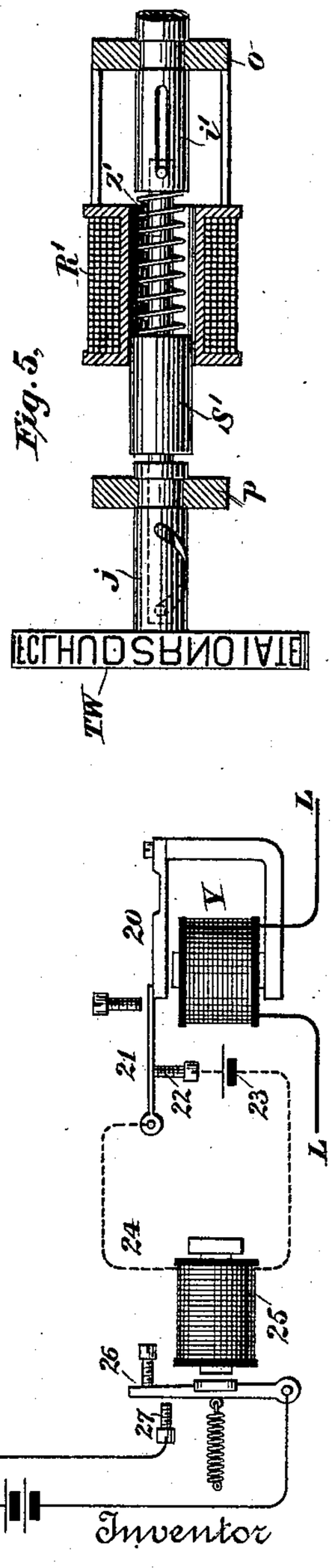

Fig. 5.

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(No Model.) 4 Sheets—Sheet 4.

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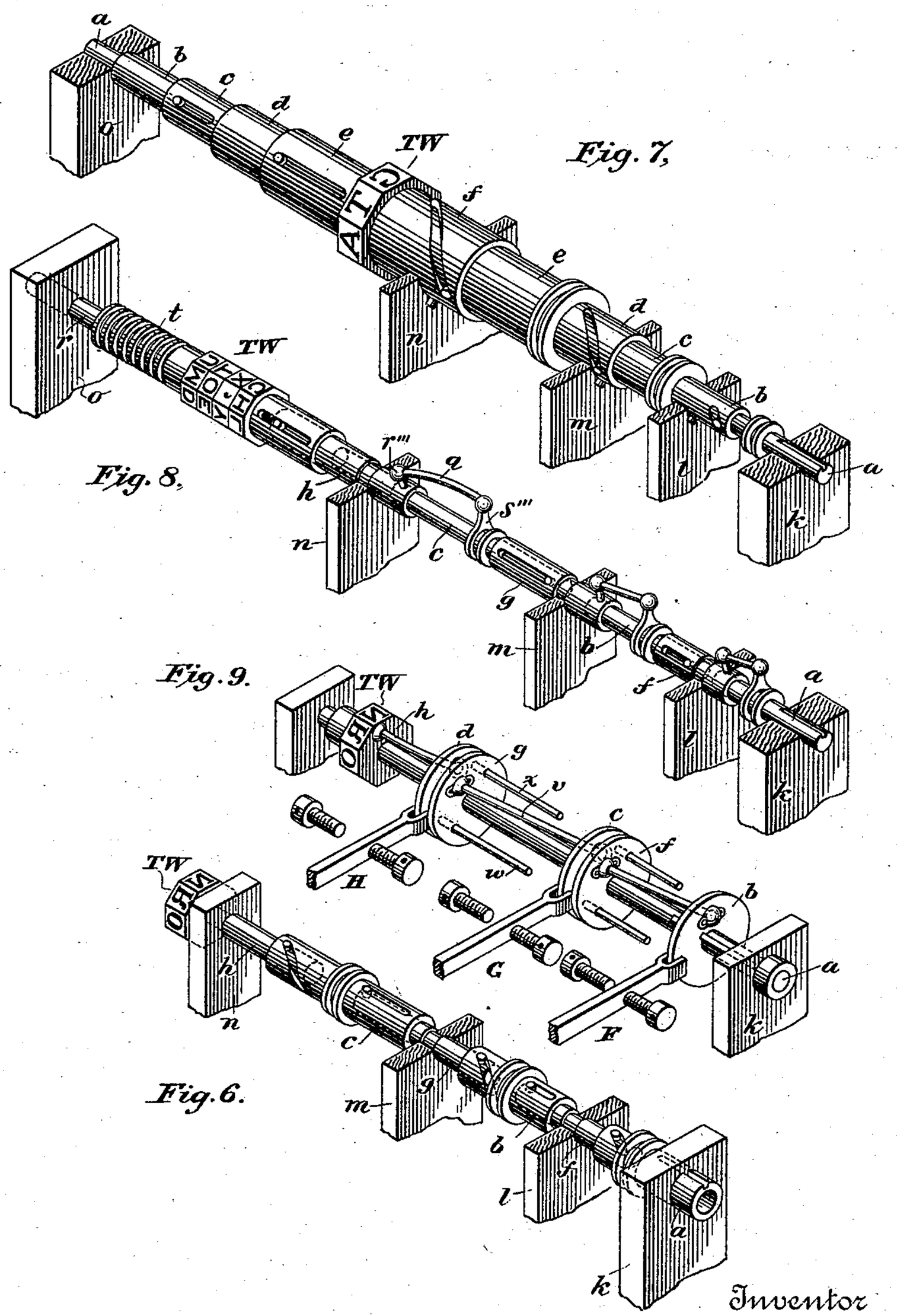

