

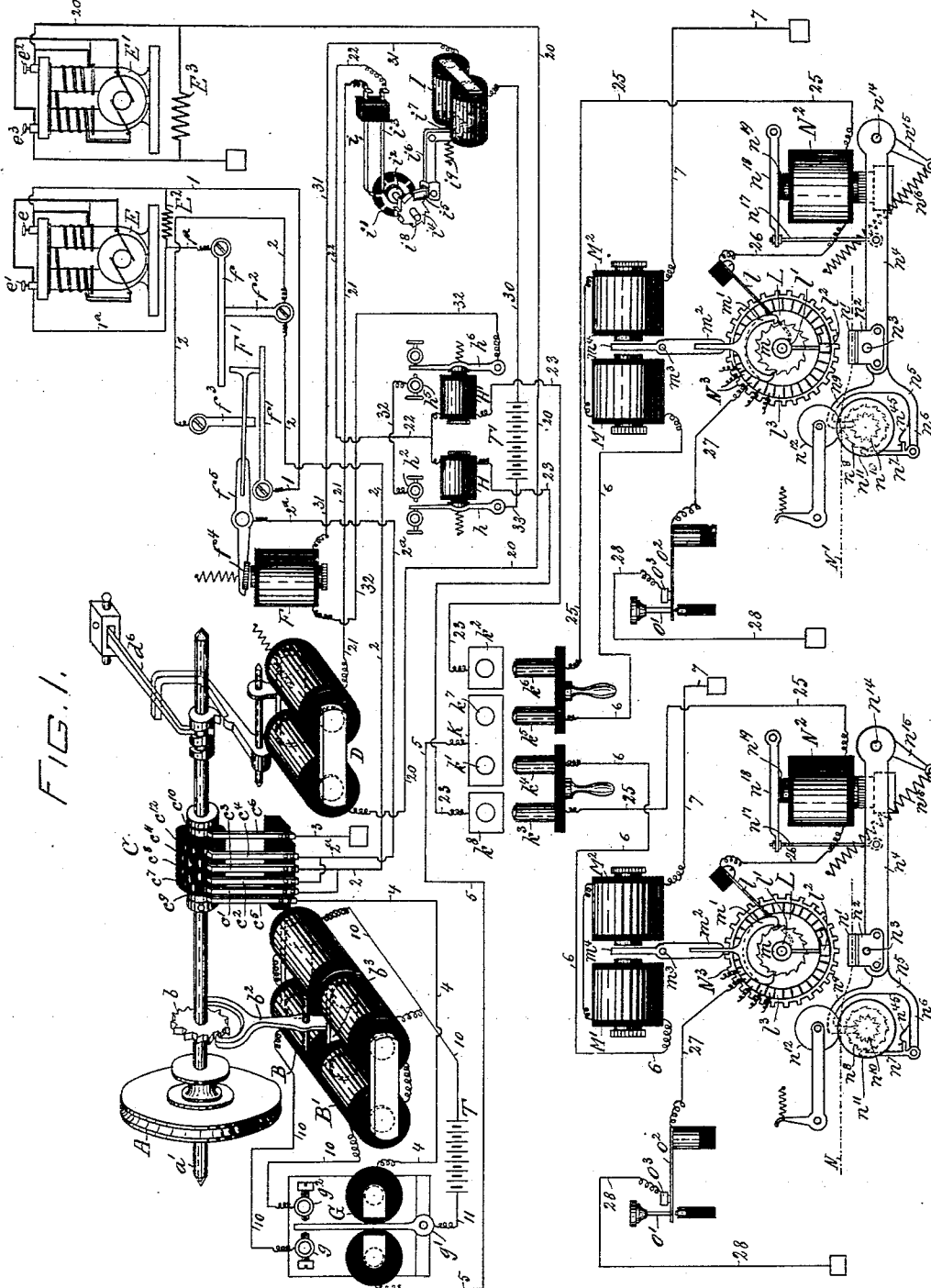
(No Model.)

2 Sheets—Sheet 1.

S. R. LINVILLE & L. F. HETTMANSPERGER.
PRINTING TELEGRAPH.

No. 504,732.

Patented Sept. 12, 1893.



WITNESSES:

John W. Archard
Arthur H. Yale

INVENTORS:

Samuel R. Linville and Louis F.
Hettmansperger
J. Walter Douglass.
ATTY.

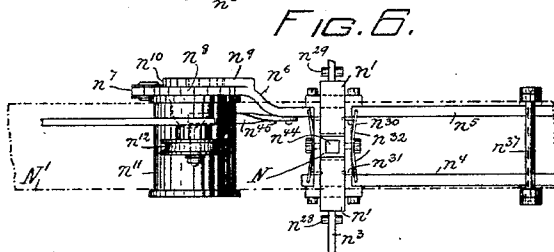
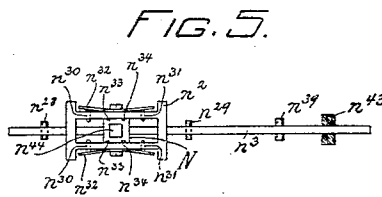
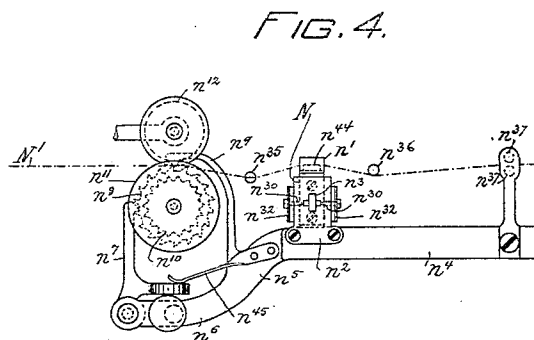
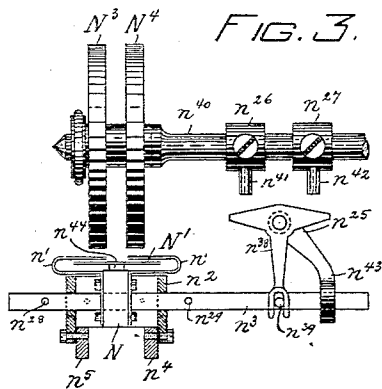
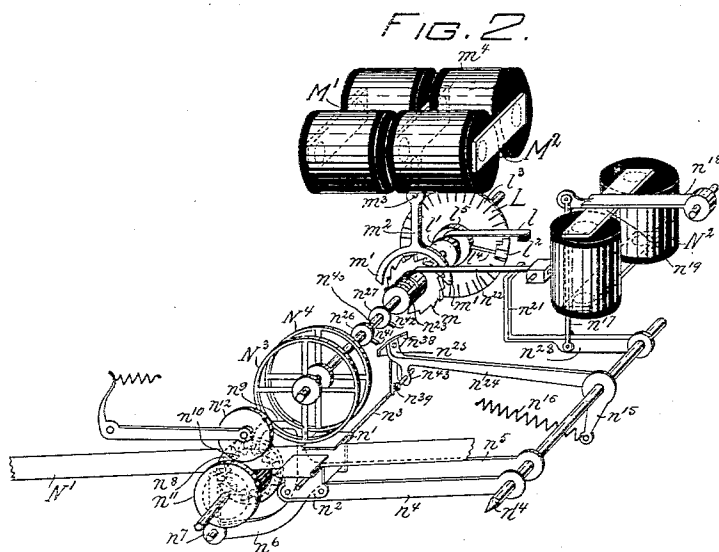
(No Model.)

