J. R. PEIRCE.

RECORDING MACHINE.

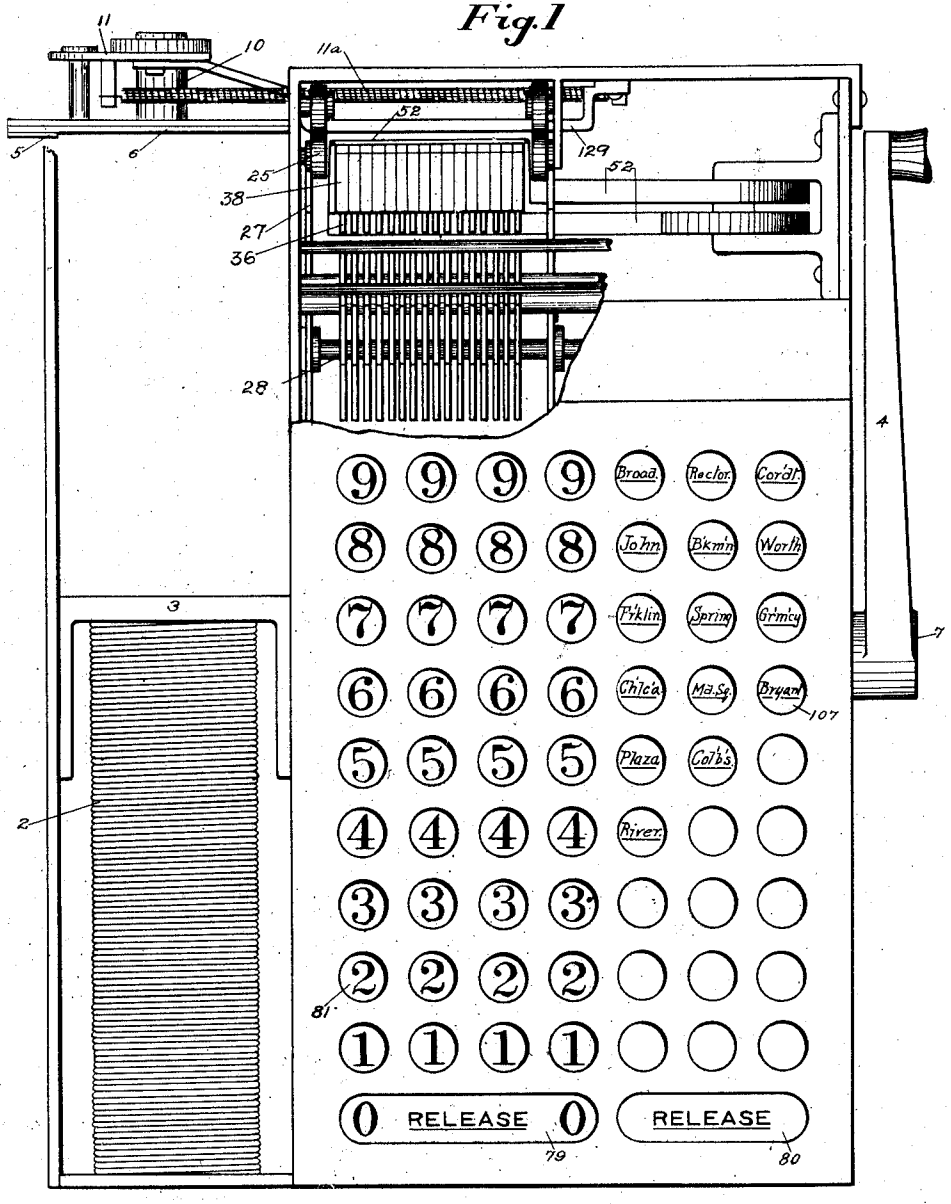
APPLICATION FILED DEC. 20, 1911.

1,245,500.

Patented Nov. 6, 1917.

12 SHEETS—SHEET 1.

Fig. 1



WITNESSES

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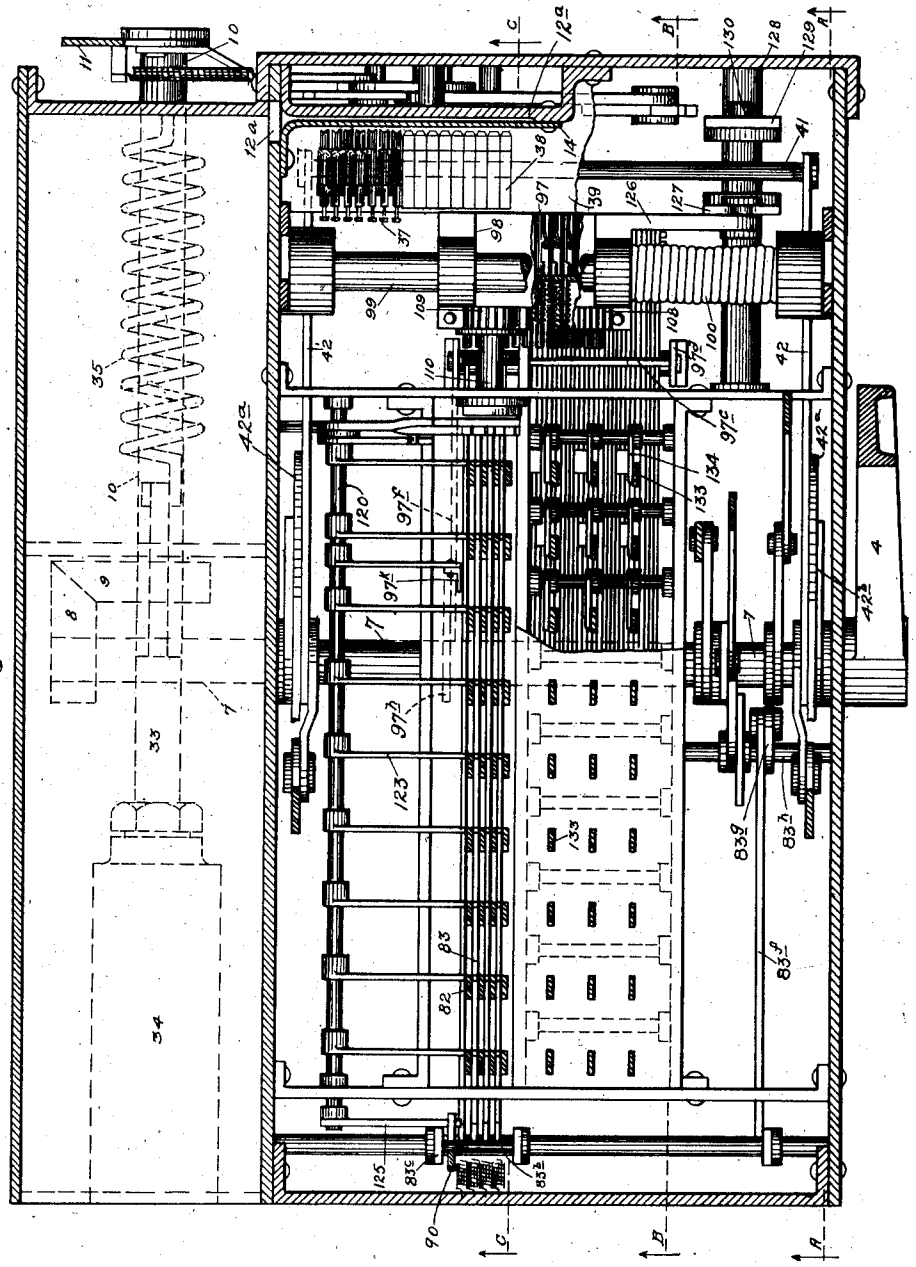
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12 SHEETS—SHEET 2.

Fig. 2



WITNESSES

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RECORDING MACHINE.

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1,245,500.

Patented Nov. 6, 1917.

12 SHEETS—SHEET 3.

Fig. 10

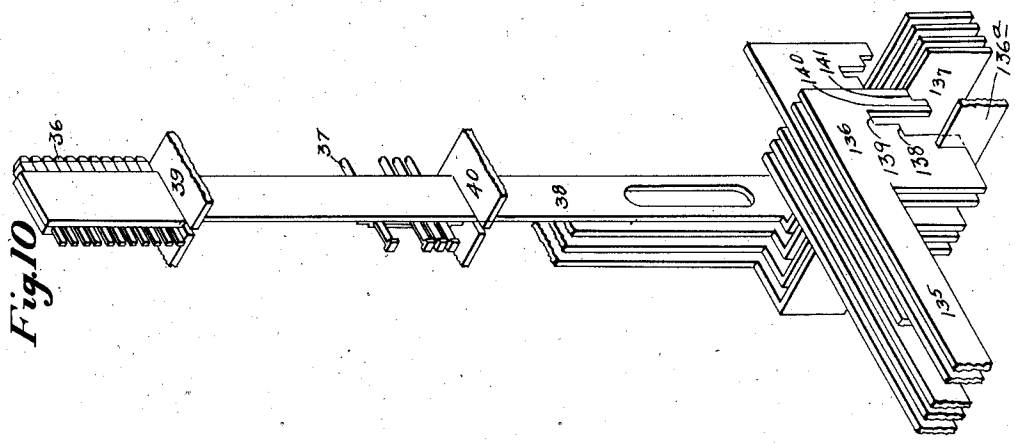


Fig. 2a

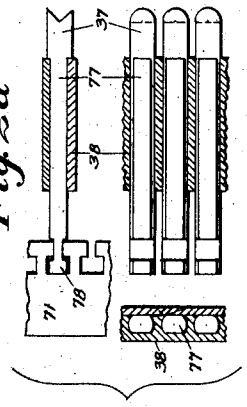


Fig. 2b

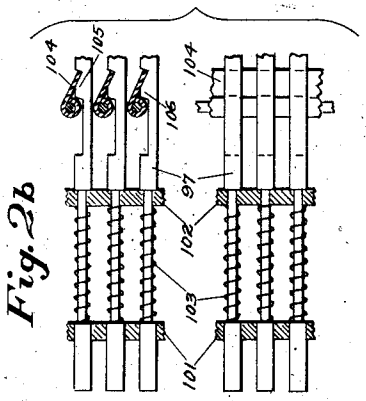


Fig. 5a

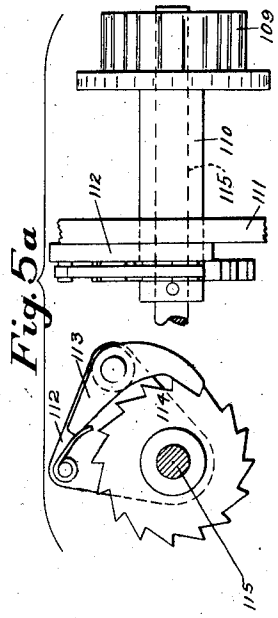
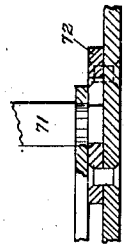


Fig. 3a



WITNESSES

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12 SHEETS—SHEET 4.

