(No Model.) 5 Sheets—Sheet 1.

Z. P. HOTCHKISS.

TELEGRAPHY.

No. 489,435. Patented Jan. 3, 1893.

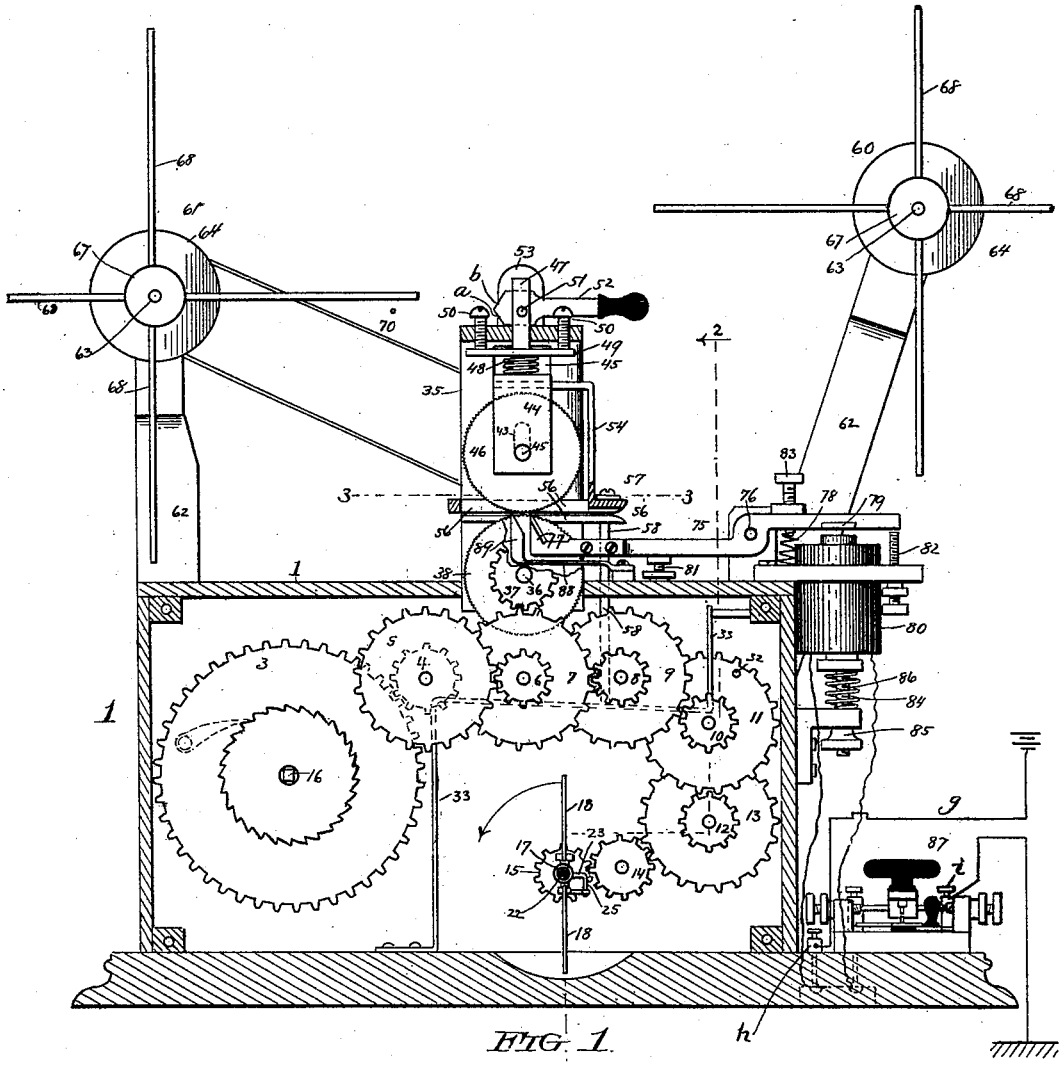

FIG. 1.

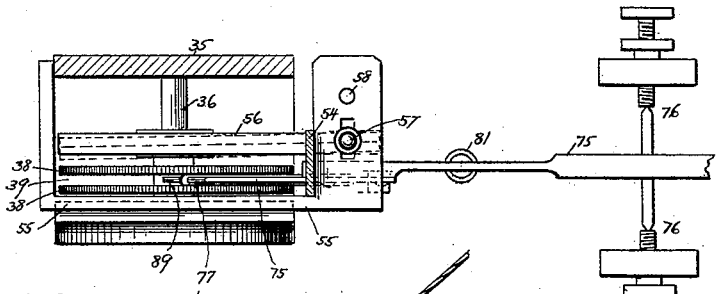

FIG. 3.

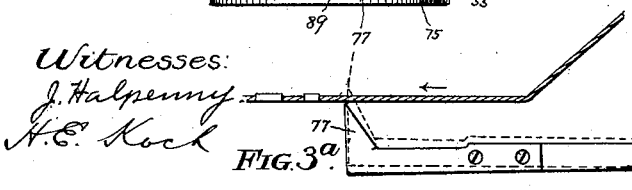

FIG. 3a.

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(No Model.) 5 Sheets—Sheet 2.

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TELEGRAPHY.

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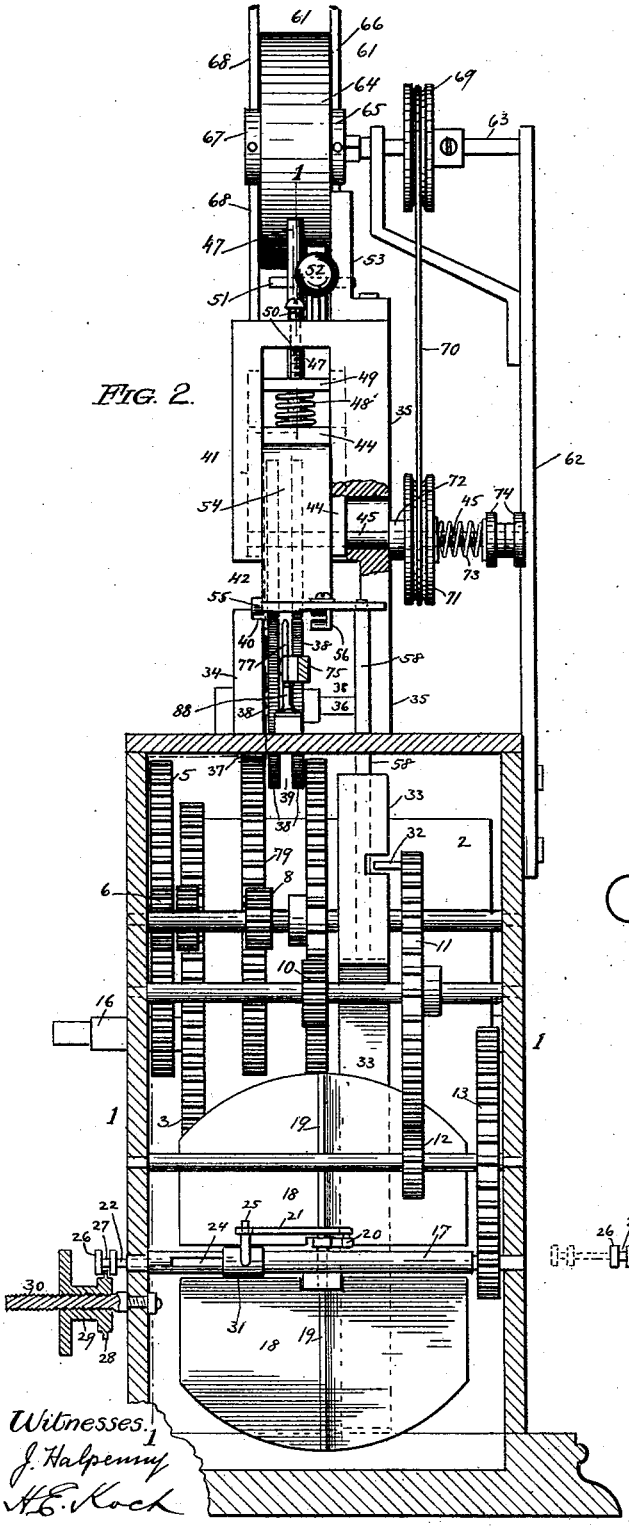

FIG. 2.