2 Sheets—Sheet 2.

S. R. LINVILLE & L. F. HETTMANSPERGER.
PRINTING TELEGRAPH.

No. 504,732.

Patented Sept. 12, 1893.



WITNESSES:

John W. Richard,
Arthur H. Gale.

INVENTORS:

Samuel R. Linville & Louis F.
Hettmansperger
BY J. Walter Douglass.
ATT'Y.

UNITED STATES PATENT OFFICE

SAMUEL RUSH LINVILLE, OF PHILADELPHIA, PENNSYLVANIA, AND LOUIS FREDERICK HETTMANSPERGER, OF CAMDEN, NEW JERSEY, ASSIGNORS TO THE UNITED STATES PRINTING TELEGRAPH COMPANY, OF PHILADELPHIA, PENNSYLVANIA.

PRINTING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 504,732, dated September 12, 1893.

Application filed December 16, 1892. Serial No. 455,353. (No model.)

To all whom it may concern:

Be it known that we, SAMUEL RUSH LINVILLE, residing at the city of Philadelphia, in the county of Philadelphia and State of Pennsylvania, and LOUIS FREDERICK HETTMANSPERGER, residing at the city of Camden, in the county of Camden and State of New Jersey, both citizens of the United States, have jointly invented certain new and useful Improvements in Printing-Telegraphs, of which the following is a specification.

Our invention relates in general to improvements in printing telegraph systems comprising a central station and its complemental electrical and mechanical devices and receiving and transmitting instruments located at subscribers' offices or residences and connected with the central station by means of suitable conductors, the various parts of the system being arranged for operation in such manner that convenient and rapid communication between the subscribers is afforded. A printing telegraph of the type above referred to is illustrated and described in and by the Letters Patent of the United States numbered 450,630, dated April 21, 1891, and granted to Samuel R. Linville and Louis F. Hettmansperger, and in and by the Letters Patent numbered 450,631, dated April 21, 1891, and granted to Samuel R. Linville. In both of these patents the type-wheels are adapted to be shifted axially through the intervention of special circuits and devices in order to cause both type-wheels to print in the same line, and in the said Patent No. 450,631 the type-wheel circuits are in parallel so that numerous circuits for separate alternators may be derived from one electrical generator, and the printing circuits pass in series through the printing magnets of two connected receiving and transmitting instruments, so that the magnets controlling the pole-changer require separate generators for each alternator. Consequently the improvements embraced in our present invention relate more particularly to circuits and mechanical and electrical devices controlled through lines connecting two subscribers' in-

struments by type-wheel and printing circuits in parallel or multiple arc to earth from one electrode of an electric generator, having the other electrode thereof connected to earth.

Our invention consists of a printing telegraph provided with subscribers' instruments, printing and type-wheel circuits in parallel to earth at the respective instruments and a central station having devices and their complemental circuits for controlling the pole changer and alternator and for effecting impressions at the subscribers' instruments.

Our invention further consists of a printing telegraph provided with normally closed parallel printing circuits operating a relay device by the depression of a transmitter key to break a local circuit through a pole-changer device adapted to arrest the type-wheels and through an interrupting device adapted to break and again close the printing circuit, whereby an impression is effected upon the arrested type-wheels.

Our invention further consists in certain details of construction of the printing pallet, the shifting mechanism therefor, and the printing springs attached thereto, whereby the impressions are clearly given in straight lines without blurring, and the characters are uniformly spaced; and our invention further consists of the improvements in printing telegraphs hereinafter fully described and particularly pointed out in the claims.

For the sake of a better explanation of our invention and before giving a brief description of the several views of the drawings and a detail description of the parts therein shown, it may be remarked that the instruments employed are each provided with two type-wheels rigidly attached to shafts that are controlled by escape-wheels and escapement pallets actuated by means of magnets and polarized armatures responding to alternating currents in parallel type-wheel circuits which pass from the electrodes of the generator at the central station through pole-changing and alternating devices, thence to earth from one terminal of the alternator, and from the other terminal in parallel through

the coils of the escapement magnets of each of two connected subscribers' instruments to earth at said instruments. One of the type-wheels of each instrument may have letters engraved upon its periphery and the other may have figures and fractions engraved upon its periphery, and the impressions are made from the respective type-wheels on a paper tape and in two parallel lines by shifting the printing pallet as may be required. The printing circuits emanate from one electrode of the generator and pass in a single line through the coils of a unison magnet and a circuit interrupter adapted to momentarily break and then close the printing circuit to effect impressions, and after passing this interrupting device the circuit divides in parallel through the magnets of relay devices at the central station, and passes in normally closed parallel circuits through the respective printing magnets and the indicating devices and keys of two connected subscribers' instruments to earth. These printing circuits may be derived from the same generator as the type-wheel circuits and in such case the resistances in the respective circuits must be balanced. However, the printing circuits may be connected to a separate generator. The printing circuits between two connected subscribers' instruments are normally closed in parallel, so that only the branch circuit through the transmitting keys of the sender's instrument can be manually broken by depressing one of said keys.

