

R. HITCHCOCK.

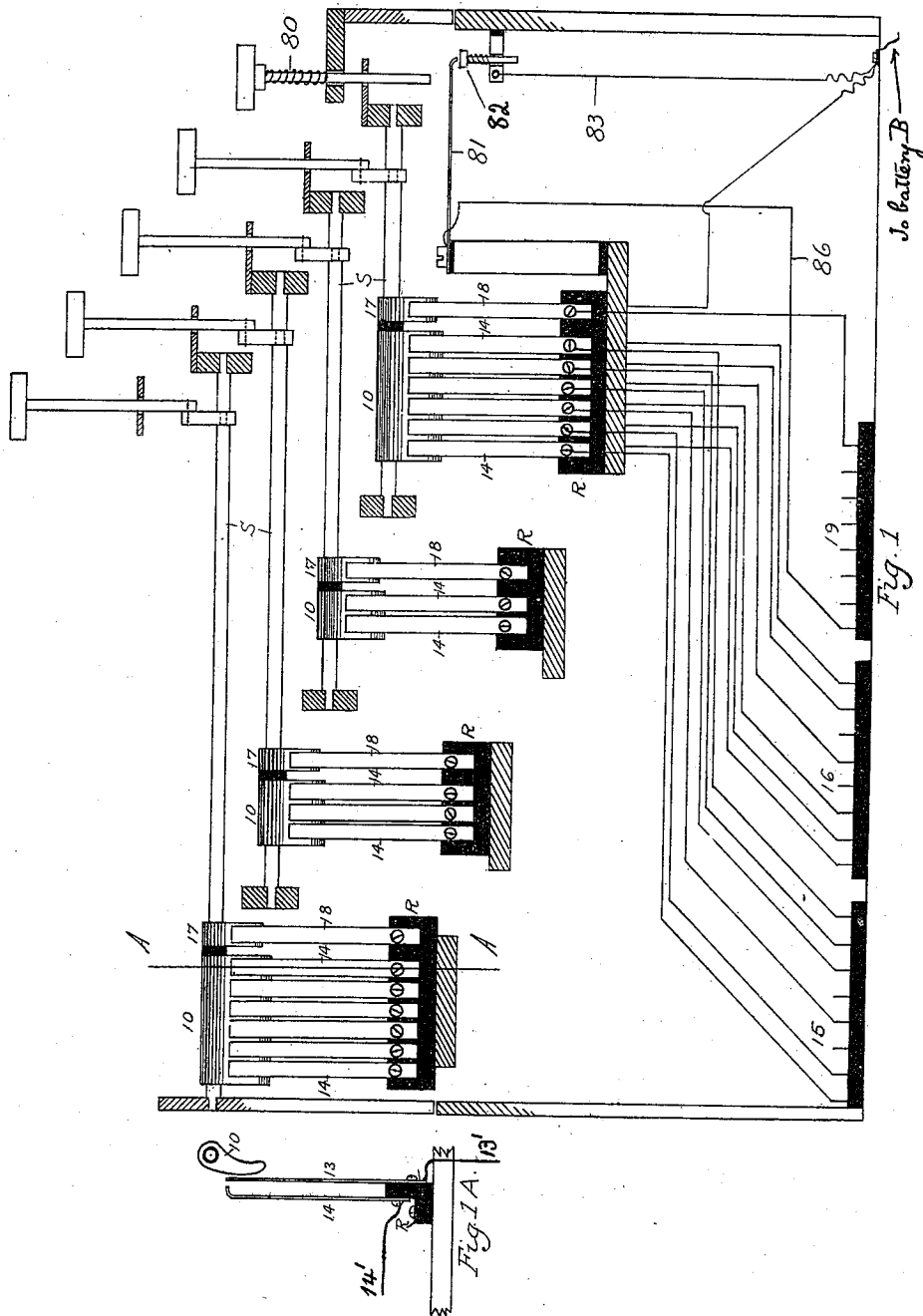
KEYBOARD APPARATUS FOR PUNCHING TELEGRAPHIC TRANSMITTING TAPES.

APPLICATION FILED AUG. 2, 1906. RENEWED APR. 12, 1910.

975,427.

Patented Nov. 15, 1910.

4 SHEETS—SHEET 1.



WITNESSES:

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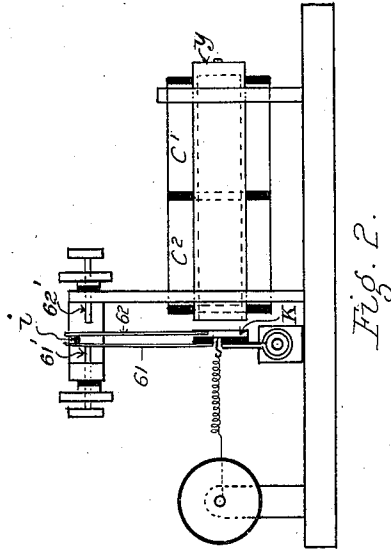


Fig. 2.

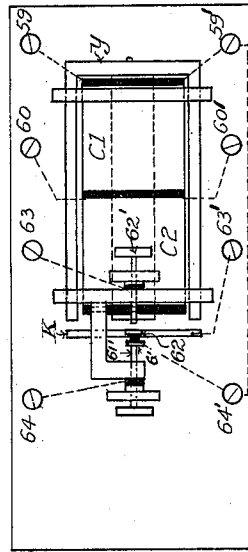


Fig. 3.

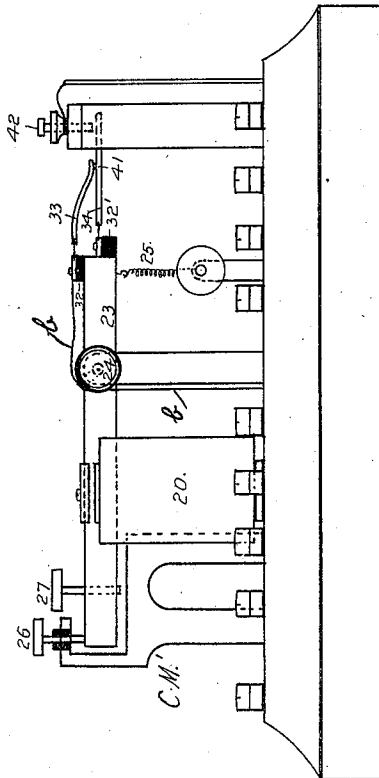


Fig. 4.

