

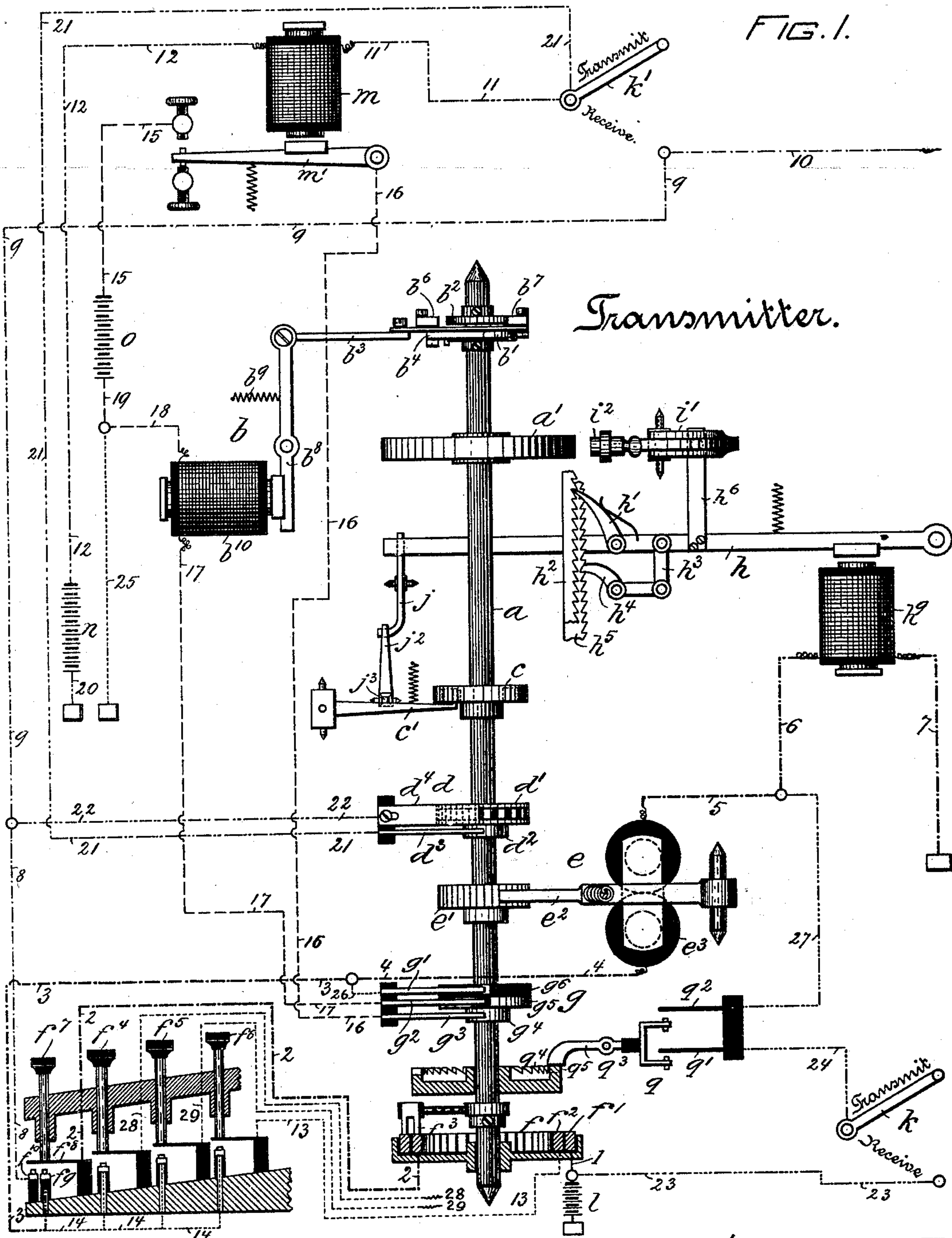
(No Model.)

4 Sheets—Sheet 1.

R. A. FOWDEN.  
PRINTING TELEGRAPH.

No. 509,430.

Patented Nov. 28, 1893.



WITNESSES:

John W. Achard,  
W. A. Schaefer

INVENTOR:  
Robert A. Fowden,  
BY J. Walter Douglas.  
ATTY.

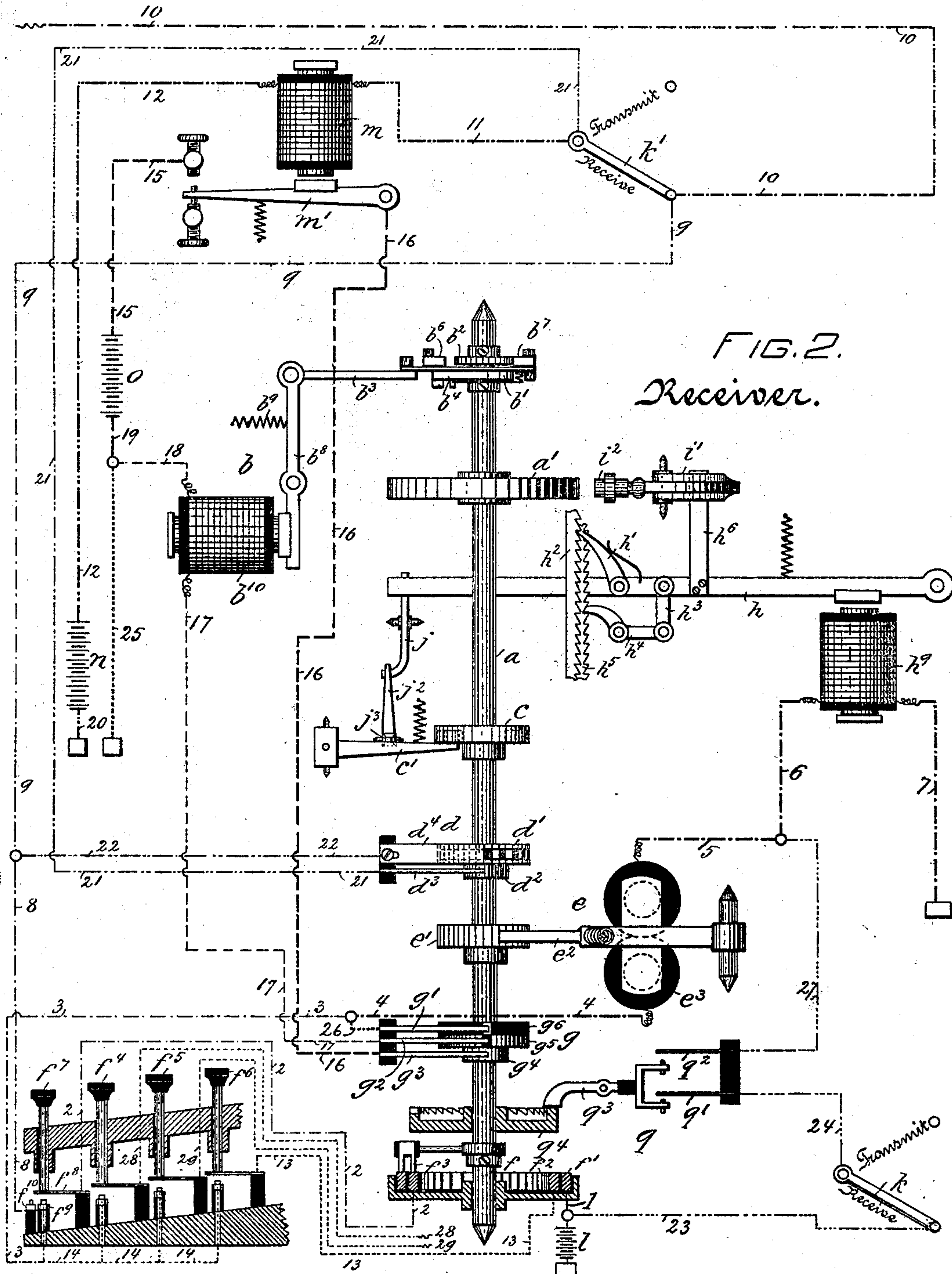
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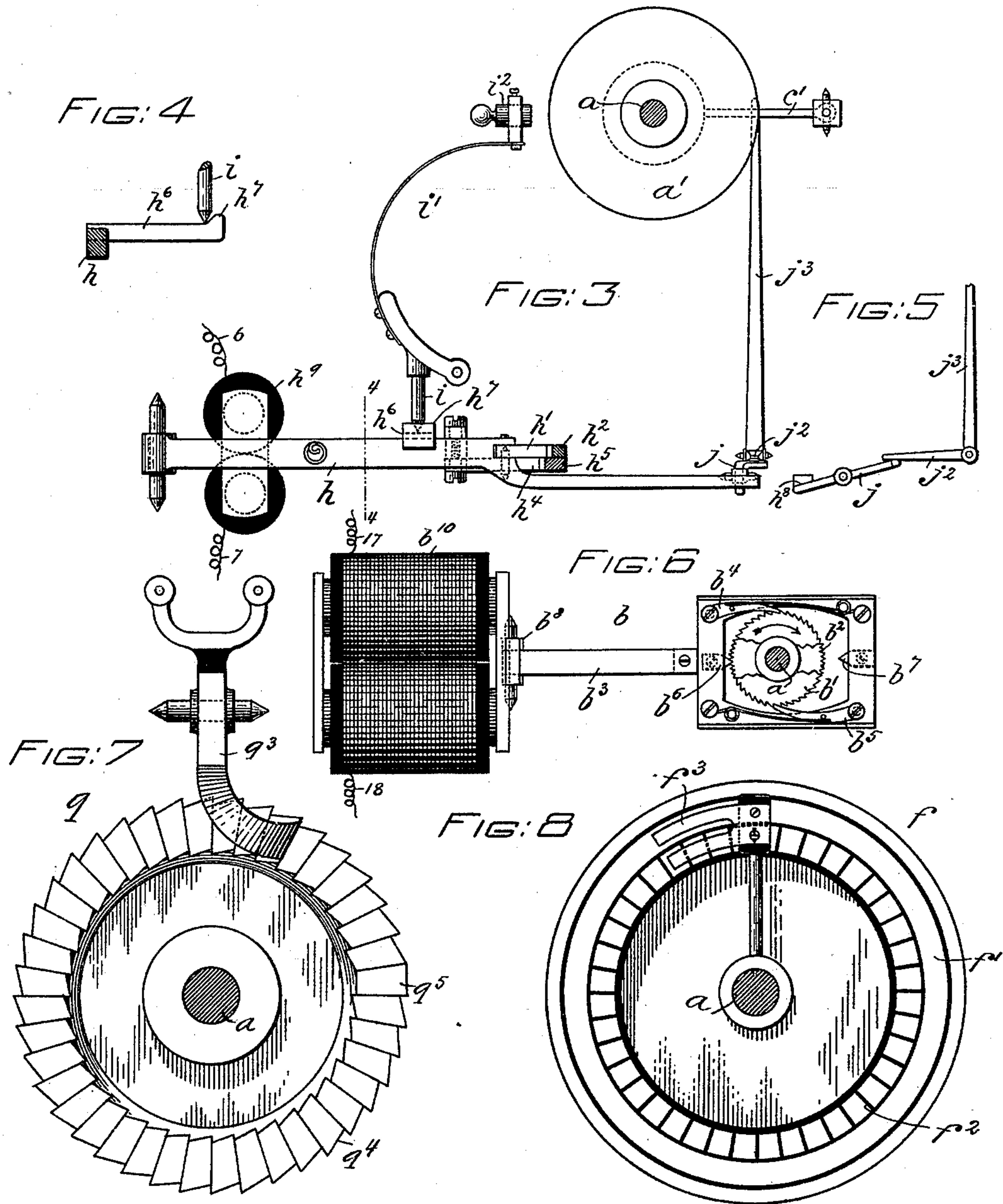
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4 Sheets—Sheet 3.