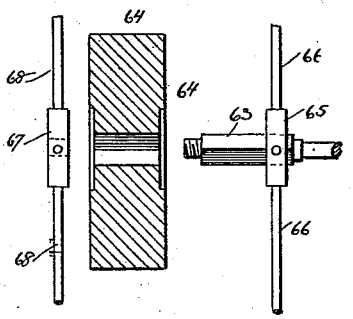

FIG. 4.

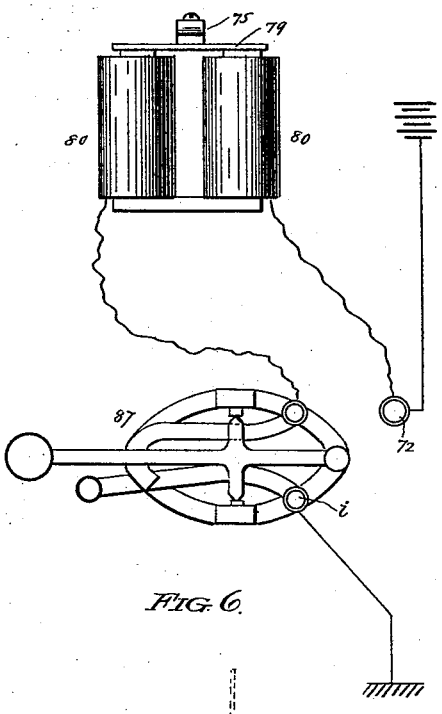

FIG. 6.

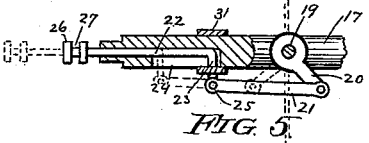

FIG. 5.

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(No Model.) 5 Sheets—Sheet 3.

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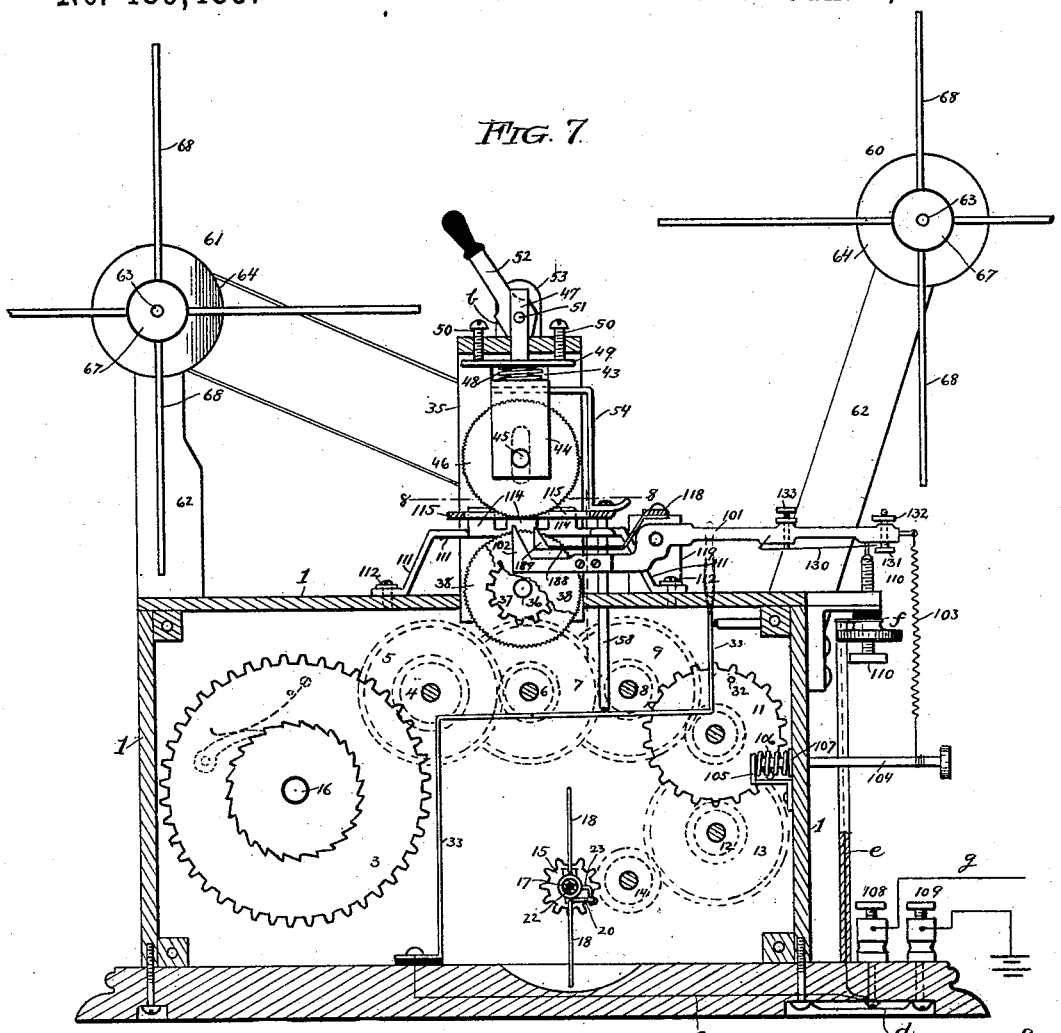
No. 489,435. Patented Jan. 3, 1893.

FIG. 7.



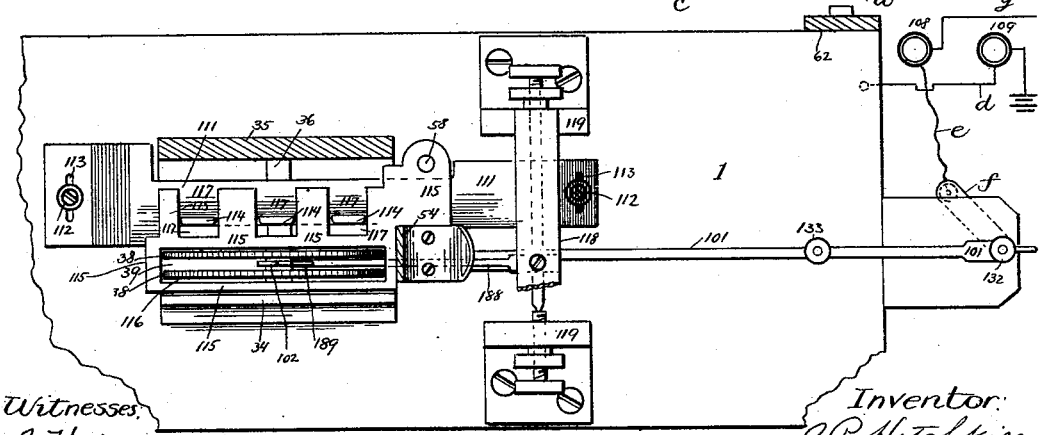


FIG. 8.

