(No Model.) 3 Sheets—Sheet 1.

C. L. BUCKINGHAM.

PRINTING TELEGRAPH.

No. 487,985. Patented Dec. 13, 1892.

Fig. 2.

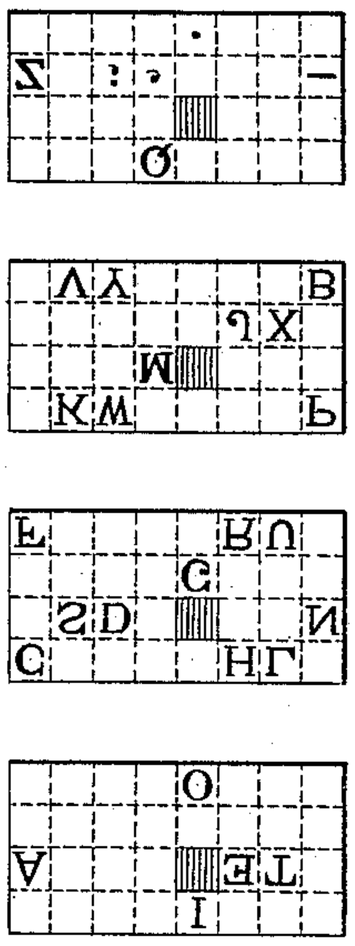
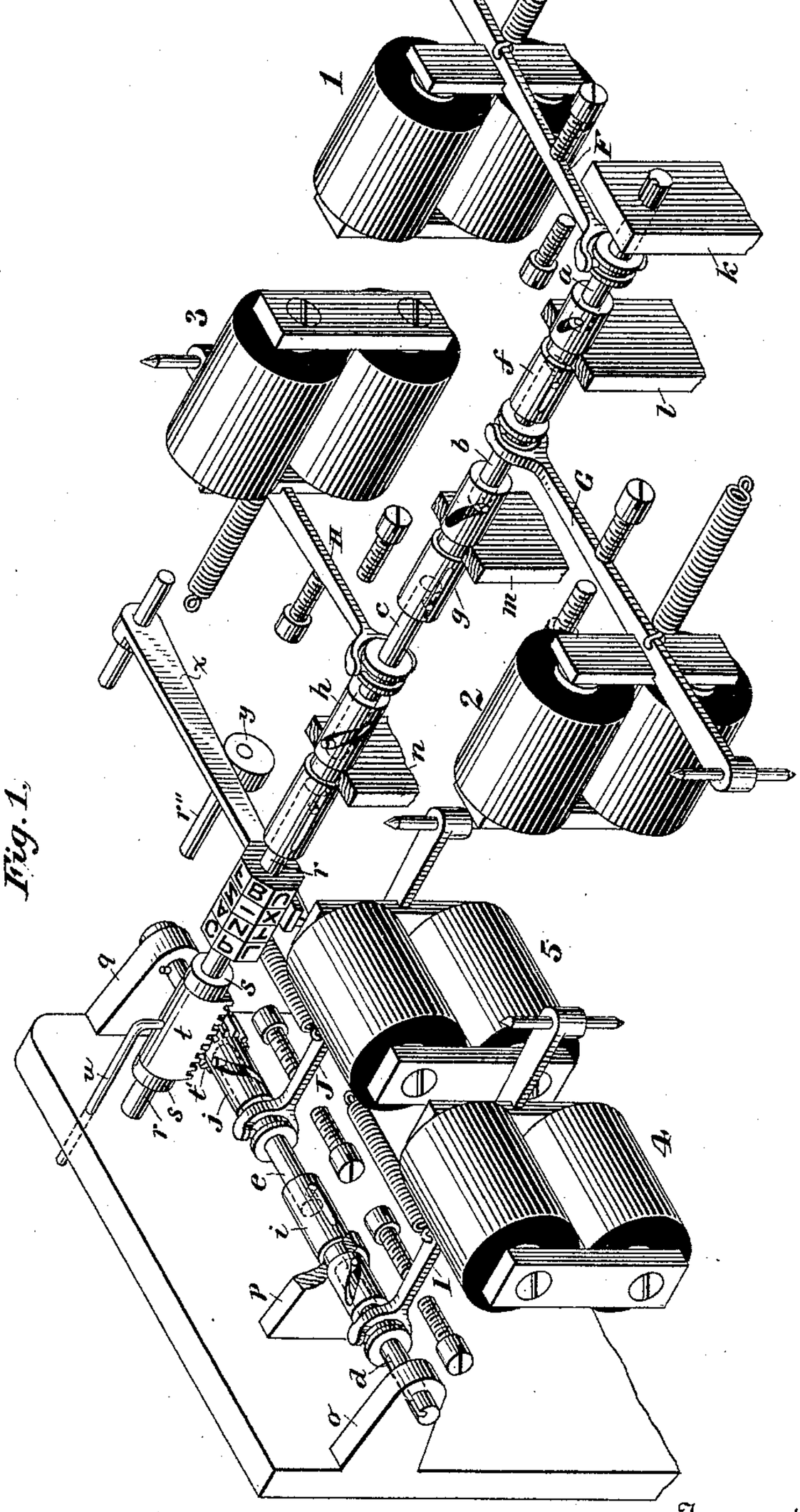


Fig. 1.