In order to effect an impression at both instruments, use is made of an electro mechanical device adapted to momentarily break and then close the printing line at a point between its generator and its point of division into parallel circuits, so that the impressions may be taken at both instruments while the printing circuit is momentarily broken. This electro mechanical device is constituted and operated as follows: The two branch printing circuits pass respectively through the coils of two relays which close through their armature-levers and front contacts a local battery circuit through the coils of the pole-changer magnet. Either relay will break this local circuit when the branch of the parallel printing circuit through it is broken at a key, and the consequent reversal of the current of the type-wheel line circuit due to the breaking of the local circuit through the pole-changer magnet, will cause the alternator and type-wheels to be arrested, as is fully set forth in the Patent No. 450,631 hereinbefore cited. The magnet of the circuit interrupting device may be included in the local circuit with the pole-changer magnet, so that the pole-changer is operated to arrest the type-wheels and the interrupter is actuated to momentarily break and then close the printing line between the generator and the point at which the printing line diverges in parallel circuits, whereby impressions are taken at the arrested type-wheels of the subscribers' instruments in con-

sequence of the momentary interruption of the parallel printing circuits.

The nature, scope and characteristic features of our 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 embodying features of our invention, and showing a central station provided with generators, an alternator, a pole-changer, relays, a printing line interrupter and terminals, and showing two subscribers' instruments adapted to be connected at said terminals, and also showing complete circuits for operating the same. Fig. 2, is a perspective view illustrating the principal parts of a tape-printer and showing the sunflower indicator, the escapement devices, unison devices and printing devices embodying features of our invention. Fig. 3, is a detail elevational view partly in section showing the type-wheels, printing pallet-lever, printing pallet, devices for shifting the printing pallet and springs for causing the type-wheels to print singly. Fig. 4, is a side elevational view of the printing pallet-lever, showing the pallet guide box, pallet-block and printing pallet, and also showing the paper feeding and guiding devices embodying features of our invention. Fig. 5, is a detached plan view of the pallet guide-box, pallet-block and printing pallet, showing springs for controlling the pallet-block and a rod for shifting the latter; and Fig. 6, is a top or plan view of Fig. 4 with certain of the devices for guiding the paper tape omitted.

Referring now more particularly to Fig. 2, the escapement magnets M' and M^2 , when energized by alternating currents in a manner hereinafter fully described, vibrate a polarized armature m^4 , attached to one end of an armature lever m^2 , pivotally supported by means of trunnions m^3 , and provided at the other extremity thereof with pallets m' that co-operate with an escape-wheel m , and thereby control the step by step rotation of the type-wheel shaft n^{40} . The number of teeth on the escape-wheel m , is equal to one half the number of divisions or characters of the type-wheel. Consequently the type-wheel is advanced one division or character at each reversal of current in the type-wheel line, it being understood that the type-wheel shaft n^{40} , is driven through the intervention of any suitable power appliance, not shown. L , is a sunflower indicator rigidly attached to the framework of the machine, not shown, and provided with a circular series of insulated segmental contacts l^3 , disposed concentrically in respect to the type-wheel shaft n^{40} . A trailer l^2 , mounted on an arm l^1 , carried by a hub l^3 , secured to and insulated from the type-wheel shaft n^{40} , sweeps over the insulated segments l^3 , of the sunflower indicator L . l' , is a hub also secured to and insulated from the type-wheel shaft n^{40} , and arranged in electrical con-

tion with the hub l^7 . l is an insulated spring that bears on the periphery of the hub l^7 . The circuit connections for the spring l , and sunflower indicator L , as well as the circuits for the whole apparatus will be hereinafter described with special reference to Fig. 1.

n^{23} , is a unison spiral rigidly mounted on the type-wheel shaft n^{40} , and n^{22} , is a pivotally supported unison-latch that terminates in a pin working in the spiral groove of the unison-spiral n^{23} . The armature n^{19} , of the printing magnet N^2 , is attached to a lever n^{18} , connected by a link n^{17} , with a lever or arm n^{28} , rigidly attached to and projecting radially from a shaft n^{14} . This lever or arm n^{28} , is provided with a right angular projection n^{21} , disposed in range of the unison latch n^{22} , and adapted to lift the same out of engagement with the unison-spiral n^{23} every time the magnet N^2 , is demagnetized, it being understood that the lever or arm n^{28} , moves upward under the influence of a spring n^{16} , hereinafter more fully described. On the shaft n^{14} , are also rigidly mounted the shifting-lever n^{24} , and the pallet-levers n^4 and n^5 . The free extremity of the shifting-lever n^{24} , is provided with a bent-arm n^{25} , to which is pivoted a T-lever n^{28} , forked at its lower extremity so as to engage a pin n^{30} , projecting from the shifting-bar n^3 . n^{43} , is an arm depending from the shifting-lever n^{24} , and provided with an aperture, in which one extremity of the shifting-bar n^3 , is afforded freedom of endwise play. n^{15} , is an arm depending from the lever n^{24} , and connected with the retracting spring n^{16} , which causes the printing-pallet to make an impression whenever the circuit through the magnet N^2 , is interrupted. The shifting-bar n^3 , passes through the pallet-block N , and is rigidly secured thereto. n^{28} and n^{29} , n^{43} and n^{40} are stops secured to the shifting-bar n^3 , and adapted to limit its range of movement. n^{36} and n^{27} , are collars or hubs mounted on the type-wheel shaft n^{40} , and provided with projecting pins n^{41} and n^{42} , Fig. 3, whereof one n^{41} , corresponds with the unison position of the type-wheels and the other n^{42} with the second position in advance of the unison position. The periphery of the type-wheel N^4 , is provided with letters of the alphabet, punctuation marks, blanks, &c., not shown, and the periphery of the type-wheel N^3 , is provided with numerals, fractions, conventional signs, &c., not shown. The demagnetization of the magnet N^2 , at the unison position of the type-wheels permits the T-lever, moving upward under the influence of the spring n^{16} , to impinge upon the pin n^{41} , whereby the printing-pallet n^{44} , is shifted directly beneath the type-wheel N^4 , and the demagnetization of the magnet N^2 , at the second position of the type-wheels in advance of the unison position permits the T-lever moving under the influence of the spring n^{16} , to impinge upon the pin n^{42} , whereby the printing-pallet n^{44} , is brought directly beneath the type-wheel N^3 , and an impression is of course

taken from the respective type-wheels at every break in the circuit of the printing line. Therefore, when the type-wheels have been arrested at the unison position and the pallet levers are actuated, the printing pallet will be shifted into position to print from the letter type-wheel in one continuous line near one edge of the paper or tape, and when the type-wheels have been arrested at the second position after the unisoning of the instrument, the pallet levers are then actuated, the printing pallet is shifted into position to print from the figure type-wheel in a continuous line parallel to the letter line and near the other edge of the paper or tape. It will be understood that when printing figures, if the printing pallet is actuated at the unison position of the type-wheels, said pallet will be shifted into the position to print letters.

