J. GELL.

APPARATUS FOR PERFORATING TAPE FOR AUTOMATIC TELEGRAPH INSTRUMENTS OR THE LIKE.

APPLICATION FILED JAN. 9, 1911. RENEWED FEB. 9, 1912.

1,038,343. Patented Sept. 10, 1912.

5 SHEETS—SHEET 1.

Fig. 1.

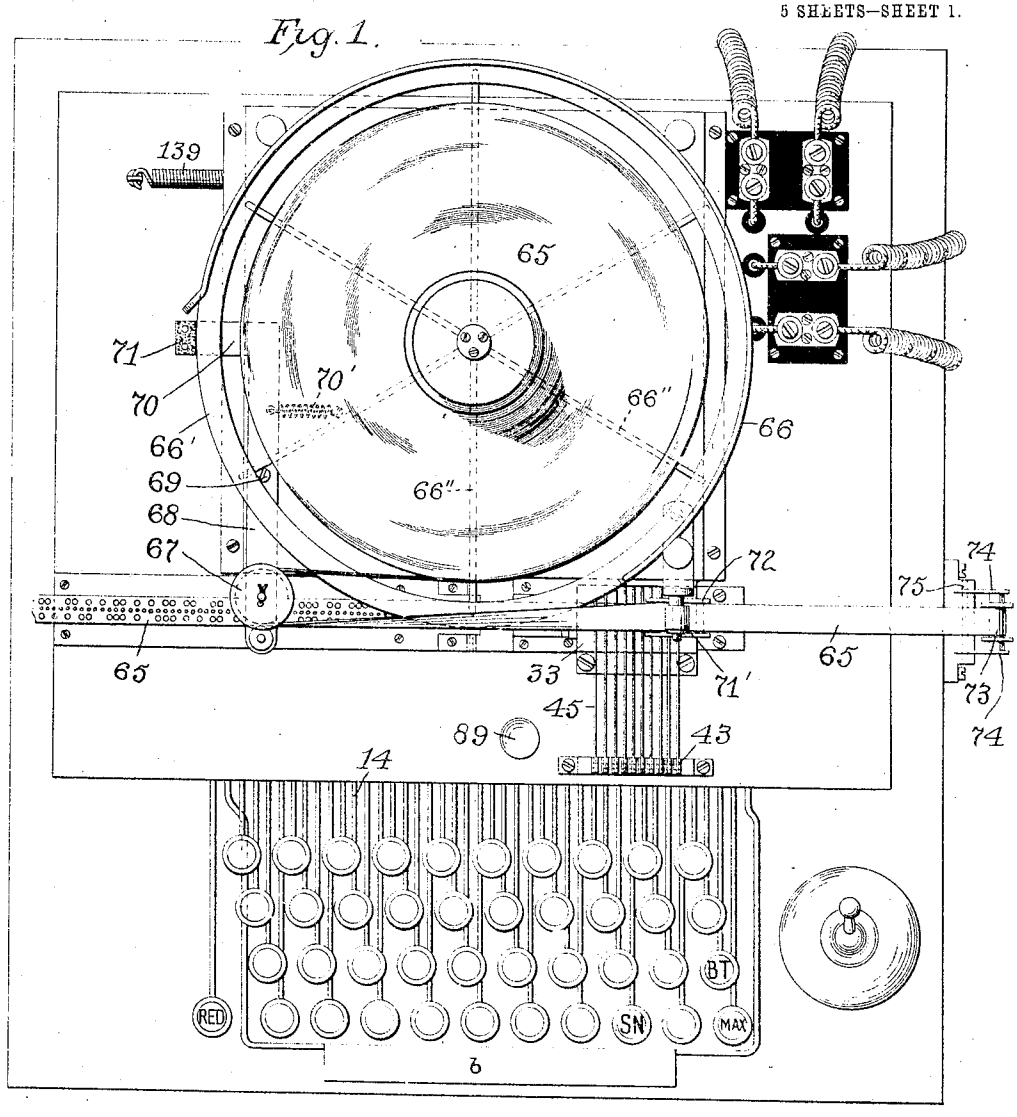


Fig. 2.

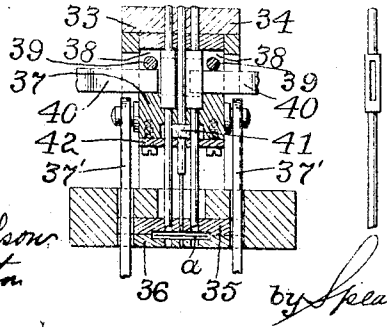
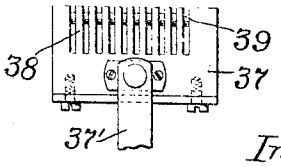


Fig. 3.

Fig. 4.



Attest:
Edwd. L. Tolson
E. H. Sarta

Inventor:
John Gell,
by Spear, Middleton, Donaldson & Spear
Atty's

J. GELL.

APPARATUS FOR PERFORATING TAPE FOR AUTOMATIC TELEGRAPH INSTRUMENTS OR THE LIKE

APPLICATION FILED JAN. 9, 1911. RENEWED FEB. 9, 1912.

1,038,343. Patented Sept. 10, 1912.

5 SHEETS—SHEET 2.

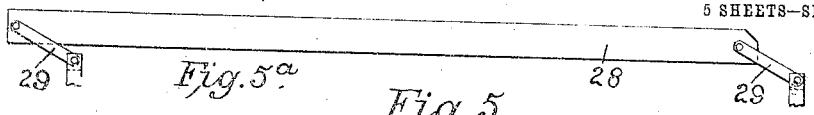


Fig. 5a

Fig. 5.