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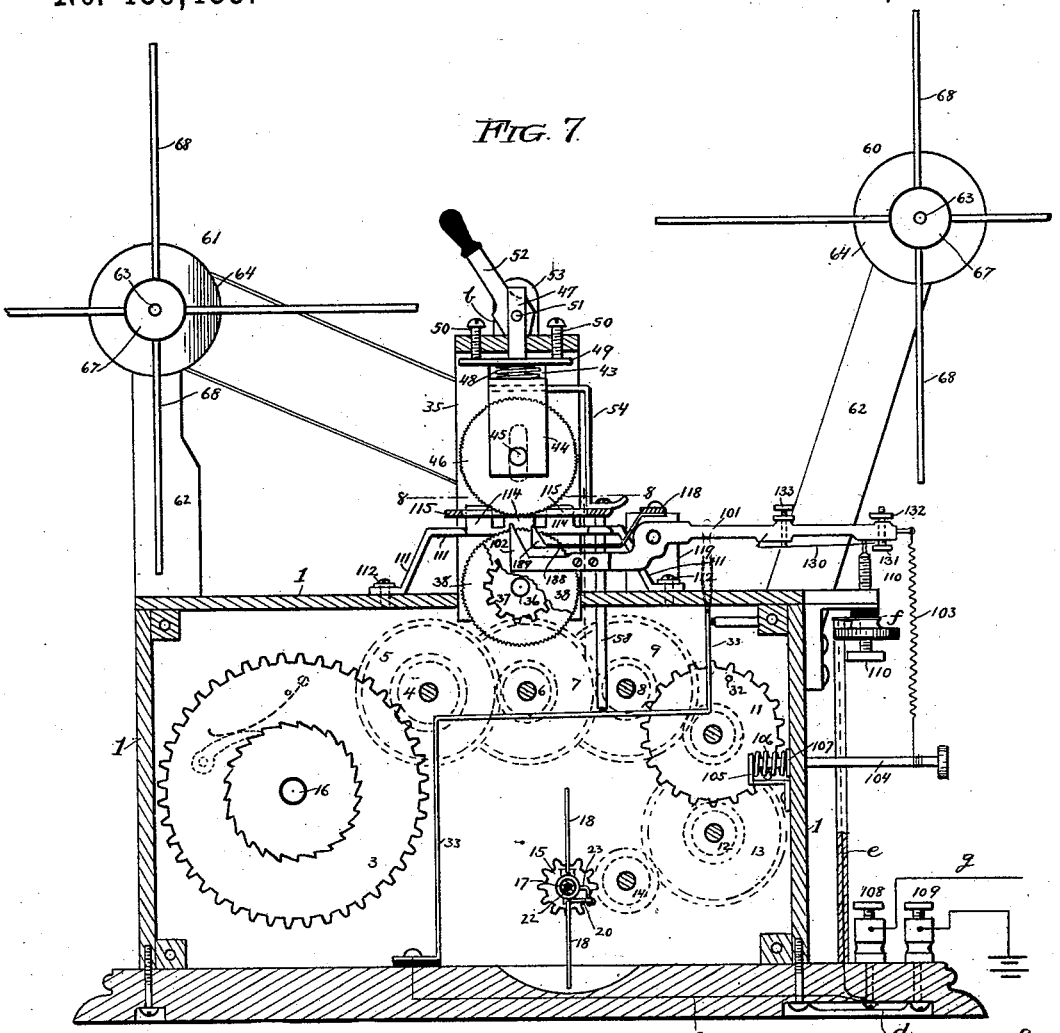
No. 489,435. Patented Jan. 3, 1893.

FIG. 7.



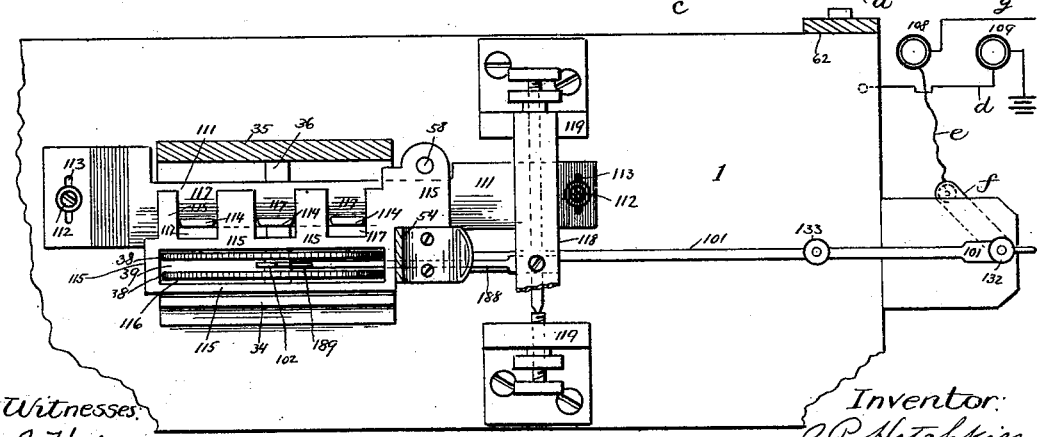


FIG. 8.

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(No Model.) 5 Sheets—Sheet 4.

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No. 489,435. Patented Jan. 3, 1893.

FIG. 9

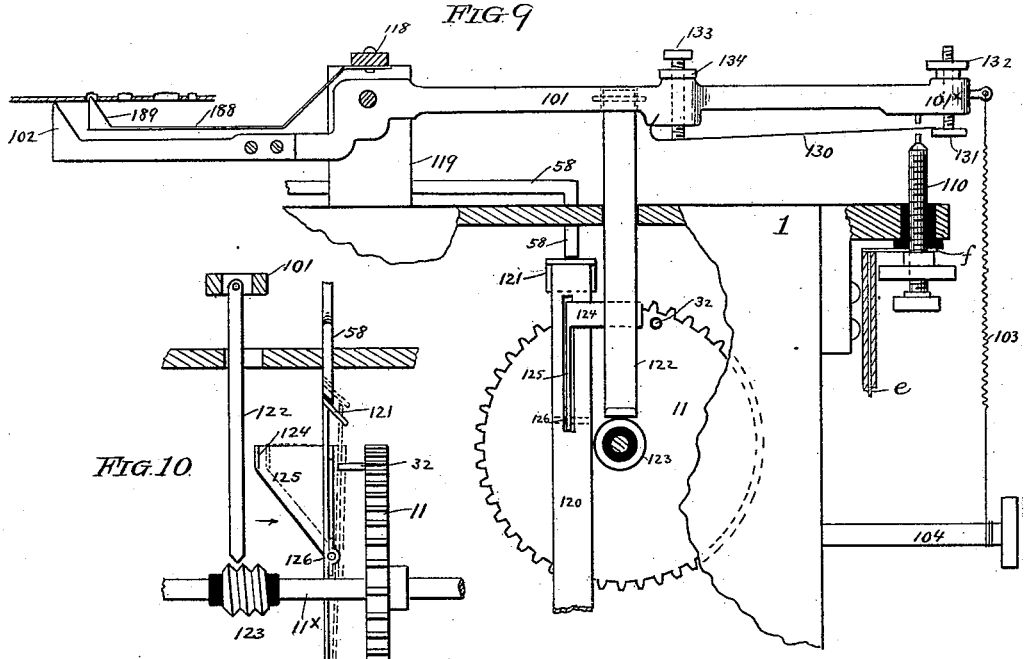
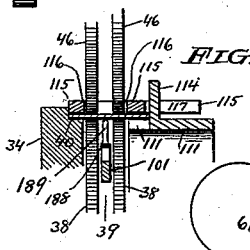


FIG. 10

FIG. 11.



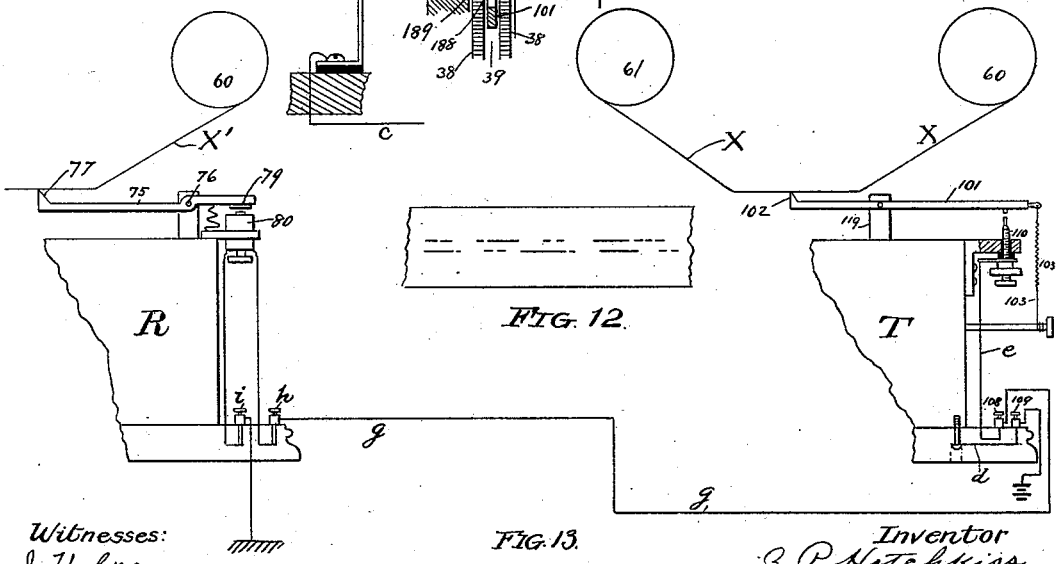


FIG. 12.

FIG. 13.

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(No Model.) 5 Sheets—Sheet 5.

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TELEGRAPHY.

No. 489,435. Patented Jan. 3, 1893.

FIG. 14.

