



(No Model.)

6 Sheets—Sheet 2.

J. E. MUNSON.

AUTOMATIC PERFORATING TELEGRAPH.

No. 330,344.

Patented Nov. 10, 1885.

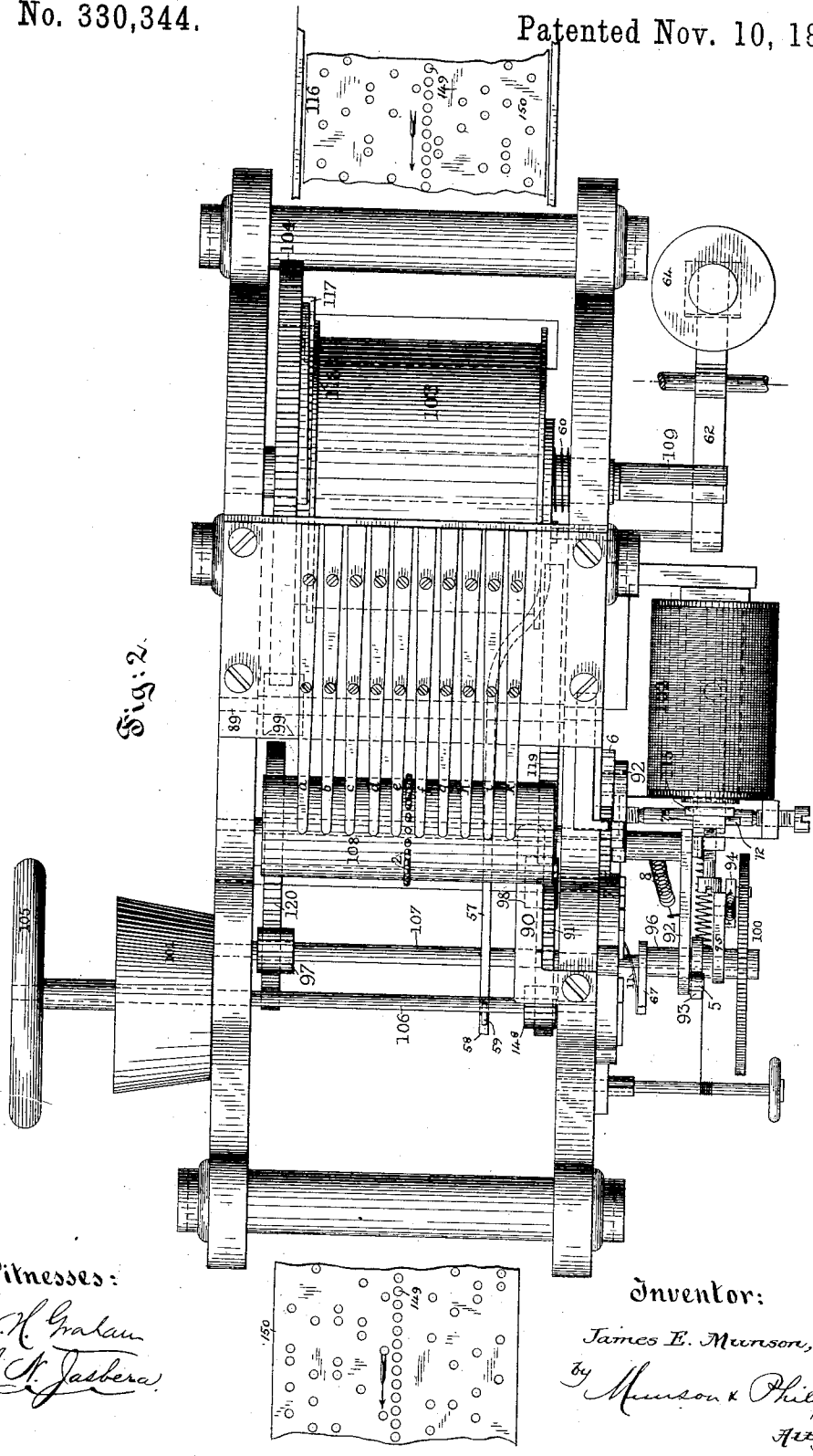


Fig. 2.

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*Geo. H. Graham*  
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(No Model.)

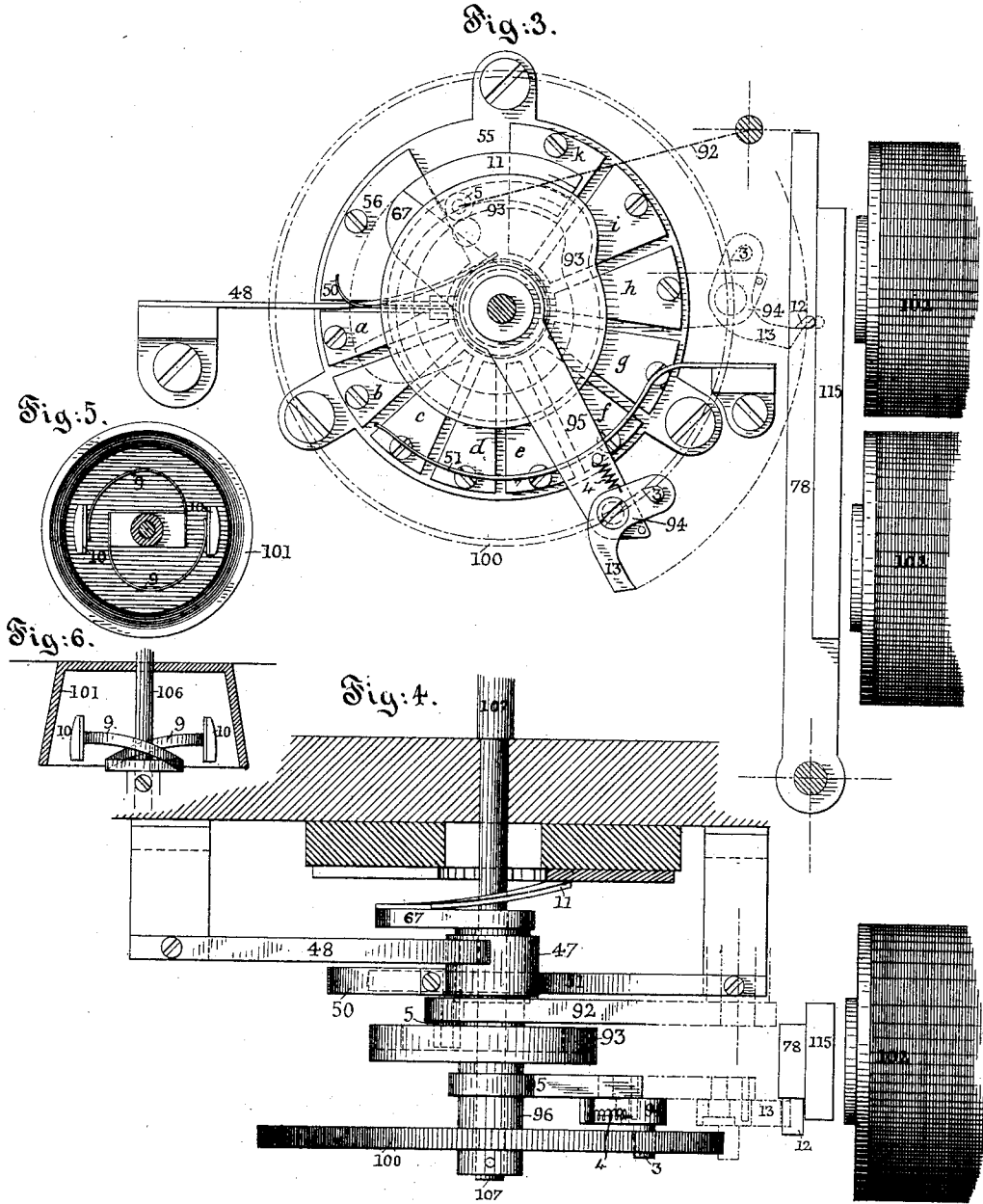
6 Sheets—Sheet 3.