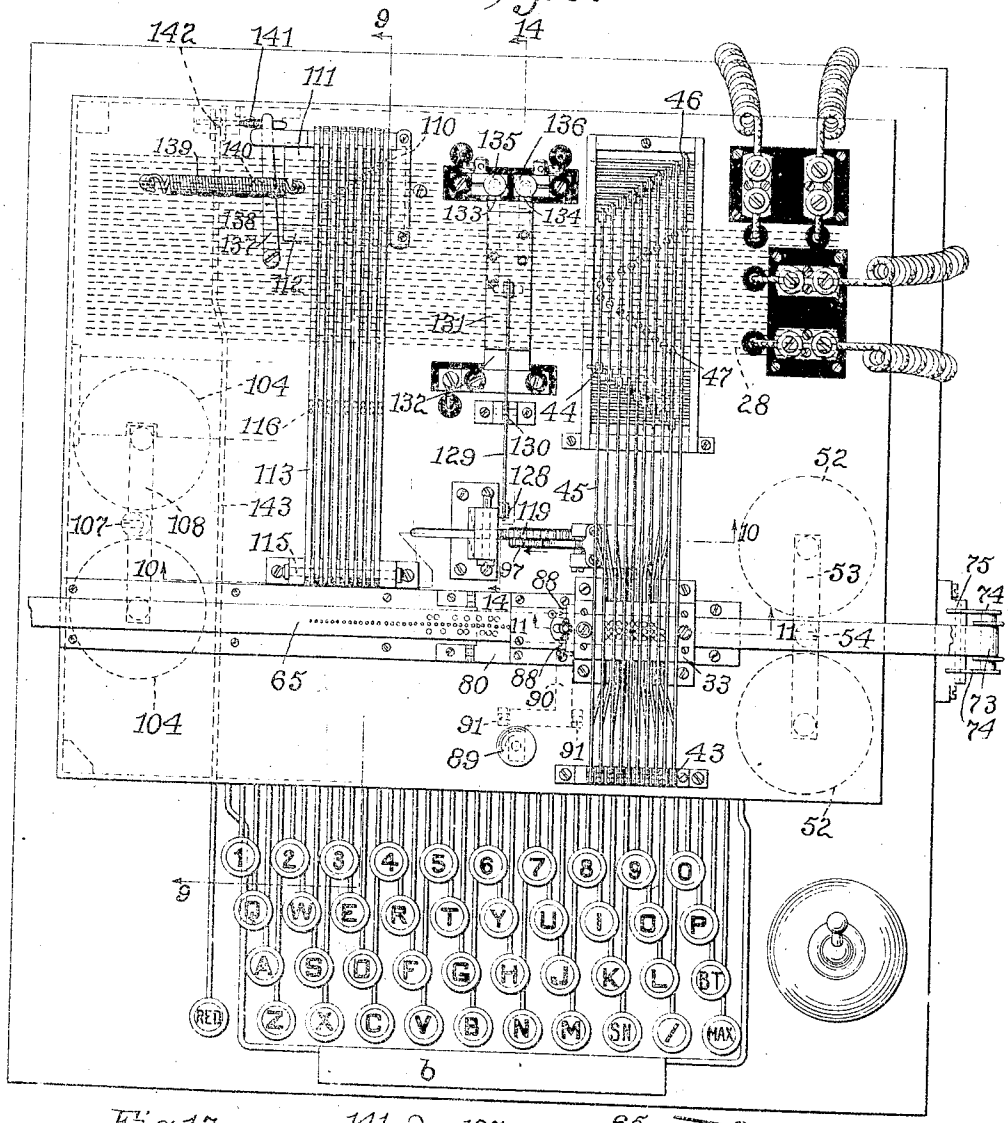
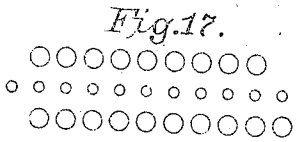


Fig. 17.



Attest:
Edwd. C. Tolson
Ernest

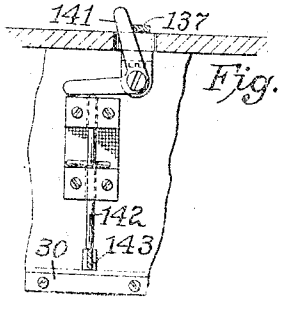


Fig. 6.

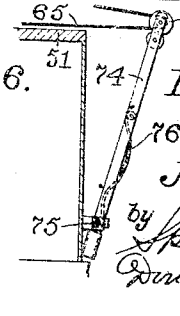


Fig. 6a

Inventor.
John Gell,
by Spear, Middleton
Donaldson & Spear
Attys.

J. GELL.

APPARATUS FOR PERFORATING TAPE FOR AUTOMATIC TELEGRAPH INSTRUMENTS OR THE LIKE.

APPLICATION FILED JAN. 9, 1911. RENEWED FEB. 9, 1912.

1,038,343. Patented Sept. 10, 1912.

5 SHEETS—SHEET 3.

Fig. 9.

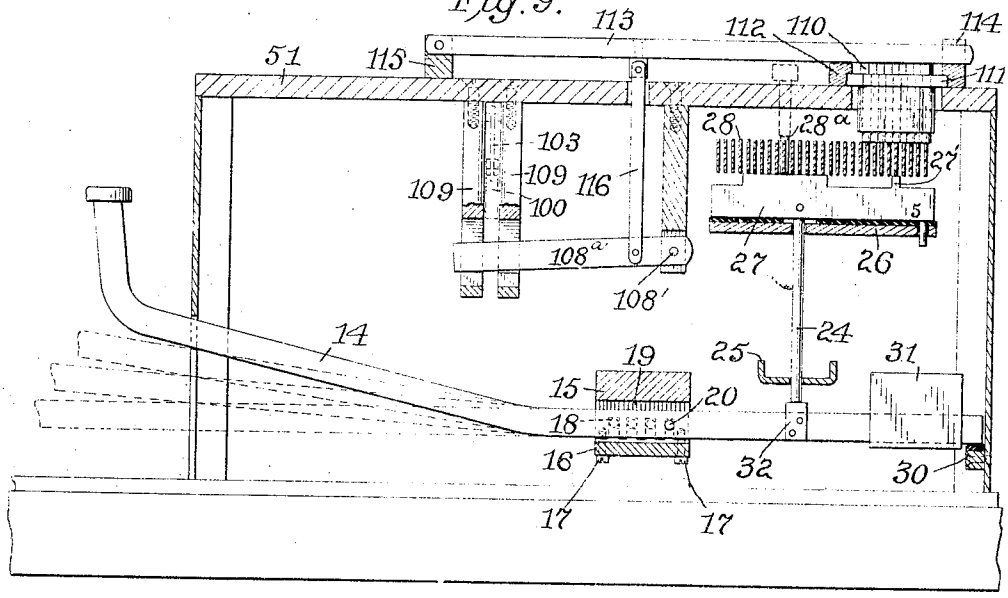


Fig. 7.

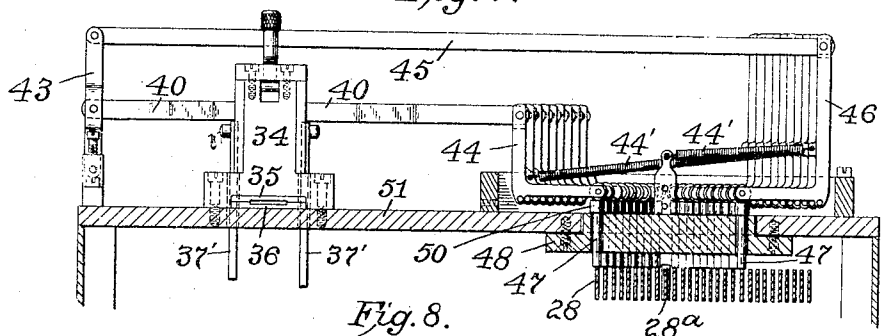
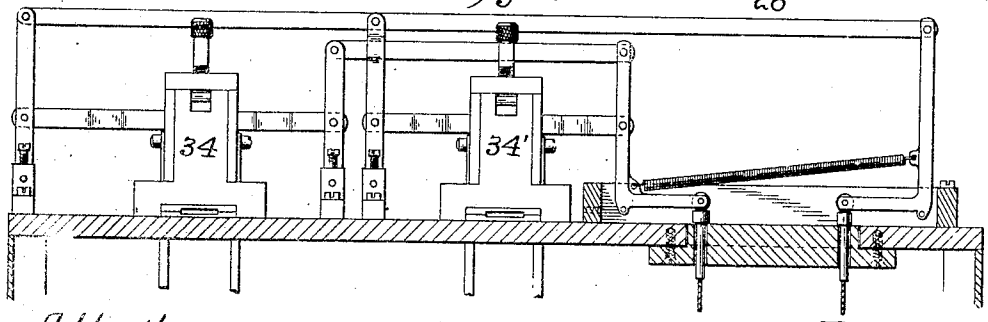


Fig. 8.