Fig. 7.

Fig. 8.

Fig. 9.

Fig. 6.

Witnesses
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Carrie E. Ashley

Inventor
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UNITED STATES PATENT OFFICE.

CHARLES L. BUCKINGHAM, OF NEW YORK, N. Y.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 487,981, dated December 13, 1892.

Application filed November 10, 1888. Serial No. 290,449. (No model.)

To all whom it may concern:

Be it known that I, CHARLES L. BUCKINGHAM, a citizen of the United States of America, residing in the city, county, and State of New York, have made a new and useful Improvement in Printing-Telegraphs and Printing-Machines, of which the following is a specification.

My invention consists of an improved telegraph system in which messages are automatically transmitted through the medium of strips of perforated paper and received by a printing-machine in Roman or other typographical characters, the transmissions, whether one or more for each character of a message, being effected within the time required to send a single impulse over the main line.

I employ an improved printing-machine, in itself new, in which the type-wheel is positively rotated by a series of independent impelling devices, each being provided with a driver and follower and through them possessing a definite capacity for positively rotating or pushing the type-wheel into a position of adjustment for printing, and while such capacities or ranges of action are preferably represented by the terms of the series one, two, four, eight, sixteen, &c., I wish it to be understood that I do not in any wise limit my invention in such proportions. Normally the drivers which alternate with the followers throughout the series together form a rigid connection or shaft from the type-wheel to the last driver of the system. Each driver, however, is capable of independent movement and is so geared with the followers on either side that the part of the shaft toward the type-wheel is given rotation by positive action, while the other part is left unmoved. It results from this construction that the type-wheel may be given a certain degree of rotation or movement by one impelling device and an additional movement by one or more of the others when brought into action, either simultaneously or successively, and thus it is that the type-wheel may be moved a distance by the conjoint action of two or more of the impelling devices equal to the sum of the spaces through which it is actuated by them separately.

Obviously the part of my invention relating to the printing-machine is not limited to specific forms of apparatus, for any one of a large variety of arrangements may be employed, in which a driver will positively actuate the follower and succeeding parts on the type-wheel side, leaving the drivers and followers on the other unmoved. The serial impelling devices may be operated by a series of receiving-instruments placed in a single main line through the agency of any of the many known systems of simultaneous transmissions. By this means all or any number of the impelling devices may be operated at the same time, as is ordinarily done in multiple telegraphy, and the type-wheel given any desired degree of rotation, all within the time required for transmitting a single impulse; but, if desired, each receiving-instrument may be operated by a separate main line or two or more receivers may be placed in one of several circuits.

In carrying out my invention I prefer to employ five receiving-instruments and a like number of impelling devices having capacities, respectively, for rotating the type-wheel through spaces equal to one, two, four, eight, and sixteen characters upon its periphery, they being adapted to the operation of a type-wheel having thirty-two divisions. With this arrangement every division of the type-wheel may be brought into position for an impression by operating the impelling devices either singly, in minor combinations, or all together, and in no case will it be necessary to call into action any of them more than once to adjust the wheel for printing, since the distance from the initial or zero point of the wheel to any character is represented by the rotation due to the single action of some one or more of said devices.

My invention further consists of a type-wheel having three or more (preferably four) rings of type, in combination with apparatus for adjusting it in one direction or the other from an intermediate position along its axis.

It also consists of improved means for rotating the type-wheel to the right or the left from its initial point, according to the character to be printed, thus rendering its complete rotation unnecessary.

It also consists of various details of construction fully described in the following specification.