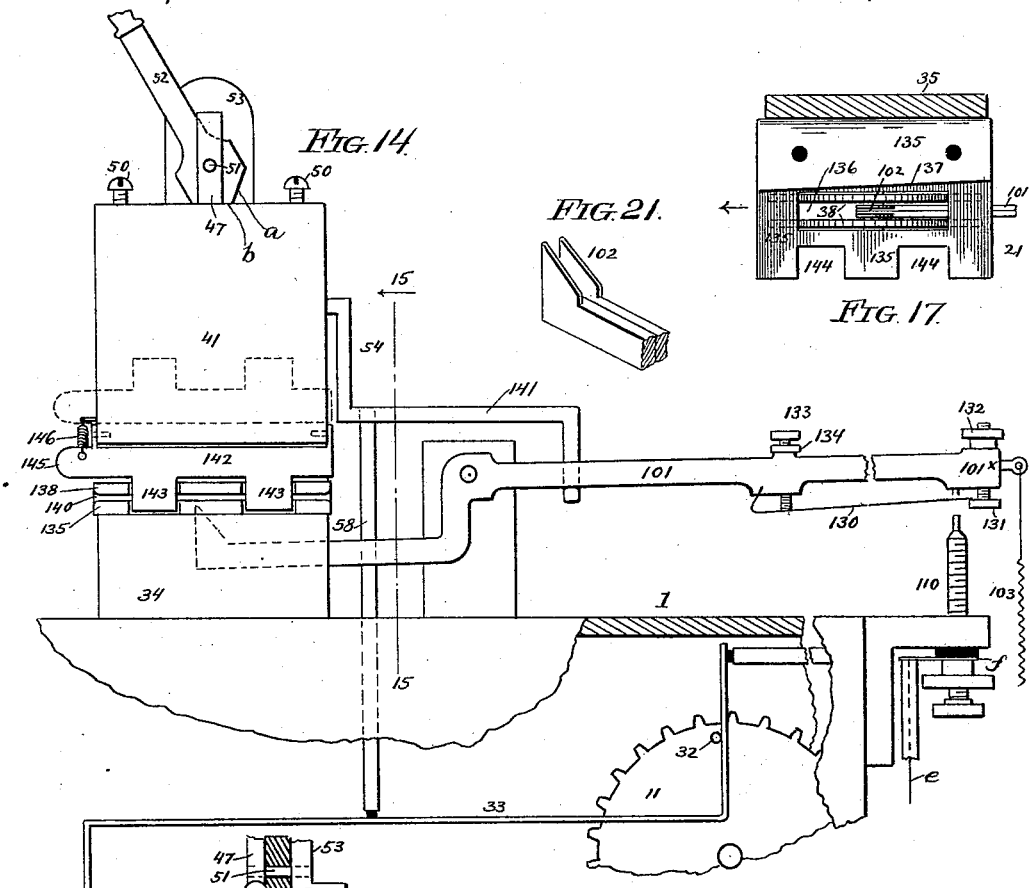

FIG. 21.

FIG. 17.

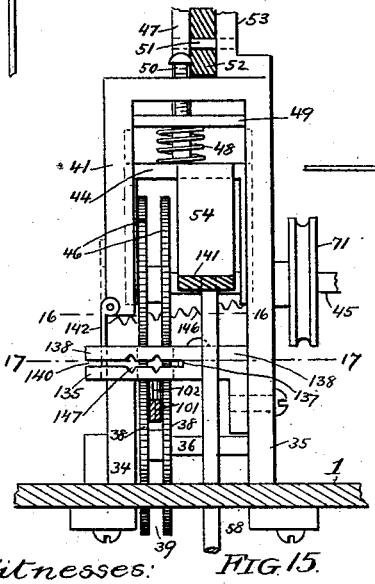

FIG. 15.

FIG. 18.

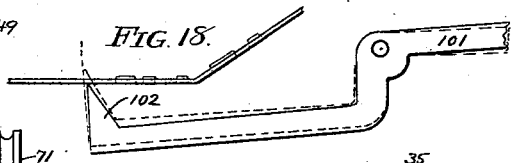

FIG. 20.

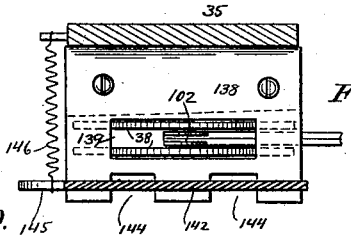

FIG. 16.

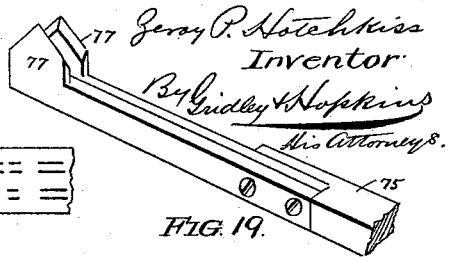

FIG. 19.

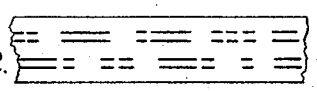

FIG. 22.

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UNITED STATES PATENT OFFICE.

ZEROY P. HOTCHKISS, OF OAK PARK, ASSIGNOR TO THE AUTOMATIC TELEGRAPH IMPROVEMENT COMPANY, OF CHICAGO, ILLINOIS.

TELEGRAPHY.

SPECIFICATION forming part of Letters Patent No. 489,435, dated January 3, 1893.

Application filed April 18, 1891. Renewed November 8, 1892. Serial No. 451,315. (No model.)

To all whom it may concern:

Be it known that I, ZEROY P. HOTCHKISS, a citizen of the United States, residing at Oak Park, in the county of Cook and State of Illinois, have invented certain new and useful Improvements in Telegraphic Instruments, of which the following is a specification, reference being had to the accompanying drawings, which are made a part hereof, and in which—

Figures 1 and 2 are sectional elevations of the improved receiver on the lines 1—1 Fig. 2 and 2—2 Fig. 1, respectively. Fig. 3 is a horizontal section on the line 3—3 Fig. 1, some of the parts below the plane of the section being omitted. Fig. 3ª is a detail view showing the relation of the perforating stylus to the ribbon. Fig. 4 is a sectional elavation of one of the paper reels with the parts detached. Fig. 5 is a sectional elevation of the mechanism for adjusting the positions of the governor blades. Fig. 6 is a diagrammatic view showing one way of wiring the machine, including in the circuit a Morse key. Fig. 7 is a longitudinal sectional elevation of the improved transmitter. Fig. 8 is a horizontal section thereof on the line 8—8 Fig. 7, some of the parts below the plane of the section being omitted. Fig. 9 is a sectional elevation on a larger scale showing the make and break, and also stopping and shunting mechanism of modified construction. Fig. 10 is an elevation of said stopping and shunting mechanism viewed from another position. Fig. 11 is a transverse section of the paper guide that is shown in longitudinal section in Fig. 7 and in plan in Fig. 8. Fig. 12 is a plan view of a strip of paper after it has passed twice through the receiver and received two rows of impressions. Fig. 13 is a diagram showing one way of electrically connecting a transmitter and a receiver. Fig. 14 is a side elevation of a portion of the upper part of the transmitter having a paper-guide of preferred form. Fig. 15 is a vertical section of some of the parts thereof on the line 15—15, the parts beyond the plane of the section, looking in the direction of the arrow, being shown in elevation. Figs. 16 and 17 are horizontal sections on the line 16—16 and 17—17, respectively, Fig. 15. Fig. 18 is a detail view showing the preferred relation of the transmitting stylus to the ribbon. Figs. 19 and 20 are, respectively, a perspective view and an end elevation of a perforating, or receiving stylus of preferred form. Fig. 21 is a perspective view of the following or transmitting stylus of preferred form. Fig. 22 is a plan view of a piece of the ribbon after it has passed twice through a receiver having a stylus of preferred form.

The object of the present invention is to provide for the rapid and accurate transmission of messages by electricity, and to this end the invention consists in certain features of novelty that are particularly pointed out in the claims hereinafter.

The casing 1 of the receiver incloses a clock mechanism, comprising a spring arranged within a drum 2, and a series of intermeshing cog-wheels numbered from 3 to 15, inclusive, which gear with each other in the order in which they are numbered, forming a connected train. The spring is so connected with a winding arbor 16 that it may be rewound from time to time without interrupting the operation of the machine.