R. A. FOWDEN.  
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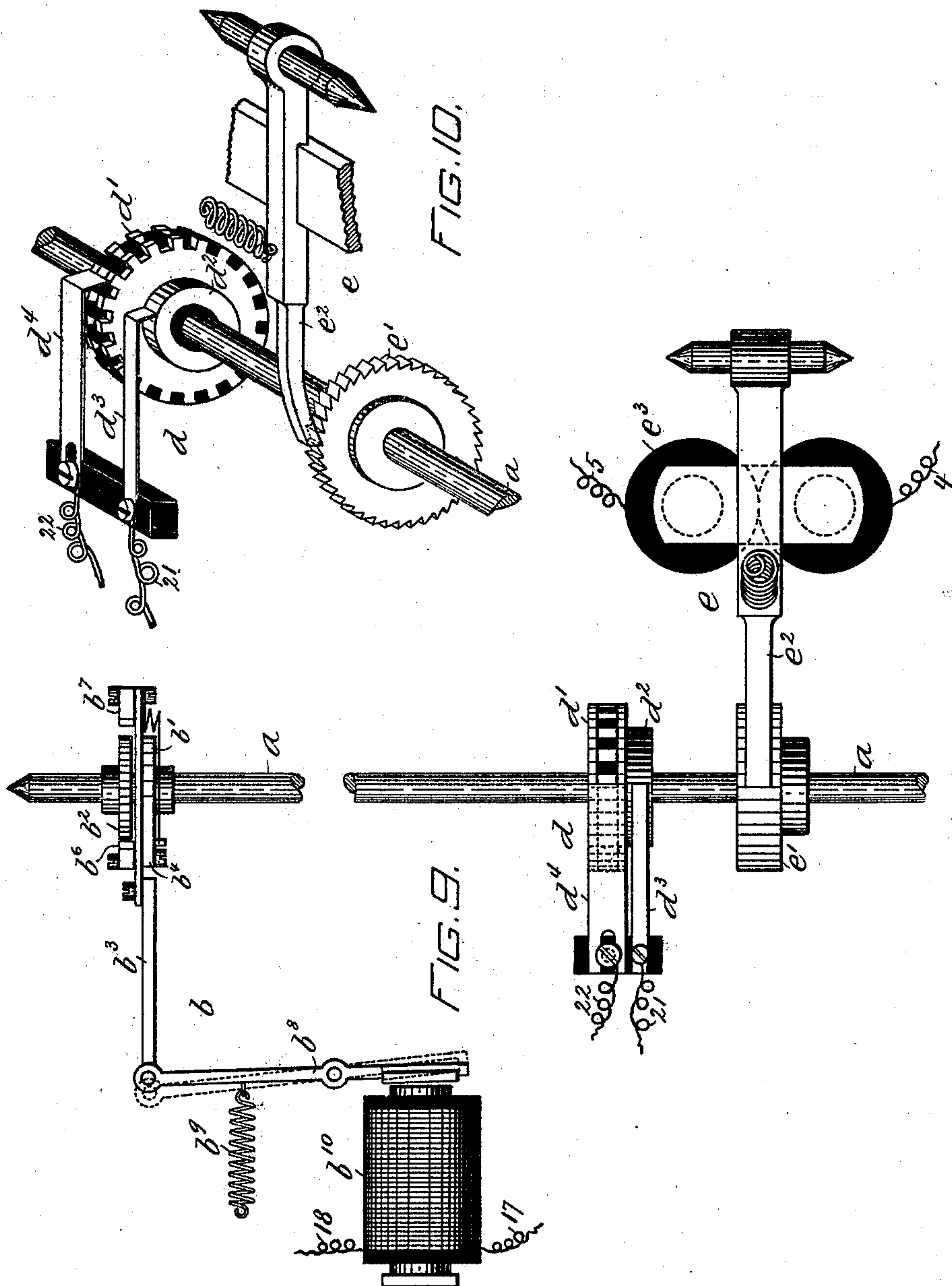
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4 Sheets—Sheet 4.

R. A. FOWDEN.  
PRINTING TELEGRAPH.

No. 509,430.

Patented Nov. 28, 1893.



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# UNITED STATES PATENT OFFICE.

ROBERT A. FOWDEN, OF PHILADELPHIA, PENNSYLVANIA, ASSIGNOR TO THE  
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JERSEY.

## PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 509,430, dated November 28, 1893.

Application filed January 31, 1893. Serial No. 460,350. (No model.)

*To all whom it may concern:*

Be it known that I, ROBERT A. FOWDEN, a citizen of the United States, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, have invented certain new and useful Improvements in Printing-Telegraphs, of which the following is a specification.

The principal objects of my invention are first, to provide an efficient, reliable and comparatively inexpensive printing telegraph instrument; second, to reduce the number of parts and to simplify the construction of the mechanical and electrical devices employed in connection with such instrument; third, to increase the efficiency and to lessen the number of circuits and circuit connections in a printing telegraph instrument; fourth, to provide compact mechanical and electrical circuit controlling devices operating to increase the efficiency of a printing telegraph instrument or a series of instruments looped together and to lessen the number of circuits, electro-magnets and relays in such instrument or instruments; fifth, to insure perfect synchronism in the movement of the type-wheel shafts of the instruments; sixth, to provide certain of the electro-magnets with simple, reliable and durable mechanical appliances, whereby double duty is performed by them; and seventh, to construct and arrange the circuit connections of the line conductor or conductors in such manner that accidental interruption or cutting out of the same arrests both the receiver and the transmitter, whereby the operator at each instrument is apprised of the occurrence of any accident or of want of synchronism in the movement of the instruments in circuit connected with each other.

In a printing telegraph system embodying features of my invention, use is made of instruments connected together by a single line conductor and provided with duplicate mechanical and electrical devices operated synchronously by means of two sets of local circuits and switches, whereof one set is employed for transmitting, and the other in receiving, and by means of two line circuits, of which one is availed of, for releasing and start-

ing the type-wheel shafts and the other for effecting the printing operations and both of the said line circuits traversing the single line conductor.

The mechanical and electrical devices at each instrument comprise a type-wheel shaft, an electric motor operated by the armature-lever of an electro-magnet and a retracting spring and adapted to revolve said shaft, a unison latch for stopping said shaft and holding the retracting spring of the motor in tension at the unison position to permit of the subsequent starting of the instrument under the influence of the retracting spring of the motor, a circuit interrupter, that is, an automatic circuit maker and breaker adapted to break the ordinary or normal line circuit through the coils of relay electro-magnets of the transmitter and receiver at the unison position, and also adapted to alternately make and break said ordinary line circuit at positions other than unison in order to operate the motors and drive the shafts, a detent, toothed wheel and locking electro-magnet for locking the shaft at the unison position and in each printing position with the circuit interrupter in position for preventing the completion of the stroke of the motor, whereby the motor is adapted to subsequently complete its stroke and proceed in its customary manner; a sunflower device, brush, printing keys and double contact unison key; a toothed wheel and ratchet switch tending to effect an impression when the type-wheel shaft is arrested at any position other than the unison position; a three way revoluble switch adapted to break the local motor circuit at the unison position and to permit the same to be closed at a position other than the unison position and adapted to permit of the actuation of the unison and locking devices by means of the local unison circuit in order to permit of the starting of the type-wheel shafts under the influence of the retracting spring of the motor, and also adapted to prevent the closing of the local unison circuit after the type-wheel shaft has been set in motion and until it is checked by the ordinary operation of the unison latch; and a printing electro-magnet having an armature lever for effecting im-



pressions, feeding the paper and transferring the unison latch from the outermost portion of its spiral to the innermost portion thereof.

The set of local unison circuits that is employed in connection with the unison line circuit and with said electrical and mechanical devices will now be described and traced.

The local unison circuit at the transmitter passes from earth through a generator to the unison contact of the sunflower device, thence to one set of contacts of a normally open double contact unison key, thence through the coils of the locking electro-magnet and through the coils of the unison and printing electro-magnet to earth. It may be remarked that the unison line circuit passes from earth through a generator, through the unison contact of the sunflower device to the other set of contacts of the normally open double contact unison key, and then through a conductor of high resistance to line, said conductor of high resistance serving to effect a proper distribution of the current in the local and line unison circuits. From the line the unison line circuit passes through the coils of a relay electro-magnet and through a generator to earth at the receiver. The local unison circuit of the receiver passes from earth through a generator, through the armature lever of the relay electro-magnet, thence through the three way revoluble switch and through the coils of the locking electro-magnet and the coils of the printing and unison electro-magnet, to earth.

The set of local printing and motor circuits that is employed after the unison line circuit has been broken and in connection with the normal printing line circuit, and the above described mechanical and electrical devices will now be traced and described.

At the transmitter the normal line circuit passes from earth through a generator and through the coils of a relay electro-magnet, whose armature-lever controls and closes the local motor circuit through a generator, the coils of the motor magnet and through the three way switch. Thence the normal line circuit passes through the circuit interrupter to line, and thence through the coils of the relay electro-magnet at the receiver and to earth through a generator. At the transmitter the local printing circuit is from earth through a generator, the sunflower device, contacts of the character keys, and through the coils of the locking electro-magnet, and the coils of the printing and unison electro-magnet, to earth. At the receiver the local motor circuit is controlled by the armature lever of the relay electro-magnet and is closed at the three way revoluble switch through the motor electro-magnet; and the local printing circuit passes from earth through a generator and through the contacts of the ratchet switch and thence through the coils of the printing and unison electro-magnet to earth.

Assuming that the instruments are in the unison position the operation of starting the

instruments and of printing are as follows:—

The double contact unison key is depressed at the transmitter, thus closing the local unison circuit through the coils of the locking electro-magnet and through the coils of the printing and unison electro-magnet, whereby the unison latch is released and the printing pallet is caused to contact with a blank space on the type-wheel and the paper fed forward, and whereby the locking bar or detent is brought into a position for locking the shaft. The depression of the unison key also closes the unison line circuit, thereby energizing the relay electro-magnet at the receiver. The relay electro-magnet at the receiver being thus energized pulls up its armature and closes the local unison three way revoluble switch circuit through the coils of the locking electro-magnet and through the coils of the printing and unison electro-magnet, whereby the unison latch at the receiver is released and the shaft is locked by the locking bar or detent as at the transmitter, so that both shafts are locked in position for holding the retracting springs of their motors in unison. The unison key at the transmitter is then released, thereby breaking the local unison circuit through the coils of the locking electro-magnet and through the coils of the printing and unison electro-magnet of the transmitter and also breaking the unison line circuit, so that the relay at the receiver is demagnetized and its armature lever falls back and breaks the local unison circuit through the coils of the locking electro-magnet and through the coils of the printing and unison electro-magnets of the receiver. Under these conditions the unison latches at both instruments are permitted to return under the influence of their retracting springs to the innermost portions of their spirals and the tension in the respective retracting springs of the motors causes the type-wheel shafts of both instruments to be slightly rotated under the influence of the motor springs. This rotation of the shafts causes the three way switches at the transmitter and receiver to close the local motor circuits through the coils of the motor electro-magnets and also causes the circuit interrupter at the transmitter to make the normal line circuit through the coils of the relay electro magnets of both instruments and to subsequently break the same and the repeated makes and breaks in the normal line circuit due to the operation of the interrupter at the transmitter will cause the motor circuits to be made and broken at the relay electro-magnets thereby causing the motors to actuate the type-wheel shafts and to insure perfect synchronism of movement, because each motor is controlled by its relay and both relays are controlled by the circuit interrupter at each transmitter. The depression of a letter key causes the local printing circuit to be closed through it at the transmitter as soon as the sunflower brush sweeps onto its corresponding contact, and then through the coils



of the locking electro magnet and through the coils of the printing and unison electro-magnet, whereby the former operates to arrest the type-wheel shaft and the latter releases the unison latch, feeds the paper and effects an impression of the characters on the type-wheel corresponding with the characters of a depressed key. The locking electro magnet at the transmitter, however, arrests its type-wheel shaft slightly before the motor has completed its stroke, so that upon the release of the key the motor will first complete its stroke and then proceed in the same manner that it did before the key was depressed. The arrest of the type-wheel shaft at the transmitter at a character in the manner above described causes its circuit interrupter to come to rest in position for causing the normal line circuit to bring the relay electro-magnet at the receiver into a condition corresponding with that of the relay electro-magnet at the transmitter. Under these circumstances the relay electro-magnet at the receiver acting through its armature-lever, arrests the motor and the latter arrests the receiver type-wheel shaft, whereupon the ratchet switch falls between the teeth of its toothed wheel, and thereby closes the circuit through the coils of the printing and unison electro-magnet and effects an impression at the receiver. When the printing key is released at the receiver, the motor completes its stroke so that both instruments are automatically set in motion and inasmuch as the unison latch is returned to its initial position during the printing operation, it follows that other letter keys may be depressed, in order to print other characters. If this is not done both instruments run to unison and may be again operated in the manner hereinbefore described.

My invention consists of a printing telegraph system provided with relay electro-magnets interposed in the line circuit and adapted to control local motor circuits at the transmitter and receiver, whereby synchronism in the movement of the type-wheels of both the transmitter and the receiver, is insured.

My invention further consists of a printing telegraph provided with relay electro-magnets interposed in the line circuit and adapted to control local motor circuits at both instruments, and a circuit interrupter located at the instrument operating as a transmitter and adapted to control the line circuit.

My invention further consists of a printing telegraph provided with a transmitter and receiver respectively having motors responding to makes and breaks in a normal line circuit, whereby an accidental interruption in the line circuit arrests the motor of each instrument in corresponding position.