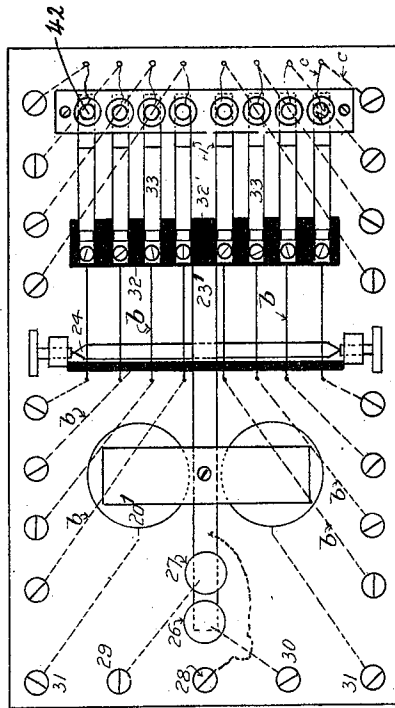


Fig. 5.

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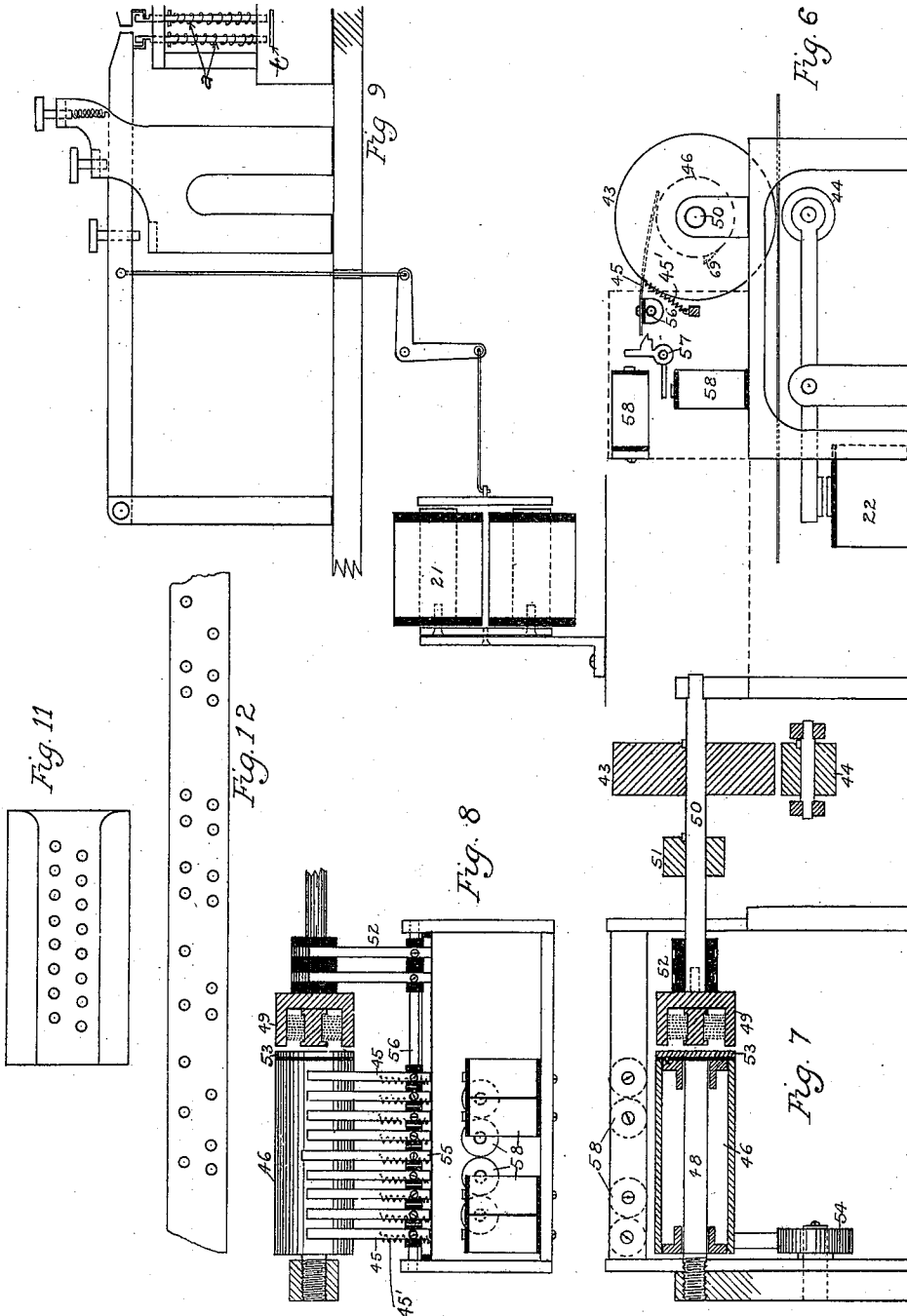
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4 SHEETS—SHEET 3.



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KEYBOARD APPARATUS FOR PUNCHING TELEGRAPHIC TRANSMITTING TAPES.

Patented Nov. 15, 1910.

4 SHEETS--SHEET 4.

Fig. 10.

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UNITED STATES PATENT OFFICE.

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KEYBOARD APPARATUS FOR PUNCHING TELEGRAPHIC TRANSMITTING-TAPES.

975,427.

Specification of Letters Patent. Patented Nov. 15, 1910.

Application filed August 2, 1906, Serial No. 328,829. Renewed April 12, 1910. Serial No. 555,100.

To all whom it may concern:

Be it known that I, ROMYN HITCHCOCK, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented certain new and useful Improvements in Keyboard Apparatus for Punching Telegraphic Transmitting-Tapes, of which the following is a specification.