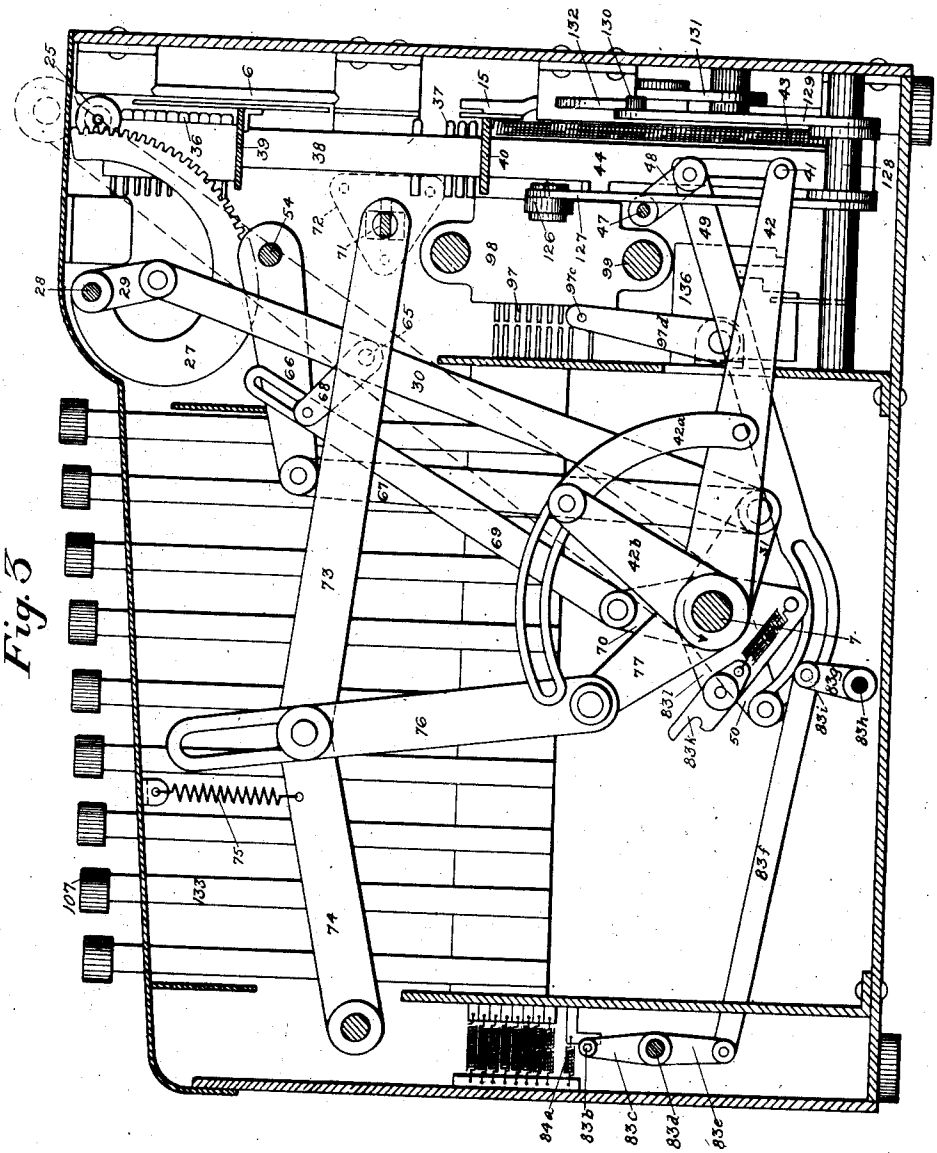


Fig. 5

WITNESSES

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12 SHEETS—SHEET 5.

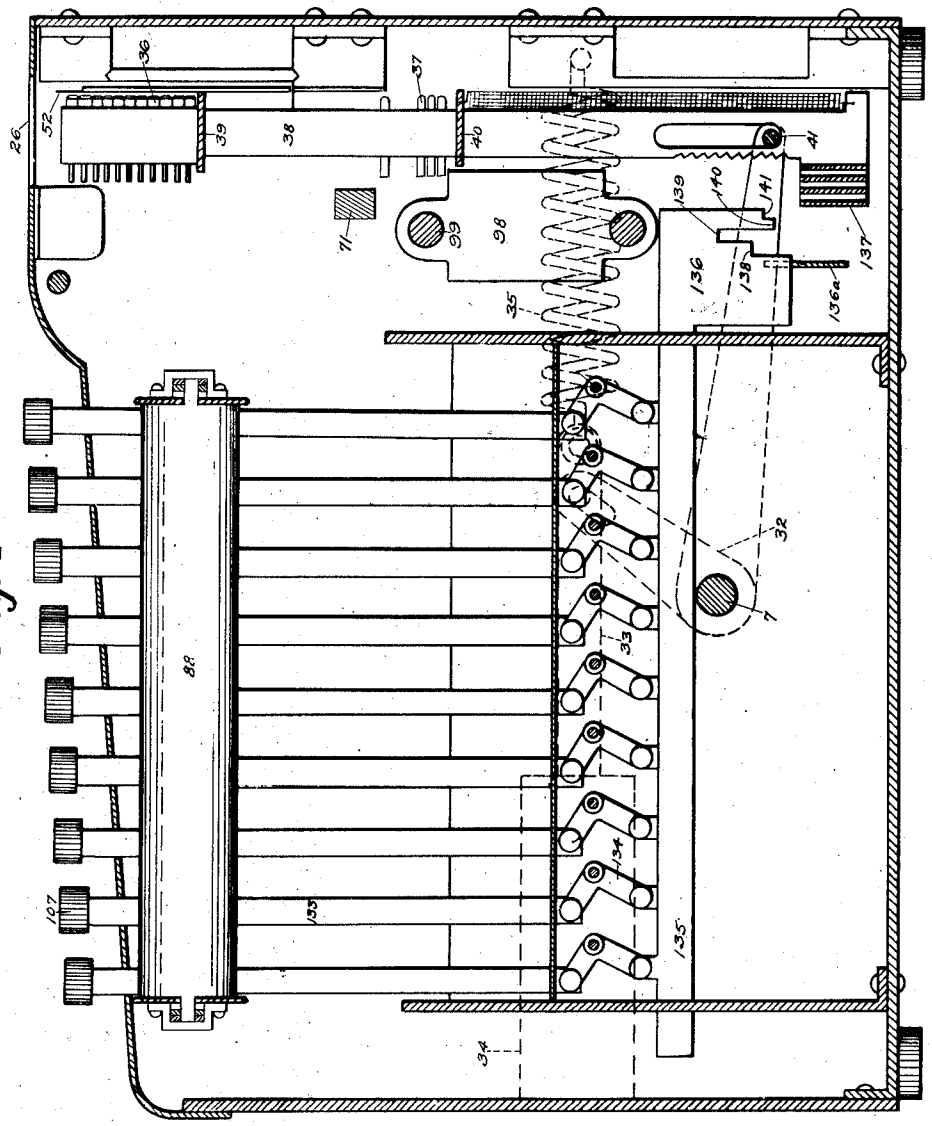


Fig. 4.

WITNESSES:

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12 SHEETS—SHEET 6.