Attest:

Edwd. C. Tolson.

Ernest Carter

Inventor:

John Gell,

by Spear, Middleton, Donaldson & Spear

Atty's

J. GELL.

APPARATUS FOR PERFORATING TAPE FOR AUTOMATIC TELEGRAPH INSTRUMENTS OR THE LIKE.

APPLICATION FILED JAN. 9, 1911. RENEWED FEB. 9, 1912.

1,038,343.

Patented Sept. 10, 1912.

5 SHEETS—SHEET 4.

Fig. 10.

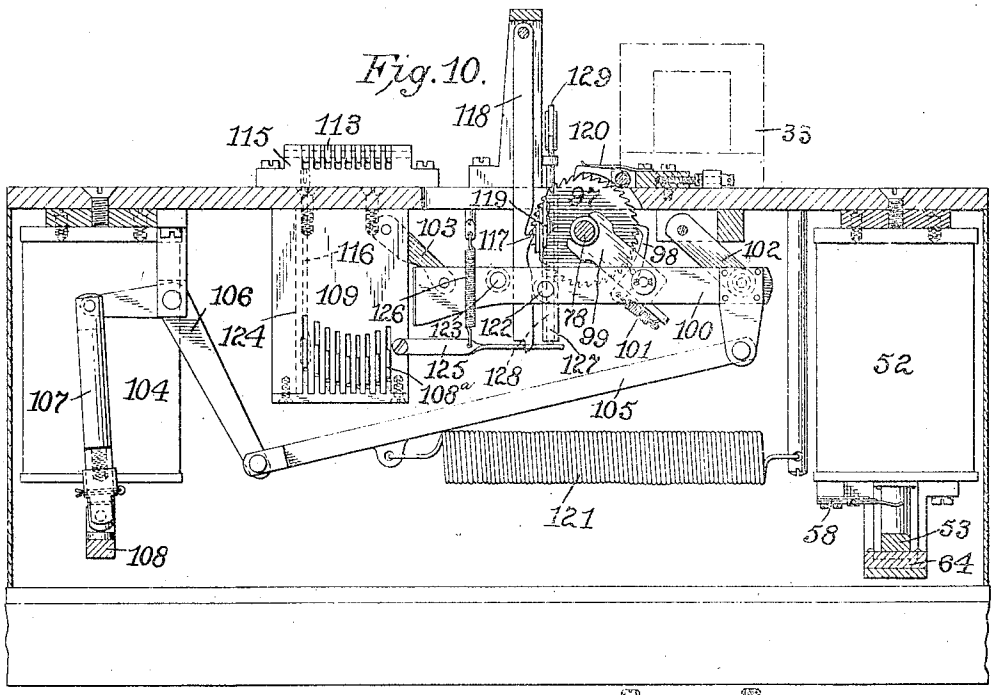


Fig. 11d.

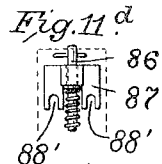


Fig. 11c.

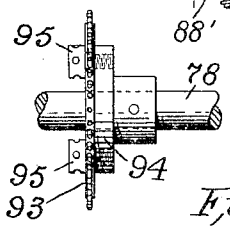


Fig. 11.

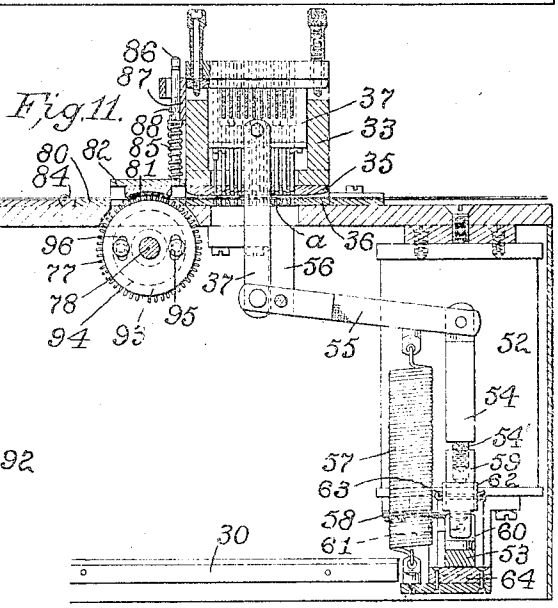


Fig. 11a.

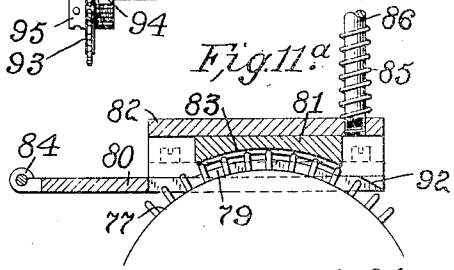
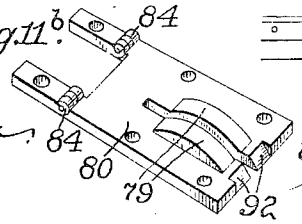


Fig. 11b.



Attest:
Edwd. C. Tolson
Eu Saxton

Inventor:
John Gell,
by Spear, Middleton, Donaldson & Spear
Atty's

J. GELL.

APPARATUS FOR PERFORATING TAPE FOR AUTOMATIC TELEGRAPH INSTRUMENTS OR THE LIKE

APPLICATION FILED JAN. 9, 1911. RENEWED FEB. 9, 1912.

1,038,343. Patented Sept. 10, 1912.

5 SHEETS—SHEET 5.

Fig. 15.

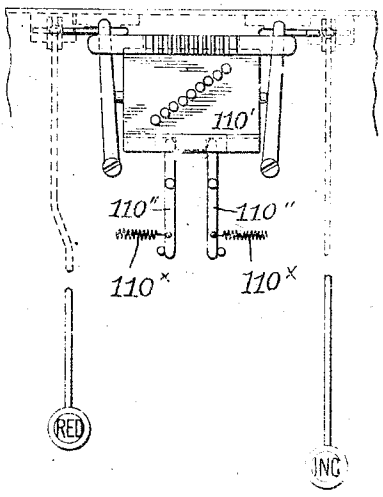


Fig. 12.

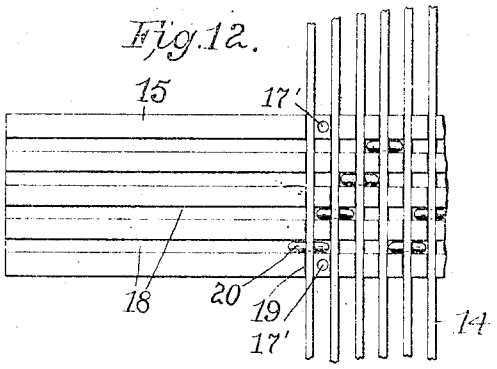


Fig. 13.