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(No Model.)

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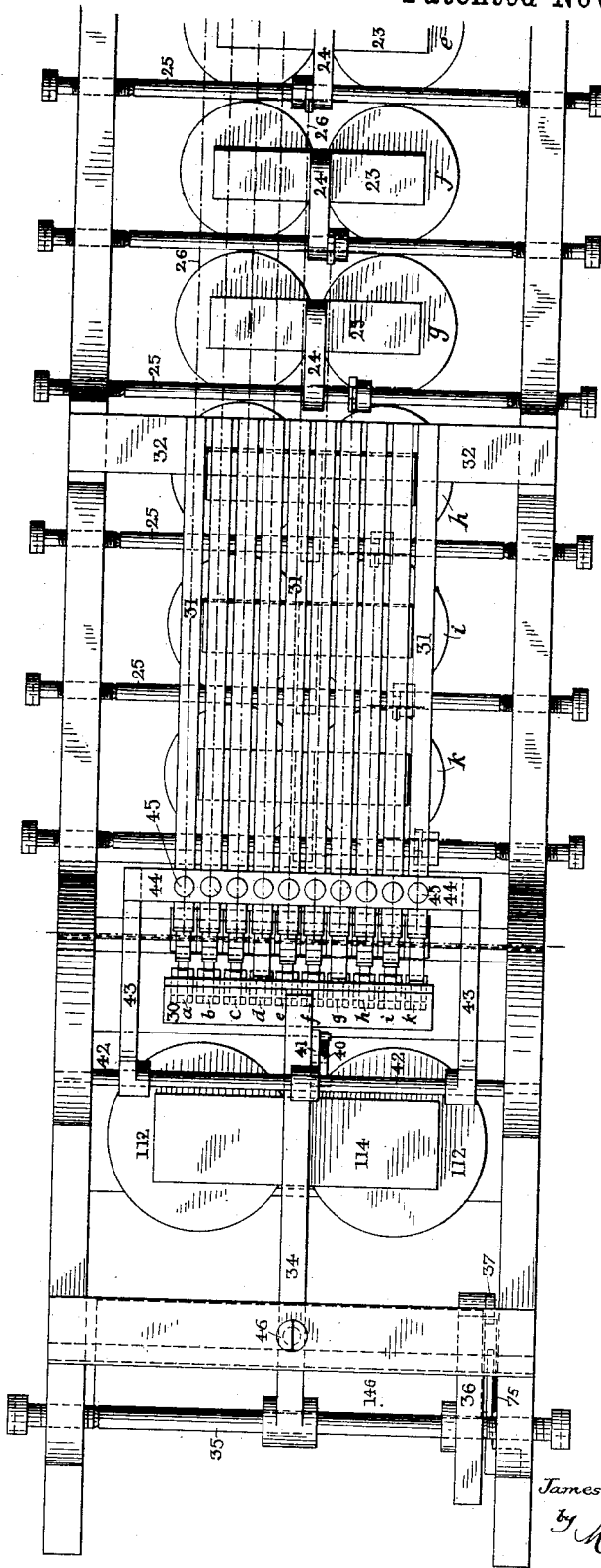
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Fig. 7



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(No Model.)

6 Sheets—Sheet 5.

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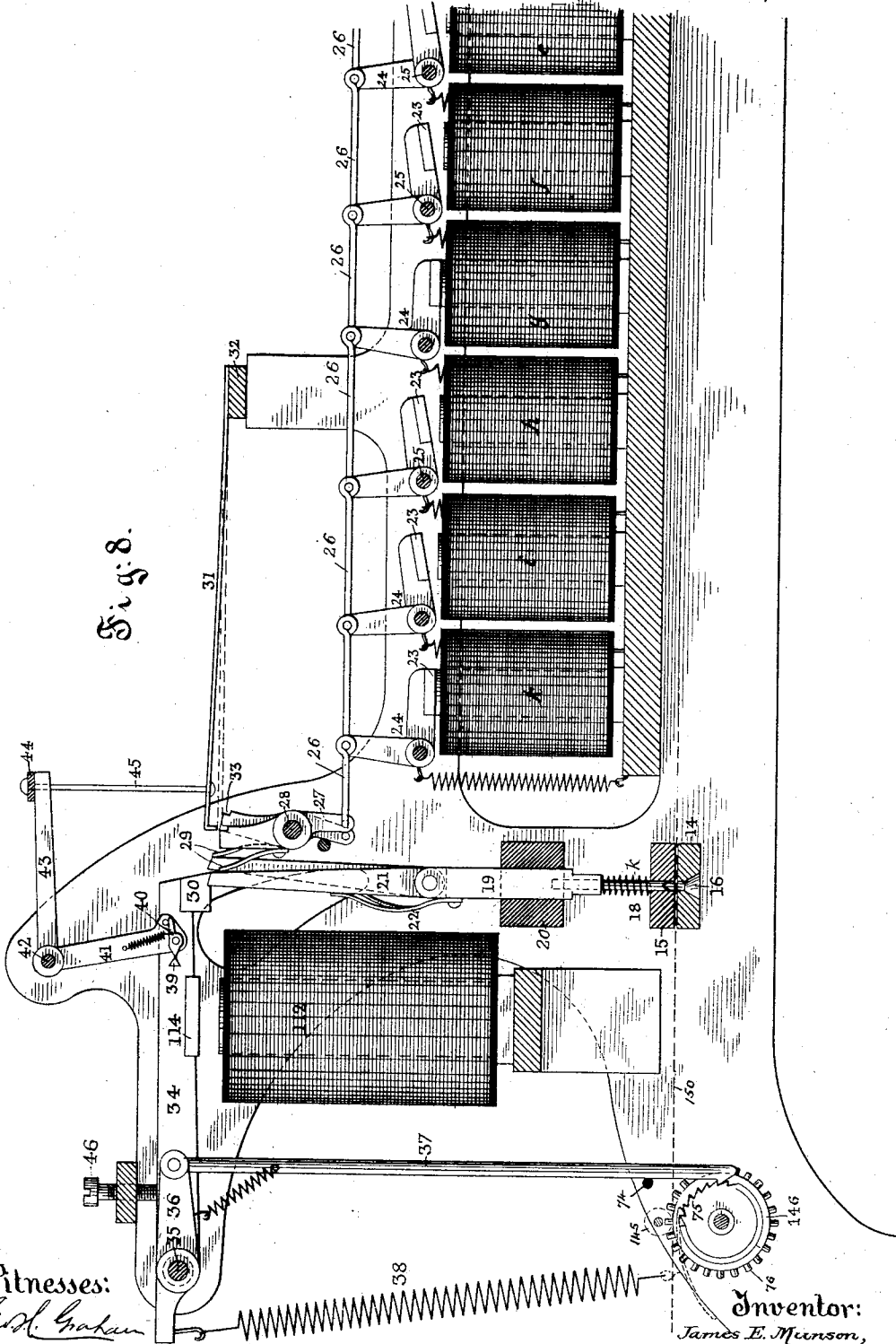