Witnesses
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Carrie E. Ashley

Inventor
C. L. Buckingham.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

(No Model.) 3 Sheets—Sheet 2.

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PRINTING TELEGRAPH.

No. 487,985. Patented Dec. 13, 1892.

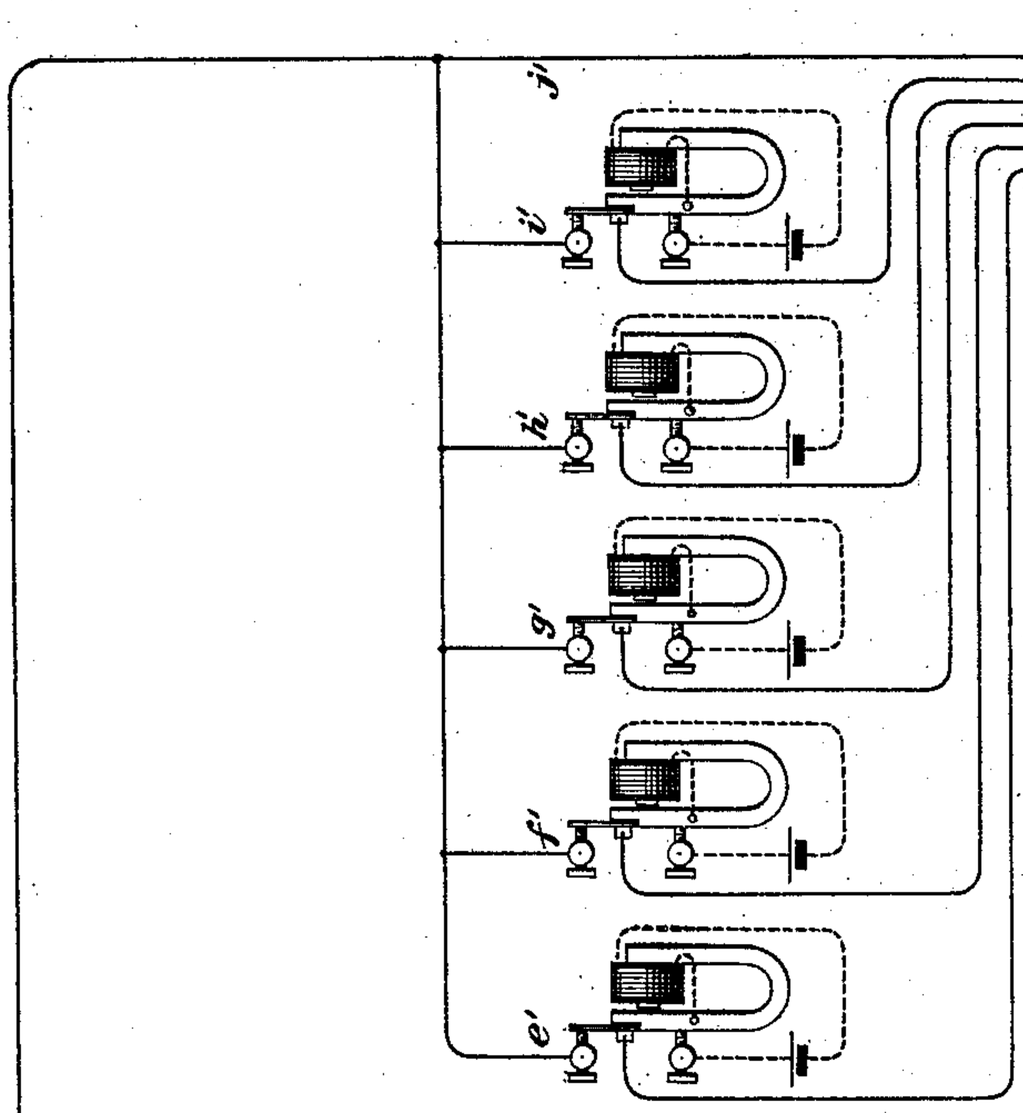


Fig. 3.