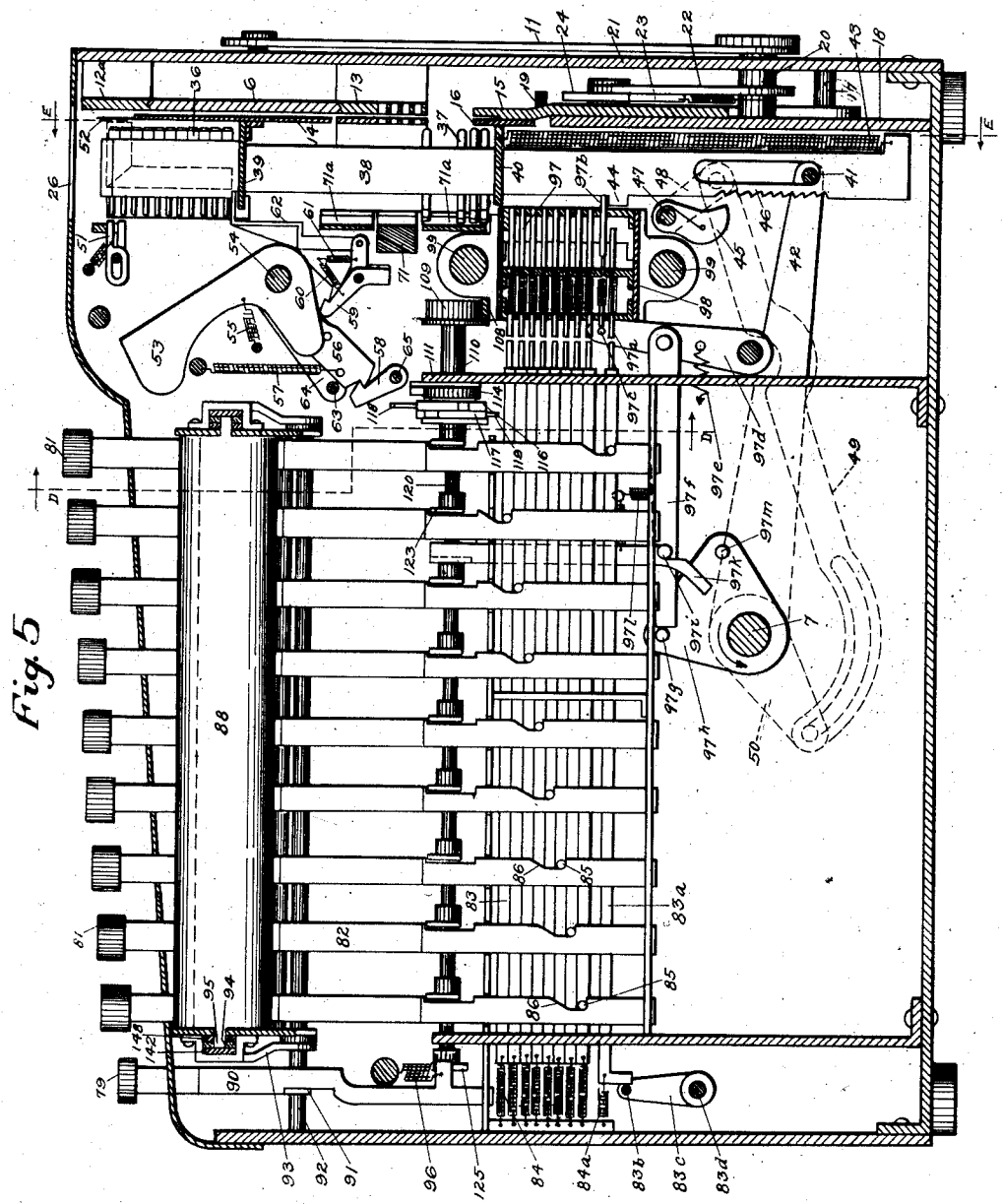


Fig. 5

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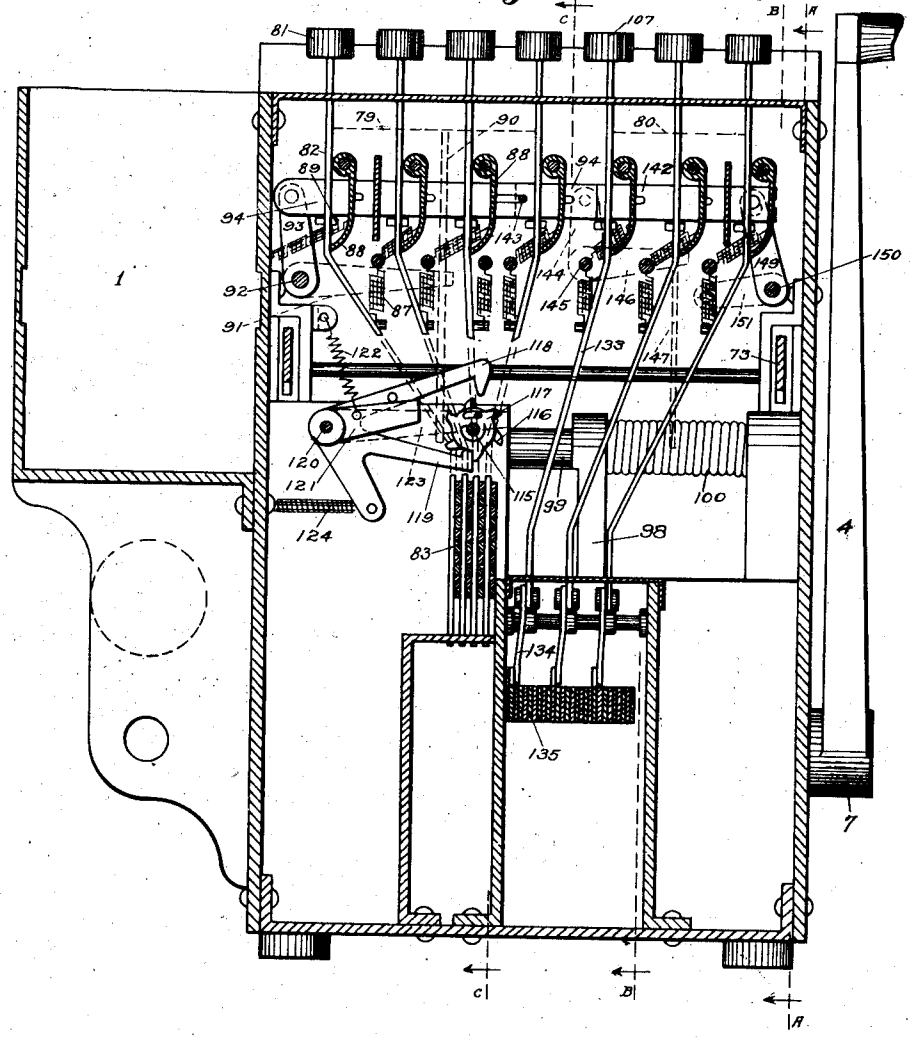
APPLICATION FILED DEC. 20, 1911.

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Patented Nov. 6, 1917.

12 SHEETS—SHEET 7.

Fig. 6



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APPLICATION FILED DEC. 20, 1911.

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Patented Nov. 6, 1917.

12 SHEETS—SHEET 8.

Fig. 6a

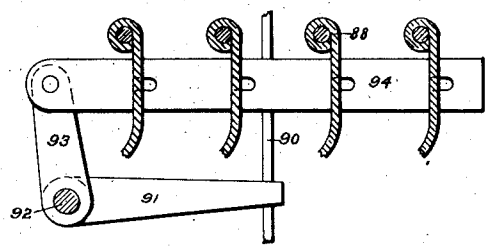


Fig. 6b

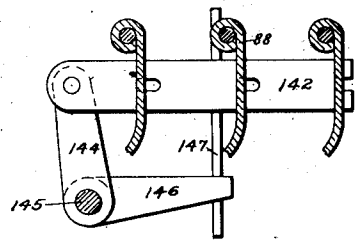


Fig. 6c

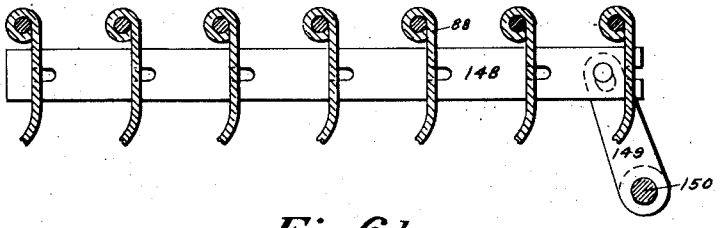
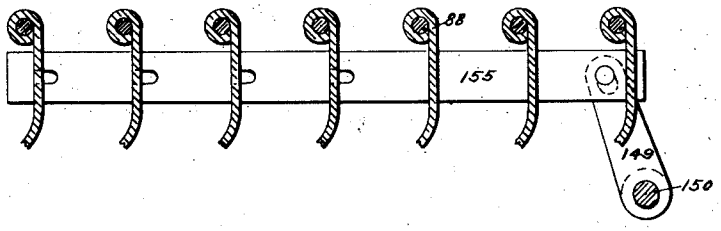


Fig. 6d



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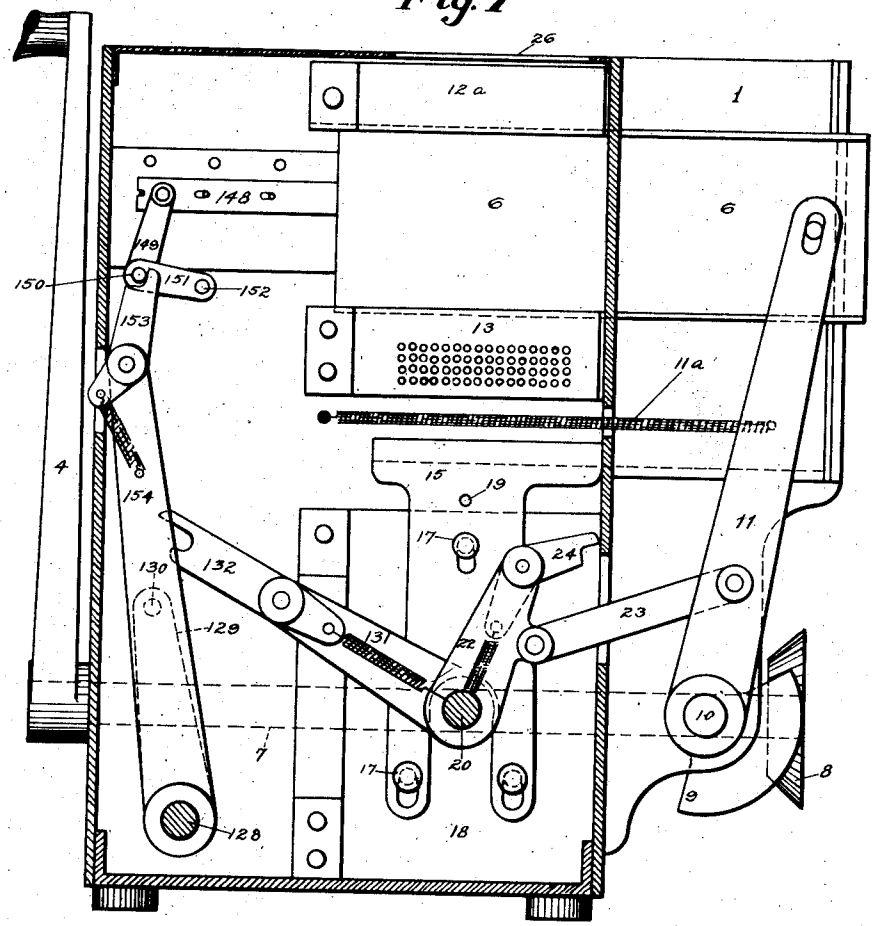
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1,245,500.

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12 SHEETS—SHEET 9.