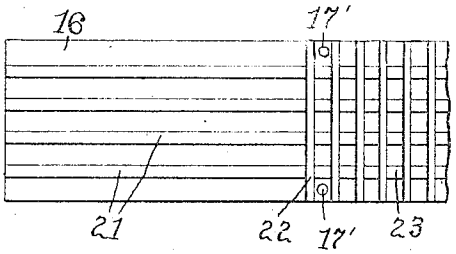


Fig. 16.

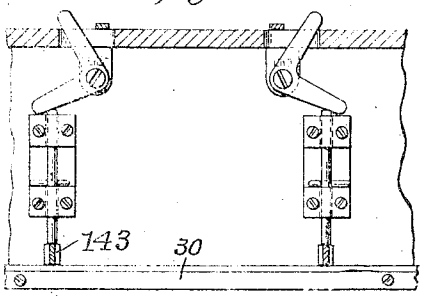
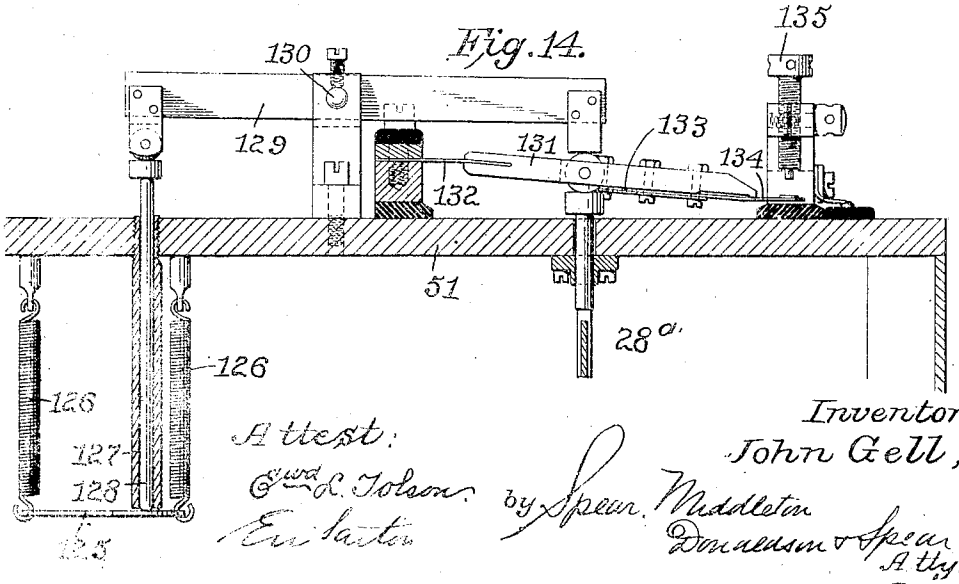


Fig. 14.



Witnesses:
Edward C. Tolson
Ewin Santee

Inventor:
John Gell,
by Spear, Middleton
Donaldson & Spear
Atty's.

UNITED STATES PATENT OFFICE.

JOHN GELL, OF LONDON, ENGLAND.

APPARATUS FOR PERFORATING TAPE FOR AUTOMATIC TELEGRAPH INSTRUMENTS OR THE LIKE.

1,038,343. Specification of Letters Patent. Patented Sept. 10, 1912.

Application filed January 9, 1911, Serial No. 601,751. Renewed February 9, 1912. Serial No. 676,692.

To all whom it may concern:

Be it known that I, JOHN GELL, subject of the King of Great Britain, and resident of London, N., England, have invented certain new and useful Improvements in Apparatus for Perforating Tape for Automatic Telegraph Instruments or the Like, of which the following is a specification.

My present invention is an improvement upon the perforator disclosed by me in Letters Patent of the United States October 7, 1902, #710,448, and February 2, 1904, #751,164, and the invention consists in the features and combination and arrangement of parts hereinafter described and particularly pointed out in the claims.

In the accompanying drawings Figure 1 is a plan view of the apparatus with the roll of tape in place; Figs. 2, 3 and 4 are detail views relating to the punches and the slider for operating them; Fig. 5 is a plan view of the machine with the roll of tape removed; Fig 5ª is a detail view of one of the parallel selecting bars; Fig. 6 is a detail view of the means for adjusting the selecting pins for reducing the tape feed; Fig. 6ª is a detail view of tape take-up or tension means; Fig. 7 is a view of the housing for the punches and the connections for interlocking the punches with the slider for operating them; Fig. 8 is a view similar to Fig. 7 showing a plurality of sets of punching mechanisms to be operated simultaneously for perforating a plurality of tapes; Fig. 9 is a view substantially on the line 9—9 of Fig. 5 of the differential check or stop mechanism of the tape-feed-means; Fig. 10 is a sectional view at right angles to that of Fig. 9 and substantially on the line 10—10 of Fig 5 with parts in elevation; Fig 11 is a sectional view substantially on the line 11 of Fig 5 but with some of the parts in elevation; Figs. 11ª, 11ᵇ, 11ᶜ and 11ᵈ are detail views relating to the tape feed wheel and presser foot mechanism; Fig. 12 is a bottom plan view of portion of the main plate of the fulcrum bar for the key levers, with some of said levers in place; Fig. 13 is a top view of the bottom plate of the fulcrum bar for the key levers; Fig. 14 is a view substantially along the line 14—14 of Fig. 5 of the contact key, with said key and other parts in elevation; Figs. 15 and 16 are respectively a plan and sectional view of the means for securing either a reduced or an increased feed of the tape; Fig. 17 is an enlarged view of diagrammatic form showing the group of the marking hole, spacing hole, punches and intermediate feed hole punches.

The arrangement of the finger keys is substantially the same as that disclosed in the patents above mentioned, excepting in the particulars hereinafter specially mentioned.

The key levers 14 are fulcrumed in a differential fulcrum bar consisting of the main portion 15 and the bottom plate 16 held thereto by the screws 17. The main plate or bar is formed as shown in Figs. 9 and 12 by grooving it longitudinally as at 18, and transversely as at 19, the transverse grooves being deeper, as shown in Fig. 9, than the longitudinal grooves. The key levers lie in the transverse grooves while the fulcrum pins 20 fixed in the key levers lie in the longitudinal grooves, being confined by the walls thereof and bearing upon the bottoms of these grooves. The bottom plate, as shown in Fig. 13, is formed so as to leave projecting longitudinal ribs 21, and as transverse grooves are also formed at 22 in this plate, there are provided a series of projections 23 which, when the bottom plate is in place and secured by the screws passing through the registering holes at 17' will enter the spaces of the main bar and bear on the fulcrum pins 20 of the key levers, thus affording fulcrum points upon which the said pins may turn, the extra depth of the transverse grooves in the main and bottom bars permitting the key levers to have the necessary amount of vertical swinging movement therein. As indicated in Fig. 12, the fulcrum pins of the key levers are arranged in echelon, being thus positioned according to the varying lengths of the key levers so that they will all have the same terminal lift.