Figure 1 is a perspective view showing my preferred form of receiving-instrument. Fig. 2 shows a diagram of circuits and the arrangement of magnets at both stations of my system, and also press mechanism and paper-feeding devices. Fig. 3 shows several developments of the type-wheel and the characters thereon, which are brought into position for printing by the various receiving-magnets when operated singly, altogether, and in minor combinations. Fig. 4 illustrates a type-wheel having only one ring of type with impelling devices and other apparatus for positively effecting its rotation. Fig. 5 shows a modified form of impelling device and driver for rotating the type-wheel. Figs. 6, 7, 8, and 9 show modified forms of apparatus for positively rotating the type-wheel to any required position by the single action of one or several impelling devices.

Fig. 4 shows a wheel T W, having a single ring of type and mechanism for rotating the same, consisting of a series of impelling devices F G H I J, a series of axially-moving drivers *a b c d e*, and a series of rotating followers *f g h i j*, with which the drivers engage. Each of the drivers is provided near its middle with a collar having a peripheral groove, within which project pins extending from the prongs of the impelling device by which it is operated, while at each end, excepting driver *a*, it is provided with a radial pin. That one of the pins nearest the type-wheel works within a spiral groove formed in the shell of the adjoining follower and the pin at the other end of the driver slides within the longitudinal slot of the preceding follower. Driver *a*, being provided with an axial slot engaging with a feather of the bearing *k*, is rendered incapable of rotation and only has capacity for longitudinal or axial movement. Likewise rotating followers *f g h i j* are provided with peripheral grooves, which prevent axial movement along their respective journal-bearings *l m n o p*. Throughout the series the slots in each follower are twice the length of those of the preceding one, and by them the range of movement of the corresponding impelling device and driver is limited, and thus they are given ranges of action represented by the terms of the series one, two, four, eight, and sixteen. It will now be seen that the operation of impelling device F imparts only an axial movement to driver *a* and a rotary movement to follower *f*, and with it type-wheel T W and all intermediate parts, thus rotating the type-wheel from its initial point the space of one letter. By the operation of impelling device G by itself driver *b* is given an axial movement twice as great as that previously imparted to *a*, thereby rotating the follower *g* and the type-wheel the space of two characters; but while the axial movement of driver *b* serves to rotate follower *g* follower *f* remains unmoved. In like manner the axial movement of driver *c* rotates follower *h* and the type-wheel as well four spaces, at the same time leaving follower *g* quiescent. Driver *d*, when separately moved by its impelling device, rotates follower *i* the space of eight letters without moving follower *h*, while follower *j* is rotated sixteen spaces by driver *e* without disturbing follower *i;* but it is in no manner essential that the impelling devices be operated singly or successively, for they may equally well be simultaneously brought into action in twos, threes, fours, or all together. If any two are simultaneously operated, it is now clear that the movement imparted by one will supplement that of the other and that the angle of rotation imparted to the wheel by their simultaneous action will equal the sum of the movements due to them when worked singly, and the same is true whatever the number of impelling devices simultaneously operated.

With the five impelling devices already described and a type-wheel having thirty-two spaces the latter may be thrown to any desired position by the single action of one or more of them, and it is also to be observed that, while the wheel is adjusted to any required position at a single bound under the single action of one or by the simultaneous operation of two or more impelling devices, it is also returned to its zero or initial position by one movement through the retracting devices acting in opposition to magnets 1 2 3 4 5 after an impression has been taken.

From the foregoing it will be seen that the mechanism for determining the movement of the type-wheel is greatly simplified over existing apparatus for accomplishing the same result and is practically limited to the form and space of an ordinary shaft, it being made up in Figs. 1, 4, 5, 6, and 8 of sleeves *f g h i j* and rods *a b c d e*.

In the modification shown in Fig. 6 the drivers *a b c*, &c., are not of rod form, but, like the rotary followers in Figs. 1, 4, and 5, are sleeves, each having a spiral groove near one end and a lengthened slot at the other. These sleeves, however, are not limited to rotary movement. They, like the rod-formed drivers of preceding figures, have varying ranges of axial motion. In this case sleeves are substituted for the rods shown in Figs. 1, 4, and 5 and rods for sleeves.

Fig. 7 shows a central shaft *a*, supported in bearings *k o* at its ends, which serves as the first driver of the system, and a series of superposed sleeves *b c d e f*, upon the outer one of which is placed a type-wheel. (The latter having for the purposes of illustration only eight characters.) Sleeves *b*, *d*, and *f* are provided with grooved journals resting in bearings *l m n* to prevent axial movement, and at one end are also provided with spiral slots, as in Fig. 4, within which work radial pins of shaft *a* and sleeves *c* and *e;* also, sleeves *c* and *e* have longitudinal slots at their oppo-

site ends, within which radial pins from *b* and *d* project. From the foregoing it will be seen that axial movement imparted to the drivers *a c e* will positively and in turn impart rotation to their respective followers *b d f* and the type-wheel precisely as in Fig. 4.