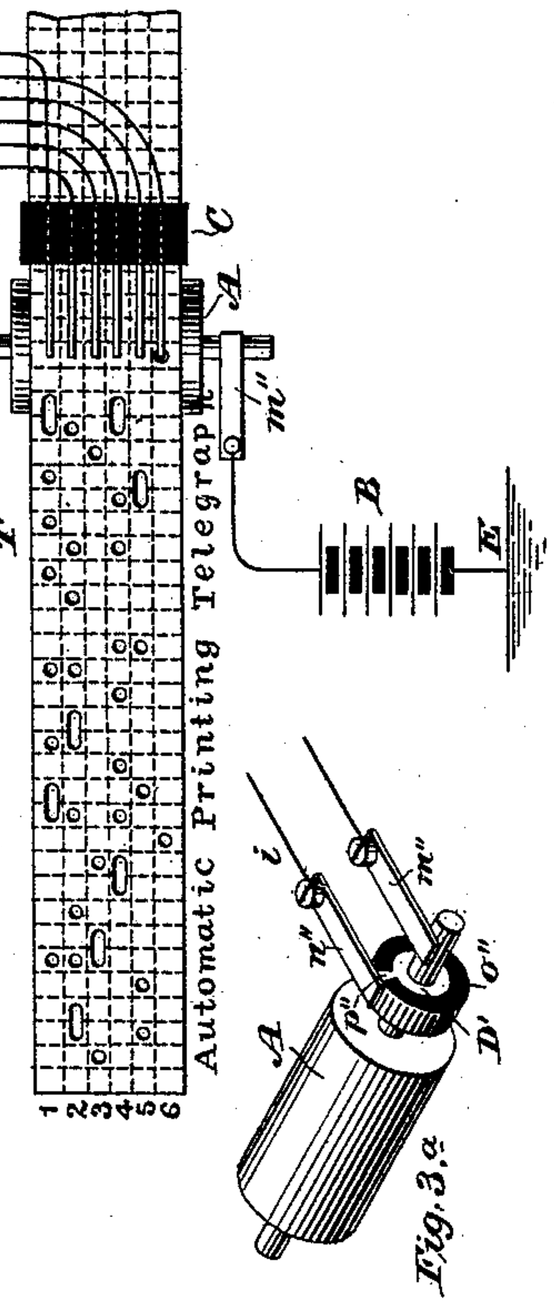
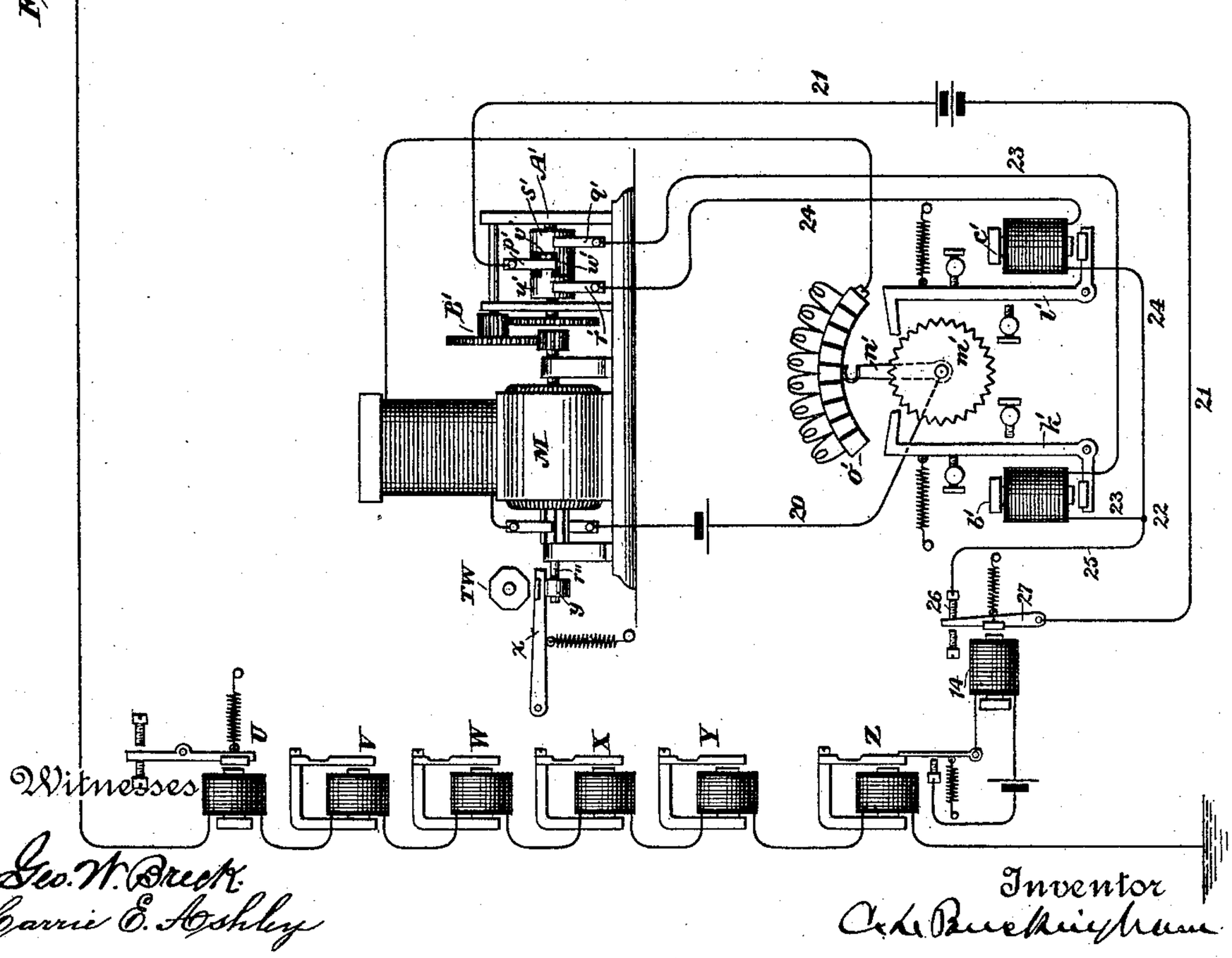


Fig. 3a.



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(No Model.) 3 Sheets—Sheet 3.