The key levers operate vertical rods 24 guided in a frame bar 25, Fig. 9, and in a frame plate 26. At their upper ends they carry each a selecting comb 27 having teeth to engage and lift certain predetermined groups or combinations of parallel bars 28 which are supported by links 29 pivotally mounted in the frame. The movement of these parallel selecting-bars controls the operation of the various groups of mechanism embodied in the apparatus, as will herein-

after appear. At the back of the frame a stop bar 30 is provided, and the key levers are weighted at 31 to hold them normally against this stop bar in order to even up the key-board, and this evening action is independent of the weight of the parallel bars, so that should a key be operated calling for the raising of a certain number of parallel bars including those bars common to another letter containing a less number of elements, the tendency of destroying the balance of the key board and the evenness thereof will be removed by the employment of the overweighted key levers and the back stop. Each key lever is provided with an anvil 32 which works against the lower end of the comb bar or stem 24.

Punching mechanism.—The grouping of the punches for perforating the tape is shown in Fig. 17, the upper row being the marking hole punches, the lower row the spacing hole punches, while the intermediate punches are for the feed holes, there being nine marking hole punches, ten spacing hole punches and eleven feed hole punches. Fig. 17 is the chart of the group of punches for the international Morse double current system. The American Morse code requires fewer punches than illustrated in Fig. 17, and the international cable code requires still fewer punches. It will be understood that my invention can be carried out with either grouping of punches, the operating mechanism being the same in each case, and my invention, therefore, is not limited to any particular code or grouping of punches, but moreover, the construction permits, where required, of a standard type of instrument with interchangeable letter combs to meet the special differences between the several systems. These punches are mounted to slide vertically in a housing 33 being guided in a top plate 34 thereof, and in the guide-die-plate 35 arranged above the cutting-die plate 36, the tape to be perforated passing through the channel or space between these die plates shown in Figs. 2 and 11. A slider 37 is movable vertically within the punch housing by pitman 37′, operated as will be hereinafter described, and this slider has slots on each side shown at 38 in Figs. 2 and 4, and cross pins 39 extending across the upper ends of the slots, these slots receiving interlocking bars or pins 40 which, when projected inwardly in any predetermined groups, as selected by the combs, will select and connect the proper punches, to represent the letter, with the slider, so that when the slider is moved down, it will carry with it the punches selected to perforate the tape with the desired number and grouping of holes to represent the character corresponding to the key operated. For this purpose each marking-hole and spacing-hole punch is provided with an eye or opening to receive the interlocking pin or bar, as shown in Fig. 3. Only those marking and spacing hole punches are carried down by the slider which are selected by the interlocking bars, but at each downward movement of the slider all of the feed hole punches are carried down to perforate the tape with the full number of feed holes. For this purpose the central feed hole punches are provided each with a boss or shoulder 41 being held in a recess in the slider by the bottom plate 42 screwed in place, and as the upper wall of this recess bears on the shoulders of the feed-hole punches, the whole series of said feed-hole punches will be carried down at each operation, whether the character printed be made up of few or many of the marking and spacing punches, and if of the former and the feed of the tape is short, some of the feed-hole punches will simply pass idly through the feed-holes which were punched at the previous operation. By the use of these feed-hole punches which operate at each depression of the slider, I am enabled to employ a maximum feed key marked "Max" on the keyboard, so that when a maximum feed of tape is required, or when a length of tape is required having only central feed-holes punched therein, instead of depressing the space key five times (when it is arranged for double spacing), or eleven times (when it is arranged for single spacing), the "max" key is operated, causing at one operation eleven holes to be cut, and the tape fed forward that distance, as will be hereinafter described.

The space key or bar is shown at *b*, and when this is depressed all of the feed-hole punches will be carried down to perforate the paper, but instead of the maximum feed of tape taking place, a shorter feed of tape, as just referred to of one or two holes, takes place for spacing between words.

The interlocking bars 40 operate in two sets, one at the front and the other at the rear of the punch housing, those of the front set being pivoted to pivoted levers 43 and those of the rear set being pivoted to bell crank levers 44. The levers 43 are connected by links 45 to bell crank levers 46, and these bell crank levers are operated by springs 44′ and by selecting pins 47 passing through a plate 48, and engaged by the parallel selecting bars 28, and as before described, these parallel bars are selected and operated in certain groups by the teeth or projections on the comb bars 27, according to which key is operated.

There are twenty-nine parallel selecting bars as shown in Figs. 7 and 9, twenty of these controlling the formation of the letters and nine controlling the tape feed action.

The selecting pin guide plate 48 is secured by screws to the top plate of the machine, so

that by removing these screws the said plate may be taken out, together with the whole set of pins 47 for cleaning the said pins and the guide holes through which they pass. The pins rest in the plate by their shoulders 50 bearing on the upper side of the plate. The object of these shoulders is to prevent the pins falling through when the upper main plate 51 is lifted clear of the parallel bars 28. In getting access to the removable pin-carrying plate, the upper frame plate 51 is first removed, and then the pin plate 48 is removed from the underside. This renders unnecessary disturbing the interlocking bar action and levers arranged above the frame plate.

The slider of the punch mechanism for forcing the punches down through the paper tape is operated by electro-magnetic means, and while I employ in my present machine solenoids, it will be understood that the substantial equivalent, *i. e.*, electro-magnets, may be employed instead. A pair of these solenoids are used, one of which is shown in Fig. 11 at 52 attached to the under side of the top plate 51 of the frame. The cores of these solenoids are attached to the cross bar 53, which has connected thereto the rod 54 which operates a lever 55 pivoted to a bracket 56 and forked to connect with the pitman 37′ of the slider, as before referred to. When the solenoids, or the electro-magnets, as the case may be, are operated, the connections will be operated to draw the slider down to force the group of selected marking and spacing punches and all the feed-hole punches through the tape, and in the form shown the connections are operated by the cores of the solenoids pulling up the cross bar 53 and operating the rod 54 and lever 55. The connections are returned to raise the punches by a spring 57, and in order to assist this spring in starting the withdrawal movement of the punches, I employ a reinforcing spring 58 of leaf form which is borne upon by the cross bar 53 when this nearly completes its upward movement, thus adding its force to that of the spring 57 to start the upward movement of the punches at the time when they might have a tendency to hang in the tape.

I provide means for adjusting the connections to alter the position of the punches in relation to the tape in a vertical direction, especially to provide means of readjustment when the punches have been shortened by resharpening. This means consists of the screw threaded shank 54′ of the bar 54 entering a screw threaded socket in the coupling member 59, which is connected with the lug 60 of the cross bar 53 by a pin 61. This pin is held in place by a sleeve 62 held on the coupling by a split pin 63, the sleeve having side portions reaching over the pin 61. By removing the pin 63 the sleeve 62 can be slid back to uncover the pin 61, which may then be removed, and then the bar 54, with the coupling, can be swung out from between the two solenoids, so that access may be had to the coupling to turn the same on the screw stem 54′ and thus adjust the connections to properly operate the punches, the parts being attached again by bringing the forked end of the coupling 59 to embrace the lug 60, inserting the pin 61, sliding the sleeve 62 over this pin and securing it in place by the split pin 63. The cross bar, when down, rests upon the stop 64, which may be of rubber.

The connection described provides for adjustment without requiring much space, and thus the solenoids can be placed close together to secure the best results.