In Fig. 8 each driver is joined to the follower to which it is designed that it shall impart rotation by a link gearing or connection. For example, driver *c* and follower *h* are joined by means of a link *q* and radial arms *r''' s'''*, as shown. The radial arms and link are joined by ordinary ball-and-socket joints to permit free movement, while to insure rotation of the follower in the right direction arm *r* is given a normal position slightly in advance of arm *s*, and where considerable rotation is to be imparted to a follower link *q* should be curved to prevent its binding against the shaft of the driver. The driver is connected to the follower at its other end by a pin and longitudinal slot, as shown, and as illustrated in Figs. 1 and 4.

Fig. 9 shows a modification in which two series of disks *b c d* and *f g h* are placed upon a central shaft *a*, the latter being feathered as far as *b*, thus preventing its rotation in bearing *k* and the rotation of *b* thereon. Disks *b c d*, forming the drivers, have only axial movement under the action of impelling devices F G H, while followers *f g h* cannot be thus moved, they only being capable of rotation. If any disk or driver is pushed along its axis, the force thus imparted through the slightly-inclined rod *v* imparts movement to the next follower toward the type-wheel. The rod *v* is joined to the disks at either end by ball-and-socket joints. Each driver, however, is connected to the preceding follower by parallel rods upon which the former may freely slide, thus enabling its axial movement without turning or disturbing the latter.

In Fig. 5 an armature-lever and friction-collar upon the driver, as shown in Figs 1 and 4, are dispensed with, the armature *s'* in this case being made a part of the driver. The axial armature is normally held out of the hollow magnet R' by means of a spiral spring *z'*.

These modifications, though specifically unlike the apparatus of Figs. 1 and 4, are nevertheless equally within the meaning of my invention, as are a great number of other forms, which will readily suggest themselves to those skilled in the art. It is only necessary to comply with the principal requirements of my invention to employ a series of drivers and followers in such manner that the drivers may be independently operated and that the operation of each driver shall rotate the type-wheel and intermediate parts on one side, leaving those on the other undisturbed.

As already stated, magnets 1 2 3 4 5 may be operated by separate main lines or two or more may be placed in one line. An important part of the present invention, however, is a system in which all of the receiving-instruments are operated and controlled by a single main line. To this end I make use of any of the several multiple-telegraph systems now known by which five or more signals may be simultaneously transmitted over one wire in the same direction. I have shown in Fig. 2 (for the purpose of illustration merely and without intending to indicate that only this arrangement may be used or that the harmonic is indispensable) one form of multiple telegraph for carrying out my invention in which four harmonic tones and one ordinary Morse transmission are used. The message is perforated upon a strip of paper, each character being formed by one or more perforations upon a transverse line. Perforations are made in five longitudinal rows on the paper, and as it passes over a conducting-roller A the five metallic fingers mounted upon insulated support C fall within the perforations, thereby making contact with the cylinder; but it is seldom that more than one or two fingers come in contact with the cylinder at once. From main line L there are five branches *e' f' g' h' i'*, connecting, respectively, with the metallic fingers, four of which include constantly-vibrating harmonic circuit-breakers having rates of vibration materially differing one with the others, and when the metallic fingers make contact with A through the perforations of the paper, tones, according to the vibrator brought into circuit, are transmitted over the main line from battery B, one pole of which is connected to earth E. The harmonic circuit-breakers, being similar in construction and only different in respect to pitch, are illustrated in a general way in Fig. 2 of the drawings. Referring to one by way of example, a permanent magnet M is provided with an electro-magnet E M at one pole, while the other carries a spring *n'*. The free pole of the permanent magnet through its elasticity at first assumes a back position and closes a local circuit at O', including battery B' and the coil of magnet E M; but contact at *o'* is then broken by the attractive force of E M, and in turn the electro-magnet is demagnetized, when contact at *o'* is again established. In this manner vibration of *n'* is automatically maintained and branch *e'* rapidly opened and closed.

At the receiving-instrument U is an ordinary Morse relay, which responds only to Morse currents sent to line when the uppermost finger of the transmitter comes in contact with the surface of metallic cylinder A. V, however, is so constructed as to respond only to the harmonic tone sent by the vibrator in branch *h'* when the second finger makes contact through the second row of perforations. Likewise receivers W X Y respond, respectively and exclusively, to harmonic vibrations set up in branches *g' f' e'*.

Armature-levers F G H I J are operated by magnets 1 2 3 4 5, and these in turn are respectively controlled by receiving-instru-

ments U V W X Y, U being a Morse relay controlling the local circuit of 1 in the usual manner. The harmonic relays, however, control the action of magnets 2 3 4 5, as is shown in detail in connection with V. This relay specifically consists of permanent magnet u', having a soft-iron core surrounded with a main-line coil at one pole and a vibrating armature bar r' or reed at the other. The reed when in motion strikes the left end of a light lever q', pivoted at t', forcing it into its extreme upper position and with its right end depressed against a yielding anvil s', and thus closes the local circuit, including the magnet 2, during the continuance of the harmonic tone. The yielding contact s' is formed by means of a very light spring (not shown) for the purpose of maintaining perfect contact between the lever and its anvil, even though q' should vibrate during vibration of r'.