Fig. 7



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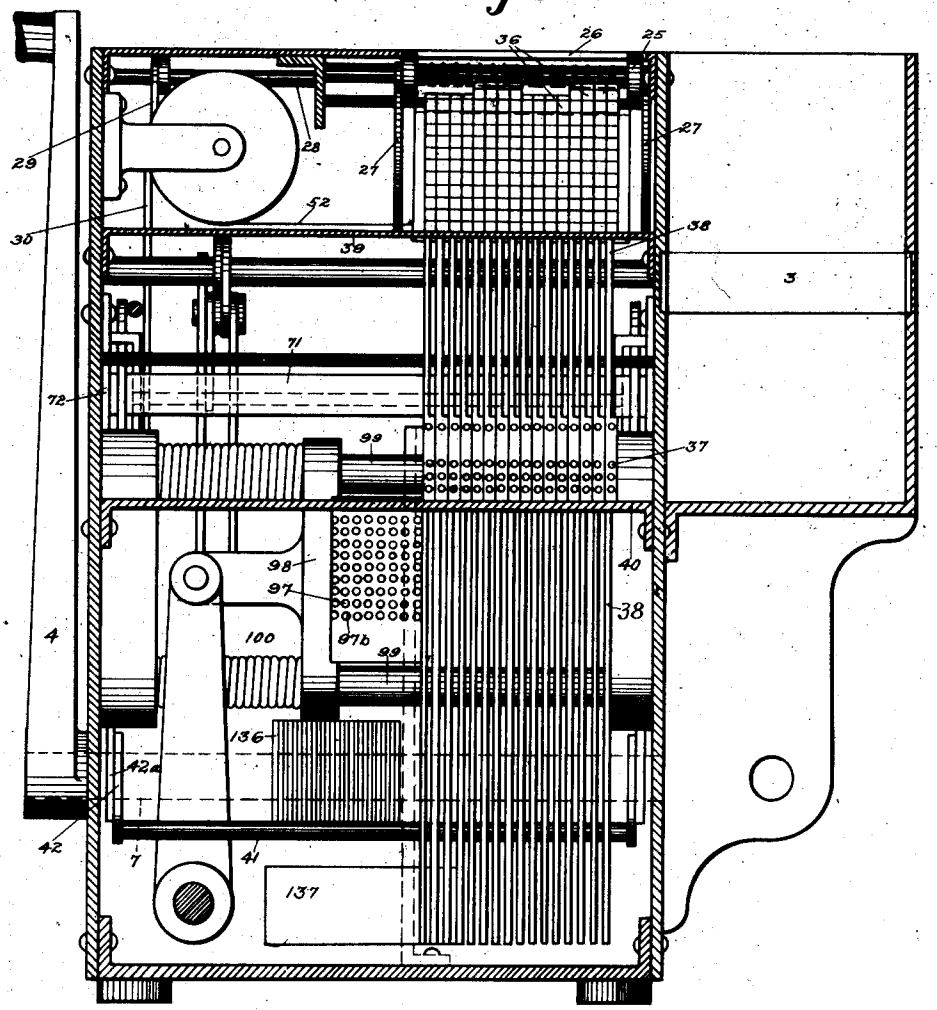
APPLICATION FILED DEC. 20, 1911.

1,245,500.

Patented Nov. 6, 1917.

12 SHEETS—SHEET 10.

Fig. 8



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APPLICATION FILED DEC. 20, 1911.

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Patented Nov. 6, 1917.

12 SHEETS—SHEET 11.

Fig. 9c

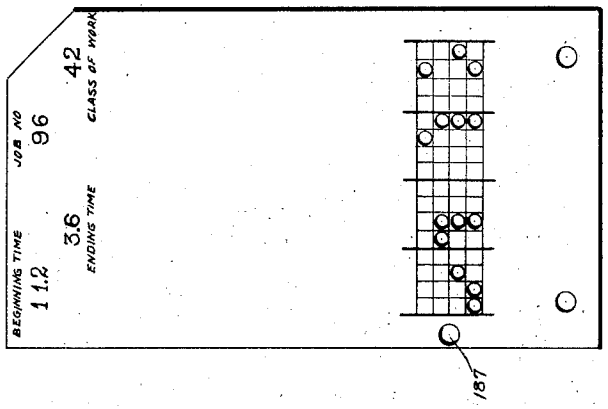


Fig. 9

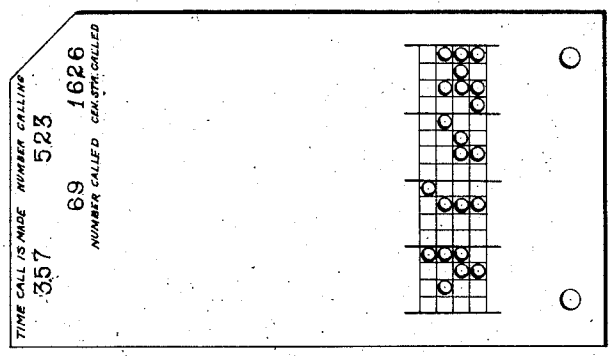
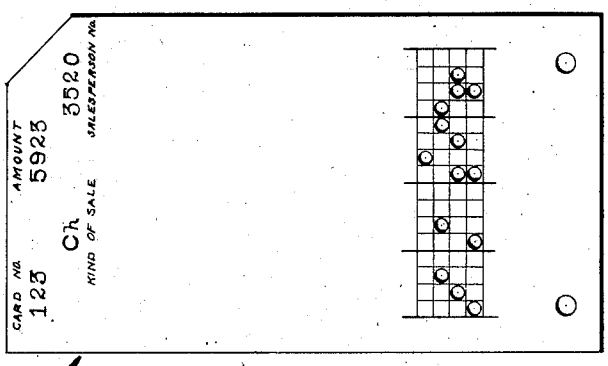


Fig. 9b

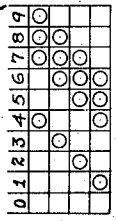


WITNESSES

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Fig. 9a



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APPLICATION FILED DEC. 20, 1911.

1,245,500.

Patented Nov. 6, 1917.

12 SHEETS—SHEET 12.

Fig. 15

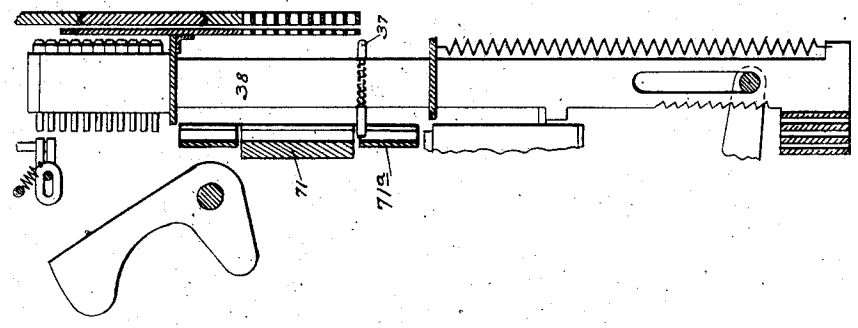


Fig. 12

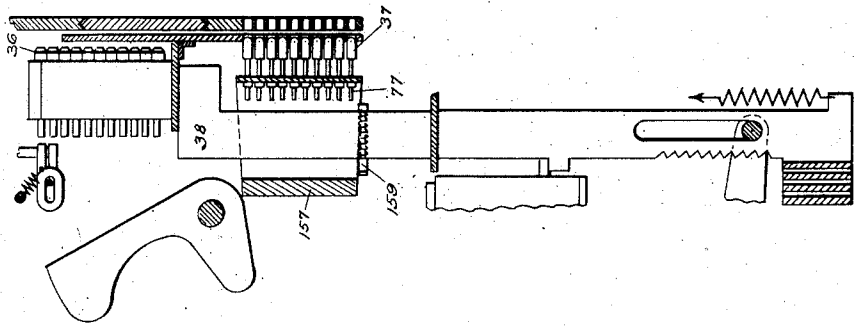
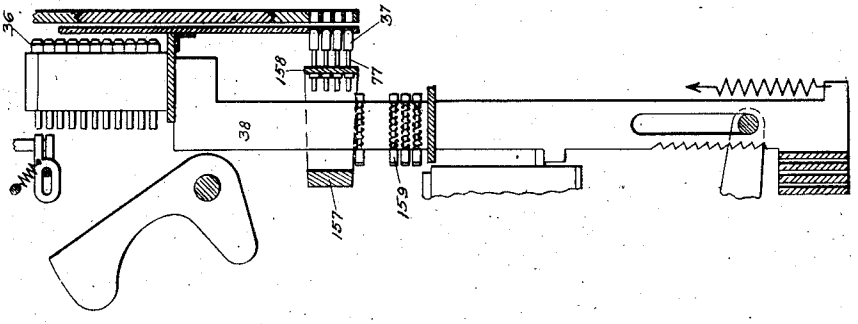


Fig. 11



WITNESSES

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UNITED STATES PATENT OFFICE.

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RECORDING-MACHINE.

1,245,500. Specification of Letters Patent. Patented Nov. 6, 1917.

Application filed December 20, 1911. Serial No. 666,944.

To all whom it may concern:

Be it known that I, JOHN ROYDEN PEIRCE, a citizen of the United States, residing in the borough of Manhattan, city, county, and State of New York, have invented new and useful Improvements in Recording-Machines, of which the following is a specification.

In the prior applications for patent I have described methods and apparatus for using perforated cards for the purpose of controlling machines which classify or distribute various items and record or list the information in various ways. Such systems are of especial value in businesses where a large number of items is to be taken care of such as railways, insurance companies, gas, electric and telephone companies, department stores, workshops, etc.

The present invention provides a machine for making the perforated cards for such systems and by means of which the cards may be made accurately and with great rapidity as the necessity for them arises and by which the information can be punched in the card and also printed thereon so that the card can be used without the necessity of reading the perforations.

The novel features of the invention are stated in the claims hereinafter. Machines embodying the invention are illustrated in the accompanying drawings.

Figure 1, is a plan partly in section of a machine especially designed for taking care of long distance telephone calls (and adapted, of course, for other uses by suitably modifying the number and design of the parts).

Fig. 2, is a horizontal section of the same.

Fig. 2^a, shows in side elevation plan and end elevation the punches in their mounting.

Fig. 2^b, shows in plan and side elevation the slide-controlling pins.

Fig. 3, is a vertical section just inside of the right hand wall of the casing on the line A—A of Figs. 2 and 6.