C. L. BUCKINGHAM.

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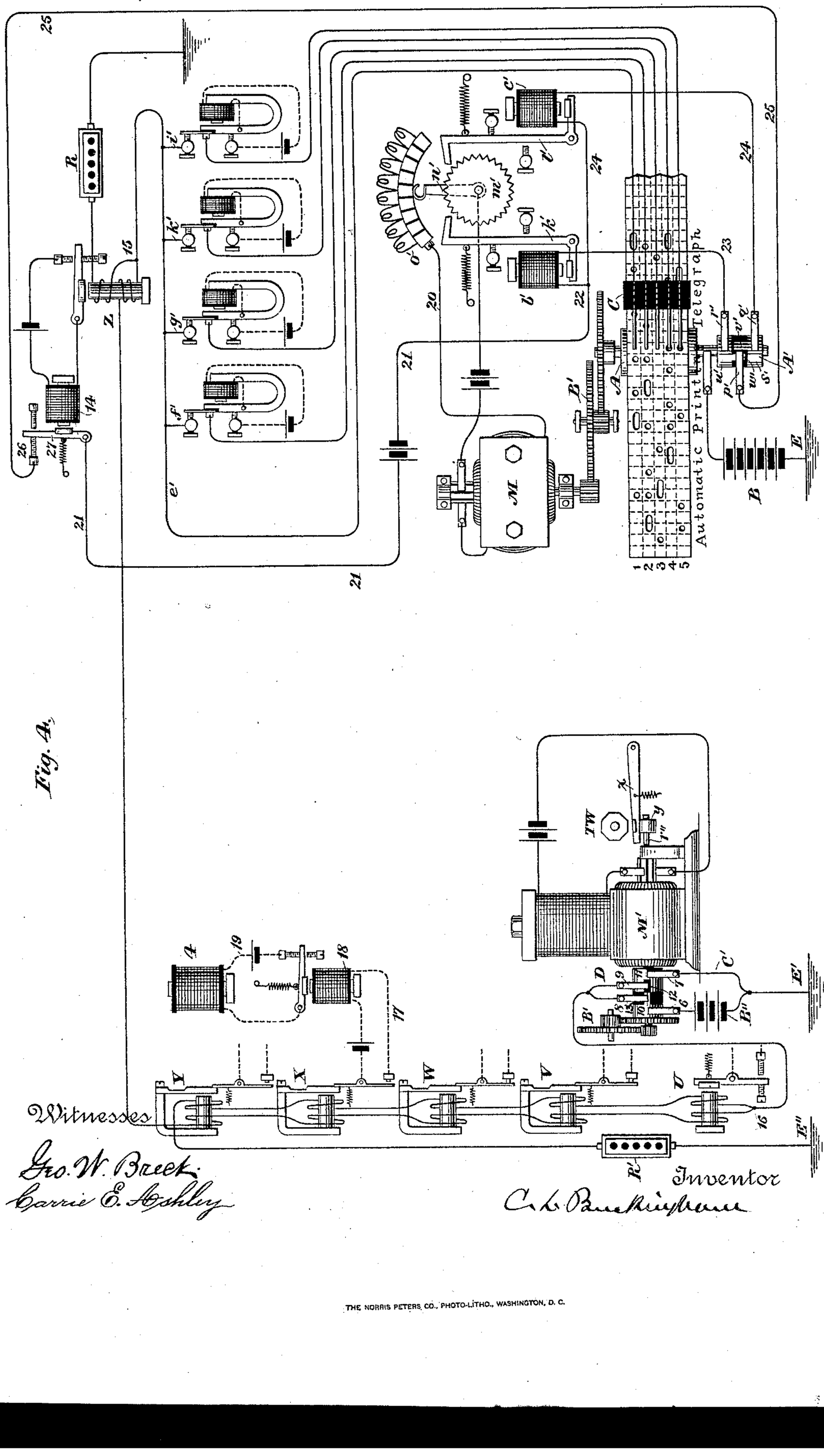

Fig. 4.

THE NORRIS PETERS CO., PHOTO-LITHO., WASHINGTON, D. C.

UNITED STATES PATENT OFFICE.

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

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 487,985, dated December 13, 1892.

Application filed December 11, 1889. Renewed June 24, 1892. Serial No. 437,843. (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, of which the following is a specification.

In another application executed by me November 2, 1888, I have described and claimed certain improvements in telegraphy and printing-machines in which a series of impelling devices employed for rotating a type-wheel are operated by a multiple-telegraph system. The several impelling mechanisms are capable of operation, separately, altogether, or in minor combinations, and act conjointly, any one of them serving to impart a movement to the type-wheel supplementary to that set up by one or more of the others, while rotation effected by two or more of said mechanisms operated together is equal to the sum of the movement due to their action when called into operation singly, and not in conjunction one with the others. In that application the press mechanism is brought into action as a condition subsequent to the operation of the type-wheel by the closing of a local circuit including a press-magnet, either through the agency of impelling devices for operating the type-wheel or by the opening and closing of such local-circuit contacts by the various positions of rotation of the type-wheel. These arrangements require the return of the type-wheel to its initial position after an impression before the press can again be brought into action; nor can the printing of a character be repeated without first returning the wheel to zero and readjusting it, and thus it is that a second blank space upon the wheel is required to enable the making of blanks between words in the recorded messages.