In Fig. 2 magnets 1 2 3 4 5 are, for convenience of illustration, represented as being operated directly from the main-line relays or receiving-instruments. The plan which I prefer, however, for controlling the type-wheel-adjusting apparatus from the main-line relays is set forth in detail in Fig. 4. As shown in Fig. 2, the armatures of the impelling devices, which should operate with great rapidity, normally rest in remote positions of the magnetic fields of magnets 1 2 3 4 5, thus rendering their movement slow. To enable the armature-levers or impelling devices to be subjected at the first instant to the maximum force employed, the modified form is adopted, it being shown in connection with magnet 5 and impelling device J. Lever J is pivoted at P, and by virtue of armature N′ is normally held in its back position by the magnetism of permanent magnet M′. If now a harmonic tone be received over line L, to which receiver Y is responsive, its vibratory reed 20 will cause arm 21 to break contact with anvil 22, thereby opening a local circuit, including battery 23 and magnet 25, whereupon armature 26 will make contact with anvil 27, closing the local circuit of magnet 5. Magnet 5 by this means neutralizes the permanent magnetism of M′, leaving lever J under the sole action of its retracting-spring Q′, which at the first will exert its maximum effect to move the lever and effect adjustment of the type-wheel. Perforations in the first or upper longitudinal row of the strip of transmitting paper T, as already noticed, effect transmissions for operating relay U and magnet 1. Likewise perforations of the second, third, fourth, and fifth rows determine transmissions for bringing into action magnets 2, 3, 4, and 5, respectively. Thus a perforation in the upper row, operating impelling device F, serves to rotate the type-wheel the space of one character—that is to say, the type-wheel will be rotated from its zero-point, bringing the next character (in this case a second blank space) to position for printing. A perforation in the second row will cause the wheel to be rotated two characters from its initial point, one in the third row four characters, one in the fourth row eight characters, and one in the fifth row sixteen characters. Any degree of type-wheel rotation may be effected by means of perforations in one or more of the longitudinal rows in a single transverse line, and thus any character upon the wheel may be reached by the single operation of one or more of the receiving-instruments. By proper arrangement of characters upon the wheel nearly half a message will be recorded in the paper by characters having only a single perforation, and the great majority of the remainder are represented by double perforations, while it is only seldom that three perforations are necessary.

Fig. 1 represents a form of printer having many advantages over the one already described, in that the weight and diameter of the type-wheel are greatly reduced. It is well known that the inertia of a wheel increases about as the square of its radius, and even if its weight were to remain the same a construction having its mass concentrated near its center of motion could be operated with much greater rapidity and would possess many features of superiority. Instead, therefore, of placing all the characters upon the wheel in one ring of type, as in Fig. 4, I make the wheel of only one-fourth the diameter and place upon its periphery four circumferential rows or rings of characters, as illustrated in Fig. 1. Another feature of my invention, as shown in Fig. 1, consists of means whereby the wheel is never given more than a half-rotation to bring any desired character into position for printing, it being rotated from its initial point to the right or the left in bringing a character to position and returned after each impression.

In this case magnets 1 2 3 are employed to rotate the type-wheel, while magnets 4 and 5 serve to move and adjust the wheel along its axis. Magnets 1 and 2 both operate to rotate the wheel in a direction opposite that due to magnet 3. The spiral slots have the same helical direction in all; but the movement of lever H is opposite that of F and G. Thus while magnets 1 and 2 effect rotation in one direction magnet 3 causes a reverse movement. The second type-ring upon the wheel is placed normally over the press-pad, while the ring at the left end is brought over the platen by the single action of magnet 4. The extreme right row is brought to the same position by magnet 5 and the second row from the right by both 4 and 5. Two sleeves i j and two rods d e—such as are used to rotate the wheel and already minutely described in connection with Fig. 4—are here used; but upon the outer end of sleeve j is attached a pinion which meshes with a rack t, carried by the type-wheel axis, thus serving to move the wheel backward and forward to adjust one type-ring or another over the platen as occasion requires.