This invention comprises an organization having a key board with a key for each code character; a group of punches with means for respectively operating them; punch selector devices acting on depression of a key to select the punches required to make in the tape a record corresponding with that of the depressed key; and automatically acting tape feeding devices that draw forward such length of tape after each actuation of the punches as to provide proper spaces between letters.

The novel means by which the above indicated operations are accomplished are hereinafter set forth in detail. It is preferred that the record upon the tape shall be effected by punches that remove from it sections corresponding with the area of the punches, instead of merely puncturing the tape to form perforations surrounded by burs, or embossing the characters thereon. These several ways of making a record upon a transmitting tape are well known.

The apparatus is designed for punching a transmitting tape for automatic or machine transmission according to the Morse or continental code, or such other code as may be desired. The arrangement of the perforations in the tape may be according to any desired plan. In the embodiment of the invention as illustrated, it is contemplated that the record punched in the tape shall be as shown in U. S. patents heretofore granted to Patrick B. Delany—for instance in his Patent No. 720,004, dated Feb. 10, 1903. In that system of punching transmitting tapes, dots and dashes are respectively formed by perforations in two parallel rows; and whether the character be a dot or dash depends upon the angular displacement of a perforation in one of the rows relatively to a corresponding perforation in the other row. In using such a tape, the signal is initiated by an impulse of current transmitted through or by one perforation in one row and is terminated by a current transmitted through or by the corresponding perforation

in the other row, the interval between the two impulses determining whether the transmitted character is a dot or a dash.

In the accompanying drawings, Figure 1 is a diagrammatic longitudinal section showing four letter keys, a space key and some of the circuit connections, this number of keys being sufficient to fully illustrate the way in which a complete key board would be organized, Fig. 1^A, a detail section on the line A, A, of Fig. 1; Fig. 2, a side elevation and Fig. 3, a plan of the spacer relay; Fig. 4, a side elevation and Fig. 5, a plan of a contact maker or selector controlling the circuits of the punch operating magnets; Fig. 6, a side elevation, Fig. 7, a cross section, and Fig. 8, a plan, partly in section, of the tape puller and spacer; Fig. 9, a diagrammatic elevation illustrative of the punch devices and operating magnets; Fig. 10, a diagrammatic view showing the general arrangement of the apparatus and circuits; Fig. 11, a plan view of the punch block; and Fig. 12 shows a portion of a punched tape.

The punching mechanism.—A set of sixteen punch rods *a*, Fig. 9, properly spaced, eight on each side of a center line, serves to make all necessary combinations for Morse characters. The arrangement of punches is indicated by the plan of the die block (Fig. 11). By the method herein described these punches are operated separately, in the manner shown in Fig. 9, each having, in the particular organization illustrated, its own magnet. The sixteen magnets 21, 21', Fig. 10, are arranged on opposite sides of the punch blocks in two groups, in the manner indicated in Fig. 10. During the punching operation the tape is stationary. After completion of the punching the spacing mechanism causes the tape to be pulled forward a distance regulated for each combination by the differential spacer, as will be described.

The contact maker.—This apparatus is shown in Figs. 4 and 5. The bar 23, turning in bearings 24, is actuated by magnet 20 opposed by spiral spring 25, and has limiting stops 26, 27, which are also contacts for current entering at binding post 28 and passing out at posts 29 and 30. The two posts 31 are connected with the coils of magnet 20. Bar 23 carries at the forward end two, hard-rubber lateral extensions, 32, 32', on each of which are eight conducting springs, 33 and 34, normally in contact at

the point 41. When magnet 20 is energized springs 33 and 34 rise together maintaining electrical contact at 41, but immediately the upward movement of spring 34 is arrested by insulated stop 42, while spring 33 is carried upward until the movement is limited by stop 27. Each of the eight springs 33 is connected with its own binding post by wire 6 and each corresponding stop 42 is connected with one of the front binding posts by wire. The object of the contact maker is to energize simultaneously any required number of the punch magnets, and to limit the duration of the current flow to the shortest time possible to insure positive action.

The keyboard.—Referring to Fig. 1 the horizontal rock-shafts S are connected with the respective keys in such manner that the depression of a key causes its shaft to turn through an arc dependent upon the limit of movement of the key. Each shaft carries two cams, 10 and 17, of the same conformation but of different lengths according to requirements. The cams are so fixed upon the shafts that cam 17 lags slightly behind cam 10, whereby the former comes first into action. Opposite cams 10 are a number of opposing pairs of spring-conductors 13, 14, shown also in Fig. 1^A, supported on insulating bases R; and opposite each arm 17 is one pair of similar spring conductors 18. Cams 10 are insulated from their shafts and connected with a source of electricity, generator G, Fig. 10.

All spring conductors 13 of the inside row in each set are connected by wires with corresponding parallel conductors of a group 16, of eight conductors, and all the spring conductors 14 of the outer set are likewise connected with parallel conductors in a group 15. The wire connections for a single key, shown in Fig. 1, represent the connections for punching the Morse character for a period.

Spring conductors 18 are connected with the proper parallel conductors of group 19 to effect differential spacing, and are in series in a circuit from battery B, Fig. 10, each pair when in contact establishing its own circuit up to a certain point beyond which a single return wire is common to all.

On depressing a key, cam 10 presses against the inner row of spring conductors, 13, forcing them in contact with the opposing spring conductors 14 of the outer row, thus establishing, as long as the key is held down, two parallel circuits in each pair of opposing spring conductors, but no current flows until the circuits are elsewhere completed.

Parallel conductors in groups 15 and 16 correspond to and are connected with the two groups of magnets 21 and 21' (Fig. 10) which operate the tape punches. The parallel conductors in group 15 are wired in

consecutive order through the contact maker CM' to punch magnets of group 21', and those of group 16 are wired through CM to magnets of group 21. Hence, all the inner spring conductors 13 control the circuits of selected magnets in group 21 and all spring conductors 14 those of selected magnets of group 21'.