Fig. 8.

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(No Model.)

6 Sheets—Sheet 6.

J. E. MUNSON.

AUTOMATIC PERFORATING TELEGRAPH.

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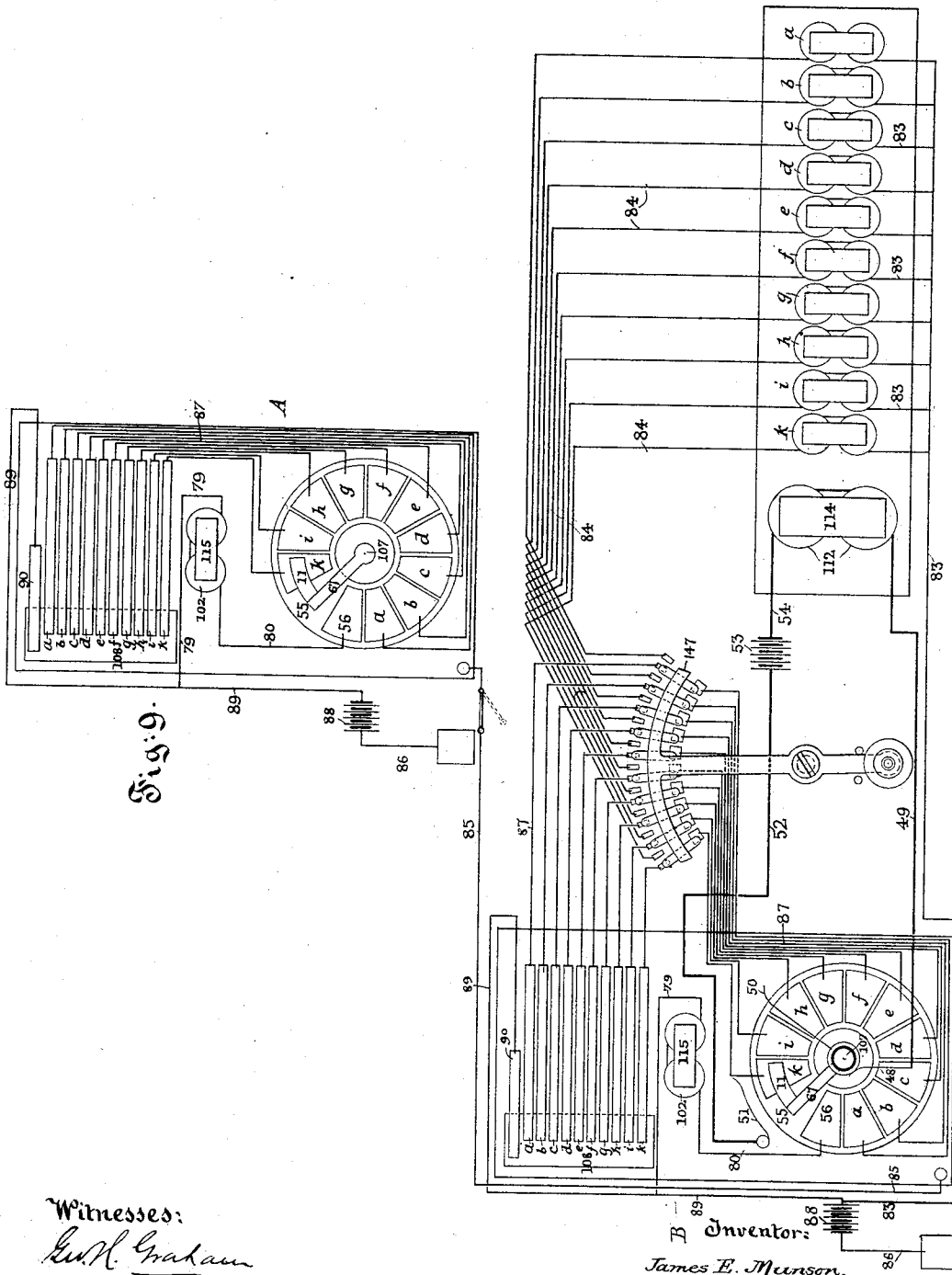


Fig. 9.

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# UNITED STATES PATENT OFFICE.

JAMES E. MUNSON, OF NEW YORK, N. Y.

## AUTOMATIC PERFORATING-TELEGRAPH.

SPECIFICATION forming part of Letters Patent No. 330,344, dated November 10, 1885.

Application filed January 18, 1883. Serial No. 82,250. (No model.)

*To all whom it may concern:*

Be it known that I, JAMES E. MUNSON, a citizen of the United States, residing in the city of New York, county of New York, and State of New York, have invented certain new and useful Improvements in Automatic Electrical Transmitting and Reproducing Apparatus, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

In a former application for United States Letters Patent I have described a method of setting type by machinery in which the matter to be composed is indicated upon a ribbon or strip of paper or similar material by perforations representing the different types, "spaces," &c., the ribbon or strip thus prepared being afterward used to control the type-selecting devices, thereby making the operation of the type-setting mechanism entirely automatic. In said application I have also described a method of correcting and justifying the composition upon the perforated ribbon before the same is used to operate the type-setting mechanism, and also a method by which this ribbon, either before or after being corrected and justified, may be automatically reproduced at a distant station, so that all the labor required to put the same matter in type at many and distant points is the preparation of a single ribbon.

The present invention relates to a mechanism for the accomplishment of this last-named purpose, and to aid in a ready understanding of its object and operation the manner of preparing and using the ribbon will be first briefly described.