In Fig. 1 rack t is formed upon the lower side of a sleeve, through the axis of which

passes rotary shaft r of the type-wheel, and such rack-sleeve is placed between two collars s upon the shaft, whereby the latter while rotating may, with the type-wheel, be moved axially by the rack and pinion. In Fig. 8 the rack is formed upon a rotary hub, the teeth extending around its circumference. The rack-sleeve is kept in proper position by means of a guide-rod u, which is attached at one end to the sleeve, while its other end slides in a guide-hole of the frame of the machine as the rack travels backward and forward. Magnets 4 and 5 show their respective armatures acting in the same direction; but in this case the helical slots of sleeves i and j are oppositely cut. Thus while by the movement of lever I the type-wheel will be moved to the right, a movement of J will cause it to move to the left; also, if both work together, whether simultaneously or successively, the wheel will be moved one space to the right and twice as far to the left, the resultant movement being one space to the left.

Where the type-wheel is returned by a reverse movement to its initial point after the printing of each character, it is advantageous to arrange the characters upon its periphery in the order of their most frequent use in the printing of a message, and to this end I have adopted the following arrangement: "blank, blank, e, t, a, i, o, u, s, h, r, d, l, u, c, f, g, m, p, b, k, v, j, w, y, x, z, q, ., ,, ;, -." The characters occurring oftenest in a message are so arranged upon the wheel as to be brought to position for printing by the operation of only one adjusting-magnet. Such characters are shown in the left diagram of Fig. 3, they being the lower blank, "E," "T," "A," and "I," and are respectively brought over the platen for impression by magnets 1 2 3 4 5. The second diagram shows those letters which are brought to position to be printed by operating the magnets two at a time, and the third diagram the characters adjusted by operating the magnets three at a time. The characters upon the fourth diagram, excepting the "-," are adjusted by operating the magnets four at a time, while the "-" alone requires the action of all. These diagrams show two blank spaces, one of which is normally over the platen, while the second is used whenever it is desired to operate the press mechanism without printing, as is the case in forming spaces between words. A blank space occurs oftener than any letter, and thus it is that it is placed nearest the initial point of the wheel.

The press mechanism shown in Fig. 1 is conditioned to operate only after the type-wheel has been started toward its position of adjustment and cannot be operated a second time without returning the type-wheel to its initial point. A local circuit, including a magnet which controls the press, is normally broken at the point of spring w, which rests upon an insulated block placed in hub v. If now the type-wheel be moved either along its axis or rotated, the local circuit will be closed and magnet 6 will attract its armature, thus causing escapement-anchor b', which is pivoted at a' to release rotary arm z, the latter being under a constant tendency to rotate through the action of a motor gearing with wheel d'. An eccentric y is placed upon the same shaft with z which upon the release of z raises the press-lever to effect printing. Arm z upon its release rotates until arrested by toe c', making about three-fourths of a rotation, and during this movement not only is the impression taken, but the press-pad is returned to almost its normal position, thus leaving the paper clear of the type-wheel and enabling the wheel to be brought back to its initial point. When the wheel is brought to its starting-point, the local circuit, including magnet 6, is again closed and arm z is released from c', making about a quarter-turn, when it is again arrested by b'. The local circuit might be normally closed and broken upon moving the wheel to operate the printing-magnet. Such an arrangement, however, is inferior to the one shown, as it is preferable to have a local circuit normally open. In Fig. 2 I have shown a similar press mechanism. except that the local circuit is closed by any one or all of the actuating-levers F G H I J—that is to say, the local circuit 8 9, including battery B'' and magnet 6, may be closed between points 10 and 19 by J, between 11 and 18 by I, 12 and 17 by H, 13 and 16 by G, and 14 and 15 by F. Whether the type-wheel be brought into position by any one, two, or more of the arms F G H I J, the press will be operated. The paper strip z' upon which the message is printed is fed a step at a time after each impression upon the backward movement of press-lever x, which carries a pawl x', engaging with a ratchet-wheel v', the latter being fixed to the drum for feeding the paper strip.

As shown in Figs. 1, 4, and 8, a type-wheel having thirty-two divisions is manipulated by means of five mechanisms, which, respectively, have capacities for giving it movements of one, two, four, eight, and sixteen spaces. It is obvious, however, that a sixth mechanism, capable of moving the wheel thirty-two divisions, and a seventh, with a capacity of sixty-four, and so on, might be employed. A type-wheel having sixty-four divisions would be operated by the six mechanisms, while with seven it could have one hundred and twenty-eight.

The rack and pinion shown in Fig. 1 for imparting axial movement to the type-wheel from the two impelling mechanisms may be substituted by apparatus of many different mechanical forms equally within my invention. It is also apparent that the mechanism for giving the type-wheel axial movement could be adapted to a wheel having three rings of type by making the length of the spiral groove in j equal that of i. Thus modified one slot would move the wheel one space to the right and the other one to the left along

its axis. It is equally apparent that by increasing the number of impelling devices for moving the wheel on its axis any desired number of type-rings could be employed and the diameter of the type-wheel correspondingly decreased without reducing the number of characters thereon.