The different circuits selected by the spring conductors of each key are completed in the contact makers. Having selected the circuits, which is the function of cams 10, the second cam 17, also insulated from its shaft, now comes into action and makes contact between the spring conductors 18 when current flows from battery B, Fig. 10. The battery current thus established performs several functions, but at this point only one of these demands attention. The current leaves the keyboard machine through one of the parallel conductors of group 19, which is the tape-spacer group, and after passing through certain instruments finally comes to the spacer return wire SR, which leads to magnets 20' and 20 of the two contact makers CM', CM, and then back to battery B. By thus energizing magnets 20, 20', the selected punching circuits are all simultaneously completed at contacts 42, and the desired perforations are punched in the tape.

The operation is as follows:—It will be seen from Fig. 10 and the connections shown in Fig. 5, that each spring 33 of the contact makers is in series with one of the parallel conductors of the keyboard and, when contacts at 42 are made, with a corresponding punch magnet. When a key is operated the punching circuits are selected by cam 10 and the potential carried to the terminals of the particular springs 34 which are in the selected circuits. Cam 17 then acts upon contacts 18 to effect closure of the circuits of magnets 20 and 20', and the circuits of the selected punch magnets are simultaneously established and immediately broken at the contact points of stops 42. When current ceases to flow through magnets 20, 20', Fig. 10, of the contact makers, it is obvious that the punching contacts would be reestablished by the return movement of bar 23 and the punches operated a second time. The punching circuit is therefore broken immediately after the punching operation and remains interrupted until bar 23 has returned to its original position. This breaking of the punching circuit is effected by utilizing the stop contacts 26 and 27 on contact maker CM', Fig. 10. An ordinary telegraph sounder TS is introduced in the circuit which is completed through point 70 as shown. The sounder is operated by a battery B² through the tongue of polar relay PR, which in return is controlled by the bar of the contact maker CM'. When bar

23' is in contact with its upper stop 26, the polar relay holds the sounder battery circuit open and the punching circuit is uninterrupted. When bar 23 makes its lower contact 27, the polar relay is reversed, the sounder bar is drawn away from its stop 70 and the current is interrupted until the polar relay is again reversed by the return of bar 23 to its upper contact.

10 *The spacer relay.*—This device fulfils two separate functions. First it insures the completion of a series of automatic operations resulting from the contacts established by cam 17 of any key, without possibility of interference by the premature depression of any other key, such as would, in a typewriter for example, result in an interference of type-bars. Second, it permits of the use of a sufficiently strong current to operate the tape puller and spacer, part of which current is shunted through the contact at 62' of the spacer relay.

25 The magnet, Figs. 2 and 3, is constructed preferably with a single core and a yoke *y*, as shown. The core is wound with two separate coils, C¹, C², connected respectively with binding posts 59, 59' and 60, 60'.

30 The armature contacts are arranged in the usual manner except that the back contact is made by a separate spring 61, electrically insulated from the front contact spring 62. The object of this arrangement is to prevent a too early break of the current at the back contact when the armature is attracted by the magnet. Bar 62 bears near the top, a point of insulation so that when the armature lever is retracted by the usual spring against the back stop, the two tongues will remain insulated from each other. Binding posts 63, 63', are connected through the front armature-contacts and 64, 64' through the back contacts.

45 *The tape puller.*—The tape is pulled or drawn from the punch block in the well-known manner between two friction grip wheels or pulleys 43, 44, Figs. 6 and 7, brought into action by magnet 22. The upper pulley 43 runs continuously, being connected with a motor by means of a pulley or gear at 51. The tape is drawn forward intermittently by the two pulleys, whenever the magnet brings them together.

55 *The differential spacer.*—The punching of tape for Morse dots and dashes requires eight different spacings for the different lengths of letters. The spacing on the tape includes not only the length of tape punched but in addition an allowance for the necessary spacing to separate the letters. A length of punched tape is shown in Fig. 12.

60 In this invention the length of tape pulled for any letter is predetermined by the duration of a contact of one of eight conducting springs 45, Figs. 6, 7 and 8, upon the surface of the intermittently turned conducting

cylinder 46, the angular speed of revolution being uniform with that of pulley 43.

Cylinder 46 is made very light and turns freely upon the fixed shaft 48 and is electrically insulated from its bearings. Shaft 50 which carries pulley 43 runs continuously during operation. At the end of this shaft is a magnetic clutch 49, current for which is supplied through spring contacts at 52. When the magnetic clutch is energized cylinder 46, which has an iron armature 53, is drawn into contact with the clutch and carried synchronously with pulley 43 so long as the current flows through the clutch coil. When the clutch releases the cylinder, the latter is instantly revolved back to its starting point by a spring at 54.

85 The eight contact spring fingers 45 turn separately on shaft 56, are separately insulated and are each urged toward the cylinder by a separate spring 45' (Fig. 6). They are ordinarily held away from the cylinder surface by spring catches 57, shown only in Fig. 6. The middle spring 55 is continuously in contact with the cylinder surface. Eight small magnets 58 are arranged in such a manner that if any one is energized it releases the spring catch 57 corresponding to it, thus permitting a particular one of springs 45 to make contact with cylinder 46, as shown in Fig. 6, and remain in contact with it until lifted by an insulation projection 69 on the cylinder, when the finger is automatically engaged by its latch 57. The drawing shows but one such projection, Fig. 6, but there is one for each spring contact 45, and they are placed in different positions circumferentially of the cylinder, so that the periods of contact of the springs respectively conform to different arcs of movement of the cylinder.