Fig. 3^a, is a horizontal section of the mounting of the end of the punch operating hammer or follower.

Fig. 4, is a vertical section approximately on the line B—B of Figs. 2 and 6.

Fig. 5, is a vertical section approximately on the line C—C of said figures.

Fig. 5^a, shows in end and side elevation respectively the escapement mechanism for the lateral shift of the pin box.

Fig. 6, is a vertical transverse section approximately on the line D—D of Fig. 5.

Figs. 6^a, 6^b and 6^c are transverse sections, similar to Fig. 6, illustrating the key releasing devices.

Fig. 6^d is a similar view of a partial keyboard releasing mechanism.

Fig. 7, is a rear elevation with the rear wall of the casing removed.

Fig. 8, is a section approximately on the line E—E of Fig. 5.

Fig. 9, is a face view of the card made in the machine of Figs. 1 to 8 (with the addition of guide lines not actually used in practice).

Fig. 9^a, is a table of the perforated spaces corresponding to the several numerals from zero to 9.

Fig. 9^b, is a view similar to Fig. 9 of a card for department store work.

Fig. 9^c, is a similar view of a card for keeping cost accounts in workshops.

Fig. 10, is a perspective view of the punch-controlling mechanism of Fig. 4.

Figs. 11, 12 and 13, are side elevations of alternative constructions of the slides carrying the punches and types.

Referring to the embodiments of the invention illustrated, and first to the use of the system in a telephone central office, the information which is to be recorded on the cards comprises the time when the call is made, the number of the party calling and the number and central station called.

Other information to be put on the card may be punched and printed thereon by other machines or by extensions to the mechanism herein illustrated. Referring to Fig. 9, the words shown thereon are previously printed on the card. A number of such cards are stacked in the machine and are automatically fed from the stack to the

recording mechanism (in which term I include both the printing and the punching mechanism). The keys are operated so as to set the machine for printing and punching each of the items. Then at one operation of the main shaft or handle the card is punched and printed as shown and ejected in convenient position to be passed to the next operator whose machine will record on the card the time when the call is completed and the elapsed time.

The figures are printed at the top of the card and the perforations made below. The central stations are indicated by numbers; No. 1626, for example corresponding to Cortlandt central station. For the purpose of indicating the locations of the perforations the cards are shown ruled, but in practice the ruling may be omitted. The system of perforations adopted is that shown and claimed in previous applications for patent which I have filed. In each column, corresponding to one figure, there are four spaces. By combining perforations in these four spaces the numerals from zero to 9 may be represented. A suitable table of such perforations is shown in Fig. 9ª. For zero there are no perforations; for the numeral 1 there is a perforation in the lowermost or first space; for the numeral 2, a perforation in the second space; for the numeral 4, perforations in the first and fourth spaces; for the numeral 6 perforations in the first, second and third spaces, etc., three being the maximum number of spaces required. With the aid of this table it will be seen that the perforations in the lower part of Fig. 9 correspond with the numbers printed on the upper part of the card.

The cards perforated to indicate the desired information are afterward run through distributing and tabulating machines shown in other applications for patent which I have filed and the charges against individual customers are thus collected and tabulated or billed.

Card feeding and ejecting mechanism.— The cards are placed upright in a pocket or magazine 1 at the left of the machine and pressed toward the rear of the machine by means of a spring 2 and a follower 3. Upon the first part of the forward movement of the handle 4 the rearmost card in the stack is engaged by a shoulder 5 of a slide 6 (Fig. 1) and shifted laterally to recording position. The mechanism for accomplishing this is shown in Fig. 7. The main shaft 7 which is operated by the handle 4 carries at its left hand end a segmental beveled gear 8 engaging a similar gear 9 on a shaft 10 which at its rear end carries an arm 11, the upper end of which is connected by pin and slot to the back of the slide 6; and is pulled to the right by a spring 11ª; so that each forward movement of the handle shifts a card through an opening 12 (Fig. 2) to a position for printing and perforating. After giving a full movement to the slide 6 the gear 8 turns beyond the gear 9 while subsequent operations are being performed. Fig. 5 shows the slide 6 guided between upper and lower backing plates 12ª and 13. The upper part of the card lies against the backing plate 12ª to receive the printing impression and the lower part of the card lies against the backing plate 13 which is perforated to permit the passing of the punches. A fixed front plate 14 lies against the forward face of the card to hold it against the backing plates. The lower edge of the card rests on a shoulder on the front face of an ejecting plate 15 and is held by a fixed plate 16. In this position the card is punched and printed as hereinafter described.

On the return movement of the handle the ejecting plate is lifted by the following mechanism (Fig. 7). The ejecting plate 15 is provided with guide slots through which pass pins 17 projecting rearwardly from a fixed plate 18; and has a pin 19 projecting its rear face by means of which it is raised, being lowered by its weight (supplemented by a spring if necessary). A short shaft 20 extends from the fixed plate 18 to the rear wall 21 of the casing, and carries an arm 22 which is connected by a link 23 to the arm 11. A spring pawl 24 is pivoted on the end of the arm 22. As the arm 11 swings forward to feed a new card the arm 22 swings with it, the pawl 24 clicking past the pin 19. On the return movement of the arm 11, after the cards have been punched and printed, the pawl 24 catches the pin 19 and is bent back so as to extend the effective length of the arm 22 and to slightly lift the ejector 15, after which the pawl escapes past the pin 19 and is restored by its spring into the position of Fig. 7.

The slight upward movement given to the card by the ejecting plate brings its upper edge between pairs of rollers 25 (Figs. 1, 3 and 8) which are in rotation at the time and which continue the upward movement of the card so as to eject it through an opening 26 provided in the top of the machine, whereupon it may be seized by the operator and transferred to the next operator or machine which is to record the elapsed time thereon. The two inner rollers 25 are positively operated for the purpose described. The mechanism for this purpose is shown in Figs. 3 and 8. Circular racks 27 engage pinions on the shaft of the two inner rollers 25 and are mounted on a transverse shaft 28, which has an arm 29 connected by a link 30 with a short arm 31 on the main shaft 7; so that on the return movement of

the shaft, which corresponds with the upward movement of the ejecting plate 15, the rollers 25 will be set in rotation in the proper direction to continue the ejection of the card.

The main shaft 7 is provided with an arm 32 connected by a pin and slot with the piston rod 33 (Figs. 2 and 4) of a dashpot 34, the piston rod being connected at its opposite end to a spring 35; so as to automatically return the handle to its starting position after a forward movement, and so as to prevent too quick a movement of the handle in either direction.

Recording means.—The recording means consist of types and punches mounted on carriers which are first shifted to bring the types and punches in proper position, after which hammers or followers actuate the carriers to print and punch the card. In the machine illustrated there are sixteen sets of types 36 and punches 37, each mounted upon a vertically sliding carrier 38 (Fig. 5). The carriers are guided in slots in transverse plates 39 and 40. Normally they are all held down by a resetting rod 41 passing through slots in the lower parts of the several slides. The resetting rod 41 is connected (Figs. 2, 3 and 5) to arms 42 loose on the main shaft 7. The arms 42 carry curved links 42^a having a pin and slot connection with arms 42^b fixed on the main shaft so as to secure an idle movement during the first part of the return movement of the main shaft and to retract the slides only toward the end of the rearward movement of the main shaft, after the punches have been restored to their normal lateral position in their slides by withdrawing them from the holes made in the card. The slides are pulled upward by means of long springs 43 and are released to permit such upward movement in the first forward movement of the main shaft, by the rising of the resetting rod 41. The amount of upward movement of each slide is determined by the pressing of the keys in the several columns of the keyboard, which (for the slides of Fig. 5) actuate certain intermediate controlling mechanism including controlling pins adapted to be projected in the line of shoulders 44 on the slides.

As soon as the upward movements of the slides have been stopped the pins referred to are withdrawn for reasons hereinafter stated. For holding the slides (Fig. 5) in the positions to which they have been set a supplementary mechanism is provided comprising a broad pawl 45 in position to engage ratchets 46 on the lower ends of the several slides. The pawl is mounted on a transverse shaft 47 to which it is connected by a leaf spring. The shaft is provided at one end with an arm 48 (Figs. 3 and 5), the end of which is pivotally connected to a link 49, the forward end of which is slotted and engages a pin on the end of an arm 50 on the main shaft 7.

The pawl 45 is freely pivoted on the shaft 47. The shaft 47, however, is frictionally connected with the arm 48 so as to be moved by the initial movement of the arm in either direction and to permit the arm to continue to move after the pawl is stopped in either direction.

Now, when the shaft 7 is turned forward its first effect is to free the resetting rod 41 and to free the slides 38 which rise to their determined positions. The pin at the end of the arm 50 then reaches the end of the slot in the link 49 and presses the latter toward the rear, throwing the pawl 45 into engagement with the several ratchets 46 and holding the slides in the several positions to which they have risen; after which the slide-controlling pins may be withdrawn. On the return movement of the shaft the resetting rod 41 is pushed down, carrying the slides 38 with it. Near the end of the downward movement of the slides the arm 50 engages the end of the slot in the link 49 and pulls the latter forward, pulling out the pawl 45 so as to leave the slides free to rise at the next operation.

There are ten types arranged in a row at the top of each slide 38. As the slide rises the types come in succession into line with a follower 51 and with a typewriter ribbon 52 (Figs. 1, 5 and 8) arranged in any usual or suitable way between the type and the card. The followers 51 are arranged on two levels, as are the tops of the type carriers (Figs. 5 and 8) in order to print on two lines as in Fig. 9. When the entire line of types is set the followers come forward and cause them to print the desired figures. Each group of four followers for the several items on the card is arranged in the usual way to suppress any zeros which might come at the left of the number to be printed. Any usual or suitable construction may be adopted, such for example as the well known system of the Wales adding machine.