The object of my present improvement is to enable spacing between words while the wheel remains in its initial position, and the repeating of characters in a message while it remains in a fixed position and adjusted to print such character. A further advantage of this improvement is that after an impression has been taken the type-wheel-impelling devices brought into action need not be returned to their original position before other devices for bringing the wheel into place for the next character are operated. While the impelling devices for giving the wheel one adjustment are returning to their normal position, other devices for giving the wheel its next position may be actuated. Thus the adjustment of the wheel to a position to print a second character is accomplished in the same time that would otherwise be required to return the wheel to its initial point after the first impression. To accomplish these results, I employ a press mechanism which is made to operate in unison with the transmitter at the distant station but by mechanism whose operation is independent of the type wheel or apparatus connected therewith. The type-wheel devices and the press mechanism are independent of each other, except that both are operated by or in unison with the transmitter, and thus it is that no movement of the wheel or apparatus connected therewith is necessary to the operation of the press. To this end a periodically-vibrating platen is used, whose movement is controlled from the transmitting-station. The press is so timed as to be raised for an impression only after the adjustment of the type-wheel, and reciprocally the action of the wheel is periodical in that its adjustment for an impression is effected at regular intervals and momentarily before the operation of the press. This result is accomplished by running a strip of perforated paper through the transmitter at a uniform speed, within which are formed characters at equal distances apart along its length and by causing the motor operating the press mechanism to run in unison with the transmitter. Synchronism or unison may be effected by periodically sending impulses from the transmitter to the receiver, thereby causing the receiver to follow the movement of the transmitter, or, instead, the movement of the transmitter may be made to follow the receiver by means of unison impulses sent from the receiver to the transmitter, thereby regulating the speed of the transmitting-paper to the action of the press mechanism.

The following is a description of two different forms of unison arrangements for carrying out my invention.

Figure 1 is a perspective view of a receiving-instrument used in connection with my present improvement. Fig. 2 represents de-

velopments of the type-wheel periphery, the diagram at the left showing the characters which are brought over the platen by operating the several impelling devices singly, the second one the characters by operating them two at a time, the third the characters by operating them three at a time, the fourth, the characters, excepting the dash, by operating them four at a time. The dash itself is adjusted by all together. Fig. 3 is a diagram showing the circuits and magnets of the system together with a regulator for causing the platen to operate in unison with the paper-drum of the transmitter. Fig. 3ª is a modification of a part of the transmitter shown in Fig. 3. Fig. 4 is a modification of the unison apparatus of Fig. 3. In Fig. 4 the paper-drum of the transmitter is made to run in unison with and follow the motor which actuates the platen at the receiver, while in Fig. 3 the motor which actuates the platen is made to follow the paper-drum.

In Fig. 1, as in my application, Serial No. 290,449, filed November 10, 1888, I show five impelling devices F G H I J, and a series of axially-movable drivers *a b c d e*, alternately arranged with a series of rotating followers *f g h i j*, the latter having grooved journals mounted in bearings *l m n p q*, to prevent axial displacement. Drivers *a* and *d* are feathered in their bearings *k o*, and are therefore incapable of rotation. From this construction it follows that by operating the impelling devices through their magnets 1 2 3 4 5 singly in minor combinations or altogether, any one of the four type-rings and any character therein may be adjusted over the platen for an impression. The platen is mounted upon a lever *x* and is actuated by a constantly-rotating eccentric, the latter being mounted upon a shaft *r''*, to which uniform rotation is imparted by any suitable motor. Rack *t* is held upon shaft *r* by two collars *s s*. Thus during its rotation said shaft may be moved backward and forward along its axis by means of pinion *t'*, to which motion is imparted through follower *j*, the latter being operated by impelling devices I J.

In the arrangement described in my preceding application printing is effected only by the operation of the impelling devices through the agency of local circuits closed by them, or by a local circuit which is closed or opened by the movement of the type-wheel or some part mechanically connected therewith. In my present application, however, the press has a movement quite independent of that of the type-wheel, except that the latter is and must be operated in advance of the former, so that the wheel may reach its position of adjustment before receiving the blow of the platen. To this end the unison mechanisms shown in Figs. 3 and 4 are employed. In Fig. 3 I have shown an automatic multiple transmitter, by which one Morse and five harmonic transmissions may be simultaneously effected. All but the last harmonic transmission are employed for operating relays U V W X Y, and they in turn impelling devices 1 2 3 4 5. The last transmission, however, (the sixth,) is wholly employed in connection with the press mechanism, and only serves to regulate the speed of the motor M, (employed to actuate press-lever *x* by eccentric *y*,) to correspond with the speed of drum A, over which passes the strip of perforated transmitting-paper T. At the transmitter six branches *e' f' g' h' i' j'* respectively connected with the six conducting-fingers mounted upon C are employed in connection with battery B, and as the perforations of the paper pass under the metallic fingers the circuit to line is closed through drum A and those branches whose fingers are permitted to make contact therewith. Five harmonic transmitters, differently keyed, are placed in branches *e' f' g' h' i'*, while branch *j'* is a continuous conductor, it being employed for sending Morse currents. By this means the six receiving-instruments U V, &c., may be brought into action in any desired combination.