Upon the shaft 17 of the last wheel 15 of the series a pair of blades, 18, are so mounted that they may, at the will of the operator, be placed in a plane parallel and radial with respect to the axis of said shaft, or they may be placed in a plane perpendicular to said axis, or in any intermediate plane, their purpose being to regulate the speed of the machine. One of these blades is situated upon each side of the shaft 17, and both are secured to an auxiliary shaft 19, perpendicular to and journaled in said shaft 17. Projecting from this shaft 19 is a crank arm 20, which is connected by a link 21 to a push-rod 22. This rod occupies a bore formed in the axis of the shaft 17 and has a right-angled bend 23 which passes out through a longitudinal slot 24 formed in said shaft 17 and a second right-angled bend 25 to which the link 21 is attached. By moving this rod longitudinally in its seat the auxiliary shaft 19 is turned to a greater or less extent, whereby the position of the blades 18 is changed. In the drawings these blades are shown parallel to shaft (the rod being at the limit of its inward movement) in which position their entire surfaces

are presented squarely to the air. When in this position the air offers a maximum resistance to their motion and consequently the machine will run at its minimum speed. By drawing out the rod 22 the position of the blades is correspondingly changed and the speed of the machine correspondingly increases, its maximum being attained when the blades have reached a position perpendicular to the shaft, as indicated by dotted lines in Fig. 5. Upon the outer end of the rod is a head 26, having a circumferential groove 27 in which fits a flange 28 on a nut 29, that is turned on to an exteriorly threaded stud 30 projecting from the side of the casing. I prefer this mechanism for operating the blades, 18, but I desire to have it understood that I do not regard my invention as necessarily limited thereto. I consider that it comprehends any sliding part, such as the rod 22 or the nut 29, or the sleeve 31, so connected with the crank arm 20 as to control its position while not interfering with the rotation of the blades. For example, the link 21 may be connected simply to a sleeve such as 31 and means similar to those just described for operating the rod 22 may be provided for moving said sleeve and holding it in position.

Projecting from the side of the wheel 11 is a pin 32, and projecting across the path of this pin is a stop 33 so arranged as to hold the machine out of action until it is moved out of the path of the pin as presently described. This stop consists simply of a strip of metal (preferably a spring) having a notch cut in its side. When the stop is moved to such position that the notch is in the path of the pin, as shown in Figs. 1 and 2, the machine is free to operate, but when said stop is permitted to resume its normal position it crosses the path of the pin as shown in Fig. 7, and prevents the machine from operating.

Journaled to a pair of standards 34 and 35, rising from the top of the casing is a shaft, 36, to which is secured a cog-wheel, 37, gearing with the wheel, 7, and a feed-wheel, 38, having its periphery milled, the top of the casing being cut away for the accommodation of said wheels. The standard, 34, extends only a trifle above the top of the wheel, 38, and has along its top inner edge a rabbet which forms a shoulder, 40, flush with said top of wheel, 38. The standard, 35, extends up farther and has a depending portion, 41, which occupies the same vertical plane as the standard, 34, and extends downward nearly to the top of said standard, leaving only a narrow opening, 42, between them.

In the inner faces of the standard proper and its depending portion, 41, are formed vertical grooves, 43, forming guide-ways for a vertically movable housing 44, in which is journaled a shaft, 45, carrying a feed wheel 46, milled on its periphery, similarly to the wheel, 38.

Projecting upward from the housing and out through a perforation in the top of the standard is a rod, 47, and surrounding this rod is a coiled spring, 48, which bears downward against the top of the housing and upward against a follower plate, 49, which latter may be raised or lowered by set screws 50, for adjusting the tension of the spring, 48. This spring tends normally to press the housing down and hold the upper and lower feed wheels firmly in contact and in order to separate said wheels the resistance of the spring must be overcome by an upward pull upon the rod 47. To this end the standard 35 is slotted to permit of the vertical movement of shaft 45, and the rod 47 is connected by a pin 51, eccentrically, to the lower end of a cam lever 52, which fits between said rod and a short post 53 rising from the top of the standard and which lever has two lifts, or cam faces *a* and *b* of different radii, adapted to bear upon the top of the standard.

Connected to the housing 44 is an arm 54 carrying at its lower end the movable parts of the paper guide. One side of this guide is formed by a bar 55 and the top part of the standard 34, said bar being so arranged that when the upper and lower feed wheels are in contact, it (the bar) rests in the rabbet of the standard but does not have contact with the shoulder 40, sufficient space being left between them to admit the edge of the paper and permit its free movement. The other side of the guide is formed of a bar 56 which has in its inner side a groove of sufficient width to admit the paper. This bar 56 is secured in place by a screw 57 passing through a slot in the foot of arm 54 in such manner that said bar may be adjusted with relation to the bar 55, so as to enable the use of paper of different widths.

Projecting downward from the foot of arm 54, or some part carried thereby is a rod 58 which enters the casing 1 and terminates in operative proximity to the spring stop 33. When the lever 52 is at the extremity of its permitted movement in one direction (as shown in Fig. 1) and neither of the cams, *a* or *b*, rests upon the top of the standard, the spring 48 will hold the upper and lower feed wheels in contact with each other, and, acting through the medium of the rod 58 and other connections, will hold the spring stop 33 in such position that its notch will be in the path of the pin 32, thereby permitting the driving spring in drum 2 to set the clock-work in motion and turn the feed wheels, feeding the paper through the machine. When the lever is at the extremity of its movement in the other direction and the cam *b* of the longer radius rests upon the top of the standard, the feed wheels will be widely separated (see Fig. 7) and the side 55 of the paper guide will be above the top of the standard 34 so that the paper can be removed from between the feed wheels, sidewise, through the opening 42. When the lever is in its intermediate position and the cam of shorter radius (*a*) rests upon the top of the standard, the feed wheels are

separated a sufficient distance to relieve their bite upon the paper, so that it can be drawn lengthwise between them, either backward or forward, but they are not separated sufficiently to bring the open side of the paper guide opposite the opening 42. In either of these two latter positions of the controlling lever 52, the rod 58 is out of engagement with spring stop 33, and said stop rests in the path of the pin 32, thereby preventing operation of the machine.

60 and 61 are the paper reels supported above the top of the casing by arms 62. Each of these reels consists of a shaft 63 having a cylindrical portion occupying suitable bearings in the supporting arm, a non-cylindrical portion on which is removably slipped a drum or spool 64 having a central opening corresponding in shape to the cross-section of the portion of the shaft which it fits, a collar 65 fixed to the shaft on one side of the spool and having the radial arms 66, and a removable collar or nut 67 having arms 68 and provided with threads for engaging corresponding threads on the extremity of the shaft. By removing the nut 67, all of the paper may be quickly removed without unwinding it, either by slipping it off of the spool or by removing the spool with the paper wound thereon.

Upon the shaft of the reel 61 by which the paper is taken up as it leaves the feed wheels, is a grooved pulley 69 for receiving a belt 70 that embraces a corresponding pulley 71 on the shaft 45. The pulley 71 is loose upon the shaft 45 and is caused to turn with it by the friction of one of its sides against a shoulder 72 against which it is pressed by a spiral spring 73 which surrounds the shaft 45 and the tension of which may be regulated by a pair of nuts 74, one of which is for the purpose of locking the other. By this arrangement there is always a pull upon the shaft of the take-up reel in the direction to wind up the paper as it leaves the feed wheels, and at the same time provision is made for a lost motion between the shafts 45 and 63, in order that the feed wheels may control the feeding of the paper, irrespective of the diameter of the take-up reel.

75 is a lever fulcrumed at 76 and having at one end a stylus, 77, which fits in a circumferential groove, 39, in the lower feed-wheel, 38, and has its point presented upward toward a similar groove in the upper feed wheel, 46.

78 is a spring situated beneath the lever for holding its stylus-end normally depressed, and 79 is an armature secured to the said lever and situated in operative proximity to one or more electro-magnets, 80, which when electrically excited, attract the armature and thereby throw the stylus-end of lever, 75, upward.

81 and 82 are adjustable stop screws engaging the lever 75 upon opposite sides of its fulcrum for regulating the amplitude of its oscillation, and 83 is an adjustable set screw tapped into the lever and engaging the spring 78 for regulating its tension.

The electro magnets are adjustable vertically toward or from the armature by means of a spiral spring 84, which tends to elevate them and a thumb-nut 85, which is screwed onto the threaded stem 86 by which they are sustained in position, and which nut may be turned in one direction to permit the spring to elevate them and in the other direction to draw them downward.

From the foregoing description it will be understood that while the paper is being fed forward by the feed wheels if the stylus 77 is elevated it perforates or indents said paper and the length of such perforation depends upon the length of time that the stylus is held elevated. If only for an instant the perforation produced will be short and may represent the dot (-) of the Morse telegraphic code, but if it is held elevated for a considerable length of time, as the paper is being constantly fed forward, the perforation will be correspondingly elongated, and may represent the dash of the same code. Hence it will be seen that by repeatedly elevating the stylus and by properly limiting the length of time that it is held up each time, any combination of dots and dashes may be made for representing the various characters of the Morse or any other telegraphic code.