The hammer mechanism also may be of any known or suitable type, the common Wales mechanism being indicated. The hammers 53 of the several decimal places are pivoted on a common shaft 54 and are drawn backward by light springs 55 which cause them to bear against pins on arms 56 also pivoted on the shaft 54 and pulled upward by stronger springs 57 but normally restrained each by a pair of pawls 58 and 59. The pawls 59 are pulled upward by light springs 60 and downward by heavy springs 61. They are provided with tails connected to links 62, the upper ends of

which engage under shoulders on the respective slides 38, so that the pawls are released as soon as the slide rises. The tails of the pawls, however, overlap each other in the well known way so as to prevent the printing of a zero except when the slide in the next higher decimal place has been moved to print a figure higher than zero. A resetting rod 63 extends over the several arms 56 for the purpose of restoring them to their normal positions, the rod 63 being mounted in arms 64 fixed on the shaft 54. The slides having risen to their desired positions and the supplementary pawls 59 having been withdrawn as desired and the resetting rod 63 having been raised by turning the shaft 54, the pawls 58 are withdrawn by turning the tripping shaft 65 on which they are mounted, causing a sudden stroke of the hammers.

The mechanism for operating the shafts 54 and 65 is shown in Fig. 3. The shaft 54 is directly connected by a fixed arm 66 and a link 67 to the arm 31 on the main shaft 7 so as to lift the resetting rod at the very first movement of the shaft. The tripping shaft 65 carries an arm 68 which is connected by a pin and slot with a link 69 connected to an arm 70 on the main shaft so that the first movement of the main shaft is without effect and time is given for rising of the resetting rod and of the carriers and for the withdrawal of the supplementary pawls before the main pawls are withdrawn to allow the hammer stroke.

The punches require a comparatively strong pressure to force them through the card and this is secured by means of a transverse hammer-bar or follower 71 arranged in line with the perforations in the plate 13 so as to act on such punches as come within the range of the four vertical spaces represented by these perforations. The position of the bar is indicated in Fig. 5, a sectional view of one end being shown in Fig. 3ª and the operating mechanism therefor in Fig. 3. The ends of the bar are arranged to slide in grooved guides 72 mounted on the side walls of the machine and are connected to links 73 each adjacent to one side of the casing. Each link 73 constitutes one member of a toggle, the other member 74 of which is pivoted to a transverse shaft running across the front of the machine, the toggle being broken upward normally by a spring 75. The central pin of the toggle passes through a slot in an operating link 76 connected to an arm 77 on the main shaft. By means of this toggle, after the card is in place and the punches are properly set the follower bar 71 is pressed forward to perforate the paper. On the return movement of the main shaft, as soon as the toggle is ever so slightly broken upward the spring 75 completes its upward movement so as to withdraw the hammer-bar quickly.

An inspection of Fig. 5 will show that the arrangement adopted for the punches corresponds with the table (Fig. 9ª). In the zero position of Fig. 5 there is no punch in line with the follower. Upon the next upward step there is a punch in the first space; upon the third upward step a punch in the third space; upon the fourth upward step punches in the first and fourth spaces; etc. The shape and mounting of the punches are shown more fully in Fig. 2ª. Each punch 37 has its shank 77 fitting closely in the carrier 38 and has slots upon its side faces forming a head 78 at its rear end. The follower 71 is shown in plan in Fig. 2ª and is provided with vertical undercut slots through which the heads 78 may pass as the punch rises to position. By this arrangement the retraction of the follower 71 serves also to withdraw the punches positively from the holes in the paper where they are held with considerable friction. Fixed guides 71ª (Fig. 5) guide the heads 78 to the bar 71.

Keys and mechanism operated thereby.— For printing the four items shown in Fig. 9 two styles of keys (Fig. 1) are used. At the left are four columns of ordinary adding machine keys with a release key 79 which releases any or all keys which have been pressed in these four columns. To represent any number a key must be pressed in each of the columns, except where the corresponding figure is zero. At the right is a series of keys marked "Broad", "Rector", etc., for recording the central station together with a release key 80 for releasing any one of the keys which has been pressed. In making a record only one of all these central station keys is pressed. Each key controls a plurality of recording devices, so that the Cortlandt key for example when pressed will cause the machine to record the corresponding number, 1626. Each of the keys at the left therefore controls a single recording device while each of those at the right controls a selected combination of recording devices. They may be termed, therefore, individual keys and combination keys respectively, and they are capable of application in various other systems than making telephone records.

Individual key mechanism.—The individual keys 81 are provided with shanks 82 (Figs. 5 and 6), the lower ends of which are brought together and located adjacent to horizontal slides 83, there being a column of these slides corresponding to each column of keys 81. The slides are pulled forward by springs 84, the several slides in each column having pins 85 corresponding with the respective keys and engaging cam-shaped notches 86 in the shanks of the several keys. The

horizontal slides 83 serve to set the pins of the intermediate controlling mechanism hereinafter described. When a key is pressed downward its cam 86 presses to the rear the corresponding horizontal slide to set the corresponding controlling pin. The keys are pulled upward by springs 87 (Fig. 6). Adjacent to each column of keys is a detent 88 held against the shank of the key by a spring and adapted to engage a pin 89 projecting from such shank. Each detent extends along an entire column of keys since only one of these keys is pressed at an operation. The release key 79 withdraws the several pawls 88. For this purpose its shank 90 has a shoulder engaging an arm 91 on a shaft 92 which carries near its opposite ends arms 93, the upper ends of which are pivoted to slides 94 having slots therein engaging pins 95 on the ends of the pawls 88; so that as the release key is pressed the pawls 88 are withdrawn from the key shanks and the latter are raised by their springs. The release key is immediately raised, after pressing it, by its spring 96, Fig. 5.

Intermediate controlling mechanism for individual keys.—Between the individual keys and the corresponding recording devices there is an intermediate mechanism which is set in position by the individual keys and which in turn controls the setting of the type and punch carriers. A number of setting pins 97 (Figs. 2 and 5) are located in a box 98 arranged to slide on guide rods 99 and pushed to the left by means of a spring 100. Normally, however, it stands in the position of Fig. 2 with its first four columns of pins in line with the ends of the horizontal slides which are actuated by the keys. There are three classes of pins in each column of the box. The lowermost pin corresponds to the figure 9; the next pin to the figure 0 and the succeeding pins, counting from the bottom upward, to the figures 1 to 8, inclusive. The number 9 pin 97^a is a dummy being shaped like the other pins of Fig. 2^b except that it is so short as not to project beyond the box. When the figure 9 is to be recorded the type and punch carrying slides rise to the limit of their movement and are stopped by the plate 40, one step above the setting pin 97 which corresponds with the figure 8. The pins 97 are illustrated in detail in Fig. 2^b. The pins are guided between plates 101, 102 and pressed toward their retracted position by springs 103. Extending vertically along each column of pins is a pawl 104 bearing with a spring pressure against the pins and bearing normally against inclined faces 105 on the pins. When a pin is advanced the first effect is to press the pawl out so as to release any other pin in the same column which was previously held by the pawl. The further advance of the pin causes the pawl to engage a shoulder 106 and hold the pin in its advanced position.

The No. 9 pin, 97^a, when operated by its key 81 withdraws the pawl 104 from the other pins in the same column, and allows said other pins to be retracted, but has no other effect.

This key, however, is used for an additional purpose. After a recording operation if it should be attempted to retract the pin box without first withdrawing such pins as have been projected, some of these pins would interfere with the projecting shoulders 44 of the raised type carriers. The pins 97^a are, therefore, operated for all columns, at the very end of the forward movement of the handle, after the recording operation has been effected. For this purpose the several slides 83^a, corresponding with these pins bear at their forward ends against a resetting rod 83^b (Fig. 5) extending between two arms 83^c on a shaft 83^d which has a lower arm 83^e (Fig. 3) connected by a link 83^f with the end of an arm 83^g on a shaft 83^h. The end of the arm 83^g carries a pin 83^i in the path of a clearing pawl 83^k mounted on a plate 83^l on the handle shaft 7. As the shaft 7 is rocked forward, at the end of its movement the pawl 83^k clicks over the pin 83^l. Then, at the very beginning of the return movement of the handle, the pawl pushes the pin 83^i toward the forward part of the machine and operates the resetting rod 83^b to advance all the No. 9 pins 97^a and to release all the other pins, which are then retracted by their springs. The pawl gives a very short movement to the pin 83^l and then passes beyond it releasing it and allowing the various slides 83^a to be retracted by their springs 84^a. The zero pins are shaped and mounted like the other pins, but are not advanced to their operative position by the keys. At the end of each operation of the handle, after the type-carriers are pulled down, these zero pins are all advanced and held by the pawls 104 engaging the shoulders 106 (Fig. 2^b). When the first numbered key is pressed the zero pin resetting mechanism is withdrawn so as to leave all the zero pins under control of the pawls 104 alone; and the advancement of a numbered pin in any column pushes out the pawl 104 for that column as above described so as to release the zero pin for the same column, which zero pin is retracted by its spring.

The resetting mechanism for the zero pins is shown best in Fig. 5. Running back of the several zero pins 97^b in the original position of the machine is a resetting rod 97^c carried between a pair of arms 97^d which are pulled toward the front of the machine by springs 97^e. One of said arms 97^d carries a link 97^f, the rear end of which bears against a pin 97^g on a plate 97^h mounted on

the handle shaft 7 so that upon the backward movement of the shaft at the end of such movement, the pin 97^s forces the resetting rod 97^c toward the rear of the machine to reset the pins. The link 97^t carries also a pin 97^l engaging a pawl 97^k which is connected at its upper end to an arm on the escapement controlling shaft 120; the link 97^t being held up by a spring 97^l. The lower end of the pawl 97^k is in the path of a second pin 97^m on the plate 97^h previously referred to. Starting from the position shown in Fig. 5, the first key pressed rocks the escapement controlling shaft 120 as hereinafter described and presses down the pawl 97^k and the link 97^t so that the forward end of the latter passes below the pin 97^s and the resetting rod 97^c is retracted by the springs 97^e. On the forward movement of the shaft the pin 97^m strikes the pawl 97^k and disengages it from the pin 97^l, allowing the link 97^t to be drawn upward by its spring and, as soon as the pin 97^s is sufficiently advanced, to snap upward into its original position so as to be struck by said pin on the return movement of the handle.