My invention further consists of a printing telegraph provided with motors at each instrument responding to makes and breaks in line produced by the revolution of the type-wheel shaft at the transmitter, a local printing circuit and devices for effecting an im-

pression and arresting the type-wheel shaft at the transmitter, whereby the motor at the receiver is caused to arrest its type-wheel shaft, and a local printing circuit and devices at the receiver controlled by a ratchet switch and adapted to effect an impression upon the arrest of the type-wheel shaft of the receiver.

My invention further consists of a printing telegraph provided with relay electro-magnets adapted to control local motor circuits and motors at each instrument and responding to makes and breaks in line produced by a circuit interrupter at the transmitter, a local printing circuit and devices for effecting an impression and arresting the type-wheel shaft and a circuit interrupter at the transmitter, whereby the motor at the receiver is caused to arrest its type-wheel shaft, and a local printing circuit and devices at the receiver controlled by a ratchet switch and adapted to effect an impression upon the arrest of the type-wheel shaft of the receiver.

My invention further consists of a printing telegraph provided with a receiver and a transmitter normally operated by motors responding to makes and breaks produced in line by the revolution of the type-wheel shaft of the transmitter, a local printing circuit and devices operating by the depression of a key at the transmitter to effect an impression and arrest the type-wheel shaft before the transmitter motor completes its stroke and before the line circuit is made or broken, whereby the motor at the receiver arrests its type-wheel shaft and effects an impression through the intervention of a local printing circuit and devices controlled by the revolution of the receiver type-wheel shaft, and whereby the motors of both instruments are permitted to again start upon the release of the key and by the completion of the partial stroke of the transmitter motor.

My invention further consists of a printing telegraph provided with a receiver and a transmitter normally operated by motors and local motor circuits controlled by relay electro-magnets responding to makes and breaks produced in line by a circuit interrupter on the type-wheel shaft of the transmitter, a local printing circuit and devices operating by the depression of a key at the transmitter to effect an impression and to arrest the type-wheel shaft before the transmitter motor completes its stroke and before the circuit interrupter makes or breaks the line circuit, whereby the relay electro-magnet at the receiver acting through its local motor circuit causes the motor to arrest the receiver type-wheel shaft and whereby the motors of both instruments are permitted to again start upon the release of the key and by the completion of the partial stroke of the transmitter motor.

My invention further consists of a printing telegraph provided with a transmitter and receiver each having an electric motor adapted to drive the type-wheel shaft and responding to makes and breaks in the normal line



produced by a circuit interrupter at the transmitter, and each having a unison latch adapted to arrest its type-wheel shaft with the retracting spring of the motor thereof in tension and with the circuit interrupter in position for breaking the normal line circuit, whereby the motors may be permitted to start under the influence of their retracting springs when the shafts are released.

10 My invention further consists of a printing telegraph having a transmitter and a receiver respectively provided with a motor responding to makes and breaks in a normal line circuit and driving the type-wheel shaft, a unison latch for locking the type-wheel shaft in such position that the retracting spring of the motor tends to start it, a detent for locking said shaft, electro-magnets and circuit connections for operating said unison latch and detent, a revoluble switch actuated by the type-wheel shaft and adapted to cut out the normal line circuit and include the unison circuits at unison position of the shaft, a double contact unison key at the transmitter 25 for controlling the local printing circuit and devices to release the unison latch and lock and unlock the transmitter type-wheel shaft and for controlling the unison line circuit to release the unison latch and lock and unlock 30 the receiver type-wheel shaft through the instrumentality of a relay and local circuit.

My invention further consists of a printing telegraph having a revoluble wheel provided with teeth and a ratchet-switch controlling a local printing circuit and riding on said teeth as the wheel is rotated and entering a space between said teeth upon the arrest of the wheel.

40 My invention further consists of a printing telegraph instrument provided with a toothed wheel actuated by a type-wheel shaft and having a wide tooth, and a ratchet switch controlling a local printing circuit and tending to enter the spaces between the teeth of said wheel upon the arrest of the shaft and restrained from such movement at the unison position of the shaft by the wide tooth.

50 My invention further consists of a printing telegraph instrument having an armature lever provided with impression and unison latch actuating devices and having a magnet for actuating said armature lever.

60 My invention further consists of a printing telegraph instrument provided with a sunflower device comprising a conducting annulus and an annulus having conducting and insulating segments, an insulated brush sweeping over each annulus, circuit connections from earth through a generator to the conducting annulus and through the brush and conducting segments to character keys controlling a local printing circuit and to a double contact unison key controlling said local printing circuit and also a unison line 65 circuit.

My invention further consists of a printing telegraph instrument provided with a three

way revoluble switch moving with the type-wheel shaft and adapted to interrupt a local motor circuit at the unison position and to permit of the closing of the same at other positions, and adapted to permit of the closing of a circuit through the coils of a printing and unison electro-magnet and through the coils of a locking electro-magnet at unison position and to prevent the closing of the circuit through said electro-magnets at other positions.

80 My invention further consists of a printing telegraph instrument provided with a circuit interrupter moving with the type-wheel shaft and adapted to actuate motors at the respective instruments, a spur-wheel mounted on said shaft, a detent for engaging said spur-wheel and arresting the circuit interrupter just before its contact passes the segment over which it is traveling whereby the transmitter motor is arrested before the completion of its stroke.

90 My invention further consists of a printing telegraph provided with a type-wheel shaft, an electro-motor and its connections for driving said shaft, and a unison latch adapted to arrest said shaft in position for maintaining the retracting spring of the motor in tension; and my invention further consists of the improvements in printing telegraphs hereinafter described and claimed.

100 The nature and general features of my invention will be more fully understood from the following description taken in connection with the accompanying drawings, forming part hereof; and in which—

Figure 1, is a diagrammatic view illustrating a printing telegraph instrument embodying features of my invention and arranged as a transmitter, and showing also the parts of said instrument in the unison position with the retracting springs of the motor held in tension by the unison latch and the motor. 105 Fig. 2, is a similar view of a printing telegraph instrument embodying features of my invention and arranged as a receiver. Fig. 3, is a view partly in side elevation and partly in section taken from the top of Sheet 1, and illustrating the armature-lever of the printing and unison electro-magnet and showing also mechanism embodying features of my invention operated thereby, and adapted to actuate the printing-pallet and unison-latch. 110 Fig. 4, is a sectional view taken on the line 4—4, of Fig. 3, and illustrating details of construction of the printing pallet operating devices. Fig. 5, is an elevational view of the right hand end of the armature-lever shown in Fig. 3, illustrating the construction of certain of the parts that actuate the unison-latch. 115 Fig. 6, is an elevational view partly in section taken from the bottom of Sheet 1, and illustrating certain parts of the electric-motor, and also showing the means whereby when the type-wheel shaft is arrested the motor is likewise arrested. Fig. 7, is a front view of the ratchet-switch showing the same provided 120 125 130



with a toothed wheel having a wide unison tooth and also showing an efficient form of ratchet-switch which is somewhat distorted in Figs. 1 and 2, for the purposes of diagrammatic illustration. Fig. 8, is a view of the sunflower and brush. Fig. 9, is a diagrammatic view illustrating portions of a type-wheel shaft provided with a spur or toothed wheel and with a circuit interrupter controlling the circuit of an electric-motor adapted to drive the shaft and showing a contact sweeping over the segments of the circuit maker and breaker, and a detent for locking the type-wheel shaft before the contact has passed off a segment over which it is traveling, whereby the motor is arrested before the completion of its stroke; and Fig. 10, is a perspective view showing certain of the parts illustrated in Fig. 9.

20 In the drawings *a*, is a type-wheel shaft afforded freedom of rotary motion in suitable bearings, not shown, and provided with a type-wheel *a'*, having in the present instance upon its rim thirty nine characters and one space, not shown.

25 *b*, is an electric-motor adapted to drive the type-wheel shaft *a*, with a uniform step by step movement and comprising a ratchet-wheel *b'*, and a star or stop-wheel *b<sup>2</sup>*, secured to the shaft *a*, a bar *b<sup>3</sup>*, provided with spring controlled pawls *b<sup>4</sup>* and *b<sup>5</sup>*, for rotating the ratchet-wheel *b'*, and with stops *b<sup>6</sup>* and *b<sup>7</sup>*, for engaging the star-wheel *b<sup>2</sup>*, at or near the completion of the stroke of each pawl, an armature-lever *b<sup>8</sup>*, and a retracting-spring *b<sup>9</sup>* and motor electro-magnet *b<sup>10</sup>*, for reciprocating the bar *b<sup>3</sup>*. When the motor electro-magnet *b<sup>10</sup>*, is energized its armature lever *b<sup>8</sup>*, shifts the bar *b<sup>3</sup>*, toward the right in Fig. 6, thus causing the pawl *b<sup>4</sup>*, to engage the ratchet-wheel *b'*, and rotate the shaft *a*, in the direction of the arrow, until the stop *b<sup>6</sup>*, meshes with the teeth of the star-wheel *b<sup>2</sup>*, and arrests the shaft *a*, in such position that one of the characters on the type-wheel *a'*, is in proper position for permitting an impression to be taken from it. When the motor electro-magnet *b<sup>10</sup>*, is demagnetized the retracting-spring *b<sup>9</sup>*, shifts the bar *b<sup>3</sup>*, toward the left in Fig. 6, thus causing the pawl *b<sup>5</sup>*, to engage the ratchet-wheel *b'*, and rotate the shaft in the direction of the arrow until the stop *b<sup>7</sup>*, meshes with the teeth of the star-wheel *b<sup>2</sup>*, and arrests the shaft *a*, in such position that the next character of the type-wheel is in proper position for permitting an impression to be taken from it. Subsequent magnetization and demagnetization of the motor electro-magnet *b<sup>10</sup>*, cause the bar *b<sup>3</sup>*, to be shifted back and forth with the result that the pawls *b<sup>4</sup>* and *b<sup>5</sup>*, and stops *b<sup>6</sup>* and *b<sup>7</sup>*, rotate the type-wheel shaft *a*, with an intermittent motion and in such manner that successive characters on the type-wheel *a'*, are brought into printing position by the actions of the motor.

It may be remarked that the detail construction of the type of electro-motor hereinbefore

described constitutes the subject-matter of an application for United States Letters Patent, serially numbered 456,142, and filed on the 23d day of December, 1892, by Job A. Davis and myself, as joint inventors, and hence is not specifically claimed herein.

*c*, is a unison spiral mounted on the type-wheel shaft *a*, and provided with a spring controlled unison latch *c'*, adapted to engage the outer end of the spiral and thus arrest the type-wheel shaft *a*, when the blank space on the type-wheel *a'*, is in the position hereinbefore designated, the printing position, and when the retracting spring *b<sup>9</sup>*, of the motor is in tension. In this connection it may be remarked that the arrest of the type-wheel shaft *a*, by the unison latch *c'*, causes the ratchet-wheel *b'*, to hold the pawl *b<sup>4</sup>*, and thus prevent movement of the bar *b<sup>3</sup>*, whereby the retracting-spring *b<sup>9</sup>*, is held in tension, so as to permit of the subsequent starting of the motors as will be hereinafter fully described.

*d*, is a circuit interrupter adapted to produce makes and breaks in the coils of the relay electro-magnet, to which the motor electro-magnet *b<sup>10</sup>*, responds and is composed of a conducting disk *d'*, insulated from the shaft *a*, and provided with insulating segments corresponding in position with divisions on the type-wheel *a'*, a second conducting disk *d<sup>2</sup>*, insulated from the shaft *a*, and in electrical connection with the disk *d'*, a contact spring *d<sup>3</sup>* for the disk *d<sup>2</sup>*, and an adjustable contact spring *d<sup>4</sup>*, for the disk *d'*.

*e*, is a type-wheel shaft locking and releasing device comprising a spur-wheel *e'*, having spaces corresponding in number and position with the divisions on the type-wheel *a'*, and a spring controlled armature-lever *e<sup>2</sup>*, provided with a detent adapted to engage the spaces between the teeth of the spur-wheel *e'*. In this connection it may be remarked that in use the adjustable contact spring *d<sup>4</sup>*, is adjusted in such manner that when the shaft *a*, is arrested by the armature-lever *e<sup>2</sup>*, the spring *d<sup>4</sup>*, occupies a position at or near the edge of the segment of the disk *d'*, upon which it is traveling, as shown in Fig. 10, so that the armature of the electro-motor *b*, cannot complete its stroke; and moreover, the condition of the line is not changed by such arrest of the type-wheel shaft. However, when the type-wheel shaft *a*, is arrested by the unison latch *c'*, the spring *d<sup>4</sup>*, rests upon an insulating segment of the disk *d'*. These adjustments or peculiarities of construction are productive of several advantageous results, as will be hereinafter more fully explained.