There are a variety of purposes for which this machine may be used, although it is designed, primarily, and is shown in the drawings arranged for use as an automatic receiver and perforator, and its greatest utility is attained when so used. When used for this purpose the electro magnets 80 are included either in the main circuit, or in a local circuit. In either case electrical pulsations coming over the main line will energize the magnets, attract the armature 79 and thereby oscillate the lever 75, elevating stylus 77. The stylus remains elevated just so long as the magnets are energized by the passage of a current through their helices, and is depressed by spring 78 as soon as said current ceases. Thus the electrical pulsations coming over the main line and representing various combinations of dots and dashes, cause corresponding combinations of dots and dashes to be cut through the paper. Instead of perforating the paper it may be simply embossed or indented by substituting a blunt stylus for the sharp one and by so adjusting the stop screw 82 as to prevent the stylus from rising high enough to puncture the paper. In view of the present state of the art of telegraphy I regard a perforation and an indentation as equivalents, and in this specification the expression of the one includes the other, excepting where a literal interpretation is necessary to the sense, and the term "impression" comprehends either, and also any other impression— for example, a raised or embossed portion.

The machine may also be used as an auto-

matic receiver and recorder, in which case a pencil or other instrument that will make a visible mark upon the paper should be substituted for the perforating stylus. In either of the above cases the message may be read from the paper by sight. It may be used, also, as a sounder, in which case the message is read by sound in the usual manner. It may also be used as an electrical perforator, *i. e.* a machine operating in conjunction with an electrical current for making in a strip of paper combinations of impressions representing the various characters in a code of signals, said strip, when so perforated, to be used as hereinafter described. For this purpose the electro-magnets are included in a local circuit which includes also a Morse key 87 (see Fig. 6) so that when a message is sent over said circuit, the electrical pulsations will cause the machine to operate precisely as when used as a receiver and perforator. Lastly it may be used as a purely mechanical perforator, *i. e.* a perforator acting without the aid of an electrical current. In this case a thumb-piece or handle, similar to the handle of a Morse key is secured to the armature end of the lever 75, so that by pressing down on said handle the stylus will be raised and thrust into or through the paper. It will be observed that the stylus is to one side of the center of the paper guide, so that the paper will be marked to one side of its center. Hence when all the paper has been unwound from the delivery reel 60 and wound upon the take-up reel 61, it may be removed from the latter, the roll turned end for end, and placed upon the former (in the manner already described) and again run through the machine, receiving a second row of perforations as shown by Fig. 14. Thus the capacity of the paper is doubled.

88 is a flexible plate-spring situated directly beneath the stylus end of lever 75, secured to the top of the casing at one end and having at the other end a blunt stylus 89, situated directly in line with the stylus 77, so that the point of the stylus 89 will follow the perforations cut by the stylus 77. The tension of the spring 88 is so regulated that it cannot force the stylus 89 through the uncut paper, but it will force it into the perforations cut by the stylus 77 and make them wider and therefore more distinct. In whatever way the paper may receive its impressions,—whether they be made by this machine operated in either of the ways above described, or whether they be made by an entirely separate machine—it may be used for transmitting the message recorded upon it, by passing it through my improved transmitter which I will now describe.

The receiver above described and the transmitter now to be described, have many parts that are similar in construction, location and operation, and these parts of the two machines are indicated by the same reference numbers. The following description of the transmitter will be confined to those parts that are not found in the receiver. 101 is a lever having at one end a blunt stylus 102 which occupies the groove, 39, in the lower feed-wheel, 38, and 103 is a very light coiled spring connected at its respective ends to the other end of said lever and to a winding post 104 journaled in the end wall of the case and a bracket 105. 106 is a coiled spring which surrounds the post 104 and bears at one end against the bracket 105, and at the other against a shoulder 107, or other device carried by the winding post, which it forces against the wall of the casing, whereby the winding post is held with a sufficient friction to enable it to control the tension of the spring 103. In this machine the spring stop 33 may be constructed precisely like the one used in the receiver, but it is electrically connected by wire *c* with a binding post 108 to which one side of the circuit is connected, and, as shown in Fig. 7, is insulated from all parts with which it has contact, excepting the wheel 11, said wheel being in electrical connection, through the medium of the metal casing 1 and wire *d* with the binding post 109 to which the other side of the electrical circuit is connected. The binding post 108 is also in electrical connection through wire *e* and plate *f*, with an adjustable screw 110 which is electrically insulated from the casing 1 and situated directly beneath the lever 101, so that the circuit will be completed either when the lever 101 is in contact with the screw 110, or when the pin 32 on wheel 11 comes in contact with the spring-stop 33. From this description the operation of the machine can be understood. A strip of paper which has been previously marked by a series of perforations or indentations, as indicated in Fig. 12 is placed between the feed-wheels 38 and 46, and the machine started. While the stylus 102 rests upon an imperforated part of the paper, the contact-end $101^{\times}$ of the lever 101 will be held out of contact with the screw 110, but when one of the perforations or indentations in said paper reaches the stylus, the stylus will enter it by reason of its constant tendency upward, due to the downward pull of the spring 103 upon the end $101^{\times}$ of the lever. This brings the lever in contact with the screw 110 and said lever being in electrical connection with the casing the circuit is completed and a current passes.

In Fig. 7 the machine is shown without the paper and consequently the stylus 102 is in its elevated position, and the lever 101 and screw 110 are in contact, the circuit being thereby completed, but in Fig. 9 the stylus is shown resting upon an imperforated part of the paper, whereby it is held depressed and the end $101^{\times}$ of lever 101 elevated and out of contact with screw 110, the circuit being thereby broken. Since the duration of this contact and the resulting current depends

upon the length of the perforation which the stylus has entered, it follows that a given series of perforations will produce in the circuit a series of electrical pulsations bearing the same relations to each other with respect to their duration and interruption as the perforations producing them bear to each other with respect to their length and distance apart. Hence, all the characters of a code of electrical signals may be arranged on a strip of paper in a single line by proper combinations of impressions of different lengths. Of this I do not claim to be the inventor, but so far as I am aware I am the first to use a strip of paper having a series of impressions of unequal lengths, for automatically controlling a machine and causing it to permit or transmit a succession of electrical pulsations corresponding in duration and significance to the length and significance of the impressions of the paper.

Referring to the diagram, Fig. 13, X represents a strip of paper upon which a message has been impressed in either of the ways above mentioned. As this paper passes through the transmitter T at one station, the impressions and intervening spaces cause the circuit to be alternately made and broken, in the manner already described, permitting electrical pulsations to pass over the line *g* to the receiver R, located at a distant station. For short distances it will do to connect the main line *g* directly to the binding post *h* of the receiver, but where the line is so long that the current is very much enfeebled before it reaches the receiving station the magnets 80 should be arranged in a local circuit and the main line carried through a relay by which said local circuit is opened and closed in the well known manner. So far as my present invention is concerned it is not material which of these arrangements be employed, the former only being shown in the drawings. In either event the pulsations passing through the magnets 80 (and passing out through binding post *i*) cause the perforating stylus 77 of the receiver to rise and fall similarly to the rising and falling of the stylus 102 in following the impressions of the paper X passing through the transmitter, and these movements of the perforating stylus 77 and the constant movement of the paper X′ through the receiver, cause said paper to receive a series of perforations similar in point of length and distance apart to the perforations of the strip X. The strip X′ that comes from the receiver may then be run through a second transmitter for sending the message on to a second receiver located at a distant station, and so on. In this way a message may be automatically received and transmitted at station after station with absolute accuracy.

It will be observed that the fulcrum 76 of the lever 75, and the point of the stylus 77 are situated on a line that intersects the plane of that portion of the ribbon with which the stylus 77 engages, so that the stylus will move in the arc indicated by the dotted line in Fig. 3ª. In other words, the stylus moves backward, or in the direction opposite to that in which the ribbon is being fed, as well as across the plane of said ribbon, and as a result the perforation made by a quick oscillation of the stylus is considerably longer and more distinct than could be made by a similar oscillation if it moved perpendicularly to the ribbon. The means shown in the drawings for producing these contrary motions is effective, but I do not regard my invention as necessarily limited thereto.