There are twelve columns of pins in the box. The first four columns being originally in line with the individual keys 81, as will appear from Fig. 2, and being at the same time in line with the last or right hand group of four punch carriers 38. When the individual keys are pressed to correspond with the first item and the release key 79 is pressed to release them the pin box, with its first four columns of pins properly set shifts one step (of four columns width) to the left. The individual keys 81 are pressed for the next item and released and the pin box moves another step to the left. The individual keys are then again operated for the third item and released and the box takes its third and last step, bringing its three groups of pins into line with the first three groups of punch carriers (counting from the left). Thereupon one of the combination pins 107 is pressed and determines the subsequent movement of the last four punch carriers; after which the combination keys are released and the handle operated to feed the card and make the record as previously described.

The mechanism for effecting the step by step movement of the pin box comprises an escapement which is controlled by a movement of any one of the individual keys and the succeeding movement of the release key 79; the spring 100 pressing the box constantly to the left. See Figs. 2, 5, 6 and 5^a. A rack 108 on the top of the box engages a pinion 109 on a hollow shaft 110 which is mounted in a transverse partition 111 and carries at its inner end a plate 112 which carries a spring pawl 113 engaging a ratchet 114 which is fixed on a shaft 115 passing through the hollow shaft 110. When the box is being returned to its starting position the pawl clicks backward over the ratchet freely. When the box endeavors to move to the left the pawl prevents such movement except as the shaft 115 is released step by step by the escapement. The shaft 110 carries the rear three-toothed ratchet wheel 116 which is provided with a pin passing through a slot in the forward three-toothed wheel 117, as shown in Fig. 6, the latter being free to turn on the shaft 115 and being pressed backward by a spring which tends to take up the play of the pin and slot connection. Upper and lower pawls 118 and 119 respectively engage the ratchets 116 and 117. These pawls are loosely mounted upon a shaft 120 and are pulled up by an arm 121 fixed on said shaft 120, engaging a pin on the pawl 118 and pulled up by a comparatively strong spring 122. The shaft 120 carries a number of arms 123, the upper edges of which are engaged by the shanks 82 of the individual keys so that as one of these keys is pressed the arm 121 is turned down to release the pawls whereupon they are pulled down by the spring 124. This allows the foremost ratchet 117 to move to a distance limited by the pin and slot, the rearmost ratchet 116 being held by the upper pawl. The shaft 120 is provided also with an arm 125 at its left hand end (Fig. 5) adapted to be engaged by the shank 90 of the release key 79 so that where one item is to be left blank and none of the individual keys is to be pressed the release key will nevertheless effect a shift of the pin box. When the release key is pressed the individual keys rise, as previously explained, and the subsequent rising of the release key frees the shaft 120 so that the strong spring 122 pulls up the arm 121 and pulls the pawls to their upward position releasing the rear ratchet 116 and allowing it to travel a distance corresponding to one-third of a revolution of the shaft 115, the foremost ratchet wheel 117 being then held, at its next tooth, by the lower pawl 119.

For returning the pin box to its starting position against the pressure of its spring it is provided at the rear with an extension 126 connected with an arm 127 on a short shaft 128 (Figs. 2, 3 and 7) which carries near its rear end an arm 129 with a projecting pin 130 by which the arm is shoved to the right hand side of the machine at the proper time and the shaft turned so as to force the box back to its starting position. This movement is effected by means of an arm 131 on the shaft 20 carrying a spring pawl 132. On the forward movement of the handle as previously explained the shaft 20 is rocked to the left (looking at Fig. 7). swinging the arm 131 downward and causing the pawl 132 to click over the pin 130, the arm 127 at this

time being advanced toward the left hand side of the machine (toward the right in Fig. 7). On the return stroke of the handle the arm 131 rises and the pawl 132 is caught by the pin 130 causing the pawl to swing back toward its straight position to increase the effective length of the arm 131 and to thrust the pin 130 back to its original position; which slides the pin box 98 back to its original position also.

Combination keys and controlling mechanism.—When one of the keys 107 is pressed a number (not greater than four in the machine illustrated) of recording devices are controlled. The control is effected by connecting the shanks 133 through bell crank levers 134 to horizontal slides 135, the rear ends of which comprise plates 136 adapted when pushed to the rear to overlie transverse extensions 137 from the lower ends of the corresponding type and punch carrying slides 38. The construction is best shown in Figs. 2, 4, 6, 8 and 10. Each key 107 is connected to a separate slide 135 so that there are nine of these slides for each column of keys. Each of the plates 136 is notched so as to provide shoulders 138, 139, 140 and 141 adapted, when the slide is advanced to overlie the successive extensions 137, of the punch carriers. The shoulders 138 etc. are located at different elevations for the different plates 136. When a key is pressed and the corresponding plate 136 is advanced to position over the extensions 137 then the carriers 38 are permitted to rise only in a certain combination and each to a determined height, thus fixing the number which shall be printed and punched on the card. A guide plate 136[a] steadies the plates 136.

The key shanks 133 are held down by pawls 88 similar to those used for the individual keys. The pawl releasing mechanism also operates similarly, but separately from the release of the pawls for the individual keys. Referring to Fig. 6, it will be observed that the slides 94 for releasing the individual keys are separate from the slides 142 which release the combination keys, the two slides 94 and 142 being overlapped and guided at their free ends by a pin 143. The slides 142 are connected with arms 144 on a shaft 145 which has a second arm 146 in engagement with the shank 147 of the releasing key 80 for the combination keys; so that when the release key 80 is pressed all the combination keys 107 are freed.

Automatic key release.—After pressing the individual keys and releasing them in successive groups as described (or, if the individual keys are to be actuated only once, as in the recording of a single item) it is not essential to operate the release key 79. Nor is it necessary to use the release key 80 except where it is desired for the correction of error or for other reasons to change the combination item which is to be recorded. The operation of the handle of the machine serves to withdraw all the pawls 88 so as to release all keys. This release occurs on the backward stroke of the handle after the printing has been effected and the carriers 38 have been returned to their lower positions so as to free the plate 136 which has been in operative position and the key which has been connected thereto. This automatic release is effected by the following mechanism:

Parallel with the key release slides 94 and 142 (Figs. 5, 6, 6[a], 6[b] and 6[c]) is a third slide 148 having slots engaging pins in the ends of the pawls 88 of the entire keyboard. It overlaps the other two slides and is connected at its right hand end to an arm 149 on a shaft 150 which at its rear end has an arm 151 (Fig. 7) with a rearwardly projecting pin 152 in the path of movement of a spring pawl 153 mounted on the end of a long arm 154 on the shaft 128. The arm 154 swings toward the left hand side of the machine (to the right in Fig. 7) as the pin box moves to its recording position. In this movement the pawl 153 clicks past the pin 152. On the rearward movement of the handle the shaft 128 turns and carries the arm 154 toward the right hand side of the machine, which causes the pawl 153 to engage the pin 152, swinging the pawl backward into line with the arm 154 so as to extend the effective length of this arm and to push up the pin 152, thus shifting the slide 148 in a direction to release all the keys.

Operation.—The operation of the machine thus far described is as follows: The cards are stacked in the magazine 1 and pressed backward by the spring 2. The operator first presses the individual keys 81 according to the time. (A modified mechanism hereinafter described automatically controls the time-recording mechanism so that no special operation of the keys is necessary therefor, but with the machine hereinbefore described it is assumed that the time record will be made by means of the keys). The time being set by the keys the operator presses the release key 79. He then operates the individual keys 81 again for the number called and presses the release key. Then he operates the individual keys again for the number calling and presses the release key. Then he presses one of the group keys 107 and pulls the handle forward to its limit and allows it to swing back.

The pressing of the individual keys sets the pins 97. The pressing of each release key, after the pressing of a numbered key, causes the escapement to permit the pin box to shift one step to the left; so that after the first three numbers have been set the pins in the box register with the proper

type-carriers. The pressing of the combination key 107 sets the stop mechanism for its group of type carriers. The forward movement of the handle then releases the combination key and causes the withdrawal of its plates 136 by the action of the springs in pulling up the keys.

The first movement of the handle causes the slide 6 to swing to the right so as to shift the rearmost card into recording position. The continued movement of the handle releases the type-carriers so that they rise to positions determined by the corresponding stops; and then operates the hammers for the types and punches.

The first rearward movement withdraws the pins through the action of the pawl 83^k and the resetting rod 83^b the type-carriers being held by the friction device 45 for the moment. The further backward movement withdraws the punches by the action of the toggle 73, 74 and lifts the card out of the machine through the action of the lifting plate 15 and the curved racks 27 and rollers 25. Thereafter the friction pawl 45 is withdrawn and the type-carrier resetting rod 41 strikes the bottoms of the slots in the carriers and pulls them down; after which the zero pins are reset through the action of the resetting rod 97^c, thus holding the carriers down. Finally the gear 8 engages the gear 9 and withdraws the card feeding slide 6 to position to engage the next card.

For any group of numbers to be recorded which does not appear on any of the keys 107 of the machine the operator may use the individual keys 81. It is only necessary in this case that the operator take care by proper manipulation of the release key 79 to insure that the pin box 98 is in proper position for recording the numbers on the desired part of the card.

The carriers 38 (Fig. 4) corresponding to the group keys 107 rise ten full spaces, to the limit allowed by the resetting rod 41, when no one of the group keys 107 has been pressed, so that the types and punches rise above the level of the hammers and followers and no record is made thereby.

As shown in Figs. 9, 9^b and 9^c the alternate items are printed in different lines. This is not only clearer in distinguishing the successive numbers from each other, but permits of the printing of the card beforehand, in large enough letters to be easily legible with such long titles as "time call is made", etc. It permits also of using a card with the corner cut off, without thereby materially affecting the usable area. This operation is secured by making the alternate groups of type-carriers 38 longer and shorter respectively so that the corresponding types 36 in the two adjacent groups stand at different levels, as shown in Fig. 8; the followers 51 for striking the types being also grouped alternately in two different levels as shown in Fig. 5.

Additions and alternatives.

The several mechanisms and elements of the complete machine may be considerably varied and various omissions may be made and various additional provisions may be applied for adapting the apparatus to different classes of work without departing from the invention. Certain alternative constructions and additional mechanisms are hereinafter described and it will be understood that various other changes may be made.