Figs. 7 and 9 show modifications in which a non-rotating shaft *a*, extending axially throughout the system of drivers and followers, is employed.

With reference to the application of a multiple-telegraph system to operate a series of mechanisms for adjusting the type-wheel my invention is not confined to the particular impelling devices illustrated in the accompanying drawings as distinguished from a series of any devices for the same general purpose. It, however, is not new with me to employ a series of adjusting mechanisms having ranges of action differing one with the others, such ranges being preferably represented by the terms of the series one, two, four, eight and sixteen for moving the type-wheel to any desired position by the single action of any one or more of them, and I therefore desire to disclaim such subject-matter.

What I claim, and desire to secure by Letters Patent, is—

1. The combination of a type-wheel, a series of independent impelling devices for actuating the same, and a driver and follower positively joining the type-wheel with each impelling device and forming a positive operative connection between them both during the single and the combined action of the impelling devices, substantally as described.

2. The combination of a type-wheel, a series of independent impelling devices for rotating the same to any desired position by the single action of one or more of them, and a driver and a follower positively joining each impelling device with said type-wheel both during their single action and their combined action when more than one is operated, all substantially as described.

3. The combination of a type-wheel, a series of rotating axially-fixed followers alternately arranged with a series of axially-adjustable drivers in the same line, and a series of independent impelling devices for positively rotating the type-wheel through the medium of said drivers and followers to any desired position by the single action of one or more of them, all substantially as described.

4. The combination of a type-wheel, a series of independently-rotating followers, a series of independent drivers respectively engaging with the followers and positively and continually connected with the type-wheels through said followers in either the single or combined operation of two or more followers, a series of independent impelling devices respectively actuating said drivers, and a series of magnets for actuating said impelling devices, all substantially as described.

5. The combination of a type-wheel, a series of independent impelling devices, a series of rotary and axially-moving drivers actuated by said impelling devices and movable axially in a line parallel to their axis of rotation, and a series of rotary followers engaging with said drivers for rotating the type-wheel, all substantially as described.

6. The combination of a type-wheel, a sectional shaft for rotating said wheel, consisting of a series of rotating followers alternately arranged with a corresponding series of axially-moving drivers and a series of impelling devices, all substantially as described.

7. The combination of a type-wheel, a sectional shaft for rotating said wheel, consisting of a series of rotating followers, each having a fixed axial support and an alternately-arranged series of axially-movable drivers, each driver at the end facing the type-wheel being joined to the contiguous follower by spiral gearing and with the follower at its other end by axial gearing which only permits longitudinal movement of said driver with reference to said follower, all substantially as described.

8. The combination of a type-wheel, a series of rotating followers *f g*, &c., having spiral and longitudinal grooves, as shown, a series of alternately-arranged drivers *a b*, &c., each driver engaging at one end with the spiral groove of a follower and with the longitudinal slot of another follower at its other end, and a series of impelling devices which engage with friction-collars upon said drivers, all substantially as described.

9. The combination of a type-wheel having three or more rings of type, a series of rotating followers, a series of alternately-arranged drivers engaging with said followers, and a series of impelling devices for rotating said wheel, and means for moving the type-wheel along its axis to bring any desired ring of type over the press-pad, consisting of a second series of independent impelling devices, a corresponding series of drivers, and an alternately-arranged series of rotatory followers gearing with the type-wheel axis, all substantially as described.

10. The combination of a type-wheel having three or more rings of type, means for rotating said type-wheel to any desired position, and means for moving said type-wheel axially, consisting of a series of followers gearing with said wheel to impart axial movement thereto, an alternately-arranged series of drivers for engaging said followers, and a corresponding series of impelling devices, all substantially as described.

11. The combination of a rotating and axially movable type-wheel having three or more rings of type, a series of followers, drivers, and impelling devices for rotating said wheel, a shaft *r*, rack *t*, pinion *t'*, and a second series of followers, drivers, and impelling devices for moving said wheel axially, all substantially as described.

12. The combination of a type-wheel, a series of rotating followers, an alternately-ar-

ranged series of drivers whose degrees of action are represented by the series one, two, four, &c., and a series of impelling devices, the gearing of the last impelling device, driver, and follower being oppositely arranged with reference to the other members of the series, whereby the last impelling device is made to impart rotation to the type-wheel in a direction opposite that due to the others.

13. A series of impelling devices simultaneously coacting to adjust the type-wheel to any desired position for printing, a press-pad, an eccentric for actuating the same, an escapement, magnet 6 for operating said escapement, a local circuit, including said magnet, an insulating-block *v* in the conducting-hub placed upon shaft *r* of the type-wheel, and a spring *w*, which rests upon said insulating-block when the type-wheel is at its initial point, but closes the local circuit upon the first movement of the type-wheel, all substantially as described.