It may be remarked that the novel details comprising part of our invention and illustrated in Figs. 4 to 6 inclusive, relate more particularly to apparatus for effecting impressions from two type-wheels, and will now be described. On the pallet-levers n^4 and n^5 , is rigidly secured a guide-box n^2 , in which the pallet block N , is permitted to slide transversely of and directly beneath the type-wheels. It should be borne in mind that the shifting-bar n^3 , that carries the pallet-block N , passes through and works freely in slots in the side walls of the guide-box n^2 . The printing-pallet n^{44} , is firmly secured to the pallet-block N , and consequently moves with it. The paper tape N' , passes between guide-pins n^{37} , under a pin n^{36} , over the pallet n^{44} , and through an axially slotted pin n^{35} , and then between the pressure-roll n^{12} , and the flanged feed-roll n^{11} . n' , are twin springs secured to each side of the pallet block N . The shanks of these springs are bent or curved outward around the edges of the paper tape N' , Fig. 3, thus allowing clearance at each side of the tape to permit of the shifting of the block N , without moving the paper tape laterally, and the extremities of these springs are bent inward over and above the paper-tape, Fig. 3, in such manner that a space is afforded between their adjacent extremities, for permitting the pallet n^{44} , to pass between them, whenever it is effecting an impression. When the printing-block N , has been shifted into position for bringing the pallet n^{44} , under the type-wheel N^3 , the pins n^{30} , moving under the influence of the springs n^{32} , fastened to the guide-box n^2 , drop into indentations n^{33} , in the printing block, and when the printing block N , has been shifted into position for bringing the pallet n^{44} , under the type-wheel N^2 , the pins n^{31} , moving under the influence of the springs n^{32} , drop into indentations n^{34} , in the printing block, so that accidental lateral movements of the pallet n^{44} , while impressions are being taken by it from the type-wheel under which it has been shifted, are prevented. n^{11} , is a feed-roll revolvably mounted upon a pin projecting from the face

plate of the instrument, not shown, and provided with a feed ratchet-wheel n^3 , and with a counter ratchet-wheel n^{10} , rigidly secured thereto. n^7 is a pawl pivotally mounted upon the curved extremity n^6 , of the pallet-lever n^5 , and held in engagement with the ratchet-wheel n^3 , by means of a spring n^{15} , engaging a projection on the pawl n^7 , Fig. 4. A pawl n^9 , is rigidly secured to the pallet-lever n^5 , and is adapted to engage the teeth of the counter ratchet-wheel n^{10} . When the circuit is broken through the printing magnet N^2 , the printing pallet n^{14} , moving under the influence of the spring n^{16} , strikes the paper tape N' , the pawl n^7 , slips over a tooth of the ratchet-wheel n^3 into position for feeding the latter, and the pawl n^9 , clears the teeth of the counter ratchet-wheel n^{10} . When the circuit is closed through the magnet N^2 , it attracts its armature n^{19} , thus shifting the pallet-levers n^4 and n^5 , downward and causing the pawl n^7 , to rotate the ratchet-wheel n^3 , and feed-roll n^{11} , whereupon the pawl n^9 , engages the counter ratchet-wheel n^{10} , and thus checks and limits the rotary motion of the feed-roll n^{11} . It may be remarked that the springs n^7 and n^{12} and their accessories, as well as the feeding devices hereinabove last described, operate with positive certainty to effectually prevent blurring of the impressions and to feed the paper tape in such manner that regular spaces of uniform length occur between the words and letters.

The operation of printing by means of the instruments hereinabove described and through the instrumentality of parallel printing and type-wheel circuits will now be explained with special reference to Fig. 1. One terminal e' , of a generator E , which may be a compound wound dynamo machine, as shown, with a shunt resistance E^2 , interposed between its leads, is connected by a conductor 1^a to one spring f , of a pole-changer F' , and the other terminal e , of said generator is connected by a conductor 1 , to the other spring f' , of the pole-changer F' ; thence the type-wheel circuit is through the back-stops f^2 or f^3 and conductor 2 , to the insulated springs c' and c^3 , of an alternator C . The lever f^5 , of the pole-changer F' , is connected by a conductor 2^a to the springs c^2 and c^4 , of the alternator C . The contacts c^7 and c^8 , of the alternator C , are insulated from the shaft a' , and from the contacts c^{11} and c^{12} , but are in electrical connection with the hub c^9 , and the contacts c^{11} and c^{12} , are in electrical connection with the hub c^{10} . The terminal spring c^6 , of the alternator C , is connected to earth by a conductor 3 , and the terminal spring c^5 , of the alternator C , is connected to line through a conductor 4 , magnets G , of the polarized relay, and conductor 5 , to the terminal block K . T , is a local battery that alternately energizes the magnets B and B' , when the circuits 10 and 11 thereof, are alternately closed at the stops g and g^2 , by the vibration of the tongue g' of the polarized re-

lay G . These magnets B and B' , vibrate an escapement-lever b^2 , which controls the step by step movement of the escape-wheel b , mounted on the shaft a' , of the alternator. When a plug k^4 , is inserted in the aperture k' , of the terminal block K , and a plug k^5 , is inserted in the aperture k^7 , the type-wheel circuits are in parallel from the terminal block K , through conductors 6 , to the escapement magnets M' and M^2 , of two communicating subscribers' instruments. These type-wheel circuits then pass through the coils of the magnets M' and M^2 , of the respective instruments in reverse direction and thence to earth by conductors 7 . It may be remarked that in practice the resistances of the branch type-wheel circuits must be equalized to give equal strength of current to the respective instruments. Moreover, by making the resistance of the printing circuits, to be presently described, equal to the resistance of the type-wheel circuits, one generator may be employed to furnish currents for both circuits, and numerous other alternators, pole-changers, terminal station apparatus and terminal blocks may be included in multiple arc circuits and many instruments may be operated thereby at the same time through the instrumentality of currents through multiple arc circuits from one generator.