The paper guide of this machine may be similar in construction to the paper guide of the receiver, or it may be of the construction shown in Figs. 7, 8 and 10, in which 111 represents a plate situated between the standards 34 and 35, the central portion of which is flush with the shoulder 40 of the standard 34, while its ends are bent downward and rest upon the top of the casing to which they are secured by screws 112 passing through slots 113. The paper is guided by tongues 114 which project upward from the plate 111, and form one side of the guide, and which tongues may be brought to the required distance from the other and fixed side of the guide (the top of standard 34) by moving the plate 111 laterally. Secured to the arm 54 is a plate 115 which overlaps the shoulder 40 and plate 111, and is cut away at 116 to permit the feed-wheels to have contact with each other, and at 117 to accommodate the tongues 114. The plate 115 is carried by the arm 54 and is so situated that when the feed wheels are in contact, there will be sufficient space between the under side of said plate 115 and the parts that it overlaps to permit the free movement of the paper through the machine, as shown in Fig. 11. A stylus 189 similar in construction and operation to the stylus 89 of the receiver, is situated in advance of the stylus 102, its supporting and operating spring 188 being secured to a cross-plate 118 secured to the tops of the posts 119 which support the fulcrum of lever 101.

While the stop mechanism of this machine may be constructed as shown in Fig. 7, still I prefer to construct it as shown in Figs. 9 and 10, in which 120 represents a flexible spring arm so secured at its lower end to the bottom of the casing that normally it will lie in the path of the pin 32, as suggested by dotted lines in Fig. 10, and 121 is a cam secured to the rod 58 and adapted, when said rod is lowered, to engage the upper end of said spring arm and move it out of the path of the pin 32 as shown more clearly by Fig. 10. When in this position the machine is free to work. The spring arm is insulated from the rod 58, and from the casing, and is connected with the binding post 108 by wire *c*. Should the stylus 102 come to the end of the paper, or enter a very long perforation, so that the contact end 101ˣ of the lever 101 will remain depressed long enough for the wheel 11 to make,

say, two revolutions, the lower extremity of a pendant 122 whose upper end is hinged to said lever will be moved in the direction of the arrow by an insulated screw or helical cam 123 on shaft $11^{\times}$ until it strikes an arm 124 of an auxiliary stop 125 pivoted at 126 to the spring stop 120, and moves said auxiliary stop across the path of the pin 32, leaving the stop 120 in the position in which it is shown by full lines in Fig. 10. This not only stops the train of clock-work, but also closes the circuit and shunts the machine.

If desired the lever 101 may have direct contact with the screw 110, but I prefer to form this contact through the medium of a spring in order to give it that elasticity that is necessary in telegraphing. To this end I secure to the lever one end of a flexible plate spring 130, the other end of which engages the head of a screw 131 tapped into said lever and locked by a nut 132. 133 is a second screw tapped into the lever and engaging the spring 130, and 134 is a nut for locking it. The screw 131 determines the extent of movement of the contact end of the spring 130, and in connection with the screw 133 enables the spring 130 to be given any desired tension. The circuit is closed and the current passes as soon as the spring 130 touches screw 110, but the tension of this spring should be so regulated with relation to the tension of the spring 103, that the latter will overcome the former when the stylus 102 enters a perforation, as shown in Fig. 7. With all of these adjustments it is possible to make and break the circuit by a very slight oscillation of the lever 101, and in rapid telegraphing this is important.

Either of the paper guides already described may be used on either the receiver or transmitter, but I prefer to use on both of these machines the guide which is shown applied to a transmitter in Figs. 14 to 17, inclusive.

Secured to the standard 35 is a plate having a portion 135 about flush with the top of the feed-wheel 38, an opening 136 through which said wheel has contact with the wheel 46, and a shoulder 137 which forms one side of the guide and converges toward the plane of the feed-wheels in the direction of the feed, as shown more clearly in Fig. 17, where the angle of convergence is exaggerated for the sake of clearness. Secured to the top side of plate 135 is a second plate 138 of similar outline, having an opening 139 for admitting the periphery of the upper feed-wheel 46. The ribbon runs in the space 140 between the two plates, which is preferably just sufficient to admit it without binding it, and in the direction indicated by the arrow in Fig. 17, and the convergence of the feed-wheels with the side 137 of the guide holds the ribbon in contact with said side when once the contact is established. This is due to the fact that so long as the edge of the ribbon remains in contact with any considerable portion of the whole length of said side, the tendency will be for the ribbon to follow the direction of said side. Hence, instead of the ribbon's approaching the bite of the feed-wheels in a direction parallel with their planes and the lines of force that they exert, it will approach slightly aslant. The consequence is that instead of exerting their force in lines that are parallel with the edges of the ribbon, they exert it in lines that intersect its edges, and thus feed it laterally (though only very slightly), as well as longitudinally.

I desire to have it understood that my invention is not limited to any particular method of constructing this inclined side 137 of the guide. In Fig. 15 it is shown as a shoulder on plate 135. It could as well be a shoulder on plate 138, or a shoulder on each of them, or a separate plate interposed between them; or the plates 135 and 138 may be integral and the space 140 formed by a saw cut, in which case the bottom of the cut would form the inclined side of the guide, this construction being shown in Figs. 1, 2 and 3. In these last named figures the bar 56 is shown to be secured at but one end by a screw 57. It may therefore be adjusted to any desired angle. If placed at the angle indicated by dotted lines in Fig. 3, the ribbon will remain in contact with it and relieve the opposite side of the guide of all duty, which goes to show that with paper such as is ordinarily used, only a narrow ledge, (such as the bottom flange of the bar 56) is required to support it. Furthermore the guide shown in Figs. 14 to 17 will work with the top plate 138 removed, which goes to show that so long as the ribbon is in the bite of the feed-wheels an angle bar (thus _|) situated in the dotted position of the bar 56 will both support and guide the paper. The other parts of the guide are, however, useful when the feed-wheels of the transmitter have to be separated to draw the ribbon backward between them for repeating a portion of the message. To facilitate this operation the stylus is automatically withdrawn from the path of the ribbon by an arm 141, that is carried by the arm 45, or other part that moves with the housing 44 and engages beneath the lever 101. To this end also the open side of the guide is closed by a shutter 142 which is pivoted to the depending portion 41 of the standard and has tongues 143 that cross the space 140, the edges of the plates 135 and 138 being notched at 144 for the admission of said tongues. A lug 145 projecting from one end of this shutter forms a convenient handle for moving it, and a delicate coiled spring 146 secured at one end to said lug and at the other to the standard 35 serves to hold said shutter either down, as shown by full lines, or up as indicated by dotted lines. If the two sides of the guide were parallel as in Fig. 8, this spring actuated shutter, forming one side, would bear against one edge of the ribbon and hold its other edge against the opposite fixed side of the guide.

147 are notches cut in the plates 135 and

138 for preventing the obliteration of the impressions on the ribbon.

In Figs. 14 and 18 the fulcrum of the lever 101 is shown to be situated above the plane of that part of the paper with which the stylus 102 engages, so that the stylus will move in the arc indicated by the dotted line in Fig. 18. In other words, the stylus moves forward, or in the direction of the feed, as well as across the plane of the ribbon, and as a consequence it enters short indentations with more certainty than it would if it moved perpendicularly to the ribbon, especially if the ribbon is being fed forward at a high rate of speed. The means which I have shown and described for accomplishing this result are effective, but I do not regard my invention as necessarily limited thereto.

By attaching to the lever 75 two perforating styluses 77, as shown on a very much enlarged scale in Figs. 19 and 20, the ribbon will receive two series of impressions, as shown in Fig. 22, each series being complete in itself and similar to the other series, and for following these two series of impressions two styluses 102 are secured to the lever 101 of the transmitter, as shown in Figs. 15, 16 and 17, and on a very much enlarged scale in Fig. 21. When the ribbon is running at a high rate of speed, in order to insure that the stylus 102 will enter every impression a sufficient distance to complete the contact, the spring 103 has to be given such a tension that there is a tendency to tear the ribbon between the successive impressions. If the ribbon have two series of impressions it can exert upon the lever, without tearing, twice as much pressure as if it had but a single series, and consequently, the spring 103 may be given sufficient tension to cause the stylus to move with the necessary rapidity. The number of styluses may be even further increased, if desired.

I have heretofore mentioned only paper, as a material for receiving the perforations, but it is obvious that any other material that is capable of receiving and retaining them may be used without departing from the spirit of my invention.