The matter which is to be put in type is first indicated upon a ribbon of paper or similar material of suitable width to be conveniently manipulated by transverse rows of perforations, each of which rows represents one of the types, spaces, or quads to beset, the particular type, space, or quad represented being determined by the positions of the perforations. The number of perforations in each row may be the same, or it may vary. Thus some of the types, &c., may be represented by a single perforation, while others are represented by combinations of two, three, or more perforations; but, as set forth in a former application for Letters Patent, it is preferable that the

same number should be used for each of the types, &c., and that this number should be three, and also that the number of possible perforations in each row should be ten.

For the purpose of enabling the composition to be justified upon the perforated ribbon, the transverse rows of perforations are separated from each other by spaces proportioned to the running thicknesses of the bodies of the types, spaces, &c., which they represent.

The perforations indicating the composition may be made by hand or by any suitable form of mechanism for that purpose—such, for example, as that shown in an application for Letters Patent filed by me on the 5th day of August, 1882, No. 68,548. After the ribbon has been thus prepared it will be examined by the proof-reader, who will note thereon the necessary corrections, after which the ribbon will pass to the justifier. By reason of the proportionate spacing before mentioned the proper points for dividing into lines can be readily ascertained by the use of a suitable scale or measure, due allowance of course being made for the corrections made by the proof-reader.

In the process of correcting and justifying the composition the changes noted by the proof-reader will be made by punching additional rows of perforations to represent types, &c., to be added, or eliminating (by covering, filling, or otherwise) rows of perforations representing improper types, &c., or both, and additional rows of perforations will be made at the proper points to represent the spaces or quads to be added to fill out short lines; or rows of perforations representing spaces, &c., which must be removed to shorten long lines will be eliminated. When a word is divided at the end of a line, a row of perforations representing the hyphen will of course be inserted and properly allowed for in the justification. At the end of each line the justifier will add a row of perforations representing a large quad, which will serve to indicate the line-divisions after the matter is put in type. The ribbon thus prepared may be used to control the operation of the type-selecting devices; but in order to permit the setting mechanism to operate uniformly and at its maximum speed it is necessary that the rows of perforations upon the

operating-ribbon should be uniformly spaced. The ribbon therefore, after having its matter corrected and justified, is reproduced with its lines of perforations uniformly spaced, and  
 5 this reproduction is used to control the type-selecting devices. This reproduction of the ribbon is effected automatically by a mechanism which will form the subject-matter of a future application for Letters Patent. The  
 10 ribbon, now having the various types, spaces, &c., represented upon it by transverse rows of perforations separated equal distances from each other, is advanced beneath a series of fillers located in an electric circuit and forming  
 15 circuit-closers, so that when they are permitted to pass through the perforations in the ribbon, circuits are formed which operate the proper selecting devices and permit or cause the types, spaces, &c., to be ejected from the  
 20 type-reservoirs in the order in which they are represented upon the ribbon, thus making the operation of the setting mechanism entirely automatic.

It is of course apparent that the rows of  
 25 perforations may be evenly spaced upon the ribbon in the first instance, and this ribbon used for controlling the selecting devices, the matter being corrected and justified after it is in type in the usual manner. It is preferable,  
 30 however, that the correcting and justifying be done upon the ribbon. The advantages of this method of operating a type-setting mechanism, and of correcting and justifying the composition, will at once be recognized by  
 35 those familiar with this art, and need not be here specified. They are, however, fully set forth in my application for Letters Patent filed September 9, 1882, and my former application  
 40 hereinbefore referred to, to which reference is made for these facts, as well as for a more detailed description of the operation of the mechanism.

It is frequently desirable that the same matter should be put in type, so as to be printed  
 45 at two or more places at a long distance from each other. This result is at present accomplished by transmitting the matter by telegraph, or otherwise, in the ordinary manner, to the various points where it is to be printed,  
 50 and then setting the type in the usual way. Instead of this I propose, after one ribbon has been properly prepared for operating the selecting devices, to automatically reproduce the same at as many different places  
 55 as it may be desired to print the same matter, thereby making all of the operations required to put the matter in type, corrected, and justified at any number of different places, entirely automatic after a single ribbon has been prepared.  
 60 By this means the same newspaper can, without extra expense for type-setting, be printed simultaneously at different places, so as to be delivered to its readers without the delay now occasioned by transportation; or the same matter, corrected and justified, can be  
 65 supplied simultaneously to many different papers. By this means, also, an author can

transmit his composition, corrected and justified, to a distant printer, and yet avoid the usual delay occasioned by returning the proof  
 70 for correction.

The present invention, as hereinbefore stated, relates to a mechanism for effecting this reproduction of the ribbon. This mechanism consists of two instruments—a transmitter at  
 75 the sending-station and a reproducer at the receiving-station—the two being located in an electric circuit and made to operate synchronically. When it is desired to capacitate the apparatus to transmit and reproduce at both  
 80 ends of the line, the two instruments will be exact duplicates; but when it is desired to transmit in one direction only the feeding mechanism of the two will be slightly different, and the reproducer alone will be provided  
 85 with a perforating mechanism.

In the accompanying drawings, Figure 1 is a side elevation of the transmitting-instrument; Fig. 2, a plan view of the same; Fig. 3, a side elevation, upon an enlarged scale, of the circuit closing and breaking mechanism and the mechanism for causing the transmitter and  
 90 reproducer to operate synchronically; Fig. 4, a plan view of the same; Fig. 5, an inside view of a governor for regulating the speed of the instruments; Fig. 6, a horizontal section of the same; Fig. 7, a plan view of the reproducing perforating apparatus; Fig. 8, a longitudinal vertical section of the same, and Fig. 9 a diagram showing the electrical connections.  
 95

Referring to Figs. 1 and 2, it will be observed that the ribbon 150, after having had the composition indicated upon it, as set forth, is led from a reel or other suitable support,  
 100 116, to the feeding roll 108, and is passed between said roll and a series of spring feelers, *a b c*, &c., equal in number to the possible  
 105 perforations in each transverse row upon the ribbon, which bear gently upon its upper side, with their ends in such position as to pass  
 110 through the perforations and come in contact with the roll when permitted. In order to insure the positive and accurate feeding of the ribbon, it may be provided, in addition to the perforations indicating the composition,  
 115 with one or more longitudinal rows of feeding-perforations, 149, which will be engaged by a series of sprockets, 2, upon the feeding-roll. The perforations 149 will preferably be made  
 120 before the composition is indicated upon the ribbon. The feeding-roll is rotated with a step-by-step movement, the length of each step being equal to the distance between the transverse rows of perforations upon the ribbon, and the parts being so timed that as the roll  
 125 and ribbon come to rest at the end of each step a row of perforations will lie directly beneath the ends of the feelers, so that certain of said feelers will enter said perforations and come in contact with the feeding-roll. The feeding  
 130 of the ribbon is automatically accomplished by means of a weight, 111, suspended from a cord, 110, wound upon a drum, 103, provided with a gear, 104, which is connected by a train



of gears, 99, 119, 98, 120, and 97, with a shaft, 107, carrying a ratchet, 100. The shaft 107 is provided with a loose sleeve, 96, (see Fig. 4,) from which extends an arm, 95, to the outer end of which is pivoted a bell-crank lever, 94, one arm of which is provided with a pawl, 3, which, by a suitable spring, 4, is held in engagement with the ratchet 100, so that as the shaft 107 revolves the sleeve 96 will be carried with it. The sleeve 96 is also provided with a cam, 93, in the path of which rests a stud, 5, projecting from the end of a pivoted lever, 92, (see Fig. 1,) the opposite end of which is provided with a pivoted spring-pressed pawl, 6, which engages with a ratchet, 7, secured to the shaft of the feeding-roll.