In Fig. 1 of the accompanying drawings a separate generator E' , for the printing circuits, is shown. However the printing circuits themselves are the same as if they were derived from one terminal of the generator E , and will now be described. E^3 , is an outside shunt resistance interposed between the leads of the generator E . The terminal e^3 , of this generator E' , is connected to earth at the generator, and the terminal e^2 , is connected by a conductor 20 , to the unison magnet D , thence through its coils and by a conductor 21 to the insulated spring i , of an interrupter, through one of the radial metallic contacts i' and hub i^2 , mounted on and insulated from the shaft i^3 , thence by a spring i^3 , and conductor 22 , to the relay magnets H and H' , through the coils of which the circuit divides in parallel and continues by two separate conductors 23 to the separate terminal blocks k^8 and k^2 . When a plug k^3 , terminating the printing line of the subscribers' instrument shown at the left hand side of Fig. 1, is inserted in an aperture in the terminal block k^8 , and a plug k^6 , terminating the printing line of the subscribers' communicating instruments, shown at the right hand side of Fig. 1, is inserted in an aperture in the terminal block k^2 , the printing circuits continue in parallel by conductors 25 , to the printing magnets N^2 , and through the coils of the same, by conductors 26 , to insulated springs l , to hubs l' , to trailers l^2 and to segments l^3 , by conductors 27 to keys o^2 and metallic bars o^3 , and thence by conductors 28 to earth. T' , is a local battery which through the circuits 30 , 31 , 32 and 33 , energizes the interrupter

magnet I, and also the pole-changer magnet F, when both the relay magnets H and H', are simultaneously energized by the printing line parallel circuits, thus causing the levers h and h^6 , to contact with the front stops h^2 and h^5 , but the circuit of the local battery T', is interrupted when either the lever h or lever h^6 , falls away from its front stop under the influence of its retracting spring in consequence of the interruption of the circuit in one of the parallel printing lines. It may be remarked that the resistances E² and E³, are inserted between the leads of the dynamo E and E', to prevent a break of circuit through the field magnets when the line circuit is interrupted and that incandescent lamps may be conveniently employed for this purpose. When the circuit of the local battery T', is closed the armature f^4 , of the pole-changer, is attracted to its magnet, and the type-wheel line circuits through the alternator C, are in such direction in consequence of its connections through the pole-changer, that the alternator shaft a' , is permitted to revolve automatically in consequence of the continuous alternation of current, and by reason of the fact that the pulley A, on the shaft a' , is solicited by a suitable power appliance, not shown. At the same time the armature i^7 , of the interrupter is attracted by the magnet I, energized by the current of the closed circuit of the local battery T'. When the circuit of the local battery T', is interrupted, the magnet of the pole-changer is demagnetized and consequently the pole-changer moving under the influence of its retracting spring suddenly changes the direction of the current through the alternator C, and polarized-relay G, whereupon the tongue g' , of the relay G, immediately ceases to vibrate, so that the armature b^3 , of the pallet-lever b^2 , is permanently attracted by one of the magnets B and B', thereby causing the pallet-lever b^2 , to hold the escape-wheel b , and consequently arrest the alternator. At the same time the magnet I, of the interrupter, is demagnetized and the lever i^6 , moving under the influence of its retracting spring i^9 , causes the pawl i^5 , to engage the ratchet-wheel i^4 , and thus rotate the shaft i^3 , and radial contacts i' , of the interrupter. This movement of the shaft i^3 , and parts connected therewith, causes the spring i , to ride from one radial contact i' , across the intervening insulating material and to the next radial contact, thus temporarily breaking and again closing the circuit of the printing line between the terminal e^2 , of the generator E', and the dividing point of the circuit to the relays H and H', so that the interruptions that occur between the contacts i' , of the interrupter, serve to interrupt the parallel printing circuits. When the type-wheels are running the parallel printing circuits are in closed circuit through the sunflowers and keys of communicating instruments, and the pallet-levers n^4 and n^5 , and pallets n^{44} , are held away from the type wheels by the magnets N². At

the instrument employed for sending messages to a communicating instrument, a key o' , may be depressed in the usual manner. The depression of this key breaks at the contact o^3 , one branch of the closed printing circuit through one of the relay magnets H or H'. This demagnetization of the relay magnets H or H' interrupts the local circuit of the battery T', thus causing the pole changer magnet F, to suddenly arrest the type-wheels of both instruments, whereupon the interrupter, by reason of the break in the circuit of the local battery T', breaks temporarily the main printing circuit 20, from the terminal e^2 , of the generator E'. During this interval, the printing magnets N², are demagnetized at both communicating instruments, and the springs n^{16} , cause the printing pallets n^{44} , to make the impression of the character indicated by the key depressed at the sending instrument. The unison latch d^5 , of the alternator, is released every time the magnet D, is demagnetized by the interruption of the circuit of the printing line, and the unison latches n^{22} , of communicating instruments are released every time the magnets N², are demagnetized. When no key is depressed, the type-wheels of both connected instruments are automatically run to unison by pulsations in line, and the alternator, making one more revolution than the type-wheels, is arrested in unison with the type-wheels. While a key o' , remains depressed, the circuit of the local battery T', cannot close, because a branch line through one of the magnets H or H', is broken. However, the type-wheels of both instruments will start as soon as both branch printing lines have been closed, and the pole-changer has reversed the direction of the current in the type-wheel circuit through the alternator and polarized relay.

It may be remarked that in sending a message, another key should be depressed before the previously depressed key has been released, in order to prevent the sunflower trailer l^2 , from passing over a segment l^3 , indicating the next character to be printed before the key connected with that segment has been depressed. At unison position the printing-pallet n^{44} , is normally under the type-wheel N⁴, or will be shifted into that position by the pin n^{41} , and T-lever n^{38} , before the pallet n^{44} , causes the paper tape to strike the type-wheel. A blank space used for spacing between words is located at the unison position of the type-wheels. At the second division after unison, the T-lever n^{38} , will strike the pin n^{42} , and shift the printing pallet under the type-wheel N³, as soon as the printing magnet N², is demagnetized.