100 *Operation.*—When a key is depressed, cam 10 closes the pairs of spring contacts 13, 14, and the cam being connected to one pole of the generator G parallel circuit connections are established through the respective springs. The circuits from springs 13 are by wires 13' to corresponding conductors of group 16 and thence to corresponding spring contacts 33 and 34, of contact maker CM, where the circuits are open. The continuations of the circuit are, however, from contacts 42, through the selected punch magnets 21, and from thence by wire G^x through closed contact 70 of sounder TS, and by wire G' to the other pole of generator G. The circuits of springs 14 may be traced in the same way by group 15 of conductors through contact maker CM' and selected punch magnets 21' back to the generator. Cam 17, acting immediately after cam 10, closes spring contacts 18 completing a circuit from battery B to one of a group of conductors 19, say the eighth one as shown, connected with binding post 8, of the spacer,

which is connected through the particular magnet 58, that acts to release the eighth spring contact 45 of the spacer, to binding post R, thence by wire B' to binding post 59 of spacer relay, through coil C' of relay to binding posts 59' and 64', through the normally closed back contact 61' of the relay, and by wire SR through magnets 20' and 20 of the contact makers, to the other pole of battery B. Current flowing in this circuit effects the following operations:

First: Magnets 20, 20' being energized, their armature levers are attracted, and when springs 34 strike contacts 42 the circuits of the selected punch magnets are completed and maintained until contact springs 33 pass out of contact with springs 34. The punch magnets are so constructed that during such brief interval they actuate the punches, which, on interruption of the circuit at 33, 34 are at once elevated to normal position by their springs. In the normal elevated position of armature lever of contact maker CM' the armature lever of polarized relay PR is in the position shown, the circuit of its local battery B³ being from one pole to the armature lever bearing against insulated contact stop 26 connected by wire x with a terminal of one winding of the reversely wound relay, whose other terminal is connected by wire x' with the opposite pole of the battery. The armature lever of the sounder relay is, therefore, maintained by its spring in connection with wire G^x. When, however, the armature lever of CM' reaches its bottom stop 27, the other (or reversely wound coil of the relay) is connected in the local battery circuit, the relay armature lever moves to its other stop, and, the magnet of TS being charged, contact of its lever with wire G^x is broken. The punch magnets cannot, therefore, be operated when contact of springs 33, 34 is restored during movement of the armature levers of CM and CM' to normal position, to which they immediately return after actuation of the punches, by reason of interruption of the circuit of magnets 20, 20' at the back contact 61' of the spacer relay.

Second: When the armature lever 62 of the spacer relay was drawn to its front contact 62', a circuit was established from generator G by wire G³ through the binding post 63', front relay contact 62' to binding posts 63 and wire G⁴ to the brushes 52 of electromagnet clutch 49, thence by wire G⁵ through magnet 22 to the other pole of the generator. At the same time current from generator G in a derived or shunt circuit through the coil C² of the spacer relay acts in lieu of current from battery B in coil C' (which has been interrupted at back contact 61') to maintain the front contact 62'. This shunt circuit may be traced as follows: from point 66 in wire G³ to binding post 60',

coil C² of relay, binding post 60, resistance R and binding post 67 to central contact finger 55 constantly bearing upon cylinder 46, and thence the circuit is by the eighth contact finger 45 that has been released, as described, to binding post 68 and point 66' of the circuit connection G⁴. The magnetic clutch being energized, cylinder 46 is attracted and commences to revolve, and at the same time magnet 22 raises tape drawing roller 44 so that the tape is frictionally gripped against the continuously driven roll 43 and drawn forward. The distance through which the tape is drawn should be such as to leave a proper space following the letter that has just been punched. This is controlled with reference to the various letters by the insulated projections 69 on the cylinder 46. When the contact finger is lifted from the cylinder by its corresponding insulated projection, current in the coil C² of the spacer relay is interrupted and the relay being deenergized, its armature lever leaves its front contact 62', thereby opening the circuit of the electromagnetic clutch 49 and of magnet 22, whereupon spring 54 acts to return the cylinder to zero position. The release of relay armature K reestablishes contacts 61, 61' and the apparatus is now in condition for the punching of another letter in the tape.

If the arc of turning of the spacer cylinder is once properly adjusted, the spacing will always be correct, irrespective of the speed of revolution of the grip pulley or of any variations in its speed.

The use of a magnetic clutch to carry the spacing cylinder in unison with the pulley is preferred but is not essential.

The operations of punching and spacing are carried on in automatic sequence as a result of the single actuating contact made by cam 17 for each key. The series of operations having been initiated, no interference with their completion is possible by any manipulation of the keys. This is so because when the armature lever of CM' reaches its bottom stop, the circuit of G^x is opened at 70 and the back contact 61 of spacer relay is not restored until the relay circuit is interrupted at the tape spacing device.

Although there is a sequence of operations, as distinguished from a simultaneous performance, the time interval between them is inappreciable. The punching operation should be completed and the punch rods raised free from the tape before the puller acts, to prevent tearing the tape.

The magnets of the contact makers and of the punches are therefore made with small time constants. The contacts at 42 are made during the first part of the upward movement of the springs. The punch magnets receive their full current and the circuits are broken at contact 70 when bar 23'

makes its lower contact 27. The punching operation itself can be effected with quickness and is probably completed by the time bar 23 has perfected its back contact 27.

5 The tape does not begin to move until the spacer current has energized the puller magnet 22 and the magnetic clutch 49, and the operation of these is dependent upon the making of the front armature contact of the
10 spacer relay at 62. The making of this contact can be appreciably delayed by proper construction and adjustment of the relay, thus affording sufficient time to complete the punching operation before moving the
15 tape.

The introduction of the spring contact 61 in rear of the armature K, or armature lever 62, of the relay is also intended to prevent a too early release of the contact maker
20 bars 23, the purpose being to afford sufficient time at the lower contact 27 of CM' to insure absolutely the breaking of the puncher circuit at 70 of the sounder TS before the return movement of bar 23.

25 An important feature, practically, is that when a sequence of operation has been initiated by the depression of a key lever, it cannot be interfered with by the manipulation of the same or any other key lever.
30 The key contacts may be made during the first part of the downward movement of the key, for example, during about one-third of the downward stroke. Any further movement of the key is therefore unnecessary, but
35 in practice advisable, since it permits of conformity to typewriter manipulation and elasticity of touch, conducive to ease of working. By thus utilizing only the first
40 part of the key movement, the time interval between the completion of one key movement and the beginning of the next, is available for the electrical operations. The different pieces of apparatus for carrying out
45 the operations described are shown as constructed in practical and efficient form, but they may be modified by those skilled in such matters without departing from the principles of this invention. No attempt is
50 made to indicate modifications since they, in one form or another, may readily be effected by those skilled in the art. For simplicity of construction, wiring, and operation of the punches, it is thought best that
55 there should be a separate magnet for each punch, the magnets and punch operating devices being arranged in any convenient or desired way.