Rotation of type-wheel T W is effected by the first five longitudinal rows of perforations, while the infrequent perforations in the sixth so regulate the action of motor M that the type-wheel will receive an impression-blow only after it has been moved into adjustment therefor. Each character is perforated in a single transverse line in the paper strip T, and such lines are placed at equal distances apart along its length, and thus the perforations for one letter or character after another come under the metallic fingers of the transmitter at regular intervals of time. The type-wheel, of course, cannot be adjusted to all positions in equal times. For example, its adjustment to print E would be more quickly accomplished than for F, owing to the fact that in one case the movement is only slight, being one-eighth of a rotation, while in the other it must not only be given an entire half-rotation but must also be moved two spaces along its axis. In transmitting the letter E, therefore, the type-wheel would be adjusted for its impression almost instantly upon bringing the perforation representing such letter under the corresponding finger of the transmitter and would remain so adjusted during the entire period of transit of such perforation and during the consequent transmission—that is to say, while the finger remains within such perforation. The character F upon the wheel, however, might not reach its position of adjustment until each of its several perforations had passed half-way or more under the metallic fingers. The longest time required for the adjustment of any character upon the type-wheel should be the period allowed for all, and thus if the time required to adjust the wheel for its most remote character from the initial point be one-half that occupied by the transit of a perforation under a finger of the transmitter it

is obvious that the press mechanism should be so timed as only to deliver its impression-blow after the first half of the perforation in each case had passed the points of the fingers--that is to say, during the last half of the transmission employed to adjust the wheel. Under these circumstances it is apparent that correct impressions will be taken if the paper upon which the message is recorded be pressed against the wheel and withdrawn during the last half of each transmission. To accomplish this result, I employ the motor M, as above stated, at the receiver (it being rotated at the same speed as is paper-drum A of the transmitter) to rapidly vibrate press-lever x by eccentric y, the latter being placed upon the shaft of the motor-armature. If motor M is running in unison with the transmitter, the press-lever x will be raised against and withdrawn from type-wheel T W during the last half of each transmission. If, however, the impression be not taken during such time, adjustment is rendered necessary, and the motor M should be made to run faster or slower, as occasion requires. Adjustment might be effected by sending a current from the transmitting-station for each impresssion, but such frequency is unnecessary. Unison can be effected by sending one impulse for each twenty characters transmitted, and to this end a unison-perforation is made in every twentieth transverse row of the perforated paper. Whenever one of these perforations comes under a finger of the transmitter harmonic relay Z is actuated, thus opening the local circuit of relay 14 and causing lever 27 to make contact with back-stop 26, and during this period if motor M is running out of unison-resistance will be automatically inserted or removed from its circuit, according as it is required to make it operate slower or faster. The motor-circuit 26 includes the armature and field coils of the motor, a rotary arm n', and a series of resistance-coils and switch-plates o'. The plates are insulated from one another, except through the resistance-coils, and thus the resistance of the motor-circuit is increased or diminished by moving arm n' to the left or the right.

A rotating commutator A′ is so geared with the shaft of the motor by means of a train of gearing B′ that it rotates once for each twenty turns of the motor-shaft. The commutator consists of two conducting-rings u' s', and they are respectively provided with inwardly-projecting conducting-pieces v' w'. Parts v' w' are separated along the length of the commutator by a strip of insulating material of such width that it will rotate under the end of contact-spring p' in the same time that is required for one of the unison-perforations of the paper strip to pass under the corresponding contact-finger of the transmitter, and if the motor and transmitter are in unison such insulating-strip will complete its movement under the point of spring p' during the movement of a unison-perforation past its finger; but if out of unison p' will make contact with either v' or w' while such finger is still within a unison-perforation. Springs r' and q' are in rotating contact with u' s' and are joined to wires 23 and 24, the latter including magnets b' c'. These wires unite at 22, and are connected to back-stop 26 by wire 25. If now motor M is working too fast spring p' will be in contact with v' during contact between drum A and the unison-finger or while lever 27 is closed upon contact 26, thus completing a local circuit by way of wires 25 24, magnet c', spring r', ring u', conducting projection v', spring p', wire 21, lever 27, and stop 26. On the other hand, if the motor were working too slowly a local circuit would be completed by way of wire 25, wire 23, magnet b', spring q', ring s', conducting projection w', spring p', and wire 21. Thus if moving too slowly magnet b' will actuate armature-lever k' and rotate star-toothed wheel m' and arm n' one step to the right, thereby diminishing the resistance of the motor-circuit and correspondingly increasing the rapidity of its speed, or if moving too rapidly magnet c' will rotate wheel m' and arm n' one step to the left at each revolution of A′ until adjustment is effected. If, however, A and A′ are in unison neither b' nor c' will be actuated, and arm n' will remain unmoved. Instead of employing a sixth row of perforations, as in Fig. 3, I may employ upon drum A a rotating circuit-closer consisting of a hub of insulating material o'', having a conducting-section p'' and a spring n'', to which is attached branch i, which includes a harmonic-circuit breaker for sending a musical tone to line to operate Z at the receiver whenever p'' and n'' come in contact. In this case the paper should be moved the space of twenty perforated characters at each rotation of drum A. Obviously the apparatus hereinbefore described may be modified to send unison-impulses with greater or less frequency by merely changing the proportions of its parts.