Tape and tape feed.—The tape 65 coiled into a roll, as shown in Fig. 1, is mounted upon a holder 66 consisting of a rim 66′ and spokes 66″, which is mounted to rotate freely when the tape is drawn, whence it passes around a pulley or guide roller 67 carried upon a lever 68 pivoted to the frame at 69, and having an arm 70 with a brake shoe 71 fixed thereto, so that the pull on the tape, due to the feeding mechanism acting thereon as will be described, will release the brake to allow the holder to rotate and the tape to be drawn freely from the coil or roll, but when the pull ceases, the brake is applied by a spring 70′. The tape passes between guide rolls 71′, 72, and over and thence under a tension roller 73 mounted in arms 74 pivoted to the frame at 75, and pressed by a spring 76, Fig. 6ª, to take up any slack in the tape, after it leaves the supply roll. From the tension roller the tape passes to the punches between the die platens, as shown at *a*, Figs. 2 and 11.

Immediately after passing the punches, the tape is engaged by the teeth of the star feed wheel 77 mounted on the shaft 78, the teeth of said wheel engaging the feed holes in the tape to feed it along the required distances in accordance with the length of the letter or in accordance with the distances required when either the "max" key, the space key *b* or the "red" feed key is pressed. In order to guide the tape to this feed wheel, it enters a channel formed between the curved surfaces 79 on the plate 80, and the curved presser foot 81, said presser foot consisting of a block fixed to a housing 82, which is screwed to the plate 80, the said presser foot having a groove 83 to receive the teeth of the star-feed wheel. The curve of the under face of the presser foot and the surfaces 79 is concentric with the star feed wheel, so that the tape is directed concentric with the path of the teeth, and a number of the teeth will be engaging the feed holes in the tape at the same time and with accuracy to jointly feed the same along.

The curved passage is of a size or height equal to double the thickness of the tape so that as a single thickness of tape is fed through, it may pass freely through the passage, but is held by the presser foot in position to insure proper engagement therewith by the teeth of the feed wheel.

The plate 80 is slotted, as shown in Fig. 11^b, to receive the star-feed wheel, the curved surfaces 79 being on each side of this slot. The plate is hinged at 84 and it, together with the presser foot, is pressed down in proper relation to the star-feed wheel by a spring 85 surrounding a stem 86 and bearing at its upper end on the underside of a bracket 87 secured by screws 88 passing through slots 88′ in the bracket or block. This block has an enlarged hole receiving the upper end of the stem of the presser foot, so that the plate 80, together with the presser foot, may be moved upwardly, turning on the pivots at 84 for this purpose, the post moving in the enlarged hole in the bracket. For thus raising the presser foot and the plate 80 for the insertion of the tape, a key 89 is pressed which rocks a lever 90 pivoted at 91 to the under side of the top plate of the casing, the end of this lever bearing upon the under side of the plate 80 and lifting it against the pressure of the spring 85, so that the curved channel will be raised in respect to the teeth of the star feed wheel for threading the end of the tape through said channel. The front edge of the plate 80 is beveled at 92 to direct the tape up into the guide channel. The presser foot does not exert any pressure on the tape, but simply positions the curved guide channel properly in relation to the teeth of the star feed wheel to insure proper engagement of the teeth with the feed holes in the tape, which is then capable of passing freely along the channel.

By loosening the screws 88, the plate 80, together with the presser foot, its stem and the bracket or guide block 87, can be thrown back on the pivots 84 to expose the star feed wheel and exit mouth of the tape passage of the punch housing for cleaning and for adjusting the star-feed wheel in relation to the punches to regulate the feed.

Star feed wheel.—This wheel is of special and simple construction, consisting of a disk or plate 93 having the teeth and secured to a disk 94 fixed on the shaft 78 by screws 95 passing through slots 96 in the wheel disk into the fixed disk. By this construction the star feed wheel can be adjusted in relation to the shaft 78, which is moved differentially, as will now be described, according to the length of the letter, and thus the teeth of the feed wheel can be set to secure accuracy of feed.

Differential tape feed.—The shaft 78, as shown in Fig. 10, is rotated by a ratchet wheel 97 fixed thereto and a pawl 98 carried by an arm 99, the forked or slotted end of which swings on the shaft 78. This arm 99 is pivotally mounted on the feed girder 100 a spring 101 keeping the pawl in engagement with the ratchet wheel. This feed-girder is hung on parallel links 102—103 pivotally mounted in the frame. The feed girder is moved leftward, Fig. 10, to move the pawl 98 in position for a new feed action by power means consisting in its best form of a pair of solenoids, one of which is shown at 104, though, as before stated, other equivalent electro-magnetic means may be employed, namely: electro-magnets. The operating connections include a pitman 105, a lever 106 pivotally mounted in a frame bracket and connected by a bar 107 with a cross bar 108, to which the cores of the solenoids are connected. The leftward setting movement of the feed girder due to the action of the feed-setting solenoids is limited differentially in accordance with the key struck and the length of the letter corresponding thereto. The limiting stops in the present case consist of swinging arms or stop-feed bars 108^s, Figs. 9 and 10, pivotally mounted at 108′ in a frame bracket and guided a their free ends through fixed cheek blocks 109 between which the feed-girder swings. There are nine of these stop-feed bars, and they are selected according to which key is depressed, by teeth 27′ on the combs 27, operating through the parallel bars 28 and selecting pins 110, Figs. 5 and 9, which pass through a carrier block 111 guided in ways 112 fixed on the frame, said pins, in turn, selecting and operating levers 113 guided at their free ends in a comb bar 114 and pivotally mounted on the frame at 115. These levers are corrected by links 116 with the stop-feed bars 108^s. By this arrangement of levers 113 and connections, a long leverage is secured, and as the pins 110 contact with the levers at or near their outer ends, the rubbing and wear of these pins on the levers will be reduced to a minimum, and ease of touch at the keys will be secured. Furthermore, the use of swinging stop feed bars 108^s instead of sliding pins renders the touch easier and the action with less movement.

Operation of the differential tape feed mechanism.—Supposing a key is depressed representing a letter with two feed holes, the first action will be to lift that one of the combs 27 corresponding to that key, and this will select the proper parallel bar of the set at 28 and through the described connections shown in Fig. 9, the first stop feed bar 108^s counting from the right of Fig. 10 will be moved up between the cheek blocks into the path of the end of the feed-girder, and as soon as this has taken place, the feed-setting solenoids are energized, as

will be hereinafter described, and the feed-girder will be moved leftward, Fig. 10, until it sets itself against the first stop feed bar, thus setting the pawl 98 back on the ratchet the amount required for feeding the tape forward two feed-holes when said pawl turns the wheel upon the movement of the feed girder to the right, as will be later referred to. The leftward setting movement of the feed girder has the effect also of removing the tooth 117 of the reverse check lever 118 from the check ratchet wheel 119 fixed on the shaft 78, and having its teeth set reversely from that of the feed ratchet wheel 97. This latter ratchet is also controlled by a detent 120. While the parts of the tape feed mechanism are in this set position with the feed girder drawn to the left, Fig. 10, ready to perform the tape feeding action, the punches are operated by the energizing of the solenoids 52 as before described, and the tape is therefore perforated, and as soon as this has been accomplished and the punches have risen free from the tape, the feed-setting solenoids 104 are deënergized and a spring 121 draws the feed-girder 100 to the right, Fig. 10, thus causing the feed pawl 98 to turn the ratchet 97 and the shaft 78, and also the star-feed wheel 93 an amount corresponding to the number of feed holes the feed mechanism has been set for, in this instance, two feed holes, the movement being arrested by the reverse check-tooth 117 on the lever 118 engaging the check ratchet. This lever 118 is controlled from the feed-girder 100 by pins or rollers 122, 123 on the feed girder bearing on the lever. This check tooth arrests the feed accurately to the number of feed holes required. If a key is pressed requiring three feed holes, then the second setting stop or check bar 108^a counting from the right of the series will be set to arrest the leftward movement of the feed girder, and when the feed-girder returns to the right, it will cause a feed of the tape equal to three feed holes, and so on throughout the series according to the length of the letters to be cut.