To space between words a space key 80 is provided. When it is depressed battery B
60 is connected by wire 83, spring contact finger 81 and wire 86 to one of the group of parallel conductors 19. The operation of the spacer relay and tape drawing devices is as already described. The connections may be
65 such that the length of tape drawn forward.

shall be the same as when letter e has been punched in the tape, that being the shortest feed of the tape by the differential tape pulling devices.

I claim as my invention:

70 1. In telegraphic tape punching apparatus, the combination of a series of keys, one for each letter and character, a plurality of electromagnetically controlled punches equal
75 in number to the maximum number of perforations required to form any letter, means for intermittently drawing the tape forward, means whereby, on depression of a key, the circuits of punches adapted to punch the
80 corresponding letter in the tape are selected and partly completed, electromagnetic means also acting thereafter during depression of the key to complete the punch circuits and effect actuation of the selected
85 punches, and means whereby when the punches have acted the paper drawing devices are automatically set into operation to draw forward the tape a length determined by the letter that has been perforated therein.

90 2. In telegraphic tape punching apparatus, the combination of a series of keys, one for each letter, a plurality of electromagnetically controlled punches equal in number
95 to the maximum number of perforations required for any letter, means for intermittently drawing the tape forward, and devices, controlled on depression of the key, to select and partly complete the circuits required for operation of the punches corresponding
100 with the key depressed and electromagnetic means also acting on depression of the key to complete said circuits to actuate the punches, and means automatically put into operation when the punches have acted
105 to draw the tape forward a distance determined by the letter that has been punched therein.

110 3. In telegraphic tape punching apparatus, the combination of a series of keys, one for each letter, a plurality of electromagnetically controlled punches equal in number
115 to the maximum number of perforations required for any letter, means for intermittently drawing the tape forward, and devices, controlled on depression of the key, first to select and partly complete the circuits required for operation of the punches
120 corresponding with the key depressed and second to electromagnetically complete said circuits to actuate the punches, means for automatically opening the punch circuits immediately the punches have acted and means automatically put into operation when the punches have acted to draw the tape forward
125 a distance determined by the letter that has been punched therein.

4. In telegraphic tape perforating apparatus, the combination of keys, one for each letter, a plurality of punches equal in number
130 to the maximum number of perforations

required for any letter, electromagnetic devices for operating the respective punches, means for intermittently drawing the tape forward, two independent sources of electrical energy, devices acting, on depression of a key, to select the circuits operating the punches corresponding with the letter represented by the key and to connect the circuits of the punch operating magnets with one such source of electrical energy, electromagnetic means for completing the circuits of the selected punch magnets to effect operation of the punches, devices, also acting on depression of the same key to connect the circuit of such electromagnetic punch circuit closing devices with the other source of electrical energy, means whereby when the punches have acted the punch operating circuits and the circuit of the electromagnetic devices for completing such punch operating circuits are both automatically opened, and means then automatically acting to put the tape drawing devices into operation to draw forward a length of tape determined by the letter that has just been punched in the tape.

5. In telegraphic tape perforating apparatus, the combination of keys, one for each letter, a plurality of punches equal in number to the maximum number of perforations required for any letter, electromagnetic devices for operating the respective punches, means for intermittently drawing the tape forward, two independent sources of electrical energy, devices acting, on depression of a key, to select the circuits operating the punches corresponding with the letter represented by the key and to connect the circuits of the punch operating magnets with one such source of electrical energy, electromagnetic means for thereafter completing the circuits of the selected punch magnets to effect operation of the punches, devices, also acting on depression of the same key to connect the circuit of such electromagnetic punch circuit closing devices with the other source of electrical energy, means whereby when the punches have acted the circuits of the punch operating magnets and the circuit of the electromagnetic devices for completing such punch operating circuits are both automatically opened, electromagnetic devices controlling the tape drawing devices and means whereby when the punches have acted said last named electromagnetic devices are connected in circuit with the source of electrical energy first mentioned to thereby put the tape drawing devices into operation, and means automatically acting to interrupt the last named circuit when the required length of tape has been drawn forward.

6. In telegraphic tape perforating apparatus, the combination with a series of keys, one for each letter, a plurality of punches equal in number to the maximum number

of perforations required for any letter and means whereby the punches are operated on depression of the key to perforate in the tape the letter corresponding with the depressed key, of paper drawing devices automatically put into operation after the punches have acted to draw forward a length of tape dependent upon the letter that has just been perforated, and comprising a continuously running driver, an intermittently rotated contact cylinder, a clutch for connecting them, a series of contact fingers adapted to bear upon the cylinder, means whereby the required finger is permitted to pass into contact with the cylinder, electromagnetically operated tape drawing devices whose circuit is completed through the cylinder and said finger and means whereby the finger is thrown out of electrical communication with the rotating cylinder when the required length of tape has been drawn forward.

7. In telegraphic tape perforating apparatus, tape drawing devices comprising a continuously running driver, a continuously running tape drawing roller driven thereby, a cooperating electromagnetically operated tape drawing roller, a rotatable contact cylinder, a clutch for connecting it with the continuously running driver, a series of contact fingers normally out of contact with the cylinder, means whereby on the perforation of a letter in the tape, the required contact finger is caused to move into contact with the cylinder, means whereby the circuit through such finger and cylinder is automatically interrupted when the tape has been drawn forward the required distance, and an electric circuit completed through the cylinder and finger and including the electromagnetic operating device of the tape drawing roller.

8. In telegraphic tape perforating apparatus, the combination with a series of keys, one for each letter, a plurality of punches equal in number to the maximum number required for any letter, electromagnetic means for controlling the punches, means, whereby on the depression of a key the required punch controlling circuits are selected, a contact maker through which the punch circuits pass and in which they are normally open, an electromagnet for controlling the contact maker, means also acting on depression of the key to complete the circuit of said magnet, after the selection of the punch circuits has been made, to thereby actuate the contact maker and complete the selected punch circuits, tape drawing devices, and means whereby, when the punches have acted, said devices are automatically put into operation to draw forward a length of tape determined by the character that has been perforated in the tape.