*f*, Fig. 8, is a sunflower device comprising a rigidly supported conducting annulus *f'*, an annulus *f<sup>2</sup>* composed of insulating and conducting segments, and a conducting brush *f<sup>3</sup>*, sweeping over the annular parts of the sunflower and carried by an insulating arm projecting from the type-wheel shaft *a*.

*f<sup>4</sup>*, *f<sup>5</sup>* and *f<sup>6</sup>*, are printing-keys correspond-



ing with the characters upon the type-wheel  $a'$ , and  $f^7$ , is a double contact unison key.

$g$ , is a three-way revoluble switch insulated from the shaft  $a$ , and comprising contact-springs  $g'$ ,  $g^2$  and  $g^3$ , and a hub  $g^4$  in electrical connection with the contacts of the disks  $g^5$  and  $g^6$ . The disk  $g^5$ , is provided with one insulating segment and the disk  $g^6$ , is provided with one conducting segment and these segments are in alignment with each other and with the blank space on the type-wheel  $a'$ , and are adapted to contact with the springs  $g'$  and  $g^2$ , at unison position for purposes to be presently described.

$h$ , is a spring controlled printing and unison magnet armature-lever provided with a spring controlled pawl  $h'$ , adapted to feed the rack  $h^2$ , of a paper-carriage, not shown, and with a link  $h^3$ , for operating a pivotal detent  $h^4$ , that co-operates with a rack  $h^5$ , and thus regulates and limits the feed imparted by the pawl  $h'$ , to the paper-carriage. The intermediate portion of this armature-lever  $h$ , is provided with a laterally projecting arm  $h^6$ , having an enlarged wedge-like extremity  $h^7$ , Fig. 4, upon which a rod  $i$ , connected with and depending from a pivotal printing hammer  $i'$ , rides in such manner that when the armature-lever  $h$ , is pulled up the wedge-like extremity  $h^7$ , trips the rod  $i$ , and causes the printing-pallet  $i^2$ , to contact with the paper and take an impression from one of the characters on the type-wheel  $a'$ . The armature-lever  $h$ , is provided at or near its free extremity and upon its under side with a wedge  $h^8$ , Fig. 5, that engages one extremity of a pivotal-lever  $j$ , the other extremity of which engages one arm  $j^2$ , of a bell crank-lever having its other arm  $j^3$ , in range of the spring controlled unison-latch  $c'$ , so that when the armature-lever  $h$ , is pulled up the wedge  $h^8$ , operating through the instrumentality of the levers  $j$ ,  $j^2$  and  $j^3$ , causes the unison-latch  $c'$ , to be thrown out of the outer end of its spiral and when the armature-lever  $h$ , falls back under the influence of its retracting spring, the unison-latch  $c'$ , is again permitted to move under the influence of its spring into engagement with the inner end of its spiral. By these means the pulling up of the armature-lever  $h$ , effects impressions, feeds the paper, and releases the unison-latch.

$q$ , is a ratchet-switch comprising a wheel  $q^4$ , Fig. 7, mounted upon the shaft  $a$ , and provided with teeth disposed in alignment with the divisions on the type-wheel  $a'$ , and a ratchet  $q^3$ , tending to fall into one of the spaces between the teeth and close a printing circuit at its free end, when the toothed wheel  $q^4$  is at rest, and restrained normally from such movement by the rotation of the wheel, and at unison position by a wide tooth  $q^5$ , upon which it rests.

The set of local unison circuits that is employed in connection with the unison line circuit for starting the instruments from unison position will now be described and traced

with special reference to Figs. 1 and 2, and in this connection it may be remarked that each instrument is provided with two manual switches  $k$  and  $k'$ , that are turned into open position as shown in Fig. 1, when the instrument is used as a transmitter and into closed position as shown in Fig. 2, when the instrument is used as a receiver. At the transmitter, Fig. 1, the local unison circuit passes from earth through a generator 1, by the conductor I, through the outer annulus  $f'$ , of the sunflower device, through the brush  $f^3$ , and the unison contact segment of the inner annulus  $f^2$ , of the sunflower device  $f$ , to the contact spring  $f^8$ , of the normally open double contact unison key  $f^7$ , by a conductor 2. When the unison key  $f^7$ , is depressed the circuit branches. One branch constitutes the unison line circuit to be presently described, and the other branch passes through one of the contacts  $f^9$ , of the unison key, thence by conductors 3 and 4 through the coils of the locking electro-magnet  $e^3$ , and thence by conductors 5 and 6, to and through the coils of the printing and locking electro magnet  $h^9$ , and by a conductor 7, to earth. When the unison key  $f^7$ , is depressed the branch constituting the unison line circuit passes from the other contact  $f^{10}$ , of the normally open double contact unison key  $f^7$ , and then through a conductor 8, of high resistance to a conductor 9, to the single line conductor 10, and by the manual-switch  $k'$ , and conductor 11, through the coils of the relay-magnet  $m$ , Fig. 2, and thence by a conductor 12 through a generator  $n$ , and to earth by a conductor 20, at the receiver. The local unison circuit of the receiver, Fig. 2, passes from earth by conductors 25 and 19 through a generator  $o$ , and by a conductor 15 through the armature-lever  $m'$ , when the relay electro-magnet  $m$ , is energized by the line unison circuit. Thence the local unison circuit of the receiver passes by a conductor 16, through the contact springs  $g^3$  and  $g'$ , of the three-way revoluble switch  $g$ , by a conductor 26, to the conductor 4, and thence by conductors 5, 6 and 7, through the coils of the locking electro-magnet  $e^3$  and the coils of the printing and unison electro-magnet  $h^9$ , to earth.

The set of local printing and motor circuits that is employed in connection with the normal printing line circuit, *i. e.*, after the unison line circuit has been broken, will now be traced and set forth.

At the transmitter, Fig. 1, the normal line circuit passes from earth by a conductor 20, through the generator  $n$ , by a conductor 12, through the coils of the relay electro-magnet  $m$ , and by conductors 11 and 21 to the contact spring  $d^3$ , of the circuit interrupter  $d$ , thence by the contact spring  $d^4$ , conductors 22 and 9, to the line conductor 10. Thence the normal line circuit passes by the switch  $k'$ , of the receiver, Fig. 2, and conductors 11, 12 and 20 through the coils of the relay electro-magnet  $m$ , and generator  $n$ , to earth. The local



printing circuit at the transmitter is from earth through the generator 1, the conductor 1, the sunflower device  $f$ , conductors 13, 28 or 29, contacts of the keys  $f^4$ ,  $f^5$  or  $f^6$ , conductors 14, 3 and 4 through the coils of the locking electro-magnet  $e^3$ , thence by the conductors 5 and 6 through the coils of the unison and printing electro-magnet  $h^9$ , and thence to earth by the conductor 7. At the receiver the motor circuit comprises a generator  $o$ , and conductors 15, 16, 17, 18 and 19, and is controlled by the armature-lever  $m'$ , of the relay electro-magnet  $m$ , and is closed at the three-way revoluble switch  $g$ , through the coils of the motor electro-magnet  $b^{10}$ , and the local printing circuit passes from earth through the generator 1, by the conductor 23, switch  $k$ , and conductor 24, through the contacts  $q'$  and  $q^2$ , of the ratchet-switch  $q$ , and thence by conductors 27, 6 and 7, to earth through the coils of the printing and unison electro-magnet  $h^9$ . However, at unison position this circuit is broken by reason of the fact that the ratchet-switch  $q$ , rests upon the wide tooth  $q^5$ , of the toothed wheel  $q^4$ , and consequently breaks said circuit at the contacts  $q'$  and  $q^2$ .

Assuming that the instruments are in unison position as shown in Figs. 1 and 2, the operations of starting them and of printing are as follows:—The double contact unison key  $f^7$ , is depressed at the transmitter, thus closing the local unison circuit 1, 2, 3, 4, 5, 6 and 7 through the coils of the locking electro-magnet  $e^3$ , and through the coils of the printing electro-magnet  $h^9$ , it being understood that the springs  $g'$  and  $g^3$ , of the three-way revoluble switch  $g$ , are in electrical connection with each other and that the line from the spring  $g^3$ , is broken at the armature-lever  $m'$ , by reason of the fact that the spring  $d^4$ , of the circuit interrupter  $d$ , rests upon an insulating segment. The magnetization of the locking electro-magnet  $e^3$ , causes its armature-lever  $e^2$ , to be pulled down into position for locking the toothed-wheel  $e'$ , and type-wheel shaft  $a$ , and the magnetization of the printing and unison electro-magnet  $h^9$ , causes its armature-lever  $h$ , to be pulled down with the result that the pawls  $h'$  and  $h^5$ , are brought into position for feeding the paper-carriage, the printing pallet  $i^2$ , brings the paper into contact with the blank space on the type-wheel  $a'$ , and the unison-latch  $c'$ , is shifted out of engagement with the outermost portion of its spiral  $c$ . The depression of the double contact unison key  $f^7$ , also closes the unison line circuit 1, 2, 8, 9, 10,  $k'$ , 11, 12 and 20, thus energizing the relay electro-magnet  $m$ , at the receiver. In this connection it may be remarked that the conductor 8, of high resistance causes a proper distribution of the current from the generator 1, to line and through the coils of the locking electro-magnet  $e^3$ , and through the coils of the printing and unison electro-magnet  $h^9$ . The relay electro-magnet  $m$ , at the receiver being thus energized pulls

up its armature lever  $m'$ , and closes the local unison circuit 25, 19, 15, 16, 26, 4, 5, 6 and 7 through the coils of the locking electro-magnet  $e^3$ , and through the coils of the printing and unison electro-magnet  $h^9$ , whereby the unison-latch  $c'$ , at the receiver is released, and the shaft  $a$ , is locked by the detent of the armature-lever  $e^2$ , in precisely the same manner as at the transmitter. The double unison contact key  $f^7$ , at the transmitter, is then released, thus breaking the local unison circuit 1, 2, 3, 4, 5, 6 and 7, through the coils of the locking electro-magnet  $e^3$ , and through the coils of the printing and unison electro-magnet  $h^9$ , of the transmitter and also breaking the unison line circuit 1, 2, 8, 9, 10,  $k'$ , 11, 12 and 20, so that the relay electro-magnet  $m$ , at the receiver is demagnetized and its armature-lever  $m'$ , is permitted to break the local unison circuit 25, 15, 16, 26, 4, 5, 6 and 7, through the coils of the locking electro-magnet  $e^3$ , and through the coils of the printing and unison electro-magnet  $h^9$ , of the receiver. Under these circumstances the unison latches at both instruments are permitted to move under the influence of their retracting springs into engagement with the innermost portions of their spirals and the armature-levers  $e^2$ , are shifted into position for releasing the shaft  $a'$ , so that the tension in the respective retracting springs  $b^9$ , of the motors, causes the type-wheel shafts of both instruments to be slightly rotated; it being understood that the unison-latches  $c'$ , always arrest the type-wheel shafts in such position that the retracting-springs  $b^9$ , are in tension as shown in Figs. 1 and 2. This rotation of the shafts causes the three-way switches  $g$ , at the transmitter and receiver to close the local motor circuit 15, 16, 17, 18 and 19, through the motor electro-magnet  $b^{10}$ , by reason of the fact that the contact springs  $g^2$  and  $g^3$ , are in electrical connection with each other through the disks  $g^4$  and  $g^5$ , and also causes the circuit interrupter  $d$ , at the transmitter to make the normal line circuit 20, 12, 11, 21, 22, 9, (Fig. 1,) 10,  $k'$ , 11, 12 and 20 (Fig. 2), through the coils of the relay electro-magnets  $m$ , of both instruments and to subsequently break and again make the same. The repetition of these makes and breaks in the normal line circuit due to the ordinary operation of the circuit interrupter at the transmitter, acting through the armature-levers  $m'$ , of the relay electro-magnets  $m$ , and in connection with the retracting springs  $b^9$ , and motor electro-magnets  $b^{10}$ , will cause the motors  $b$ , to propel the type-wheel shafts  $a$ , and perfect synchronism of movement is insured, because each motor is controlled by its relay and both relays are controlled by the circuit interrupter at the transmitter. This is important, because accidental breakage in the line conductor 10, would result in a stoppage of the transmitter, as well as of the receiver, so that the operator at the transmitter would be apprised of the accident and would not attempt