It may be remarked that other printing circuits in multiple arc, may be derived from the generator E', and used for energizing other systems of relay magnets H and H', and for affording other terminals k' and k^2 , that may be employed for other communicating

instruments, and it may be further remarked that by employing lines of equal resistance the system of alternators, polarized relays, pole-changers, relays and interrupters may be re-duplicated to any desired extent, and all of these devices may be supplied with current in multiple arc from one or more generators, so as to furnish idle terminals, by means of which it is possible to connect, as required, the numerous lines radiating from one general exchange to a great number of subscribers' instruments. In this connection use may be made of the apparatus for and methods of signaling fully illustrated and described in the Letters Patent of the United States No. 450,631, and hereinabove referred to.

Obviously our invention is not limited to the employment of the specific devices shown and described for interrupting and again closing the printing circuits, because modifications may be readily made in the same; nor do we limit ourselves to any specific number of generators, because the employment of one or more generators is within the scope of our invention. Furthermore, our invention is not limited to the employment of printing instruments designed for use as stock printers, because our novel controlling devices and circuits may be employed to operate page printers, and also tape printers of numerous type, provided the circuits actuating the same are controlled by alternators and printing circuit devices located at an exchange station.

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

1. An exchange system of printing telegraphy comprising subscribers' instruments, printing and type-wheel circuits in parallel to earth at the respective instruments and a central station having devices and their complementary circuits for controlling the pole-changer and alternator and for effecting impressions at the subscribers' instruments, substantially as and for the purposes set forth.

2. In an exchange system of printing telegraphy, normally closed parallel printing circuits, a relay, a transmitting instrument, a local circuit, a pole changer, an interrupting device, and said printing circuits adapted to operate said relay by the depression of a key of the transmitting instrument or instruments to break the local circuit through the pole changer device adapted to arrest the type-wheels of the instrument or instruments and through the interrupting device to break and again close the said printing circuit for effecting an impression from the arrested type-wheels, substantially as set forth.

3. In an exchange system of printing telegraphy, an electric generator, an alternator and its complementary pole-changer in a type wheel line circuit from the generator, an escapement, escapement-magnets located in a local circuit and controlling the rotation of the alternator, a polarized-relay controlling the local circuit, a line from one terminal of

said alternator to earth, a line from the other terminal of the alternator to a terminal block at an exchange or central station through said polarized relay, communicating subscribers' instruments provided with type-wheels and their complementary polarized escapement armature and escapement magnets, sunflower indicators and keys and with printing magnets, type-wheel circuits in parallel from said terminal block to earth through said escapement magnets, and printing circuits in parallel through the sunflower indicators, keys and printing magnets of the communicating instruments, substantially as described.

4. In an exchange system of printing telegraphy, a central station provided with a generator and with mechanical and electrical devices and their accessories for alternating and reversing the current in a type-wheel line leading to terminals at said station, subscribers' instruments, type-wheel circuits in parallel from said terminal to earth through the escapement magnets of said communicating instruments and printing circuits in parallel through the indicators, keys and printing magnets of said communicating instruments, substantially as and for the purposes set forth.

5. In an exchange system of printing telegraphy, a central station provided with an electric generator and with mechanical and electrical devices including an alternator for alternating and a pole-changer for reversing the current in a type-wheel line connected with one terminal of the alternator and leading to a terminal block, a line from the other terminal of the alternator to earth, communicating subscribers' instruments provided with type-wheels and their complementary polarized escapement armatures and escapement magnets, sunflower indicators, keys and printing magnets, type-wheel circuits in parallel from said terminal block to earth through said escapement magnets, and printing circuits in parallel through the indicators, keys and printing magnets of the communicating instruments, substantially as described.

6. In an exchange system of printing telegraphy, an electric generator, a pole-changer and its magnet, a circuit interrupter and its magnet adapted to momentarily break and close a printing circuit, an alternator and its unison magnet and controlling devices, a local battery circuit through said pole-changer magnet and interrupter magnet, two neutral relays adapted to close at their front contacts the circuit of said local battery and either relay adapted to break said local circuit, communicating instruments having sunflower indicators, escapements, type-wheel keys, and printing magnets and devices, type-wheel circuits in parallel, and a printing line circuit from one electrode of said generator through the contacts of said interrupter, thence in parallel through each of the magnets of said relays, sunflower indicators, printing magnets and keys of the communi-

eating instruments to earth, the arrangement being such that a break in either branch of the parallel printing circuits at a depressed key breaks the local circuit and arrests the alternator and the type-wheels of the communicating instruments and momentarily breaks and again closes the printing line circuits, thereby effecting impressions from the type-wheels of communicating instruments.

7. In an exchange system of printing telegraphy, an electric generator, a type-wheel line in parallel, mechanical and electrical devices controlled by a pole-changer adapted to arrest the type-wheels, a local battery circuit through the magnets of said pole-changer, two relays adapted to close at their front contacts the circuit of said local battery and either relay adapted to break said local circuit, an interrupter interposed in said local circuit and adapted to momentarily break and close a printing line circuit in parallel through the magnets of said relays and thence through the keys and magnets of communicating instruments to earth, the arrangement being such that a break in either branch of the parallel printing circuits at a depressed key arrests the type-wheels of communicating instruments and momentarily breaks and again closes the printing line circuit, thereby effecting impressions at the communicating instruments during a break of circuit.

8. In an exchange system of printing telegraphy, a type-wheel line and its accessories in parallel, a printing line and its accessories in parallel, a local battery circuit and its accessories for causing the type-wheel line to arrest the type-wheels, two relays adapted to close at their front contacts the circuit of said local battery and either relay adapted to break said local circuit and an interrupter interposed in the local circuit and adapted to momentarily break and close the printing circuit before it divides in parallel, the arrangement being such that a break in either branch of the parallel printing circuits arrests the type-wheels of communicating instruments and momentarily breaks and again closes the printing line circuits, thereby effecting impressions at the communicating instruments.

9. In an exchange system of printing telegraphy, a central or exchange station provided with an automatically controlled alternator, unison and pole-changing devices, an interrupter having its contacts in the undivided portion of the printing circuit from one electrode of a generator and with relays controlling the interrupter and located in the divided portion of the printing circuits, and communicating subscribers' instruments provided with indicators and keys interposed in said divided portion of the printing circuits and with connections for conveying said circuits to earth at said instruments, substantially as and for the purpose set forth.