14. The combination of a type-wheel, a series of impelling devices simultaneously coacting by a single movement of one or more of them to rotate the type-wheel to any desired position for printing, a press-pad, an eccentric for operating the same, an unequal step-escapement and magnet for operating the eccentric, a local circuit, including the escapement, and means for opening and closing said circuit upon the operation of any one or more of the impelling devices for rotating the type-wheel, all substantially as described.

15. In a printing-telegraph system in which the type-wheel is adjusted to any one of its positions for printing by the single movement of a series of independent impelling devices operated individually or in various combinations according to the position desired, a series of multiple-telegraph receiving-instruments for operating any one of said impelling devices or two or more of them in the time required for the single main-line transmission by which one alone is actuated, and a corresponding series of multiple-telegraph transmitters for sending the required single or combined transmissions according to the letter to be printed, as and for the purpose described.

16. The combination of a type-wheel in a printing-telegraph, a series of impelling devices capable of conjoint action to adjust the type-wheel to any desired position for printing, a series of multiple-telegraph receivers to actuate or control said impelling devices singly or in various combinations, and an automatic transmitter at a distant station, consisting of a strip of paper upon which each letter is formed by one or more perforations in a single transverse line, such perforations controlling, individually or in combination, the single or simultaneous transmissions corresponding to those transmitted by multiple-telegraph transmitters.

17. In a printing-telegraph system in which the type-wheel is adjusted to any desired position by the conjoint action of a series of impelling devices, a paper strip for automatic transmission upon which each letter is formed by one or more perforations in a single transverse line, the paper being divided longitudinally into as many divisions as there are impelling devices employed, and multiple-telegraph transmitting and receiving apparatus, the individual, single, or simultaneous transmissions of which are individually controlled by the perforations of a division, while the receiving devices responding individually to the transmissions are combined with said series of impelling devices, as and for the purpose described.

18. In a printing-telegraph system in which the type-wheel is adjusted to any one of its positions by the single movement of a series of independent impelling devices operated individually or conjointly in various combinations according to the position desired, a series of harmonic receiving-instruments for operating any one of said impelling devices or two or more of them simultaneously in the time required for transmitting the single main-line transmission by which one alone is actuated, a series of harmonic transmitters at a distant station for sending the required single or combined transmissions, and a perforated paper strip for controlling said harmonic transmitters, all substantially as described.

19. In a printing-telegraph system, the combination of a series of receiving-instruments, (Morse and harmonic,) a type-wheel, a series of impelling devices controlled by said receiving-instruments under whose conjoint action the type-wheel is adjusted to any desired position, a single main line, a series of Morse and harmonic transmitters for said receivers, and a perforated band of paper containing messages for automatically controlling said transmitters, all substantially as described.

20. In a printing-telegraph receiver, the combination, with the type wheel or carrier having its alphabet distributed in two or more lines of type, of a series of independent impelling devices each positively joined with the type-wheel through devices by which it may by a single action move the type-wheel positively both forward and backward a definite distance different for the different impelling devices, the number of said devices and their combined capacities or ranges of action being such that the type-wheel may be moved to any one of all its printing positions either by the single movement of one impelling device or by the single movement of two or more of them operated in the proper combination either simultaneously or successively.

21. In a printing-telegraph system, a type-wheel upon whose periphery the alphabet is distributed in four rings of type, in combination with a series of independent impelling devices each positively joined with the type-wheel through mechanism by which it may by a single action move the type-wheel posi-

tively both forward and backward a definite distance different for different impelling devices, the number of said devices and their combined capacities or range of action being such that the type-wheel may be moved to any one of all its printing positions either by the single movement of one impelling device or by the single movement of two or more of them operated in the proper combination either simultaneously or successively.

22. In a printing-telegraph receiver, the combination, with the type wheel or carrier having the alphabet distributed upon its periphery in two or more rings of type and adapted to have a movement both of rotation and in the direction of its axis, of a series of independent impelling devices each positively joined with the type wheel or carrier through a driver and follower by which it may by a single action move the type-wheel a definite distance different for the different impelling devices, the number of said devices and their combined capacities or range of action being such that the type-wheel may be moved to any one of all its printing positions either by the single movement of one impelling device or by the single movement of two or more of them operated in the proper combination either simultaneously or successively.

23. In a printing-telegraph receiver, the combination, with the type wheel or carrier, of a series of independent impelling devices each positively joined with the type-wheel through a driver and follower by which it may by a single action move the type-wheel a definite distance different for the different impelling devices, the number of said devices and their combined capacities or range of action being such that the type-wheel may be moved to any one of all its printing positions either by the single movement of one impelling device or by the single movement of two or more of them operated in the proper combination either simultaneously or successively.

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Witnesses:

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