to transmit messages until the necessary repairs had been effected. The depression of a letter key, for example, the key  $f^6$ , at the transmitter, causes the local printing circuit 1, 13, 14, 3, 4, 5, 6 and 7 to be closed through it as soon as the sunflower brush  $f^3$ , sweeps onto the contact connected with the conductor 13, whereupon the locking electro-magnet  $e^3$ , and printing and unison electro-magnet  $h^9$ , are energized. Under these circumstances the locking electro-magnet  $e^3$ , attracts its armature and arrests the type-wheel shaft, and the printing and unison electro-magnet feeds the paper, throws the unison-latch out of action, and effects an impression on the character of the type-wheel, that corresponds to the character of the depressed key. The locking electro-magnet  $e^3$ , at the transmitter, however, arrests its type-wheel shaft before the spring  $d^4$ , has passed off the segment of the disk  $d'$ , over which it is traveling, as shown in Fig. 10, and before the motor has completed its full stroke, as shown by full lines in Fig. 9. Consequently upon the release of the key  $f^6$ , the unison-latch will be returned to its initial position and then proceed in the same manner as it did before the key  $f^6$ , was depressed. The arrest of the circuit interrupter at the transmitter in the manner above described, *i. e.*, with the contact spring  $d^4$  at or near the edge of the segment over which it is traveling, causes the normal line circuit 20, 12, 11, 21, 22, 9, 10, (Fig. 1,)  $k'$ , 11, 12 and 20, (Fig. 2,) to bring the relay electro-magnet at the receiver into a condition corresponding with the condition of the relay electro-magnet at the transmitter. Under these circumstances the relay at the receiver acting through its armature-lever  $m'$ , arrests its motor and the latter arrests the receiver type-wheel shaft, whereupon the ratchet-switch  $q^3$ , falls between the teeth of the toothed wheel  $q^4$ , and thus closes the local printing circuit 1, 23,  $k$ , 24, 27, 6 and 7 through the printing and unison electro-magnet  $h^9$ , and effects an impression at the receiver of the character corresponding to the character of the depressed key, and also releases the unison-latch, and feeds the paper. When the printing key  $f^6$ , is released, the motor at the transmitter completes its stroke, as shown by dotted lines in Fig. 9, the unison latches are permitted to return to their initial positions and both instruments are again set in motion. Inasmuch as the unison latches  $c'$ , are returned to their initial positions every time an impression is taken, it follows that another letter key, as  $f^4$ , may be depressed at the transmitter before the shafts are permitted to run to unison. However, whenever it becomes necessary or desirable to bring the instruments to unison, this result may be accomplished by releasing all the keys, and afterward the instruments may be again operated in the manner above described, or the switches  $k$  and  $k'$ , in Fig. 1, may be closed, and those in Fig. 2 opened, with the result that the instrument of Fig. 2,

becomes the transmitter and the instrument of Fig. 1 the receiver.

It will be obvious to those skilled in the art to which my invention appertains that modifications may be made in details. For example, one generator may be employed at each instrument and the respective circuits may be derived from it in parallel or use may be made of a central station and of a plurality of instruments, without departing from the spirit of my invention.

Having thus described the nature and objects of my invention, what I claim as new, and desire to secure by Letters Patent, is—

1. A printing telegraph system, comprising relay electro-magnets adapted to control local motor circuits at the transmitter and receiver and responding to makes and breaks in a line circuit, and a revoluble circuit maker and breaker interposed in the conductor of said line circuit and mounted on the transmitter type-wheel shaft, substantially as and for the purposes set forth.

2. A printing telegraph system, comprising relay electro-magnets interposed in the line circuit and adapted to control the local motor-circuits at the transmitter and receiver, a conducting disk and a disk having peripheral insulations alternating with contacts in electrical connection with the conducting disk mounted on the transmitter type-wheel shaft, and contact springs bearing on said disks and interposed in the line circuit, substantially as and for the purposes set forth.

3. A printing telegraph system, comprising a transmitter and receiver provided with motors responding to makes and breaks in a normal line circuit, a conducting disk and a disk having peripheral insulations alternating with contacts in electrical connection with the conducting disk mounted on the transmitter type-wheel shaft, and contact springs bearing on said disks and interposed in the line circuit, substantially as and for the purposes set forth.

4. A printing telegraph system, comprising motors at the transmitter and receiver instruments responding to makes and breaks in line, a circuit maker and breaker interposed in the line circuit and mounted on the type-wheel shaft at the transmitter, relay electro-magnets interposed in the line circuit and adapted to control the local motor circuit of the transmitter and receiver instruments, a printing circuit and devices at the transmitter independent of the line circuit for effecting an impression and arresting the type-wheel shaft thereof, a printing circuit at the receiver and a ratchet switch and said circuit controlled by said switch and adapted to effect an impression upon the arrest of the type-wheel shaft thereof, substantially as and for the purposes set forth.

5. A printing telegraph system comprising a receiver and transmitter normally operated by motors responding to makes and breaks produced in line by the revolution of the type-



wheel shaft of the transmitter, a local printing circuit and devices operating by the depression of a key at the transmitter to effect an impression and arrest the type-wheel shaft before the completion of the stroke of the transmitter motor and before the line circuit is made or broken, whereby the motor at the receiver arrests its type-wheel shaft and effects an impression through the intervention of a local printing circuit controlled by the revolution of the receiver type-wheel shaft and whereby the motors of both instruments are permitted to again start upon the release of the key and by the completion of the partial stroke of the transmitter motor, substantially as set forth.

6. A printing telegraph system comprising a receiver and a transmitter normally operated by motors and local motor circuits controlled by relay electro-magnets responding to makes and breaks produced in line by a circuit interrupter on the type-wheel shaft of the transmitter, a local printing circuit and devices operating by the depression of a key at the transmitter to effect an impression and arrest the type-wheel shaft before the completion of the stroke of the transmitter motor and before the circuit interrupter makes and breaks the line circuit, whereby the relay electro-magnet at the receiver acting through its local motor circuit causes the motor to arrest the receiver type-wheel shaft, and whereby the motors of both instruments are permitted to again start upon the release of the key and by the completion of the partial stroke of the transmitter motor, substantially as set forth.

7. A printing telegraph system comprising a receiver and a transmitter normally operated by motors responding to makes and breaks produced in line by a circuit interrupter on the type-wheel shaft of the transmitter, a local printing circuit and devices operating by the depression of a key at the transmitter to effect an impression and arrest the type-wheel shaft before the completion of the stroke of the transmitter motor and before the circuit interrupter makes or breaks the line circuit, whereby the motor at the transmitter is arrested and arrests its type-wheel shaft, and whereby the motors of both instruments are permitted to again start upon the release of the key and by the completion of the partial stroke of the transmitter motor, substantially as set forth.

8. A printing telegraph system comprising a transmitter and a receiver each having an electro-motor adapted to drive a type-wheel shaft and responding to makes and breaks in the normal line circuit produced by a circuit interrupter at the transmitter and each having a unison latch adapted to arrest its type-wheel shaft with the retracting spring of the motor thereof in tension and with the circuit interrupter in position for breaking the normal line circuit, whereby the motors are adapted to start under the influence of their retracting springs and by the release

of the type-wheel shafts, substantially as set forth.

9. A printing telegraph system comprising a transmitter and a receiver each having a relay electro-magnet responding to makes and breaks in the normal line circuit produced by an interrupter on the type-wheel shaft of the transmitter, a motor operating the driving shaft and controlled by the armature-lever of said relay electro-magnet through circuit connections, and a unison-latch adapted to arrest its type-wheel shaft with the retracting-spring of the motor in tension and with the circuit interrupter in position for breaking the normal line circuit, whereby the motors are permitted to start under the influence of their retracting springs and by the release of the type-wheel shafts, substantially as and for the purposes set forth.

10. A printing telegraph system comprising a transmitter and a receiver and each provided with a motor responding to makes and breaks in a line circuit and adapted to drive the type-wheel shaft, a unison-device for locking the type-wheel shaft in such position that the retracting spring of the motor tends to start it, a detent for locking said shaft, magnets for operating said unison-latch and detent, a revoluble switch actuated by the type-wheel shaft and adapted to cut out the line circuit and include the local unison circuit at the unison position of the shaft, a double contact unison key at the transmitter for controlling the local printing circuit to release said unison-device and lock and unlock the transmitter type-wheel shaft and for controlling the unison line circuit to release said unison device and lock and unlock the receiver type-wheel shaft through the intervention of a relay electro-magnet and a local circuit, substantially as and for the purposes set forth.

11. In a printing telegraph system comprising a single line conductor adapted to be included in a line circuit, and in a unison line circuit, a transmitter and a receiver normally operated by motors responding to makes and breaks in the line circuit and provided with means for automatically closing the unison line circuit through said conductor at the unison position and for closing the line circuit through said conductor at other positions, local motor circuits at each instrument and a local printing circuit and devices controlled by a key at the transmitter and a local printing circuit and devices controlled by the type-wheel shaft at the receiver and a local unison circuit and devices controlled by a unison-key at the transmitter and a local unison circuit and devices controlled by a relay and armature lever and an automatic switch on the type-wheel shaft at the receiver, substantially as and for the purposes set forth.

12. In a printing telegraph system, a single line conductor adapted to be included in a line circuit and in a unison line circuit, combined transmitters and receivers normally



operated through relay electro-magnets controlling the local circuits of motors and responding to makes and breaks in said line circuit and provided respectively with two  
5 sets of local unison and printing circuits and devices, automatic switches mounted on the type-wheel shafts and adapted to include one set of local circuits at unison position and the other set at other positions, and manual-  
10 switches for changing the circuits to cause the instruments to operate as transmitters and receivers, substantially as and for the purposes set forth.

13. A printing telegraph system comprising  
15 a receiver and a transmitter having unison and locking electro-magnets and devices, a relay electro-magnet at the receiver adapted to control a local unison circuit through its armature-lever and through the coils of the  
20 unison and the locking electro-magnets at the receiver, a double contact unison key adapted to close a local unison circuit through the coils of the unison and locking electro-magnets of the transmitter and to close a unison  
25 line circuit through the coils of the relay electro-magnet at the receiver, substantially as and for the purposes set forth.

14. A printing telegraph system comprising a receiver and a transmitter having unison  
30 and locking electro-magnets and devices, a relay electro-magnet at the receiver adapted to control a local unison circuit through its armature-lever and through the coils of the unison and of the locking electro-magnets at  
35 the receiver, a double contact unison key adapted to close one branch of the circuit through the coils of the unison and locking electro-magnets of the transmitter and to  
40 close the other branch through a resistance and through the coils of the relay electro-magnet at the receiver, substantially as and for the purposes set forth.

15. In a printing telegraph system, a transmitter provided with a line circuit maker and  
45 breaker mounted on its type-wheel shaft and with a locking electro-magnet and its devices for arresting the type-wheel shaft and its line circuit maker and breaker, a local circuit through the coils of said electro-magnet, and  
50 a unison key and character keys and their accessories adapted to make and break said local circuit to stop and release the type-wheel shaft and cause the circuit maker and  
55 breaker to suspend the makes and breaks in line, substantially as and for the purposes set forth.

16. In a printing telegraph system, a receiver provided with a locking and a unison  
60 electro-magnet, a local circuit through the coils of said magnets and adapted to be made and broken by the armature-lever of a relay magnet responding to makes and breaks in  
65 line, and a revoluble switch mounted on the receiver type-wheel shaft and adapted to close said local circuit through the locking and unison magnets only at unison position, substantially as and for the purposes set forth.

17. In a printing telegraph system, a transmitter provided with a local printing circuit independent of the line circuit, keys and a  
70 type-wheel shaft locking magnet interposed in said local circuit, a receiver provided with a local printing circuit and its accessories and adapted to automatically effect printing upon the arrest of the receiver type-wheel shaft,  
75 and electrical and mechanical devices and circuits independent of the local circuits and keys and operating upon the arrest of the transmitter type-wheel shaft to stop the motor of the receiver type-wheel shaft, substantially as and for the purposes set forth.  
80

18. In a printing telegraph system, an instrument provided with a switch tending to close a local printing circuit and restrained  
85 from such action by the movement of said instrument, and at unison position substantially as and for the purposes set forth.

19. In a printing telegraph instrument, a locking electro-magnet for arresting the type-wheel shaft, a printing and unison electro-  
90 magnet, a local circuit having one branch controlled by keys and adapted to be closed through the coils of both of said magnets, and having the other branch controlled by a switch tending to close it through the print-  
95 ing electro-magnet and restrained from such action by the movement of the instrument, and a manual-switch for opening and closing the second branch circuit to permit of the operation of the instrument as a receiver or  
100 transmitter, substantially as and for the purposes set forth.

20. A printing telegraph system having a combined transmitting and receiving instrument provided with a switch tending to close  
105 a local circuit and restrained from such action by the actuation of said instrument and means for automatically restraining such action of the switch at unison position, substantially as and for the purposes set forth.  
110

21. A printing telegraph system having a combined transmitting and receiving instrument, means tending to close a local printing circuit and restrained from such action by  
115 the actuation of said instrument, means, substantially as described, for restraining such action of the switch at the unison position, and means substantially as described adapted to open and close said local circuit to permit of its actuation either as a transmitting or as  
120 a receiving instrument, substantially as and for the purposes set forth.