10. In an exchange system of printing telegraphy, a central station provided with an interrupter having its contacts in the undivided

portion of the printing circuits and with relays controlling the interrupter and interposed in the divided portion of the printing circuits, and communicating instruments provided with indicators and keys and printing magnets interposed in said divided portion of the printing circuits, substantially as and for the purposes set forth.

11. In an exchange system of printing telegraphy, an automatically controlled alternator, unison and pole-changing devices, the interrupter having its contacts in an undivided portion of the printing circuits from one electrode of a generator, and relays in the divided portion of the printing circuits from said electrode and communicating instruments provided with indicators and keys interposed in said divided portion of the printing circuits, substantially as and for the purposes set forth.

12. In an exchange system of printing telegraphy, an automatically controlled alternator, unison, pole-changing and interrupting devices and their magnets and line contacts, a printing circuit from one electrode of an electric generator through the contacts of said interrupter, neutral relays in each of two subdivisions of said printing circuit, a local battery circuit through the levers and stops of said relays and the magnets of said interrupter and pole-changer, and communicating instruments provided with indicators, keys and printing magnets and devices located in said divided circuit, the construction and arrangement being such that the depression of a key demagnetizes said pole-changer magnet and reverses said pole-changer, interrupts and closes said printing circuit, and effects impressions on two communicating instruments, substantially as and for the purposes set forth.

13. In an exchange system of printing telegraphy, an automatically controlled alternator and its accessories for reversing and alternating the current, a type-wheel line, an interrupter and its magnets, a single printing circuit through the contacts of said interrupter, neutral relays in each of two subdivisions of said single printing circuit, a local battery circuit through the levers and stops of said relays and the magnets of said interrupter, and communicating instruments provided with indicators, keys and printing magnets and devices in said divided circuit, the construction and arrangement being such that the depression of a key reverses said pole-changer, interrupts and closes said single circuit and effects impressions on two communicating instruments during the interruption of said circuit, substantially as and for the purposes set forth.

14. In an exchange system of printing telegraphy, a pole-changer and its accessories, an interrupter, a single circuit from one electrode of an electrical generator through the contacts of said interrupter, neutral relays in each of two sub-divisions of said single cir-

cuit, a local battery circuit through the levers and stops of said relays and the magnets of said interrupter and pole-changer, and communicating instruments having their keys and printing magnets and devices in said divided circuit, the construction and arrangement being such that the depression of a key reverses said pole-changer, interrupts and closes said single circuit and effects impressions at two communicating instruments during the interruption of said circuit, substantially as and for the purposes set forth.

15. In a double line exchange system of printing telegraphy, electric generators, alternators and controlling devices at an exchange station, type-wheel lines in parallel from said alternator to communicating instruments, and printing lines in parallel from one electrode of an exchange generator to said instruments, substantially as and for the purposes set forth.

16. In a double line exchange system of printing telegraphy, electric generators, alternators and controlling devices at an exchange station, type-wheel circuits to said alternator and thence to ground and in parallel to communicating instruments, and printing lines in parallel from one electrode of an exchange generator to said instruments, substantially as and for the purposes set forth.

17. In a double line exchange system of printing telegraphy, electric generators, a pole-changer and controlling devices at an exchange station, type-wheel lines in parallel from said communicating instruments, and printing lines in parallel from one electrode of an exchange generator to said instruments, substantially as and for the purposes set forth.

18. In an exchange system of printing telegraphy, alternating devices, arresting devices and electric generators at an exchange or central station, communicating instruments provided respectively with type-wheel printing lines in parallel from said generators through said alternating and arresting devices, relays in the parallel printing circuits, and interrupting devices interposed in a local circuit controlled by said relays and the contacts of said interrupting devices included in the printing circuit and operating by the breaking of a branch printing circuit to momentarily break and close the parallel printing circuits of two communicating instruments, substantially as and for the purposes set forth.

19. In an exchange system of printing telegraphy, electric generators, alternators and arresting devices at an exchange or central station, interrupting devices, relays controlling said devices, communicating printing instruments having type-wheel escapement devices, printing devices, indicating devices and key-boards and type-wheel and printing circuits in parallel from said generators, substantially as and for the purposes set forth.

20. In an exchange system of printing telegraphy, an exchange or central station, print-

ing instruments having type-wheels, escapement magnets and devices, printing magnets and devices, indicators and key-boards, type-wheel and printing circuits respectively in parallel and converging to terminals at said station, and electric generators, alternating, arresting and interrupting devices located at said station and included in the circuit of said generators and terminals and operating to control the parallel type-wheel and printing circuits through said instruments, substantially as and for the purposes set forth.

21. In an exchange system of printing telegraphy, electric generators, alternators, arresting and circuit interrupting devices at an exchange or central station and in multiple arc circuits from said generators, terminals for the printing and type-wheel circuits of the respective alternators and arresting devices and type-wheel and printing lines converging from the respective printing instruments to said exchange or central station, the resistances of said type-wheel and printing lines being balanced to permit of their connection in multiple arc at will to the terminals of different alternators and arresting devices, whereby many communicating instruments may be operated in multiple arc from one or more generators, substantially as set forth.

22. The combination of the printing magnet N^2 , armature n^{19} , armature lever n^{18} , link n^{17} , shaft n^{14} , lever n^{28} , curved arm n^{25} , T-lever n^{38} , shifting-bar n^3 , pin n^{39} , pallet-levers n^4 and n^5 , guide-box n^2 , pallet-block N , printing pallet n^{44} , springs n^7 , and means for operating the T-lever, substantially as and for the purposes set forth.

23. The combination, in a printing telegraph, of two type-wheels, a printing pallet disposed between twin springs secured to a block and having portions bent outward around the edges of the paper or tape to allow clearance at each side to permit of the shifting of said block without moving the paper or tape and the said springs bent inward over and above said paper or tape to provide space between their adjacent ends to permit said pallet to pass between said springs while an impression is being effected, and means for actuating said pallet, substantially as set forth.