It will be observed that in Fig. 1 the cam 93, instead of being shown as a path-cam, is a plain cam, against which the stud 5 is held by a spring, 8, so that the lever 92 is moved in one direction by a spring, instead of being moved in both directions positively, as in the constructions shown in Figs. 3 and 4.

The shaft 107 is further provided with a gear, 91, which engages with a gear, 148, upon a shaft, 106, the outwardly-extending end of which is provided with a balance-wheel, 105, and a governor, whereby the motion of the shaft 107 is regulated and sudden variations in its speed prevented.

The governor may be of any approved construction, but in the present case is shown (Figs. 5 and 6) as consisting of a rim or shell, 101, fixed upon the frame of the instrument, and a pair of spring-arms, 9, secured to the shaft 106, and carrying upon their outer ends weights 10, which, as the shaft 106 increases in speed, will be caused to take positions farther from said shaft, thereby pressing against the rim 101 and increasing the resistance offered by the governor to its movement. The balance-wheel 105 is frictionally secured to its shaft, so that when the instrument is suddenly arrested the wheel can continue its revolution for a short distance independent of the shaft, and so have its inertia so gradually overcome as to prevent undue strain upon the parts. The drum 103 is fast to the shaft 109; but the gear 104 is mounted loosely upon said shaft, and is provided with a pawl, 117, which engages with a ratchet, 118, secured to the end of the drum, so that as the cord 110 is unwound the gear 104 will be caused to revolve with the drum. The shaft 109 extends beyond the frame of the instrument, and is made of suitable form to receive a key or crank by which the cord can be rewound upon the drum at the proper times.

As already stated, each transverse row of perforations in the ribbon 150 represents one of the types, spaces, &c., to be set, and, for reasons also stated, the number of perforations in each row, as shown in the present case, is three. It will therefore be seen that from the operation of the mechanism just described the ribbon is so advanced that at each revolution of the sleeve 96 a new row of three

perforations is brought beneath the ends of the feelers *a b c*, &c., so that three of said feelers are permitted to come into contact with the roll 108, and remain in contact therewith during one revolution of the sleeve 96. The roll 108 is mounted in insulated bearings, or has its surface insulated from its shaft, and is provided with a contact-spring, 90, secured to the frame of the instrument, but insulated therefrom, and connected, by a wire, 89, (see Fig. 9,) with one pole of a battery, 88, the other pole of which is attached to a ground-wire, 86. The feelers *a b c*, &c., are insulated from the frame of the instrument, and are connected by a series of wires, 87, with a series of insulated contact-plates, *a b c*, &c., arranged in the form of a circle upon the side frame of the instrument and corresponding in number with the feelers. From this arrangement it will be seen that whenever any one or more of the feelers comes into contact with the roll 108 an electrical connection is formed between the battery 88 and the contact plate or plates corresponding with said feelers. The shaft 107 is not insulated from its sleeve 96 or from the frame of the instrument, and said sleeve is provided with an arm, 67, which carries upon its outer end a contact spring or brush, 11, so positioned and arranged that as said sleeve revolves it will sweep successively across each of the plates *a b c*, &c., thereby allowing electrical currents to pass successively between the battery 88 and the frame of the instrument through the several feelers resting upon the roll 108.

The frame of the instrument at the sending-station, which for convenience is designated A, (see Fig. 9,) is connected by a line-wire, 85, with the frame of the instrument at the receiving-station, which is designated B, and which is identical in construction with the instrument at the sending-station. When, however, this instrument is operated as a reproducer, the pawl 6, Fig. 1, will be thrown out of engagement with the ratchet 7, and a switch, 147, Fig. 9, will be shifted so that its series of contact-plates *a b c*, &c., instead of being connected with its corresponding series of feelers, will be connected, through a series of wires, 84, with one pole of a series of electromagnets, *a b c*, &c., equal in number to the contact-plates, the opposite poles of said magnets being connected by a series of wires, 83, with one pole of its battery 88, the opposite pole of which is provided with a ground-wire, 86.

From the connections just described it will be seen that when both instruments are put in motion and made to operate synchronically the ribbon will be advanced with a step-by-step movement over the roll 108 of the transmitting-instrument, and that at the end of each step three of the feelers *a b c*, &c., will pass through perforations in the ribbon and come in contact with the roll, and that the brushes 11 of the two instruments, moving in unison, will sweep across the faces of their cor-

responding contact-plates at the same time, so that circuits will be successively completed through the three feelers resting upon the roll, the three corresponding contact-plates in the instrument A, the corresponding contact-plates in the instrument B, and the three corresponding magnets of the series *a b c*, &c. It will readily be understood, however, that, no matter how accurately the mechanisms of the two instruments might be adjusted, they could not for any length of time be made to operate in perfect unison—that is to say, one would either gain or lose in speed, so that its brush 11 would be upon the plate *b*, for example, when the brush of the other instrument was upon the plate *a* or *c*—thus preventing the formation of a circuit and stopping the operation of the apparatus. To prevent this, and to insure that the two instruments shall always be in substantial unison, each instrument is provided, in addition to the contact-plates *a b c*, &c., with an extra plate, 56, which is connected by a wire, 80, with one pole of an electro-magnet, 102, the opposite pole of which is connected by a wire, 79, Fig. 9, and the wire 89 with the battery, from which it results that when the brushes 11 of both instruments are upon the plates 56 both of the magnets 102 is energized. The armature 115 of the magnets 102 is mounted upon an oscillating arm 78, provided with a small lug or projection, 12, so positioned that as the arms 95 revolve, the arms 13 of the bell-crank levers 94 (see Fig. 3) will be engaged thereby just at the time when the brushes 11 are passing across the plates 56.