22. A printing telegraph provided with an instrument having a ratchet-switch tending to close a local printing circuit and restrained  
125 from such action by the rotation of a toothed wheel, and means for restraining such action of the switch at unison position substantially as and for the purposes set forth.

23. A printing telegraph provided with an  
130 instrument having a ratchet-switch tending to close a local printing circuit at positions other than unison and normally restrained from such action by the rotation of a toothed-



wheel, and a manual-switch for opening and closing said local circuit to permit of the operation of the instrument as a receiver or as a transmitter, substantially as and for the purposes set forth.

24. A printing telegraph provided with an instrument having a pivotal-switch tending to close a local printing circuit through its contacts at positions other than unison and restrained from such action by the movement of the instrument, substantially as and for the purposes set forth.

25. A printing telegraph provided with an instrument having a pivotal switch tending to close a local printing-circuit through its contacts at positions other than unison and restrained from such action by the movement of the instrument, and a manual-switch for opening and closing said local circuit to permit of the operation of the instrument as a receiver or as a transmitter, substantially as and for the purposes set forth.

26. A printing telegraph provided with a toothed-wheel moving with a type-wheel shaft and a ratchet-switch controlling a local printing circuit and riding over the teeth of said wheel as the shaft is rotated and entering a space between said teeth upon the arrest of the shaft at positions other than unison, substantially as and for the purposes set forth.

27. A printing telegraph provided with a toothed-wheel moving with a type-wheel shaft and a ratchet-switch controlling a local printing circuit and riding over the teeth of said wheel as the shaft is rotated and entering a space between said teeth upon the arrest of the shaft at positions other than unison, and a manual-switch for opening and closing said local circuit to permit of the operation of the instrument as a receiver and transmitter, substantially as and for the purposes set forth.

28. A printing telegraph provided with a toothed wheel moving with a type-wheel shaft and a pivotal ratchet-switch, whereof one end is provided with contacts controlling a local printing circuit and whereof the other end rides over the teeth of said wheel as the shaft is rotated and enters a space between the said teeth upon the arrest of the shaft, at positions other than unison substantially as and for the purposes set forth.

29. A printing telegraph provided with a toothed-wheel moving with a type-wheel shaft and a pivotal ratchet-switch, whereof one end is provided with contacts controlling a local printing circuit, and whereof the other end rides over the teeth of said wheel as the shaft is rotated and enters a space between said teeth upon the arrest of the shaft at positions other than unison, and a manual-switch for opening and closing said local circuit to permit of the operation of the instrument as a receiver and transmitter, substantially as and for the purposes set forth.

30. The combination, of a revoluble wheel

provided with teeth, and a ratchet-switch tending to enter the spaces between said teeth at positions other than unison and normally restrained from such action by the revolution of the wheel, substantially as and for the purposes set forth.

31. The combination, of a revoluble wheel provided with teeth, and a pivotal switch tending to enter the spaces between said teeth at positions other than unison and normally restrained from such action by the revolution of the wheel, substantially as and for the purposes set forth.

32. The combination, of a revoluble wheel provided with teeth and a pivotal switch, whereof one end is provided with contacts and the other end tends to enter the spaces between said teeth at positions other than unison normally restrained from such action by the revolution of said wheel, substantially as and for the purposes set forth.

33. A printing telegraph provided with a wheel having a series of teeth and a comparatively wide tooth, a ratchet-switch controlling a local printing circuit and tending to enter a space between said teeth upon the arrest of the wheel and restrained from such movement at the unison position by the wide tooth, and a manual-switch for opening and closing said local circuit, substantially as and for the purposes set forth.

34. A printing telegraph provided with a wheel having a series of teeth and a comparatively wide tooth, and a pivotal ratchet-switch controlling a local printing circuit and tending to enter the spaces between said teeth upon the arrest of the wheel and restrained from such movement at the unison position by the wide tooth, substantially as and for the purposes set forth.

35. A printing telegraph provided with a wheel actuated by a type-wheel shaft and having a wide tooth, a pivotal ratchet-switch controlling a local printing circuit and tending to enter the spaces between said teeth upon the arrest of the shaft and restrained from such movement at the unison position of the shaft by the wide tooth, substantially as and for the purposes set forth.

36. A printing telegraph provided with a toothed-wheel actuated by a type-wheel shaft and having a wide tooth, a pivotal ratchet-switch controlling a local printing circuit and tending to enter the spaces between the teeth of said wheel upon the arrest of the shaft and restrained from such movement at the unison position of the shaft by the wide tooth, and a manual-switch for opening and closing said local-circuit, substantially as and for the purposes set forth.

37. A printing telegraph provided with a wheel having a series of teeth and a comparatively wide tooth, and a ratchet-switch controlling a local printing circuit and tending to enter the spaces between said teeth upon the arrest of the wheel and restrained from



such movement at the unison position by the wide tooth, substantially as and for the purposes set forth.

33. A printing telegraph provided with a wheel actuated by a type-wheel shaft and having a wide tooth, and a ratchet-switch controlling a local printing circuit and tending to enter spaces between said teeth upon the arrest of the shaft and restrained from such movement at the unison position of the shaft by the wide tooth, substantially as and for the purposes set forth.

39. The combination of a revoluble wheel provided with small teeth and one wide tooth, and a switch tending to enter spaces between said small teeth and restrained at unison position by the wide tooth, substantially as and for the purposes set forth.

40. The combination, of a normally revolving shaft provided with a type-wheel, means for arresting said shaft with the divisions of the type-wheel at the printing position, mechanical and electrical printing devices and a local printing circuit, a wheel on said shaft provided with recesses in alignment with the characters of the type-wheel, and a ratchet-switch controlling the local circuit and engaging said recesses upon the arrest of said shaft at positions other than unison, substantially as and for the purposes set forth.

41. The combination, of a normally revolving shaft provided with a type-wheel having characters and a blank space, means for arresting said shaft with the divisions of the type-wheel in the printing position, mechanical and electrical devices, a local printing circuit, a wheel on said shaft provided with recesses in alignment with the characters on the type-wheel and with a projection in alignment with the blank space, and a ratchet-switch controlling said local circuit and adapted to enter said recesses and to rest on said projection, substantially as and for the purposes set forth.

42. A printing telegraph having an armature-lever provided with printing, feeding and unison latch actuating devices and having an electro-magnet and local circuit connections independent of the line circuit and controlled by keys at the transmitter and by a ratchet-wheel having a wide tooth at the receiver, substantially as and for the purposes set forth.

43. In a printing telegraph, a pivotal spring printing lever having at its free end a printing pallet, an armature-lever provided with an arm having an enlarged extremity adapted to engage a projection on said printing lever to actuate the pallet under the influence of the spring and an electro-magnet and circuit connections for actuating said armature-lever, substantially as and for the purposes set forth.

44. In a printing telegraph, a spring controlled unison-latch, a system of levers for operating said latch, a printing and paper feeding armature-lever provided with a wedge in sliding engagement with one of said levers,

and an electro-magnet and circuit connections for actuating said armature-lever, substantially as and for the purposes set forth.

45. In a printing telegraph, a spring controlled unison-latch, a system of levers for operating said latch, an armature-lever actuating printing devices and provided with a wedge in sliding engagement with one of said levers, and an electro-magnet and circuit connections for actuating said armature-lever, substantially as and for the purposes set forth.

46. In a printing telegraph, a spring controlled unison-latch, a system of levers for operating said latch, a pivotal printing hammer, an armature-lever provided with an arm having a projection in range of a rod on the printing-hammer and with a wedge for operating the system of levers, and an electro-magnet and circuit connections for actuating said armature-lever, substantially as and for the purposes set forth.

47. In a printing telegraph, a spring controlled unison-latch, a system of levers for operating said latch, a pivotal printing-hammer, an armature-lever provided with pawl-and-ratchet connections for feeding a paper-carriage and with a wedge for operating the system of levers, a projection on said armature-lever disposed in range of a rod on the printing-hammer, and an electro-magnet for actuating said armature-lever, substantially as and for the purposes set forth.

48. In a printing telegraph, a spring controlled unison-latch, a bell crank lever having one arm in range of said latch, a pivotal lever having one arm in range of the bell crank-lever, a paper feeding and printing armature-lever provided with a wedge in sliding contact with the pivotal lever, and an electro-magnet and circuit connections for actuating said armature-lever, substantially as and for the purposes set forth.

49. The combination, in a printing telegraph, of a pivotal printing-hammer, a unison-latch, an armature-lever provided with a projection for operating the printing-hammer and with a wedge for operating link-work engaging the unison-latch, an electro-magnet and local printing circuit for operating said armature-lever, a normally rotating wheel provided with teeth, and a ratchet-switch controlling said local circuit and adapted to enter spaces between the teeth of said wheel, substantially as and for the purposes set forth.

50. The combination, in a printing telegraph, of a type-wheel shaft provided with a type-wheel and a toothed wheel, means for normally rotating said shaft, a pivotal printing-hammer, a unison-latch, an armature-lever provided with a projection for operating the printing-hammer and with a wedge for operating link-work engaging the unison-latch, an electro-magnet and a local printing circuit for operating said armature-lever, and a ratchet-switch controlling said local circuit and adapted to enter spaces between the teeth



of said wheel, substantially as and for the purposes set forth.

51. The combination, in a printing telegraph, of a shaft provided with a type-wheel and a toothed wheel, means for normally rotating and arresting said shaft, a pivotal printing-hammer, a unison-latch, an armature-lever provided with a projection for operating the printing-hammer, and with a wedge for operating link-work engaging the unison-latch, pawls actuated by said armature-lever and adapted to feed a paper-carriage, an electro-magnet and local printing circuit for operating said armature-lever, and a pivotal ratchet-switch controlling said local-circuit and adapted to enter spaces between the teeth of said wheel, substantially as and for the purposes set forth.

52. The combination, in a printing telegraph receiver, of a type-wheel shaft provided with a toothed-wheel and with a type-wheel, a motor responding to makes and breaks in a normal line circuit and adapted to rotate and check said shaft, a pivotal printing-hammer, a unison-latch an armature-lever provided with a projection for operating the printing-hammer and with a wedge for operating link-work engaging the unison-latch, an electro-magnet and local printing circuit for operating said armature-lever, and a ratchet-switch controlling said local-circuit and adapted to enter spaces between the teeth of said wheel, substantially as and for the purposes set forth.

53. The combination, in a printing telegraph, of a type-wheel shaft provided with a type-wheel and a toothed-wheel, means for normally rotating said shaft, a pivotal printing-hammer having a spring shank, an armature-lever provided with a projection for operating the printing-hammer, an electro-magnet and local printing-circuit for operating said armature-lever, and a ratchet-switch controlling said local-circuit and adapted to enter spaces between the teeth of said wheel, at positions other than unison substantially as and for the purposes set forth.

54. The combination, in a printing telegraph, of a type-wheel shaft provided with a toothed-wheel and a type-wheel having characters disposed in alignment with the spaces of the toothed-wheel, and having a blank in alignment with a tooth of said wheel, means for normally rotating and arresting said shaft, a pivotal printing-hammer, a unison-latch, an armature-lever provided with a projection in range of a rod connected with the printing-hammer, an electro-magnet and local printing circuit for operating said armature-lever, and a pivotal ratchet-switch, whereof one end controls said local-circuit and whereof the other end is adapted to enter spaces between the teeth of said wheel at positions other than unison, substantially as and for the purposes set forth.

55. A printing telegraph provided with a sunflower-device comprising a conducting annulus and an annulus having conducting

and insulating segments, an insulated brush sweeping over each annulus, circuit connections from earth through a generator to the conducting annulus and through the brush and conducting segments to character keys controlling a local printing circuit and devices and to a double contact unison key controlling said local printing circuit and a unison line circuit, substantially as and for the purposes set forth.

56. A printing telegraph provided with a sunflower device comprising a conducting annulus and an annulus having conducting and insulating segments, an insulated brush sweeping over each annulus, circuit-connections from earth through a generator to the conducting annulus and through the brush and conducting segments to character keys controlling a local printing-circuit and devices and to a double contact unison-key controlling said local printing circuit and devices and a unison line circuit and devices, and a high resistance interposed in the unison line circuit, substantially as and for the purposes set forth.

57. A printing telegraph provided with a sunflower device comprising a conducting annulus and an annulus having conducting and insulating segments, an insulated brush sweeping over each annulus, circuit-connections from earth through a generator to the conducting annulus and through the brush and unison conducting segment to a double contact unison key controlling a local printing circuit and devices and to a unison line circuit, substantially as and for the purposes set forth.