9. Telegraphic tape perforating apparatus

comprising the combination of a series of keys, one for each letter, a plurality of punches equal in number to the maximum number required for a letter, electromagnetic means for actuating the punches, a source of electrical energy, means whereby, on the depression of a key, the required punch circuits are selected and connected with such source of energy on open circuit, electromagnetic means for completing such selected punch circuits, a second source of energy, means acting on depression of the key after the punch circuits have been selected to connect the electromagnetic circuit completing devices in closed circuit with said second source of energy whereby the punch circuits are completed and the punches operated, a spacer relay in the circuit of the punch circuit completing devices and through the back contacts of which relay said circuit is completed whereby, on charging of said relay and actuation of the circuit completing devices, the circuit of the latter is opened at the back contacts of the relay, means for then automatically opening the selected punch circuits, tape pulling devices having a series of contact fingers, one for each of the several lengths of tape to be drawn forward after the punching operation, means whereby, on completion of the circuit of the punch circuit completing device, the corresponding contact finger of the tape puller is released, a circuit from the first named source of energy through the front contacts of the spacer relay and through the winding thereof and through said released contact finger of the tape puller to said generator, electromagnetically controlled tape drawing devices and an electromagnetic clutch both included in the last named circuit, a continuously moving driver, a rotatable conducting cylinder coupled to the driver by said clutch and upon which bears the released contact finger and means whereby, when the tape has been drawn forward a required distance, the circuit through the cylinder and finger is interrupted.

10. In telegraphic tape perforating apparatus, the combination of a series of keys, one for each letter, a plurality of punches equal in number to the maximum number required for any letter, electromagnetic devices for controlling them, a series of circuit connections therefor, means whereby, on the depression of a key, the circuits of the required punches are selected, and partly completed, electromagnetically controlled contact making devices through which said circuits normally pass having corresponding series of contacts at which said circuits are normally open and means acting on the depression of the finger piece and after the selection of the punch circuits to close the circuit of the contact making devices to effect closure and opening at the series of

contacts thereof of the selected punch circuits.

11. Telegraphic tape perforating apparatus comprising the combination of keys, one for each letter, punches and their controlling magnets, a source of electrical energy and parallel circuit conductors forming parts of the circuits of the punch controlling magnets, a cam associated with each key and acting on the depression of the key to connect the required conductors in parallel circuits with the source of energy, electromagnetic devices for completing the punch magnet circuits, a source of energy and a second cam associated with each key whereby on the depression of the key the circuit completing devices are caused to act to close the circuits of the punch magnets.

12. Telegraphic tape perforating apparatus comprising the combination of a keyboard, tape punching apparatus, differential tape pulling devices and a double wound spacer relay having back and front circuit completing contacts, and circuit connections whereby when the key is depressed a circuit is completed to effect actuation of the punches, to start the initial movement of the tape pulling devices and to charge the relay through one set of contacts thereof, and when the relay armature is attracted to establish another circuit through its other set of contacts that effects actuation of the tape pulling devices to draw forward a length of tape determined by the character that has just been punched in the tape.

13. In telegraphic tape perforating apparatus of the general character described, the combination with the key board, tape punching apparatus and tape pulling apparatus, of a double wound relay controlling the tape pulling apparatus and having back and front circuit completing contacts and circuit connections through which respectively the two windings of the relay are completed, substantially as described.

14. Telegraphic tape perforating apparatus comprising the combination with the keyboard, tape punching apparatus and tape pulling apparatus, of a double wound relay, a circuit established through one coil and the back contact thereof, an electromagnetic device in such circuit, contacts established by the actuation thereof, a circuit completed by said last named contacts and including the second winding of the relay whereby when the relay armature is attracted it is maintained against its front contact, a third circuit actuating the tape pulling devices established through the front contact of the relay and means for interrupting the second named circuit to deenergize the relay when the required length of tape has been drawn forward.

15. A keyboard tape perforator comprising a series of parallel circuits normally

open at the keyboard and uniting in a common return wire, an electromagnetically controlled contact maker through which the parallel circuits pass having for each circuit normally closed but separable contacts and a contact through which the circuit is completed, and means whereby on the actuation of a key the parallel circuits are closed at the keyboard and the circuit completer energized to first close the parallel circuits and then open them, means for then opening the common return wire and for closing it when the circuit completer returns to normal position.

16. A keyboard tape perforator comprising the combination with punches, controlling magnets therefor and their parallel circuits, of a contact maker through which the parallel circuits pass and comprising for each circuit normally closed but separable contacts and a contact through which the circuit is completed and by which the normally closed contacts are opened when the contact maker is energized, and electromagnetic means operating on the depression of a key to effect actuation of the contact maker.

17. A keyboard tape perforator comprising electromagnetically controlled punches, parallel circuits therefor uniting in a normally closed common return, means whereby during depression of a key the parallel circuits are individually closed and then opened, means for then automatically opening the common return wire and means for again closing the latter when the parts re-assume normal position.

18. A keyboard tape perforator comprising electromagnetically controlled punches, normally open parallel circuits therefor having a common return, means actuating on depression of a key to individually close and then open the respective parallel circuits, means for then opening the common return wire, and electromagnetically controlled means acting on completion of the punching operation to draw forward a length of tape determined by the character punched therein.

19. A keyboard perforator comprising electromagnetically controlled punches, parallel circuits therefor normally open at two points and having a normally closed common return wire, means whereby on depression of a key corresponding punch magnet circuits are first closed at one normally open point and then closed and again broken at the second normally open point, means then acting to open the normally closed common return wire and electromagnetically controlled tape drawing devices acting after the punching operation is completed to draw forward a length of tape determined by the character that has been punched therein.

20. A keyboard tape perforator comprising a contact maker having a rocking armature lever, normally closed pairs of contact points 33, 34, fixed on the armature lever and a stationary contact point 42 one for each pair of normally closed contacts the organization being such that when the armature lever is rocked the normally closed contacts are separated by limitation of movement of one of the members of each pair.

21. A keyboard tape perforator comprising electromagnetically controlled punches and parallel circuits therefor, an electromagnetically controlled contact maker for controlling said parallel circuits, a spacer relay having normally closed contacts in the circuit of the controlling magnet of the contact maker and normally open contacts closed on energization of the relay, and electromagnetically controlled tape drawing devices whose circuit is completed at the normally open contacts of the relay when the latter are closed.