Drum A should be rotated at as nearly a uniform rate of speed as is possible by any suitable motor, as M, which is substantially the same as M′ of Fig. 4, though even if its rate were somewhat irregular unison would be maintained through the agency of the devices already described.

In commutator A′ conducting-pieces v' w' may be given greater circumferential lengths than are here shown, and in practice it would be desirable to do so in order that regulation may be effected when A′ is running much faster or slower than A.

Instead of employing a sixth transmission in the same direction, as shown in Fig. 3, to establish unison between the transmitter and press mechanism of the receiver, the sixth transmission may be in a direction opposite to the other five, as represented in Fig. 4.

In Fig. 4 shaft r'' of motor M′ carries an eccentric y, which operates press-lever x, and a commutator D′ is so geared to shaft r'' as

to rotate, for example, once for each twenty revolutions of the latter. This commutator affords a normal earth connection at the receiver by way of spring 9, conducting-ring 11, and spring 7, while at the same time the circuit of battery B″ is broken but once during each revolution an insulating-block 12 breaks such earth connection and at the same time establishes connection to battery B″ by way of spring 6, conducting-ring 10, and spring 8. Rings 10 and 11 are separated from each other by means of insulating-sections 13 and 12. In order that currents from B″ may in no wise interfere with receiving-instruments U V W X Y, an artificial line, beginning at 16, and of a resistance substantially equal to that of the main line, is employed, within which are included equating-coils of the relays, also rheostat R′. A condenser may be used in the usual manner to overcome the effects of static induction in case of very long lines. A differential magnet Z, Fig. 4, is also employed at the transmitting-station, and it is actuated by currents from battery B″ at the receiving-station, but is neutral in respect to outgoing currents, owing to the action of the equating-coil, which is placed in circuit with a rheostat R, whose resistance is equal to that of the main line from point 15 to earth at the distant station. A current transmitted from B″ passes directly to earth through the transmitter or through both coils of Z and thence to earth through the artificial line, and thereby opens the circuit of magnet 14, permitting lever 27 to fall upon its back contact 26. Motor M is geared with the paper-drum A of the transmitter, and upon the axis of the latter is placed a commutator A′, precisely the same as A′ in Fig. 3, and in connection with such commutator are a system of local circuits, magnets *b′ c′*, arms *k′ l′*, a star-toothed wheel *m′*, arm *n′*, rheostat *o′*, consisting of resistance-coils and switch-plates, local circuit 20, and motor M, and gearing B′, identically the same as that of Fig. 3, already described. It is thus seen that if operating in exact unison commutators D′ and A′ will occupy the relation shown in Fig. 4—that is to say, while B″ is connected to line through spring 6, ring 10, and spring 8, the point of spring *p′* will rest upon the insulating-space between conducting-sections *v′ w′;* but if they are out of unison when B″ is connected to line, *p′* will come in contact with either *v′* or *w′*, and in consequence thereof the speed of the motor will be increased or decreased and made to equal that of M′, thereby causing the press mechanism to deliver its impression-blows only after the type-wheel has been adjusted to its desired position. In Fig. 4 shaft *r″* of motor M′ extends through an axial opening of commutator D, while said shaft and commutator are so joined by train B′ that the former rotates twenty times as often as the latter.

In Figs. 3 and 4 I have, for convenience of illustration, shown the armature and field-coils of motors M M′ as included in a single local circuit. The preferable plan, however, would be to sustain the fields by a separate and independent local circuit of constant resistance. Both plans are, however, equally well known in the art, and neither in itself forms any part of my invention.

Many efficient unisons have been devised for causing a rotating object at one station to move in synchronism with another at a distant station by means of periodically-transmitting currents or otherwise, and while there are many features of novelty in the particular unison which I have hereinbefore described, my invention relates more particularly to the use of any unison for telegraphically establishing synchronism between transmitting and receiving stations, and to thereby cause the action of a vibrating press-lever to closely follow that of a type-wheel, so that impression-blows may only be given after the wheel has been adjusted.

In Fig. 4 I have shown a local circuit 17, including magnet 18, which when X is operated by harmonic impulses is broken, thereby closing local circuit 19. The latter circuit includes magnet 4 of the series employed to actuate the impelling devices of the printer. The other harmonic receivers have like local arrangements, each being provided with a local circuit 17, which is normally closed. During vibration the harmonic reeds of the relays raise the supplemental pivoted levers from their contacts and thus break the local circuit of the repeating-relays. The local circuit of U may operate a repeating-relay and the latter a magnet for operating an impelling device of the receiver, or such magnet may replace the repeating-relay.

From the foregoing it will be seen that if the type-wheel is once adjusted, the same character may be printed as many times as may be desired without moving the wheel or any part connected therewith. Again, it is apparent that to adjust the wheel to print a second character the impelling devices brought into action for such purpose may be actuated while the ones for effecting the preceding adjustment are being returned to their normal positions. In other words, while one set of adjusters is returning to normal position a second set may be brought into action. If, however, printing were only performed as a consequence of the return of the type-wheel to zero after each adjustment, as is the case in my other application, a second set of impelling devices could not begin their movement until the first had returned to their original position. It also results from my improved method of printing that where adjoining characters have perforations in the same horizontal row of the paper, they may be run together, as shown in Figs. 3 and 4, and thus it is that the impelling device controlled by them will remain in the same position during the printing of both.