When the two instruments are operating in perfect unison, their brushes 11 will of course pass across the plates 56 together, thereby completing a circuit through the magnets 102, which will cause them to attract their armatures, thereby rocking the arms 78, and carrying the lugs 12 out of the paths of the arms 13 of the bell-crank levers 94, and permitting the brushes to continue their revolutions. When, however, the two instruments are not running in perfect unison, so that the brushes 11 do not pass simultaneously across the plates 56, no circuit will be completed through the magnets 102, and the arms 78 will remain in the position shown in Fig. 3, so that the lugs 12 will be in the paths of the arms 13 of the levers 94. When this occurs, as soon as the brush of the instrument which is in advance arrives at its plate 56 the arm 13 of the lever 94 of that instrument will strike against the lug 12, so as to rock the lever and withdraw the pawl 3 from engagement with the ratchet 100, thereby disconnecting the sleeve 96 from the shaft 107, and permitting the brush of that instrument to remain at rest until the brush of the tardy instrument arrives at its plate 56. As soon as the brush of the second instrument touches its plate 56, the circuit will be completed through the magnets 102, and the lug 12 will be removed from the path of the arm 13, so that the pawl 3 will be permitted to again

engage with its ratchet, and the two brushes will move on together. It will be seen, however, by reference to Fig. 9, that the correct-  
ing mechanism just described would be liable  
to be rendered inoperative for that purpose if  
the brush 11 of the tardy instrument passed in  
contact with any one of the plates of the series  
*a b c*, &c., after the brush of the accelerated  
instrument had come into contact with its  
plate 56. To make this clear, let it be sup-  
posed that the brush of the transmitting-in-  
strument has arrived at the plate 56 while the  
brush of the reproducing instrument is still  
upon the plate *k*. In this case a circuit will be  
completed through ground-wire 86, battery 88,  
wire 83, magnet *k*, wires 84 to 87, plate *k*, brush  
11, and shaft 107 of the reproducing-instru-  
ment, line-wire 85, and shaft 107, brush 11, plate  
56, wire 80, magnet 102, wire 79, wire 89, bat-  
tery 88, and ground-wire 86 of the transmit-  
ting-instrument, thereby energizing magnet  
102, and immediately releasing the brush 11  
of the transmitting-instrument. The same  
difficulty would occur if the transmitting-in-  
strument were tardy, provided its brush should  
pass over a plate corresponding with one of  
the feelers which was in contact with the roll  
108 at the time. To obviate this difficulty,  
the last plate of the series *a b c*, &c., is sepa-  
rated from the plate 56 by a blank space, 55,  
of such width that, under all ordinary circum-  
stances, the brush of the tardy instrument will  
have left the last plate of the series *a b c*, &c.,  
before the brush of the accelerated instrument  
reaches the plate 56.

As the brushes of the two instruments upon leaving the plates 56 will be in substantial unison, the plates *a* may be comparatively narrow; but as the brushes are liable to vary somewhat in speed as they continue their revolutions, the plates of the series gradually increase in width, Fig. 3, so that the brush of the accelerated instrument may not pass from any one of the plates before the brush of the tardy instrument reaches it.

Referring now particularly to Figs. 7 and 8, the reproducing mechanism will be described. In this case the ribbon which receives the record and becomes the operating-ribbon for the type-setting mechanism, having been previously prepared with feeding-perforations, is passed between a pair of plates, 14 15, and entered between a pair of feeding-rolls, 145 146, the latter of which is provided with suitable sprockets, 76, to engage with the feeding-perforations. The plates 14 15 are provided with openings 16, through which work a series of punches, *a b c*, &c., corresponding in number to the series of magnets *a b c*, &c., and provided with springs 18, for holding them in their raised position. These punches are attached to heads 19, which reciprocate in a head-block, 20, and are provided at their upper ends with hinged arms 21, which are acted upon by springs 22, so as to normally occupy a slightly-inclined position. The armatures 23 of the magnets *a b c*,

&c., are attached to bell-crank levers 24, mounted upon rock-shafts 25, and having their upwardly-extending arms connected by a series of rods, 26, to a series of rock-arms, 27, mounted upon a transverse shaft, 28, and so positioned as to be abreast of the series of arms 21 of the punch-heads. The arms 27 are provided with springs 29, which, as the arms are rocked, bear upon the arms 21 with a yielding pressure tending to throw them into a vertical position. Resting upon the upper ends of the rock-arms 27 are a series of springs, 31, which are secured to a transverse bar, 32, in such position that when the arms 27 are rocked forward their ends will drop into recesses 33 in said arms, and hold them in their forward position until released by the raising of the springs. When the arms 21 are in a vertical position, their upper ends will lie beneath a transverse bar, 30, secured to the end of a rock-arm, 34, which is mounted upon a transverse shaft, 35, and to which is also secured the armature 114 of an electro-magnet, 112. The shaft 35 is also provided with an arm, 36, to the end of which is attached a pawl, 37, which engages with the ratchet 75 of the feeding-roll 146. The armature 114 and pawl 37 are normally held in a raised position by means of a spring, 38, which acts upon a forwardly-extending portion of the arm 36. The arm 34, in addition to the other devices, is provided with a wedge-shaped lug, 39, which, as the arm descends, acts upon the inclined edge of a pivoted dog, 40, mounted upon the end of an arm, 41, extending from a rock-shaft, 42. The shaft 42 is also provided with a pair of arms, 43, the ends of which are connected by a bar, 44, from which depends a series of rods, 45, the lower ends of which are connected with the springs 31, these parts being so adjusted that as the arm 34 is drawn downward any of the springs 31 which have dropped into the recesses 33 will be raised, so as to release the arms 27. As the arm 34 is raised, the dog 40 will turn on its pivot so that the arm 41 will not be moved. The feed of the ribbon is regulated by an adjusting-screw, 46, which controls the upward movement of the arm 34, and through it the throw of the pawl 37.

The sleeve 96 of each instrument is, in addition to the devices already mentioned, provided with a narrow insulated band, 47, (see Fig. 4,) against which rests a contact-spring, 48, which is insulated from the frame of the instrument and connected by a wire, 49, Fig. 9, with one pole of the electro-magnet 112. The band 47 is provided with a spring-arm, 50, which at each revolution of the sleeve 96 is carried into contact with a spring, 51, also insulated from the frame of the instrument, and connected by a wire, 52, with one pole of a battery, 53, the other pole of which is connected by a wire, 54, with the electro-magnet 112. From this arrangement it will be seen that at each revolution of the sleeve 96 an electric current will be sent through the magnet 112, thereby causing it to draw its arma-

ture and the bar 30 downward, so as to operate any of the punches which have by the action of the magnets *a b c*, &c., been thrown into operative position.

The circuit formed by the connections just described, will be provided at some convenient point with a switch, by which it can be broken when the instrument is to be used as a transmitter.

In order to permit the punches to be withdrawn from the ribbon before the feed commences the parts are so adjusted that the throw of the pawl 37 is somewhat in excess of what is required for effecting the proper feed of the ribbon, and a stud, 74, is arranged, as shown in Fig. 8, in such position as to hold the pawl out of engagement with the ratchet during the first part of its upward movement.