24. The combination, in a printing telegraph, of two type-wheels, a printing pallet arranged between twin springs secured to a block so as to leave a clearance or space between adjacent ends thereof, and means, substantially as described, for shifting said pallet transversely of and into contact with said type-wheels so as to cause said springs moving with said pallet to cover the characters on one of the type-wheels and expose the characters on the other of said wheels, substantially as and for the purposes set forth.

25. The combination of the pallet levers n^4 and n^5 , guide-box n^2 mounted thereon, pallet block N adapted to move freely in said guide-box, shifting bar n^3 secured in said pal-

let-block, springs n' integral with said pallet block, springs n^{32} secured to said guide-box and carrying pins n^{30} and n^{31} adapted to engage in indentations n^{33} and n^{34} in the pallet-block N, and means for operating the shifting-bar n^3 , substantially as and for the purposes set forth.

26. In a printing telegraph, a printing-block working in a guide-box provided with spring controlled pins tending to engage said block and prevent accidental movement thereof, substantially as and for the purposes set forth.

27. In a printing telegraph, type-wheels, pallet levers provided with a guide-box, a printing-block movable in said guide-box, means for actuating said block, and spring controlled pins tending to engage recesses in said block to prevent accidental movement thereof, substantially as and for the purposes set forth.

28. In a printing telegraph, type-wheels, pallet-levers provided with a guide-box, a printing block movable in said guide block, springs moving with said block and serving to cover one and expose the other of the type-wheels, and spring controlled pins tending to engage recesses in said block to prevent accidental movement thereof, substantially as and for the purposes set forth.

29. The combination of the pallet-lever n^5 , pawl n^7 , spring n^{45} , ratchet-wheel n^8 , counter-pawl n^9 , counter-ratchet-wheel n^{10} , feed-roller n^{11} and pressure-roller n^{12} , all operating to feed the paper tape with a regular intermittent motion, whereby the letters and characters are evenly spaced, substantially as and for the purposes set forth.

30. The combination of the pallet lever n^5 , pawl n^7 , spring n^{45} , ratchet-wheel n^8 , counter-pawl n^9 , counter-ratchet-wheel n^{10} and feed roller n^{11} , operating to feed the paper tape with a regular intermittent motion whereby the letters and characters are evenly spaced, substantially as and for the purposes set forth.

31. The combination, in a printing telegraph, of a shaft provided with type-wheels and pins, a printing magnet for operating a shaft provided with an arm, a lever mounted on said arm and adapted to contact with said pins and shift a block provided with springs, a feed-roll provided with ratchet-wheels, a printing pallet lever having a pawl and a counter pawl, the construction and arrangement being such as to respectively rotate and check said feed-roll, and means, as described, for actuating the same, substantially as and for the purposes set forth.

32. In a printing telegraph, a type-wheel shaft provided with type-wheels and pins, a printing magnet for operating a shaft provided with a radial arm, a T-lever mounted on said arm and adapted to contact with said pins and shift a rectangular pallet-block provided with printing springs, a printing pallet-lever, a feed-roller provided with a ratchet

and a counter ratchet-wheel, and a pawl and a counter-pawl carried by the printing pallet lever, the construction and arrangement being such that impressions are effected on a paper tape in either of two parallel lines and from either of the type-wheels, substantially as and for the purposes set forth.

33. In a printing telegraph, a type-wheel shaft n^{40} , type-wheels N^3 and N^4 and pins n^{41} and n^{42} mounted on said type-wheel shaft, in combination with a printing magnet N^2 , its armature and lever, a spring controlled shaft n^{14} , a link n^{17} , a lever n^{23} , a lever n^{38} mounted on a lever n^{24} , a pallet lever, a rectangular shifting pallet-block, a feed-roller, a ratchet and a counter ratchet wheel, a pawl and a counter-pawl, the construction and arrangement being such that impressions on a paper tape are effected in a straight line from either of said type-wheels, substantially as and for the purposes set forth.

34. In a printing-telegraph, the pallet-lever n^5 , pawl n^7 , spring n^{45} and counter-pawl n^9 , in combination with a feed-roller n^{11} provided with a ratchet-wheel n^8 and a counter ratchet-wheel n^{10} , a pressure roller n^{12} , guide-pins n^{36} and n^{37} , and a slotted pin n^{35} , substantially as and for the purposes set forth.

35. The combination, in a printing telegraph, of a shaft provided with type-wheels and pins, a printing magnet for operating a shaft provided with an arm, a lever mounted on said arm and adapted to contact with said pins and shift a block provided with twin springs, a feed-roll provided with ratchet-wheels adapted to be actuated so as to rotate and check said feed-roll, and a slotted pin between said type-wheels and feed roll for guiding the paper thereto, substantially as and for the purposes set forth.

36. The combination, in a printing telegraph, of two type-wheels, a printing pallet disposed between twin springs secured to a block so as to leave a clearance between adjacent ends thereof, a feed roll provided with ratchet and counter-ratchet wheels, pins for presenting a paper tape to said printing pallet and a slotted pin for guiding said paper tape to the feed roll, substantially as shown and for the purposes set forth.

37. The combination, in a printing telegraph, of type-wheels, a printing pallet arranged beneath twin springs secured to a block connected with a shifting lever, means substantially as described, for actuating said lever and block, a feed roll provided with ratchet-wheels, pins for presenting a paper tape to the printing pallet, a slotted pin for guiding said paper tape to the feed roll and means, substantially as described, for actuating said feed roll, substantially as and for the purposes set forth.

38. In a printing telegraph, a guide-box n^2 mounted on pallet levers n^4 and n^5 , in combination with the pallet block N, secured to the shifting-bar n^3 , the printing pallet n^{44} integral with said pallet block N, the retaining

springs n^{32} secured to the guide-box n^2 , pins n^{30} and n^{31} attached to said springs and tending to engage the indentations n^{33} and n^{34} in the pallet-block N, and the curved-springs n' secured to said pallet block and passing over the paper tape N', the extremities of the springs n' being separated for a distance equal to or greater than the thickness of the face of the type-wheels N³ and N⁴ to permit of the taking of impressions from either type-

wheel, substantially as and for the purposes set forth.

In testimony whereof we have hereunto set our signatures in the presence of two subscribing witnesses.

SAMUEL RUSH LINVILLE.

LOUIS FREDERICK HETTMANSPERGER.

Witnesses:

THOMAS M. SMITH,

RICHARD C. MAXWELL.