58. A printing telegraph provided with a sunflower device comprising a conducting annulus and an annulus having conducting and insulating segments, an insulated brush sweeping over each annulus, circuit-connections from earth through a generator to the conducting annulus and through the brush and unison conducting segments to a double contact unison key controlling a local printing-circuit and devices and a unison line circuit and devices, and a high resistance interposed in the unison line circuit, substantially as and for the purposes set forth.

59. The combination, in a printing telegraph, of a sunflower-device comprising a conducting annulus and an annulus having conducting and insulating segments and connections, local printing circuit connections from earth through a generator to the conducting annulus through the contacts of a ratchet-switch, the coils of a locking electro-magnet, and the coils of a printing and unison electro-magnet to earth, substantially as and for the purposes set forth.

60. The combination, in a printing telegraph, of a sunflower-device comprising a conducting annulus and an annulus having conducting and insulating segments and connections, local printing circuit connections from earth through a generator to the conducting



annulus, the contacts of a ratchet-switch and coils of a locking electro-magnet and a printing and unison electro-magnet to earth, and a manual-switch for controlling the local printing circuit, substantially as and for the purposes set forth.

61. A printing telegraph provided with a motor and its local circuit, a printing and a unison electro-magnet, a local circuit controlled by the armature-lever of a relay electro-magnet interposed in line and a three-way revoluble switch moving with the type-wheel shaft and adapted to interrupt the motor local circuit and to close the armature-lever local circuit only at unison position and adapted to close the motor local circuit and interrupt the armature lever local circuit at positions other than unison, substantially as and for the purposes set forth.

62. A printing telegraph provided with a three-way revoluble switch having its conducting parts in electrical communication and comprising a conducting disk, an insulating disk having a conducting segment in alignment with a blank space on the type-wheel and a conducting disk having a similarly disposed insulating segment, a contact spring riding over the conducting disk and interposed in a local circuit, a contact-spring riding over the conducting disk having an insulating segment and interposed in the local motor-circuit, and a contact-spring riding over the insulating disk having an insulating segment and interposed in the local printing circuit, substantially as and for the purposes set forth.

63. A printing telegraph provided with a circuit interrupter moving with the type-wheel shaft and adapted to control electro-motors at the respective instruments, a spur-wheel mounted on said shaft, a detent for engaging said spur-wheel and arresting the circuit interrupter just before its contact passes off the segment over which it is traveling, whereby the transmitter motor is arrested before the completion of its stroke, substantially as and for the purposes set forth.

64. The combination, of a revolving shaft provided with a type-wheel having characters and a blank space, means for arresting said shaft with the divisions of the type-wheel in the printing position, mechanical and electrical printing devices, a local printing circuit, a wheel on said shaft provided with recesses in alignment with the characters on the type-wheel and with a projection in alignment with the blank space, means for controlling said local circuit and adapted to enter said recesses at positions other than unison and to engage with said projection, at unison position substantially as and for the purposes set forth.

65. A printing telegraph provided with a type-wheel shaft having two conducting disks, whereof one is provided with insulated segments alternating with conducting segments,

a spur-wheel mounted on said shaft, a detent for engaging said spur-wheel and arresting said disks, double contact springs interposed in a line circuit controlling an electro-motor at each instrument, and means for adjusting one of said springs, substantially as and for the purposes set forth.

66. The combination, in a printing telegraph, of a type-wheel shaft provided with a ratchet and a stop-wheel, a reciprocating bar slotted for the accommodation of said shaft and provided at the sides of said slot with spring controlled pivotal pawls engaging said ratchet-wheel and at the ends of said slot with fixed detents for engaging the stop-wheel pawls and detents co-operating with said wheels, a spring controlled armature-lever connected with said bar, an electro-magnet responding to makes and breaks in line, produced by a circuit breaker and closer on the transmitter type-wheel shaft and a ratchet-switch controlled by a toothed-wheel on said shaft and adapted to make and break a local printing circuit, substantially as and for the purposes set forth.

67. The combination, in a printing telegraph, of a type-wheel shaft provided with a ratchet and a stop-wheel, a reciprocating-bar slotted for the accommodation of said shaft and provided at the sides of said slot with spring controlled pivotal pawls engaging said ratchet-wheel and at the ends of said slot with fixed detents for engaging the stop-wheel pawls and detents co-operating with said wheel, a spring controlled armature lever connected with said bar, and actuated by a motor electro-magnet and circuit, a relay electro-magnet controlling said local circuit through its armature-lever and responding to makes and breaks in line produced by a circuit breaker and closer on the transmitter type-wheel shaft, and a ratchet-switch controlled by a toothed-wheel on said shaft and adapted to make and break a local printing circuit, substantially as and for the purposes set forth.

68. The combination, in a printing telegraph, of a receiver and a transmitter, each having a type-wheel shaft provided with a ratchet and a stop-wheel, a reciprocating bar slotted for the accommodation of said shaft and provided at the sides of said slot with spring controlled pivotal pawls engaging said ratchet-wheel and at the ends of said slot with fixed detents for engaging the stop-wheel pawls and detents co-operating with said wheels, a spring controlled armature-lever connected with said bar and an electro-magnet responding to makes and breaks in line, a ratchet-switch at the receiver controlled by a toothed wheel on the receiver type-wheel shaft and adapted to make and break a local printing circuit, and a circuit interrupter mounted on the type-wheel shaft of the transmitter and interposed in the line circuit, substantially as and for the purposes set forth.



69. The combination, in a printing telegraph, of a receiver and a transmitter each having a type-wheel shaft provided with a ratchet and a stop-wheel, a reciprocating-bar provided with pawls and detents co-operating with said wheels, a spring controlled armature-lever connected with said bar and actuated by a motor electro-magnet and circuit, a relay electro-magnet controlling said local circuit through its armature-lever and responding to makes and breaks in line, a ratchet-switch at the receiver controlled by a toothed-wheel on the receiver type-wheel shaft and adapted to make and break a local printing-circuit, and a circuit-interrupter mounted on the type-wheel shaft of the transmitter and interposed in the line circuit, substantially as and for the purposes set forth.

70. A printing telegraph having an instrument provided with a ratchet and a stop-wheel, a reciprocating bar having pawls and detents co-operating with said wheels, a spring controlled armature-lever connected with said bar, a relay electro-magnet responding to makes and breaks in line and controlling through its front stop the local circuit of the magnet appertaining to the spring controlled armature-lever and a ratchet-switch controlled by a toothed-wheel on said shaft and adapted to make and break a local printing circuit, a circuit interrupter interposed in line, and a manual-switch interposed in the local printing-circuit, substantially as and for the purposes set forth.

71. The combination, in a printing telegraph, of a type-wheel, a type-wheel shaft provided with a ratchet and a stop-wheel, a reciprocating-bar provided with pawls and detents co-operating with said ratchet and stop-wheels, a spring controlled armature-lever connected with said bar, a motor electro-magnet responding to makes and breaks in line, a pivotal printing-hammer, a printing electro-magnet provided with an armature-lever having a projection for actuating the printing hammer, and a ratchet-switch controlled by a toothed-wheel on said shaft and adapted to make and break the local circuit through the coils of the printing electro-magnet, substantially as and for the purposes set forth.

72. The combination, in a printing telegraph, of a type-wheel, a type-wheel shaft provided with a ratchet and a stop-wheel, a reciprocating-bar provided with pawls and detents co-operating with said ratchet and stop-wheels, a spring controlled armature-lever connected with said bar, a motor electro-magnet, a relay electro-magnet responding to makes and breaks in line and controlling through its armature-lever the local-circuit of the motor electro-magnet, a pivotal printing-hammer, a printing electro-magnet provided with an armature-lever having a projection for actuating the printing-hammer, and a ratchet-switch controlled by a toothed-

wheel on said shaft and adapted to make and break said local circuit through the coils of the printing electro-magnet, substantially as and for the purposes set forth.

73. The combination, in a printing telegraph, of a type-wheel shaft provided with a unison-spiral and with ratchet and stop-wheels, a reciprocating-bar provided with pawls and detents co-operating with said ratchet and stop-wheels, a spring controlled armature-lever connected with said bar, a motor electro-magnet responding to makes and breaks in line, and a unison-latch adapted to arrest said shaft in position for maintaining the spring of the armature-lever in tension, substantially as and for the purposes set forth.

74. The combination, in a printing telegraph, of a type-wheel shaft provided with a unison-spiral and with ratchet and stop-wheels, a reciprocating-bar provided with pawls and detents co-operating with said ratchet and stop-wheels, a spring controlled armature-lever connected with said bar, a motor electro-magnet disposed in a local motor circuit controlled through the armature-lever of a relay electro-magnet responding to makes and breaks in line, and a unison-latch adapted to arrest said shaft in position for maintaining the spring of the armature-lever in tension, substantially as and for the purposes set forth.

75. The combination, in a printing telegraph, of printing mechanism, a paper-carriage, a type-wheel shaft provided with a unison spiral and with ratchet and stop-wheels, a reciprocating bar slotted for the accommodation of said shaft and provided at the sides of said slot with spring controlled pivotal pawls engaging said ratchet-wheel and at the ends of said slot with fixed detents for engaging the stop-wheel, a spring controlled armature-lever connected with said bar, a motor electro-magnet responding to makes and breaks in line, produced by a circuit maker and breaker on the transmitter type-wheel shaft a printing and unison electro-magnet and circuit connections having an armature-lever provided with devices for actuating the unison latch, printing mechanism and paper carriage, substantially as and for the purposes set forth.

76. The combination, in a printing telegraph, of printing mechanism, a paper-carriage, a type-wheel shaft provided with a unison spiral and with ratchet and stop-wheels, a reciprocating-bar provided with pawls and detents co-operating with said ratchet and stop-wheels, a spring controlled armature-lever connected with said bar, a motor electro-magnet interposed in a local motor circuit controlled by the armature-lever of a relay electro-magnet responding to makes and breaks in line, and a printing and unison electro-magnet and circuit connections having an armature-lever provided with devices



for actuating the unison-latch, printing mechanism and paper-carriage, substantially as and for the purposes set forth.

77. A printing telegraph provided with type-wheel shafts having ratchet and stop-wheels, reciprocating-bars slotted for the accommodation of said shafts and provided at the sides of said slots with spring controlled pivotal pawls engaging said ratchet-wheels and at the ends of said slots with fixed detents for engaging the stop-wheels, spring controlled armature-levers connected with said bars, motor electro-magnets, relay electro-magnets interposed in the line-circuit and adapted to control the local circuits of the motor electro-magnets at the transmitter and receiver, whereby synchronism in movement is insured of the type-wheels of both instruments, substantially as set forth.

78. A printing telegraph provided with relay electro-magnets interposed in the line-circuit and adapted to control local motor circuits at the transmitter and the receiver, magnetic devices interposed in said local motor circuits and provided with spring controlled armature-levers, ratchet and stop-wheels on the type-wheel shafts of each instrument, a bar attached to said armature-lever and slotted for the accommodation of said shaft and provided at the sides of said slot with spring controlled pivotal pawls engaging said ratchet-wheel and at the ends of said slot with fixed detents for engaging the stop-wheel, and a circuit interrupter mounted on the receiver type wheel shaft and adapted to control the line circuit, substantially as and for the purposes set forth.

79. A printing telegraph provided with a relay interposed in a line circuit and adapted to control a local motor circuit or circuits at both transmitting and receiving instruments, devices interposed in the motor circuit or circuits, ratchet and stop wheels on a shaft carrying a type-wheel of each instrument, mechanism co-operating with said wheels, and a circuit interrupter located on the type wheel shaft of the transmitter and adapted to control the line circuit, substantially as and for the purposes set forth.

80. A printing telegraph system, comprising a transmitter and a receiver having motor electro-magnets responding to makes and breaks in a normal line circuit, spring controlled armature levers, ratchet and stop wheels on the type-wheel shaft of each instrument, reciprocating bars provided with pawls and detents co-operating with said ratchet and stop wheels and said bars slotted for the accommodation of the type-wheel shaft provided at the sides of said slot with spring controlled pivotal pawls engaging said ratchet-wheels and at the ends of said slot with fixed detents for engaging said stop-wheels, and relay electro-magnets interposed in a line circuit and adapted to control the local circuits of the motor electro magnets at the trans-

mitter and receiver, substantially as and for the purposes set forth.

81. A printing telegraph provided with a transmitter and a receiver having motors responding to makes and breaks in a line circuit, a bar actuated by an electro-magnet and provided with pawls and detents, a ratchet and a stop-wheel on the type-wheel shaft of each instrument and a circuit maker and breaker mounted on the transmitter type-wheel shaft and having its contact springs interposed in the line circuit, substantially as and for the purposes set forth.