In my preceding application it is found nec-

essary to employ two blank spaces upon the type-wheel, because (as the paper-feed of the receiver is operated by the press mechanism and the press in turn by the type-wheel) it had to present a blank space to the platen after having been moved, to enable spacing between words in the received message. This was accomplished by rotating the wheel one step, bringing the second blank over the platen, and by then actuating the latter. This mode of spacing required the transmitting-paper to be so perforated as to send an impulse which would operate an impelling device to bring the second blank into position for an impression. In my present form, however, the paper band is left blank where spacing is required, and only one blank space upon the type-wheel is necessary. Another advantage is that the type-wheel remains stationary while spaces are formed.

By referring to Figs. 3 and 4 it is seen that the type-wheel adjustments required in printing the words "automatic printing-telegraph" are effected by thirty-four independent transmissions. It is thus found that only little more than a single transmission per letter is required, (as there are twenty-six letters and two spaces involved,) and that a single transmission suffices to adjust the wheel for about half the characters occurring in a message. As seen in Fig. 3, a single perforation in the third longitudinal row of the transmitting-paper is required for "a," one in the second and one in the fourth for "u," one in the second, which is run into the upper perforation of the preceding character, for "t," one in the fourth for "o," perforations in the first, second, and third for "m," and so on.

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

1. In a printing-telegraph system, the combination of an automatic transmitter and a uniformly-moving motor for operating the same, a type-wheel of the receiving-instrument which is periodically adjusted for an impression by said automatic transmitter, a periodically-operating press device for giving impression-blows after the type-wheel has been brought to position for printing, a motor for operating said press mechanism, and a telegraphic unison for causing the motor which actuates said press mechanism to operate synchronously with the motor for driving the transmitter, substantially as described.

2. The combination of a multiple-telegraph system, an automatic transmitter therefor, a motor for operating said transmitter, a receiving-instrument having a type-wheel and a series of impelling devices for periodically adjusting the same for printing, a press mechanism for periodically giving impression-blows to the type-wheel when adjusted, a motor for operating said press mechanism, and a unison mechanism for causing the press-motor to operate synchronously with that of the transmitter, substantially as described.

3. In a printing-telegraph, the combination of a type-wheel and a press mechanism, the two being independent one of the other, an automatic transmitter for periodically adjusting the type-wheel, a motor for periodically operating said press mechanism to give impression-blows after each adjustment, and a unison mechanism connecting the impression devices and transmitter, all substantially as described.

4. In a telegraphic unison, the combination of motors M M′, a main telegraph-line, a transmitting-commutator D′ for sending unison impulses to line, a receiving-commutator A′, a rheostat *o′* for regulating the speed of motor M, main-line relay Z, a local circuit controlled by said relay and commutator A′, and motor mechanism controlled thereby for inserting or removing coils of rheostat *o′* from the circuit of motor M, all substantially as described.

5. The combination of commutator A′, consisting of rings *u′ s′*, having projecting conductors *v′ w′*, with an intervening section of insulating material, springs *p′ q′ r′*, magnets *b′ c′*, a local circuit therefor, relay Z, rheostat *o′*, motor M, and a local circuit including said rheostat and motor, substantially as described.

6. The combination of motor M in a local circuit, including rheostat *o′*, switch-arm *n′*, star-wheel *m′*, arms *k′ l′*, magnets *b′ c′*, a commutator A′, having rings *u′ s′*, projecting parts *v′ w′*, with an interposed insulating section and springs *p′ q′ r′*, relay Z, a main line, a unison-transmitter at a distant station, and a motor for operating the same having an approximately-uniform speed of rotation.

7. In a printing-telegraph system, the combination of an automatic transmitter, a main line, a type-wheel which is periodically adjusted to print by said transmitter, a motor for operating said transmitter, press mechanism for periodically giving impression-blows to the type-wheel, a motor for actuating said press mechanism, a unison-transmitter operated by said press-motor for transmitting impulses to the transmitting-station, and a regulating mechanism at the transmitter operated by said unison-currents, whereby the transmitter is made to run in unison with and follow the movement of the press-motor, all substantially as described.

8. In a printing-telegraph system, the combination of a type-wheel, a system of multiple transmission in one direction for adjusting the type-wheel, and an additional transmission in the opposite direction to effect unison between the press-motor at one station and the transmitter at the other, differential relays U V, &c., for controlling the type-wheel, differential relay Z at the transmitting-station, commutators D′ A′, and motors M′ M, all substantially as described.

9. In a printing-telegraph, the combination of a type-wheel, a constantly-acting motor M′, eccentric *y* for operating press-lever *x*, a uni-

son-transmitter operated by said motor, a main line, a unison-receiver at the distant station, a motor controlled by said unison-receiver, and transmitting mechanism for controlling the type-wheel operated by such motor in unison with the press-motor, all substantially as described.

10. In a printing-telegraph, a type-wheel which is adjusted to position for printing at regular intervals and a periodically-acting press mechanism which is disconnected with the type-wheel mechanism, all substantially as described.

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Witnesses:
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