For the maximum feed, when the "max" key is depressed, no one of the stop feed bars is operated, the stop, in this instance, being the end wall of the check block indicated by a dotted line at 124 in Fig. 10, the feed girder, in this case, swinging its maximum distance to the left in being set.

It will be observed that the pawl carrying arm 99, instead of being pivoted on the shaft 78, engages the same loosely or by a forked or slotted connection, and that the feed girder is hung upon the two links 102 and 103, the arm 99 being simply for the purpose of carrying the feed pawl. This avoids strain on the parts and particularly the shaft.

In order to avoid rebound of the check-tooth lever 118 under high speed and a consequent overthrow of the feed mechanism, I provide a detent lever 125 pressed by spring 126 and arranged to engage the toothed lower end of the check-tooth-lever when this swings to the right to check the movement of the feed ratchet. This detent brings up against a tubular stop arm 127 depending from the casing. The detent is depressed to free the check tooth lever for the setting action of the feed mechanism by a pin 128 passing down through the tubular stop and bearing on the detent. This release pin is operated by a lever 129, Fig. 14, pivoted to the top plate at 130, and in turn operated by the lifting of the contact key or plate 131 mounted on a spring leaf or blade 132 and carrying the spring contacts 133, 134, which close the electric circuits in which are included the feed setting solenoids and the punch operating solenoids, and these contact springs are so arranged relatively to their contact screws 135 and 136 that the feed setting mechanism will be operated first and then the punch solenoids. The release pin is depressed to release the detent from the check tooth lever as soon as the contact key or plate is lifted, and this lifting is due to the parallel bar 28^a which is common to all the combs 27. In the use of this contact plate or key held by the spring blade 132, I avoid the use of pivots which are objectionable in that wear of these pivots would cause side play in the key.

Electric-circuit connectors.—As the electric circuit connections are substantially the same as those of the Patent 751164 above mentioned, and as the sequence of operations is the same as set forth in said patent, it is not thought necessary to describe or illustrate the same herein.

Reducing or increasing feed.—The selecting pins 110 which are selected by the feed controlling parallel bars and which, in turn, select the proper set of levers 113 for setting the check or stop feed bars 108^a, are carried by the plate 111 slidable in the guide ways 112. This plate is controlled by a lever 137, Fig. 5, which bears upon a pin 138 (dotted lines), on the carrier plate. The plate is drawn to the left by a spring 139, a pin 140 determining the position of the plate in this direction.

A bell crank lever 141, Figs. 5 and 6, when the reduce-feed key marked "Red" is depressed, is operated through a rod 142 from the reduce key lever 143, Fig. 6, and thus moves the carrier plate to the right so that, for instance, the selecting pin which would have selected that lever 113 for setting the second stop feed bar 108^a for a three hole feed, when the carrier plate 110 was in normal position, will now select the first lever, so that the tape will be advanced

only two feed holes instead of three, and thus by first depressing the reduce-feed key and then the letter key, one feed hole will be eliminated where otherwise there would have been two feed holes, and if another letter key is now depressed, the perforations representing this letter will be cut contiguous to the perforations first cut to form a composite character, which, for instance, will represent one of the punctuation or arbitrary signs as may be previously determined upon. On release of the reduce-feed key, the carrier plate, with its selecting pins, resumes its normal position under the action of spring 139.

Increase feed mechanism.—As shown in Figs. 15 and 16, I employ an increase feed key for the purpose of increasing the space between successive characters. This mechanism consists of a key marked "Inc", and when this is pressed, the carrier plate 110′ for the selecting pins would be given a movement to the left instead of to the right, so that the reverse effect from that just described in connection with the reduce-feed key would take place, namely: the feed of the tape would be increased above the normal. This increase-feed key is also combined with the reduce feed key "red" as shown in said figure, so that the carrier plate may be moved either way for either of the above effects.

For holding the carrier plate in normal position, and for returning it to said normal position when moved either way therefrom, I provide the two levers 110″ one bearing on each side of a projection on the carrier plate, said levers being pressed by springs 110ˣ to hold them normally against stop pins, and thus set the carrier plate in normal position. If the plate is moved either way, the lever 110″ on that side will yield to permit the movement, but as soon as the key lever is released, the carrier plate will resume its normal position under the action of the spring 110ˣ.

Producing a plurality of tapes.—When more than one tape is required to be perforated for use on different circuits, I employ the arrangement shown in Fig. 8, in which one or more additional sets of punches may be used in punch blocks or housings 34, 34′, the inter-locking bars of the different blocks being connected up to operate in unison from the same selecting mechanism above described.

In the art as heretofore practised, when it was necessary to punch more than one tape, the passageway *a* between the dies 35 and 36 was increased, and the superimposed tapes were passed through the punch block as though they were one tape. But a limit is soon reached as to the number of tapes that may be so superimposed, and to meet this difficulty I provide the mechanism shown in Fig. 8, which is used in connection with the rest of the mechanism as previously described, the only alterations being in extending the feed shaft 78 and employing as many star-feed wheels and presser-feet as there are punch blocks.

I claim:—

1. In combination in apparatus of the class described, tape feed mechanism, tape perforating mechanism, selecting mechanism, key levers, and a differential fulcrum comprising the upper bar having longitudinal and transverse grooves, pins on the key levers lying in the longitudinal grooves, and a second bar secured at the bottom of the first bar and having longitudinal and transverse grooves forming projections fitting in the longitudinal grooves of the first bar and upon which projections the fulcrum pins rest, substantially as described.

2. In combination in apparatus of the class described, a series of marking-hole and spacing-hole punches, a set of feed-hole punches corresponding to the marking-hole and spacing hole punches, selecting means for the marking-hole and spacing-hole punches, and means for operating the selected punches and for simultaneously operating therewith all of the feed-hole punches irrespective of the length of the character perforated.

3. In combination in a machine of the class described, marking-hole punches, spacing-hole punches, a slider, selecting mechanism to connect the said punches in different groups with the slider to be operated thereby, and a series of feed-hole punches operated by the slider independently of the other punches, substantially as described.

4. In combination, marking and spacing-hole punches, a slider, selecting mechanism to connect the said punches in predetermined groups with the slider, a series of feed-hole punches all of which are operated by the slider at each action, character keys with means for operating the selecting mechanism and the slider, differential tape-feed means controlled from the character keys, and a key with connections for effecting the operation of the slider to move the series of feed-hole punches independently of the character punches, substantially as described.