82. A printing telegraph provided with a transmitter and a receiver, each having a motor responding to makes and breaks in line circuit produced by an interrupter at the transmitter type wheel shaft and comprising stop and ratchet-wheels on the type-wheel shaft and a bar provided with pawls and detents and actuated by the spring controlled armature-lever of an electro-magnet, and each having a unison-latch adapted to arrest its type-wheel shaft and cause the same to hold the retracting spring of said armature-lever in tension and to hold the circuit interrupter in position for breaking the line circuit, and permitting of the closing of the circuit of a unison key to line, substantially as and for the purposes set forth.

83. In a printing telegraph, a single line conductor adapted to be included in a line circuit and in a unison circuit, combined transmitters and receivers normally operated through relay electro-magnets controlling local motor circuits and responding to makes and breaks in the line circuit, a motor electro-magnet in said local circuit, bars provided with detents and pawls and connected with the spring controlled armature-levers of said motor electro-magnets, ratchet and stop wheels on the type wheel shafts, independent local printing circuits controlled at the transmitter by keys and at the receiver by an automatic switch on the type-wheel shaft, unison circuits controlled at the transmitter by a unison key and in parallel to line and through the devices of the transmitter to earth, a local unison circuit at the transmitter controlled by the armature lever of the relay electro-magnet in response to the branch unison circuit in line, three-way switches for automatically controlling the circuits at unison position, and manual-switches for reversing the circuits to permit the instruments to interchangeably operate as transmitters or receivers, substantially as and for the purposes set forth.

84. In a printing telegraph, a transmitter provided with a local printing circuit and its accessories, a receiver provided with a local printing circuit and its accessories and adapted to automatically effect printing upon the arrest of the type-wheel shaft of the receiver at positions other than unison, a motor electro-magnet at the receiver having a spring



controlled armature-lever provided with a bar having pawls and detents co-operating with ratchet and stop-wheels on the type-wheel shaft, and mechanical and electrical devices and circuits operating upon the arrest of the transmitter type-wheel shaft to cause said bar to arrest the type-wheel shaft at the receiver, substantially as and for the purposes set forth.

85. The combination, in a printing telegraph, of a type-wheel shaft provided with a type-wheel and a toothed-wheel, a motor electro-magnet and circuit connections, a bar connected with the spring controlled armature-lever of the motor electro-magnet and provided with pawls and detents engaging ratchet and stop-wheels on said shaft, a pivotal printing-hammer, a unison-latch, an armature-lever provided with a projection for operating the printing-hammer and with a wedge for operating link-work engaging the unison-latch, an electro-magnet and local printing circuit for operating said armature-lever, and a ratchet-switch controlling said local circuit and adapted to enter spaces between the teeth of said wheel, substantially as and for the purposes set forth.

86. The combination, in a printing telegraph, of a type-wheel shaft provided with ratchet and stop-wheels, a bar provided with pawls and detents co-operating with said wheels, an electro-magnet provided with circuit connections and with a spring controlled armature-lever connected with said bar and a switch tending to close a local printing circuit and restrained from such action by the movement of the instrument and at unison position, substantially as and for the purposes set forth.

87. The combination, in a printing telegraph, of a type-wheel shaft provided with ratchet and stop-wheels, a bar provided with pawls and detents co-operating with said wheels, an electro-magnet provided with circuit connections and with a spring controlled armature-lever connected with said bar, a switch tending to close a local printing circuit and restrained from such action by the movement of said type-wheel shaft and at unison position, and a manual-switch for making and breaking said local circuit to permit of the operation of the instrument as a receiver and as a transmitter, substantially as and for the purposes set forth.

88. The combination, in a printing telegraph, of a type-wheel shaft provided with ratchet and stop-wheels, a bar provided with pawls and detents co-operating with said wheels, an electro-magnet provided with circuit connections an armature-lever connected with said bar, and a pivotal switch tending to close a local printing circuit through its contacts and restrained from such action by the movement of the type-wheel shaft and at unison position, substantially as and for the purposes set forth.

89. The combination, in a printing tele-

graph, of a type-wheel shaft provided with ratchet and stop-wheels, a bar provided with pawls and detents co-operating with said wheels, an electro-magnet provided with circuit connections and with a spring controlled armature-lever connected with said bar, a pivotal switch tending to close a local printing circuit through its contacts and restrained from such action by the movement of the type-wheel shaft and at unison position, and a manual-switch for making and breaking said local circuit to permit of the operation of the instrument as a receiver and as a transmitter, substantially as and for the purposes set forth.

90. The combination, in a printing telegraph, of a toothed wheel movable on a shaft, a pivotal ratchet-switch, whereof one end is provided with contacts controlling a local printing circuit and whereof the other end rides over the teeth of said wheel as the shaft is rotated and enters a space between said teeth upon the arrest of said shaft except at unison position, a bar provided with spring controlled pawls and detents co-operating with ratchet and stop-wheels on said shaft, and an electro-magnet provided with circuit connections and with a controlled armature-lever attached to said bar, substantially as and for the purposes set forth.

91. The combination, in a printing telegraph, of a toothed-wheel movable on a type-wheel shaft, a pivotal ratchet-switch whereof one end is provided with contacts controlling a local printing circuit and whereof the other end rides over the teeth of said wheel as the shaft is rotated and enters a space between said teeth upon the arrest of said shaft except at unison position, a manual-switch interposed in the local printing circuit, a bar provided with spring controlled pawls and detents co-operating with ratchet and stop-wheels on said shaft, and an electro-magnet interposed in a local motor circuit and provided with a spring controlled armature lever attached to said bar, substantially as and for the purposes set forth.

92. The combination, in a printing telegraph receiver, of a wheel mounted upon a shaft and having a series of teeth and a comparatively wide tooth, a ratchet-switch controlling a local printing-circuit and tending to enter one of the spaces between said teeth upon the arrest of the shaft and restrained from such action at unison position by the wide tooth, a motor electro-magnet provided with circuit connections and with a spring actuated armature-lever having pawls and detents co-operating with a detent and a stop-wheel on the shaft, and a unison latch and its accessories for arresting said shaft, substantially as and for the purposes set forth.

93. In a printing telegraph, a spring-controlled unison latch, a system of links for operating said latch, an armature-lever provided with a wedge adapted to actuate said links, an electro-magnet and circuit connec-



tions for actuating said armature-lever, a type-wheel shaft provided with a ratchet and a stop-wheel, a spring controlled bar provided with pawls and detents co-operating  
5 with said wheels, and a motorelectro-magnet and connections for operating said bar, substantially as and for the purposes set forth.

94. A printing telegraph provided with receivers and transmitters each having a motor  
10 electro-magnet adapted to reciprocate a spring controlled bar provided with pawls and detents co-operating with ratchet and stop-wheels mounted on the type-wheel shaft, a circuit interrupter moving with the type-  
15 wheel shaft of the transmitter and provided with circuit connections and devices adapted to control the motorelectro-magnets at the respective instruments, a spur-wheel mounted on the shaft of the receiver, a detent for engaging  
20 said spur-wheel and arresting the circuit interrupter just before its contact passes off the segment over which it is trailing, whereby the transmitter bar is arrested before its armature-lever completes its stroke, substantially  
25 as and for the purposes set forth.

95. In a printing telegraph instrument, a printing and unison electro-magnet and a locking electro magnet and their devices, a generator, an automatic switch tending to  
30 close a local printing circuit and restrained from such action by the movement of the instrument and at unison position, circuit connections from earth through the generator, and in parallel by one branch through a manual  
35 switch and the contacts of the automatic switch and the coils of the printing and unison electro-magnet to earth, and by the other branch through the contacts of the sunflower device and the contacts of depressed keys  
40 and the coils of both of said magnets to earth, and a switch mounted on the type-wheel shaft and adapted to control the second branch circuit, substantially as and for the purposes set forth.

96. In a printing telegraph instrument, a printing and unison electro-magnet and devices, a generator, an automatic switch tending to close a local printing circuit and restrained from such action by the movement  
50 of the instrument and at unison position, a manual-switch, circuit connections from earth through the generator and the manual-switch and the contacts of the automatic switch and the coils of the printing and unison electro-  
55 magnet to earth, normally open keys and a sunflower device, a locking electro-magnet, and circuit connections from said generator through the contacts of the sunflower device to the contacts of the keys and the coils of  
60 both of said magnets, substantially as and for the purposes set forth.

97. In a printing telegraph instrument, a printing and unison electro-magnet and devices, a generator, a switch tending to close  
65 one branch of a local printing circuit through the coils of said electro-magnet and restrained from such action by the movement of the in-

strument, a locking electro-magnet interposed in the other branch of the local printing circuit, and keys tending to normally interrupt  
70 the branch circuit through the coils of the locking electro-magnet, substantially as and for the purposes set forth.

98. In a printing telegraph instrument, a printing and unison electro-magnet and de-  
75 vices, a generator, an automatic switch tending to close one branch of a local printing circuit through the coils of said electro-magnet and restrained from such action by the movement of the instrument, a manual switch  
80 interposed in said branch of the local circuit, a locking electro-magnet interposed in the other branch of the local printing circuit, and keys tending to normally interrupt the branch  
85 circuit through the coils of the locking electro-magnet, substantially as and for the purposes set forth.

99. In a printing telegraph instrument, a printing and unison electro-magnet and de-  
90 vices, a generator, a switch tending to close one branch of a local printing circuit through the coils of said electro-magnet and restrained from such action by the rotation of a toothed wheel, a locking electro-magnet interposed in  
95 the other branch of the local printing circuit, and keys tending to normally interrupt the branch circuit through the coils of the locking electro-magnet, substantially as and for the purposes set forth.

100. In a printing telegraph instrument, a  
100 printing and unison electro-magnet and devices, a generator, an automatic switch tending to close one branch of a local printing circuit through the coils of said electro-magnet and restrained from such action by the  
105 rotation of a toothed wheel, a manual switch interposed in said branch of the local circuit, a locking electro-magnet interposed in the other branch of the local printing circuit, and keys tending to normally interrupt the branch  
110 circuit through the coils of the locking electro-magnet, substantially as and for the purposes set forth.

101. In a printing telegraph instrument, a printing and unison electro-magnet and de-  
115 vices, a generator, an automatic switch tending to close one branch of a local printing circuit through the coils of said electro-magnet and restrained from such action at unison position by a projection on a revoluble toothed  
120 wheel, a locking electro-magnet adapted to be included in the other branch of the local printing circuit and in a local unison circuit controlled by impulses in line, and means for automatically breaking the branch of the  
125 printing circuit appertaining to the locking electro-magnet and for closing the local unison circuit at unison position, substantially as and for the purposes set forth.

102. In a printing telegraph instrument, a  
130 printing and unison electro-magnet and devices, a generator, an automatic switch tending to close one branch of a local printing circuit through the coils of said electro-mag-



net and restrained from such action at unison position, a locking electro-magnet adapted to be included in the other branch of the local printing circuit and in a unison circuit  
5 controlled by a unison key and means for automatically breaking the branch of the local printing circuit appertaining to the locking electro-magnet and for closing the local unison circuit at unison position, substantially as and for the purposes set forth.  
10

103. A printing telegraph system, comprising a double contact unison key, circuit connections, a type-wheel and a type-wheel shaft in an instrument and a relay electro-magnet  
15 and its circuit connections, the construction and arrangement being such as to synchronously release the type-wheel shaft of the instrument through said relay and circuit connections, substantially as shown and for the  
20 purposes set forth.

104. A printing telegraph system comprising character keys and circuit connections for synchronously arresting and releasing a transmitter and a receiver, and a local printing circuit and mechanical and electrical devices  
25 tending to automatically effect an impression upon the arrest of the receiver at positions other than unison, substantially as and for the purposes set forth.

30 105. A printing telegraph system comprising character keys and circuit connections for

synchronously arresting and releasing a transmitter and a receiver, and a local printing circuit and mechanical and electrical devices  
35 independent of the line circuit and tending to automatically effect an impression, feed the paper, and actuate the unison latch at the receiver at positions other than unison, substantially as and for the purposes set forth.

106. In a printing telegraph system, transmitting and receiving instruments, relay electro-magnets for controlling said instruments,  
40 a line through the coils of said relay electro-magnets, circuit interrupters as described on the type-wheel shaft of each instrument,  
45 branch circuits from said line through said circuit interrupters, a manual-switch at each instrument for controlling said branch circuits and for permitting of an instrument  
50 being used either as a transmitter or receiver, and mechanical and electrical devices adapted to automatically effect an impression upon the arrest of one of the instruments, substantially as and for the purposes set forth.

In testimony whereof I have hereunto set  
55 my signature in the presence of two subscribing witnesses.

ROBERT A. FOWDEN.

Witnesses:

THOMAS M. SMITH,  
RICHARD C. MAXWELL.