22. A keyboard tape perforator comprising electromagnetically controlled punches, parallel circuits therefor, a contact maker through which said circuits pass and in which they are closed and then opened on actuation of the contact maker, a normally closed common return for said circuits, and means acting on the actuation of the contact maker after the circuits have been closed and opened to automatically open the return wire.

23. A keyboard tape perforator comprising electromagnetically controlled punches, parallel circuits therefor, a contact maker through which the parallel circuits pass, its actuating electromagnet, a double wound spacer relay having normally closed separable contacts and normally open but closable contacts, the circuit of the contact maker magnet passing through the normally closed contacts of the relay, and electromagnetically controlled tape drawing devices whose circuit passes through the normally open contacts of the relay, and means acting on the depression of a key to select the circuits of the corresponding punch magnets and close one of the circuits through the relay.

24. A keyboard tape perforator comprising a relay having two windings, a pair of normally closed but separable contacts and a pair of normally open but closable contacts, an electromagnetic punch circuit contact maker whose circuit passes through the normally closed contacts of the relay, and electromagnetically controlled tape drawing devices whose circuit passes through the normally separated contacts of the relay, means acting on energization of the punch circuit contact maker to close the circuit of one of the coils of the relay thereby effecting separation of its normally closed contacts and

closure of its normally open contacts, means for then closing the circuit of the second winding of the relay to maintain its armature attracted, electromagnetically controlled differential tape-drawing devices whose circuit is completed through said second coil of the relay and through the now closed but normally open contacts thereof, and means whereby the circuits of the tape drawing devices and the second winding of the relay are automatically opened when a length of tape determined by the last character punched therein has been drawn forward.

25. A keyboard tape perforator comprising a relay having two windings and two sets of contacts one set normally open and the other set normally closed, an electromagnetic punch circuit contact maker whose circuit passes through the normally closed contacts of the relay and a differential tape drawing device whose circuit passes through the normally open contacts of the relay.

26. A keyboard tape perforator comprising a relay having two separate coils and its armature lever having normally closed and normally separated contacts, one winding of the relay being completed through the normally closed contacts and the other winding of the relay being completed through the normally open contacts when the latter are closed.

27. A keyboard tape perforator comprising a relay having two separate coils, an armature having normally closed and normally separated contacts, one winding of the relay being completed through the normally closed contacts and the other winding of the relay being completed through the normally open contacts when the latter are closed, electromagnetic means for controlling the punch circuits whose circuit passes through the normally closed contacts of the relay and differential spacer devices whose circuit passes through the normally open contacts of the relay.

28. A keyboard tape perforator comprising parallel punch circuits having normally separated contacts at the keyboard, keys, means acting on depression of the keys to close said normally separated contacts, an electromagnetic contact maker for completing said parallel circuits, and means also actuated on depression of the keys to close the circuit of said contact maker.

29. A keyboard tape perforator comprising parallel punch circuits having normally separated contacts at the keyboard, keys, means acting on depression of the keys to close said normally separated contacts, an electromagnetic contact maker for completing said parallel circuits, and means also actuated on depression of the keys to close the circuit of said contact maker, electromagnetically controlled differential tape-

drawing devices, means by which the circuit thereof is closed on depression of a key and after the circuit of the punch circuit contact maker is closed.

30. A differential spacer device for a keyboard tape perforator comprising a continuously driven tape drawing-wheel, a normally stationary contact cylinder, contact fingers one for each determined spacing movement of the tape normally out of contact with the cylinder, electromagnetic means for putting the respective contact fingers into contact with the cylinder, an electric circuit completed through any one of the contact fingers in contact with the cylinder, electromagnetic means included in said circuit for putting the tape into operative engagement with the continuously driven tape-drawing wheel and causing rotation of the contact cylinder and means whereby when the tape has been drawn forward the determined distance said circuit is automatically opened.

31. A differential spacer device for a keyboard tape perforator comprising a continuously driven tape drawing-wheel, a normally stationary contact cylinder, contact fingers one for each determined spacing movement of the tape normally out of contact with the cylinder, electromagnetic means for putting the respective contact fingers into contact with the cylinder, an electric circuit completed through any one of the contact fingers in contact with the cylinder, an electromagnetic clutch in said circuit to cause rotation of the cylinder synchronously with the continuously driven tape-drawing wheel, an electromagnet also in said circuit and a normally inactive tape drawing-wheel acted upon thereby to press the tape into operative engagement with the continuously driven tape-drawing wheel.

32. A differential spacer device for a keyboard tape perforator comprising a continuously driven tape drawing-wheel, a normally stationary contact cylinder, contact fingers one for each determined spacing movement of the tape normally out of contact with the cylinder, electromagnetic means for putting the respective contact fingers into contact with the cylinder, an electric circuit completed through any one of the contact fingers in contact with the cylinder, electromagnetic means included in said circuit for putting the tape into operative engagement with the continuously driven tape-drawing wheel and causing rotation of the contact cylinder, means whereby when the tape has been drawn forward the determined distance said circuit is automatically opened, and a double wound relay having normally closed contacts and normally opened contacts which relay controls the aforesaid circuit in which the contact cylinder is included and also the

circuit of the electromagnetic devices that put the respective contact fingers into contact with the cylinder.

5 33. A differential spacer device for a key-board tape perforator comprising a continuously driven tape drawing-wheel, a normally stationary contact cylinder, contact fingers one for each determined spacing movement of the tape normally out of contact
10 with the cylinder, electromagnetic means for putting the respective contact fingers into contact with the cylinder, an electric circuit completed through any one of the contact fingers in contact with the cylinder,

and a double wound relay having normally 15 closed contacts and normally opened contacts which relay controls the aforesaid circuit in which the contact cylinder is included and also the circuit of the electromagnetic devices that put the respective 20 contact fingers into contact with the cylinder.

In testimony whereof, I have hereunto subscribed my name.

ROMYN HITCHCOCK.

Witnesses:

GEORGE R. MACEY,
F. W. G. DAVIDSON.