Having thus described my invention the following is what I claim as new therein, and desire to secure by Letters Patent:

1. The combination with an electrical circuit, and a receiver, of a piece of material having a series of impressions, the stylus 102, the lever 101 by which said stylus is carried, the spring 130 forming one side of a make and break included in said circuit and having one of its ends secured to said lever, the adjustable set screw 131 for confining the free end of said spring, and the set screw 133 for engaging it, whereby its tension may be regulated, substantially as set forth.

2. The combination with a circuit including a make and break and a receiver, of a strip of material having a series of impressions, a stylus adapted to follow said impressions, means connecting said stylus with one side of said make and break, means for feeding said strip of material through the machine, including a part having electrical connection with one side of the circuit, an insulated stop having electrical connection with the other side of said circuit, means for opening the circuit at the make and break and means for bringing said stop in contact with said part, whereby the machine is stopped and the circuit closed, substantially as set forth.

3. The combination with a circuit including a make and break, and a receiver, of a strip of material having a series of impressions, a stylus adapted to follow said impressions, means connecting the stylus with one side of the make and break, means for feeding said strip of material including the wheel 11, having electrical connection with one side of the circuit, an insulated stop adapted to engage said wheel and having electrical connection with the other side of the circuit, and means for controlling the position of said stop, substantially as set forth.

4. The combination with a circuit including a make and break, and a receiver, of a strip of material having a series of impressions, a stylus adapted to follow said impressions, means connecting said stylus with one side of the make and break, and a shunt conditioned to operate automatically when the stylus is allowed to remain in one position for a given length of time, substantially as set forth.

5. The combination with the ribbon, and the feeding mechanism of a stylus, a lever by which it is carried, a pendant carried by said lever, a cam, adapted to engage said pendant, and move it into contact with one of the parts of the feeding mechanism when the stylus is allowed to remain in one position a given length of time, substantially as set forth.

6. The combination with the ribbon and the feeding mechanism including a part having electrical connection with one side of the circuit, of a stylus adapted to have contact with said ribbon, a lever by which said stylus is carried, a pendant carried by said lever and having electrical connection with the other side of the circuit, and a cam engaging said pendant and adapted to move it into contact with one of the parts of the feeding mechananism when the stylus is allowed to remain in one position a given length of time, substantially as set forth.

7. The combination with an electrical circuit having a make and break, of a stylus, a lever by which it is carried, said lever being included in said circuit and carrying one side of the make and break, a pendant carried by said lever, a ribbon, a feeding mechanism having wheel 11 having electrical connection with the stylus lever, and an insulated cam adapted to engage said pendant and move it into contact with a part having electrical connection with the other side of the circuit, substantially as set forth.

8. The combination with an electrical cir-

cuit having a make and break, of a stylus, a lever by which it is carried, included in said circuit and carrying one side of said make and break, a pendant carried by said lever, a ribbon, a feeding mechanism having wheel 11 in electrical connection with the stylus lever, an insulated cam adapted to engage said lever, an insulated stop adapted to engage said wheel and having electrical connection with the other side of the circuit, means for operating said stop, and a part carried by said stop and movable independently of it, and adapted to be engaged by the pendant and moved into contact with said wheel, substantially as set forth.

9. The combination with an electrical circuit, a piece of material having a series of impressions, and means for feeding said material forward, of a stylus adapted to enter said impressions, means for moving said stylus across the plane of said material and also in the direction in which said material is moving, and means controlled by said stylus for controlling said circuit, substantially as set forth.

10. The combination with an electrical circuit, a piece of material having a series of impressions, and means for feeding said material forward, of a stylus adapted to enter said impressions, a lever carrying said stylus and having means for controlling said circuit and means for moving said stylus toward said material, the fulcrum of the lever being so situated that the stylus moves across the plane of the material and also in the direction in which said material is moving, substantially as set forth.

11. The combination with a circuit, having a make and break, and a receiver, of a ribbon having impressions, a feeding mechanism, a stylus, a lever by which it is carried and by which one side of the make and break is carried, a second stylus situated in front of the first stylus, and a spring for actuating this second stylus, substantially as set forth.

12. In a telegraphic instrument, the combination with the ribbon, of the feed mechanism and a guide for the ribbon having an open side and a spring-actuated shutter adapted to close said open side, substantially as set forth.

13. In a telegraphic instrument, the combination with the ribbon, of the feed-wheels, the plates 135 and 138, separated by space 140 and having notches 144, the hinged shutter 142 having tongues occupying said notches, and the spring 146, substantially as set forth.

14. In a telegraphic instrument, the combination with the stylus, and a lever by which it is carried, of the separable feed-wheels 38 and 46, the housing 44 supporting the feed-wheels 46, means for moving said housing, and arm 54 and 141 carried by the housing and adapted to engage the stylus-lever, substantially as set forth.

15. In a telegraph instrument, the combination with a stylus, separable feed-wheels, means for driving them, and a stop, of the housing 44, means connecting the housing with one of the feed-wheels, means connecting the housing with the stylus, and means connecting the housing with the stop, whereby when the housing is moved in the proper direction the feed wheels are separated, the stylus withdrawn and the machine stopped substantially as set forth.

16. In a telegraphic instrument the combination with the stylus, the separable feed-wheels, the movable housing carrying one of said wheels, and means for moving said housing, of mechanism for driving the feed-wheels, a stop for controlling said mechanism, and a connection between the housing and stop, whereby the position of said stop is controlled by the position of the housing, substantially as set forth.

17. In a telegraphic instrument, the combination with the ribbon, the stylus, the feed-wheels, and a take-up reel, of a pulley 69 fixed to the shaft of said reel, a pulley 71 loose upon the shaft 45 of feed-wheel 46, the shoulder 72 on said shaft, the spring 73 surrounding the shaft and engaging pulley 71, the nuts 74, and the belt 70 embracing pulleys 69 and 71, substantially as set forth.

18. In a telegraph instrument, the combination of a stylus, a delivery reel, a take-up reel and means for feeding the paper from one to the other, said reels having removable and interchangeable spools, whereby the ribbon may be wound from one spool onto the other, utilizing one of its edges, and the spools then removed, turned end for end, and transposed, whereupon the ribbon will be rewound onto the first spool, utilizing its other edge, substantially as set forth.

19. In a telegraphic instrument, the combination with the driving mechanism, of a shaft geared therewith, a blade pivoted perpendicularly to said shaft, a crank-arm projecting from the pivot of the blade; a sliding part carried by the shaft, and a connection between said sliding part and crank-arm, substantially as set forth.

20. In a telegraphic instrument, the combination with the driving mechanism, of a shaft geared therewith, a blade pivoted perpendicularly to said shaft, a crank-arm projecting from the pivot of said blade, a sleeve upon said shaft connections between said crank arm and sleeve, and means for moving said sleeve and for securing it in any desired position, substantially as set forth.

21. In a telegraphic instrument, the combination with the driving mechanism of a shaft 17 geared therewith and having a central bore and longitudinal slot 24, a blade 18 pivoted perpendicularly to said shaft, a crank arm 20, the rod 22 occupying the bore of the shaft 17 and having bend 23 occupying slot 24, and means connecting said rod and crank, substantially as set forth.

22. In a telegraphic instrument, the combination with the driving mechanism, of a shaft geared therewith, a blade pivoted perpendicularly to said shaft, a sliding part carried by-

the shaft and having groove 27, means connecting said sliding part and blade, and the screw nut 29 having flange 28 fitting in said groove, substantially as set forth.

23. In a telegraphic instrument, the combination with the driving mechanism, of a shaft 17 geared therewith, a second continuous shaft 19 carried by the first and situated transversely to it projecting from its opposite sides, a pair of blades 18 secured to the shaft 19, one on each side of the shaft 17, and means for turning the shaft 19 to adjust the positions of the blades, substantially as set forth.

24. The combination with the feed-wheels, a ribbon-guide having one side inclined with respect to said wheels, a perforating stylus, and means for operating said stylus, of a transmitter having feed-wheels, a guide having one side inclined with respect to said feed-wheels, a following stylus, and an electrical circuit controlled by said stylus, the stylus and guide of the transmitter being situated in the same relations to each other as are the stylus and guide of the perforator, substantially as set forth.

25. The combination with the ribbon, the feeding mechanism, a perforating stylus, and an electro magnet for operating said stylus, of a second stylus following in the line of the first, and a spring for forcing said second stylus into the perforations made by the first for widening them, substantially as set forth.

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Witnesses:
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