In operating an apparatus of this character it is of course necessary at times to temporarily arrest the transmission or reproduction, and in such case it is desirable to stop the opposite instrument, so as to prevent the needless unwinding of the cord 110. To accomplish this automatically, the shaft 109 of each instrument carries a loose arm, 57, Figs. 1 and 2, the forwardly-extending end of which is provided with a hook, 58, arranged in such position that when the arm is raised it will engage with a pin, 59, extending from the shaft 106. The shafts 109 are provided with springs 60, the tension of which is sufficient to press the arms 57 against the heads of the drums 103 with such force that as the drums revolve, the arms will be raised into the paths of the pins 59. Each of the arms 57 is connected by a link, 61, with one end of a pivoted lever, 62, the opposite end of which carries the armature 63 of an electro-magnet, 64, one pole of which is connected with a contact-post, 65, while the other is connected with a contact-arm, 66, extending from the oscillating arm 78, (the armature-lever of 102,) the circuit thus formed being of course supplied with suitable battery-connections. From this arrangement it results that when the two instruments are operating in the regular manner the circuits through the magnets 64 will be closed at each revolution of the brushes 11, thereby energizing said magnets, and through their armatures 63 drawing the arms 57 downward, so as to prevent the hooks 58 from engaging the pins 59 and stopping the instruments. When, however, it is desired to stop both instruments, the circuit connecting them will be broken, (for which purpose the line-wire 85 will be provided with a switch at each station,) as indicated in Fig. 9, thereby preventing the magnets 102 from becoming energized, and keeping the circuits through the magnets 64 open, so that the hooks 58 will be carried into engagement with the pins 59 and both instruments be stopped. Upon closing the circuit connecting the two instruments the magnets 102 and 64 will be at once energized, thereby releasing the pawls 3 and pins 59, and permit-

ting the instruments to resume their movements.

The operation of the apparatus in reproducing the perforated ribbon is as follows: The switch 147 of the transmitting-instrument will be set so as to connect the feelers and the contact-plates *a b c*, &c., and the switch of the reproducing-instrument will be set so as to connect the contact-plates and the magnets *a b c*, &c., and the magnet 112 of the latter will be put in connection with the springs 50 51. The two instruments being then put in motion, the ribbon of the transmitting-instrument will be advanced with a step-by-step movement until its first transverse row of perforations is beneath the ends of the feelers, when the feelers corresponding to the perforations in this row will pass through said perforations and come into contact with the roll 108. The movements of the two instruments and of their various parts will be so timed with relation to each other that the feeding of the ribbon takes place after the brushes 11 have left the plates *k*, and before they arrive at the plates *a*. While the brushes 11 are passing over the space between the plates *k* and *a* the contact-springs 50 51 will come together, thereby completing the circuit through the magnet 112 of the reproducing-instrument, and drawing the bar 30 and pawl 37 downward. The spring 51, it will be observed, is of such length and shape that this contact will be maintained, so as to hold the bar 30 in its lowered position during a considerable portion of the revolution of the brushes 11.

It has already been stated that the number of perforations in each row upon the ribbon is not material; but that, for reasons elsewhere stated, it is preferable that each row should consist of three perforations. For convenience, therefore, it will be assumed that each row contains this number, and that the three forming the first row correspond to the feelers *a d k*, so that said feelers have come into contact with the roll 108.

As the brushes of the two instruments continue their revolution, they will pass simultaneously across the plates *a*, so as to complete a circuit through the ground-wire 86, battery 88, wire 89, contact-spring 90, roll 108, feeler *a*, and its wire 87, contact-plate *a*, brush 11, and shaft 107 of the transmitting-instrument, line-wire 85, and shaft 107, brush 11, contact-plate *a*, and its wires 84 87, magnet *a*, wire 83, battery 88, and ground-wire 86 of the reproducing-instrument, thereby energizing the magnet *a*, so that its armature 23 will be drawn downward. This movement will rock the corresponding arm, 27, and compress its spring 29 against the arm 21 of the punch *a*, thereby pressing said arm against the bar 30, and allowing one of the springs 31 to drop into its recess 33, so as to hold the arm 27 in its forward position, as shown. There being no perforations in the ribbon beneath the ends of the feelers *b* and *c*, said feelers will be kept out of contact with the roll 108, so that no circuits will be com-

pleted by the brushes 11 as they pass across the plates *b* and *c*. When the brushes pass across the plates *d*, however, a second circuit will be completed through the connections already mentioned and the feeler *d* of the transmitting-instrument and the magnet *d* of the reproducing-instrument. This magnet being thus energized, its armature 23 will be drawn downward, and the arm 21 of the punch *d* will be pressed and held against the bar 30 in the manner just described. At or about the time at which the brushes pass across the plates *d* the springs 50 51 will pass out of contact, thereby breaking the circuit through the magnet 112 and releasing its armature 114. Upon the release of the armature 114 the spring 38 will draw the bar 30 and pawl 37 upward, thereby, through roll 146, advancing the ribbon one step, and permitting the springs 29 to expand and throw the ends of the arms 21 of the punches *a* and *d* under the bar 30. There being no perforations in the ribbon beneath the ends of the feelers *e, f, g, h, and i*, these feelers, like the feelers *b* and *c*, are held out of contact with the roll 108, so that no circuits will be completed by the brushes as they pass across the plates *e, f, g, h, and i*. When, however, they pass across the plates *k*, a third circuit will be completed through the connections already named and the feeler *k* of the transmitting-instrument and the magnet *k* of the reproducing-instrument, thereby energizing said magnet, and, through its armature 23 and connections, pressing and holding the end of the arm 21 of the punch *k* beneath the bar 30. While the brushes are passing over the blank space 55 the springs 50 51 will again come into contact, so as to complete the circuit through the magnet 112, thereby energizing the same, and causing the bar 30 to descend and force the punches *a d k* through the ribbon, thereby making a transverse row of perforations corresponding in number and position with the row beneath the feelers of the transmitting-instrument.

As the bar 30 descends, the lug 39, acting upon the dog 40, will, through arms 41 43 and rods 45, raise the springs 31; so as to permit the arms 27 to resume their normal position. About simultaneously with the descent of the punches in the reproducing-instrument the cam 93 of the transmitting-instrument will operate the lever 92 and pawl 6, so as to bring the next row of perforations in the ribbon beneath the ends of the feelers, which perforations, it will be assumed, correspond to the feelers *a b c*.

If during the operation just described the movements of one of the instruments have been slightly faster than those of the other, so that its brush arrives at the plate 56 before the brush of the other instrument reaches the same point, the arm 13 of the bell-crank lever 94 will come into contact with the lug 12 of the arm 78, so that the lever will be rocked and the pawl 3 withdrawn from engagement with the ratchet 100, thereby arresting the

sleeve 96 and the brush. As soon, however, as the brush of the tardy instrument reaches its plate 56, a circuit will be completed through the magnets 102, which will at once cause said magnets to rock the arms 78 and withdraw the lug 12, thereby permitting the pawl 3 to resume engagement with the ratchet 100 and the two brushes to proceed together. Of course if neither instrument has gained upon the other during the revolution, so that both brushes arrive at their unison-plates together, a circuit will at once be completed through the magnets 102, and the lug 12 will be withdrawn without stopping either brush.