5. In combination in a machine of the class described, marking-hole punches, spacing-hole punches, a slider, selecting mechanism to connect the said punches in different groups with the slider to be operated thereby, a series of feed-hole punches operated by the slider independently of the other punches, and a maximum feed key with means controlled thereby for operating the slider to operate the feed-hole punches, and differential tape feed mechanism to feed the tape according to the length of the

character perforated or to give the maximum feed when the maximum key is operated, substantially as described.

6. In combination in a machine of the class described, a series of marking hole and spacing hole punches, a series of feed hole punches corresponding thereto, selecting mechanism for the marking and spacing hole punches, a slider for carrying the selected punches and all the feed hole punches, a space key, and a maximum feed key with connections for operating the slider and differential tape feed mechanism to give one feed when the space key is depressed and another and longer feed when the maximum space key is depressed, substantially as described.

7. In combination marking-hole punches, spacing-hole punches, a series of feed hole punches, a maximum feed key, connections between the same and the series of feed-hole punches for operating them all at one operation and independently of the marking-hole and spacing-hole punches, character keys, and differential tape feed mechanism, substantially as described.

8. In combination in a machine of the class described, punches, a slider, interlocking pins to connect the punches with the slider, selecting mechanism consisting of the combs, the parallel bars and the selecting pins, and a plate carrying the selecting pins and detachably mounted in the frame for removing all the pins at one operation independent of the parallel bars, substantially as described.

9. In combination the punches, electro-magnetic means with connections for operating the punches through the tape, a spring for returning the punches, and a reinforcing spring for starting the return movement of the punches, said spring then going out of action to permit the return being completed by the main spring, substantially as described.

10. In combination the punches, electro-magnetic means for operating the punches including two electro-magnetic members, a cross bar operated thereby and a connection extending between them to operate the punches, said connection having a detachable section adjustable on the other section by turning it on the screw joint between the sections, and a coupling to hold the adjustable section to the cross bar, substantially as described.

11. In combination the punches, a tape holder adapted to rotate, tape feed means for drawing the tape from said holder past the punches, and a brake acting on the rotary tape holder, said brake having the tape guided thereby and being controlled by the pull on the tape to release the holder, said brake acting on the holder when the pull on the tape ceases, substantially as described.

12. In combination punches, a star feed wheel, the curved guideway concentric with the teeth of the star-feed wheel for guiding the tape about the periphery of said wheel and through which guideway the tape can freely pass, said guideway being formed of curved guide surfaces upon which the tape rests on each side of the star-feed wheel, and a curved guide shoe held in fixed relation to said guide surfaces, substantially as described.

13. In combination punches, a star feed wheel, a pivoted plate slotted to receive the star feed wheel and carrying a free way for the tape concentric with the star-feed wheel, a spring for forcing the plate down, said plate being adapted to be swung back to permit access to the star feed wheel and tape, substantially as described.

14. In combination punches, a star feed wheel, a pivoted plate slotted to receive the star-feed wheel and carrying a free way for the tape concentric with the star-feed wheel, a spring for forcing the plate down, said plate being adapted to be swung back to permit access to the star-feed wheel and tape, a stem connected to the plate and surrounded by the spring, a bracket removably held and having an enlarged opening to receive the stem, substantially as described.

15. In combination punches, a star feed wheel, a movable member carrying a channel concentric with the teeth of the star-feed wheel, and a finger piece with a lever operated thereby for raising the movable member, substantially as described.

16. In combination with punches, a star feed wheel consisting of a disk with teeth thereon, a shaft, feed mechanism for operating the shaft, a carrier on the shaft, said feed wheel having its disk adjustably secured to the carrier by a screw and slot connection permitting the disk to be adjusted circumferentially in relation to the shaft, substantially as described.

17. In combination punches, a star feed wheel, and its shaft, an oscillating feed girder, a pair of parallel links supporting said feed girder, an arm pivoted to the feed girder and fulcrumed axially of the star feed wheel shaft, a pawl carried by the arm and a ratchet wheel operated by the pawl, substantially as described.

18. In combination punches, a star feed wheel, a fed girder, with a connection to the star feed wheel for operating the same, a series of stop-feed bars pivotally mounted to swing into the path of the feed girder, keys, means operated thereby for setting the bars, and means for operating the feed girder, substantially as described.

19. In combination punches, differential tape feed mechanism including a feed girder, pivotally mounted stop feed bars, operating levers pivotally mounted at one end.

selecting pins operating under the other ends of said levers for raising them, and links connecting the operating levers and the pivoted stop bars at intermediate points in the length of said levers and bars, substantially as described.

20. In combination punches, a star-feed wheel for the tape, a ratchet wheel, a pawl, means for operating the pawl to turn the ratchet, comprising an oscillating feed-girder, a check tooth lever connected with the feed girder, and a detent for the check-tooth lever for preventing rebound and over feed, substantially as described.

21. In combination punches, a star-feed wheel for the tape, a ratchet wheel, a pawl, means for operating the pawl to turn the ratchet, comprising an oscillating feed-girder, a check tooth lever connected with the feed girder, a detent for the check-tooth lever for preventing rebound and over feed, and means for releasing said detent controlled from the keys, substantially as described.

22. In combination punches, a star-feed wheel for feeding tape, a feed-girder with connections for operating the star feed wheel therefrom, electro-magnetic means for operating the feed girder, electro-magnetic means for operating the punches, a contact key for controlling said electro-magnetic means, a reverse-check-tooth lever for arresting the feed, a detent for preventing rebound and overfeed, and a connection for releasing the detent consisting of the pin bearing on the detent and the lever operated from the contact key for moving said pin, substantially as described.

23. In combination in apparatus of the class described, punches, tape feed mechanism, differential stop feed bars, keys, connections between the keys and the stop feed bars including selecting pins, and a carrier therefore, connections between said selecting pins and the stop feed bars, said connections being selected by the said selecting pins, a carrier for said selecting pins, and an increase-feed key for shifting said carrier to make the selecting pins select a stop-feed bar for a longer feed than normal, substantially as described.

24. In combination in apparatus of the class described, punches, tape feed mechanism, character keys with means controlled thereby for operating the punches and the tape feed mechanism, a reduce-feed key and an increase-feed key with connections controlled thereby for reducing or increasing the tape feed when the character keys are operated, substantially as described.

25. In combination in apparatus of the class described, punches, tape feed mechanism, character keys, differential stops for the tape feed mechanisms, an operating connection for each stop, selecting pins for operating said connections, a carrier for the selecting pins, a reduce-feed key with connections for moving the carrier in one direction and an increase-feed key for moving the carrier in the other direction to make the pins select the stops other than those for which the carrier is normally set, substantially as described.

26. In combination in apparatus of the class described, a plurality of groups of punches, for receiving each a separate tape or tapes, a slider for each group of punches, interlocking bar for each group of punches and connections for operating the corresponding interlocking bars of the several groups of punches in unison, substantially as described.

In testimony whereof I affix my signature in presence if two witnesses.

JOHN GELL.

Witnesses:
WALLER DONALDSON,
BENNETT S. JONES.