Any variation between the transmitting and reproducing instruments having been thus corrected, the brushes will, as they pass over the plates *a b c* upon the second revolution, complete circuits successively through the connections already described and the feelers *a b c* of the transmitting-instrument and the magnets *a b c* of the reproducing instrument, thereby placing the arms 21 of the punches *a b c* in position to be pushed under the bar 30 as soon as it is raised. As the brushes continue their revolution the circuit through the magnet 112 will be broken, the bar 30 raised, and the ribbon in the reproducing-instrument advanced one step in the manner already described. At the end of the revolution the bar 30 will be again depressed, carrying down the punches *a b c*, and making a second row of perforations, and so the operation will continue to be repeated.

It will be observed that the length of time which the springs 50 51 remain in contact is such that the punches have ample time to act; and, further, that by reason of the hinged arms 21, and the other devices operating in connection therewith, no time is lost in the punching operation, as while the punches for making one row of perforations are being operated the magnets *a b c*, &c., are enabled to act to place the punches for making the next row in operative position.

It is of course to be understood that when it is not desired to make each instrument capable of operating both as a transmitter and a reproducer for the other, the roll 108, the feelers, and their auxiliaries will be omitted in the reproducing-instrument, and the perforating mechanism will be omitted in the transmitting-instrument.

Although the apparatus herein described is especially adapted for the particular work stated, yet it may be used successfully for automatically transmitting ordinary messages. When used for this purpose, the reproducing or receiving instrument may be provided with a punching mechanism to indicate the message; or needles or blunt points may be substituted for the punches, so as to indicate the message by small perforations or simple indentations; or, instead of either of these, pens or pencils may be used, so as to indicate the message by dots or marks. The apparatus may also be used for the transmission of or-

dinary messages by omitting the perforating mechanism, and allowing the roll 108 of the receiving-instrument to feed forward a ribbon of chemically-prepared paper beneath the feelers *a b c*, &c., so that when currents are sent through any of the feelers the paper beneath them will be discolored, and so indicate the message. When the message is indicated upon the ribbon in this manner, the feed of the ribbon in the receiving-instrument may, as will readily be seen, be continuous instead of intermittent.

It will readily be seen that instead of one several reproducing-instruments may be located at different points in the same circuit, so that the same ribbon may be simultaneously reproduced at several different points.

The ribbon 150, instead of being provided with perforations indicating the composition, may be saturated, at points corresponding to the perforations, with some conducting substance so that connections will be formed with the roll 108 through the ribbon; or the apparatus may be reversed so that the various operations will be performed by breaking instead of making the circuit.

Various modifications may also be made in many of the details of the apparatus without departing from the principle or losing the advantages of the invention.

What I claim is—

1. The combination, in an electric circuit, of a transmitting-instrument adapted, in connection with a perforated ribbon, to transmit to the receiving-station electric impulses corresponding to the perforations in said ribbon, a reproducing-instrument adapted to receive such electric impulses, and thereby automatically reproduce said ribbon, and an automatic correcting mechanism, by which each instrument controls the operation of the other, all substantially as described.

2. The combination, in an electric circuit, of an automatic transmitting-instrument and an automatic reproducing-instrument, each provided with a brush, as 11, a series of contact-plates, as *a b c*, &c., means whereby the brushes of the two instruments are periodically brought into unison, and connections and operating mechanism, all substantially as described.

3. The combination, in an electric circuit, of an automatic transmitting-instrument and an automatic reproducing-instrument, each provided with a brush, as 11, a series of contact-plates, as *a b c*, &c., means whereby the brush of each instrument controls the movements of the brush of the other, and connections and operating mechanism, all substantially as described.

4. The combination, in an electric circuit, of an automatic transmitting-instrument and an automatic reproducing-instrument, each provided with a contact-plate, as 56, a brush, as 11, and operating mechanism independent of the circuit, and means whereby the breaking of the circuit automatically arrests the

operating mechanism of both instruments, all substantially as described.

5. The combination, in an electric circuit, of an automatic transmitting-instrument and an automatic reproducing-instrument, each provided with a contact-plate, as 56, a brush, as 11, and operating mechanism independent of the circuit, and means whereby the arresting of the brush of either instrument out of contact with its plate 56 automatically arrests the operating mechanism of both instruments, all substantially as described.

6. The combination, in an electric circuit, of an automatic transmitting-instrument and an automatic reproducing-instrument, each provided with a brush or contact-spring, as 11, a series of contact-plates, as *a b c*, &c., a contact-plate, as 56, and an electro-magnet, as 102, and connections, substantially such as described, whereby the brush of either instrument is not permitted to pass its plate 56 until the brush of the other instrument arrives at the same position.

7. The combination, in an electric circuit, of a transmitting and a reproducing instrument, each provided with a brush, as 11, a series of contact-plates, as *a b c*, &c., and a contact-plate, 56, the two being separated by a space, as 55, an electro-magnet, as 102, and operating mechanism and connections, substantially as described.

8. The combination, with a series of feelers, as *a b c*, &c., of two series of contact-plates, as *a b c*, &c., and 56, two brushes, as 11, two magnets, as 102, a series of magnets, as *a b c*, &c., and connections and operating mechanism, substantially as described.

9. The combination, with a series of feelers, as *a b c*, &c., of two series of contact-plates, as *a b c*, &c., and 56, two brushes, as 11, two magnets, as 102, a series of magnets, as *a b c*, &c., a like series of punches, and connections and operating mechanism, substantially as described.

10. The combination, with a series of feelers, as *a b c*, &c., two series of contact-plates, as

*a b c*, &c., and 56, two brushes, as 11, two magnets, as 102, a series of magnets, as *a b c*, &c., a like series of punches, a magnet, as 112, and connections and operating mechanism, substantially as described.

11. The combination, with the shaft 107, carrying the ratchet 100, of the sleeve 96, carrying the arm 95, provided with pawl 3 and arm 13, and magnet 102, having armature 115 and lug 12, all substantially as described.

12. The combination, with the shaft 107, having ratchet 100, of the sleeve 96, carrying brush 11, pawl 3 and arm 13, magnet 102, having armature 115 and lug 12, and the series of contact-plates *a b c*, &c., and 56, all being arranged and operating substantially as described.

13. The combination, with the shaft 107, carrying ratchet 100, of the sleeve 96, carrying-band 47, provided with contact-spring 50 and pawl 3, and the contact-springs 48 and 51, substantially as described.

14. The combination, with the series of magnets *a b c*, &c., and their armature, of the corresponding series of punches provided with pivoted arms, as 21, and connections, substantially as described.

15. The combination, with the series of magnets *a b c*, &c., and their armatures, of the corresponding series of punches provided with pivoted arms, as 21, the magnet 112, and its armature and connections, all substantially as described.

16. The combination, with the series of magnets *a b c*, &c., and their armatures, of the punches *a b c*, &c., and their pivoted arms 21, the series of rock-arms 27, provided with springs, as 29 and 31, and connections, substantially as described.

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

JAMES E. MUNSON.

Witnesses:

JAS. A. HOVEY,  
T. H. PALMER.