Alternative automatic key release.—It may be desired to leave in the machine a certain central station for a number of successive operations; that is to say to leave one of the combination keys 107 pressed downward. In this case the key releasing slide 148 of Fig. 6^c will be substituted by a slide 155 which has no engagement with the pawls 88 corresponding to the combination keys, but which has the previously described slotted engagement with pins on the ends of the pawls 88 of the several individual keys. The same principle may be applied in the various uses of the machine where any number or group of numbers is to be repeated in a number of successive operations.

Alternative cards.—Fig. 9^b shows a card of a style suitable for department store accounts. The card number (123 in the drawing) can be put on automatically, that is without the pressing of any keys, by the use of the counting mechanism hereinafter described. For the kind of sale the corresponding types in the machine may carry letters of the alphabet instead of numerals, only a few letters being necessary to indicate the comparatively few kinds of sale desired, as "charge" "credit" "C. O. D."; and these being abbreviated if necessary. The sales person's number will be recorded by means of one of the group keys 107, each machine being designed for use by a limited number of sales persons and each group key bearing the number of one of such persons. The amount will be recorded in the usual way by means of the individual keys 81.

Fig. 9^c shows a card for keeping account of the time spent on a job in a workshop. When work is commenced the card is put into a machine of the same general type as for telephone accounts with certain additional mechanism hereinafter referred to; the card being punched under key-control with the job number and class of work. When work ceases the card is again put in the machine and the handle is pulled, automatically making a record of the ending time, completing the card like Fig. 9^c and ejecting it.

Alternative punching devices.—In previ-

ous figures I have shown for clearness sake the simplest arrangement of the punches 37 and the punch-operating hammer or follower 71. I prefer, however, for reliability of construction to substitute therefor the arrangement shown in Fig. 11. According to this arrangement the punches 37 are mounted in a plate 158, one punch being provided for each of the four spaces. The hammer-bar 157 is operated similarly to the bar 71 of the previously described constructions and straddles the slides 38 which carry types 36. The hammer-bar is connected by its rear face to the plate 158 engaging collars on the shanks 77 of the punches so as to withdraw the punches by the return movement of the hammer-bar. The carrier 38 instead of carrying the punches (as in the previously described construction) carries followers 159 grouped and located upon the carrier so as to come in line with the several punches in such a way that when the hammer-bar 157 is advanced it acts through one or more of the followers 159 to advance the punches in accordance with the table, Fig. 9a.

Fig. 12 shows the same principle of operation as Fig. 11, but applied to a system using ten vertical spaces and making a perforation in only one of these spaces for any one of the figures to be printed. In this case the carrier 38 carries a single follower 159 and there are ten punches 37 spaced apart in the same way as the types 36. As the carrier rises the follower 159 is brought successively into line with the several punches 37. The hammer-bar 157 spans the entire line of punches so as to operate the follower 159 in whatever position it may be set. Fig. 13 shows an adaptation of the mechanism of Fig. 5 to a system using ten spaces. A single punch 37 is used in this case and mounted directly in the carrier 38 and the hammer-bar 71 is made of a sufficient height to span the entire column of ten spaces.

Single column machine.—The key-board of Fig. 1 shows four columns of individual keys 81 and a number of group keys 107. The invention includes not only such keys and the grouping thereof illustrated, but also machines with various other keys and combinations of keys. For example, a convenient machine simpler than the one illustrated, but still adapted for many purposes, might have a key-board containing a single column of keys 81. The release key 79 would then be simply a zero key and each key would set the intermediate mechanism for recording the controlling devices and would also effect a release of the escapement a distance of one column.

Laterally shifting card.—Instead of securing the lateral arrangement of the successive records of a single line by shifting the intermediate mechanism, this mechanism may be made stationary and the card shifted. In this case the intermediate controlling mechanism would be stationary and would contain only the same number of columns as there are on the key-board. The handle would, therefore, have to be operated to make the record on the card and to shift the card step by step for each group of numbers recorded.

No claim is made herein to the punching and printing means disclosed except as they may constitute parts of the recording mechanism as defined in the following claims.

What I claim is:

1. A machine of the class described having two sets of keys, mechanism controlled by each of the keys of one of said sets for recording on a card in print and in perforations a single character and a different mechanism controlled by each of the keys of the other set for similarly recording a certain group of characters.

2. A machine of the class described including in combination a plurality of columns of keys, each of said columns comprising a complete set, devices for recording characters in a number of columns greater than the number of columns of keys, and an intermediate mechanism for transferring the control of said keys to successive recording devices.

3. A machine of the class described including in combination character keys, recording devices, an intermediate mechanism adapted to be operated by said character keys, a release key and means controlled by said release key for causing said intermediate mechanism to transfer the control of the character keys to said recording devices.

4. A machine of the class described including in combination character keys, recording devices, out of line with said character keys, an intermediate mechanism originally in line with said character keys and adapted to be operated thereby, a release key, and means controlled by said release key for shifting said intermediate mechanism to position in line with said recording devices to transfer the control of the character keys thereto.

5. A machine of the class described including in combination a plurality of columns of keys, each of said columns comprising a complete set, recording devices, intermediate mechanism for transferring the control of said keys to said recording devices and means for shifting said control group by group, so as to permit an operation of the keys in the several columns, the shifting of the control by such keys to the desired recording devices, and the repeated operation of such keys.

6. A machine of the class described including in combination a plurality of col-

umns of keys, each of said columns comprising a complete set, devices for recording characters in a number of columns greater than the number of columns of keys, and an intermediate mechanism for transferring the control of said keys to successive recording devices, and an additional set of combination keys, each of which is adapted to control a plurality of recording devices.

7. A machine of the class described having a key-board comprising a plurality of complete sets of characters, recording devices and intermediate mechanism upon which the movements of said key-board may be impressed a plurality of times in succession, said intermediate mechanism controlling said recording devices in accordance with the successive movements of the key-board.

8. A machine of the class described including in combination a plurality of column of keys, recording devices and intermediate mechanism for transferring the control of said keys to said recording devices, said intermediate mechanism comprising columns of setting pins 97 adapted when operated to limit the movement of the recording devices, one column of such pins 97 for each column of keys.

9. A machine of the class described including in combination a plurality of columns of keys, recording devices and intermediate mechanism for transferring the control of said keys to said recording devices, said intermediate mechanism comprising columns of setting pins 97 adapted when operated to limit the movement of the recording devices, one column of such pins 97 for each column of keys, and means for shifting said intermediate mechanism to bring the columns of pins 97 into register with different columns of keys.

10. A machine of the class described including in combination a plurality of columns of keys, recording devices and intermediate mechanism for transferring the control of said keys to said recording devices, said intermediate mechanism comprising a column of pins, which are movable by the movement of the corresponding keys and which when moved serve to limit the movement of the recording devices accordingly, and a fixed stop for limiting the movement of the recording devices according to one of said keys.

11. A machine of the class described including in combination a plurality of columns of keys, recording devices and intermediate mechanism for transferring the control of said keys to said recording devices, and said intermediate mechanism comprising a column of pins, which are movable by the movement of the corresponding keys and which when moved serve to limit the movement of the recording devices accordingly, and a fixed stop for limiting the movement of the recording devices according to one of said keys, and a dummy pin corresponding to the same key as said fixed stop and adapted when operated to release the other pins, and means for causing the retraction of said pins from their advanced position when released.

12. A machine of the class described including in combination a plurality of columns of keys, recording devices and intermediate mechanism for transferring the control of said keys to said recording devices, said intermediate mechanism comprising a column of pins, which are movable by the movement of the corresponding keys and each of which when moved serves to limit the movement of the recording devices accordingly and to release the other pins in the same column, a fixed stop for limiting the movement of the recording devices according to one of said keys, and a dummy pin corresponding to the same key as said fixed stop and adapted when operated to release the other pins, means for causing the retraction of said pins from their advanced position when released, and means for operating the zero pin after a recording operation to cause the retraction of any other pin which may have been advanced.

13. A machine of the class described including in combination a plurality of columns of keys, recording devices and intermediate mechanism for transferring the control of said keys to said recording devices, said intermediate mechanism comprising columns of setting pins 97 adapted when operated to limit the movement of the recording devices, one column of such pins 97 for each column of keys, a zero pin in each column which when operated releases the other pins in said column, and means for operating the zero pins of the several columns after a recording operation.

14. A machine of the class described including in combination a plurality of columns of keys, recording devices and intermediate mechanism for transferring the control of said keys to said recording devices, said intermediate mechanism comprising columns of setting pins 97 adapted when operated to limit the movement of the recording devices, one column of such pins 97 for each column of keys, a zero pin in each column, means for retracting said zero pin upon the operation of one of the other pins in the same column and means for automatically advancing the zero pins of the several columns after each operation and the retraction of the recording devices.

15. A machine of the class described including in combination a plurality of columns of keys, recording devices, intermediate mechanism for transferring the control of said keys to the recording devices, a re-

lease key for releasing keys which have been pressed, and an escapement device operated by said release key for causing the shifting of said intermediate mechanism to positions for controlling successive recording devices.

16. A machine of the class described including in combination a plurality of columns of keys, recording devices, intermediate mechanism for transferring the control of said keys to the recording devices, a release key for releasing other keys which have been pressed, and an escapement device operated by said release key for causing the shifting of said intermediate mechanism to positions for controlling successive recording devices, an operating shaft and means controlled thereby for restoring said intermediate mechanism to its original position after the recording operation.

17. A machine of the class described including in combination recording devices, a set of carriers carrying said devices, springs for moving said carriers to operative positions, a retracting rod for said carriers, key-controlled mechanism for limiting the movement of said carriers by their springs, an operating shaft and means actuated thereby for releasing said carriers, causing the operation of said recording devices and operating said retracting rod.

18. A machine of the class described including in combination recording devices, a set of carriers carrying said devices, springs for moving said carriers to operative positions, a retracting rod for said carriers, key-controlled mechanism for limiting the movement of said carriers by their springs, an operating shaft and means actuated thereby for releasing said carriers, causing the operation of said recording devices and operating said retracting rod, said recording devices including means for punching holes in a card, and means controlled by said shaft for withdrawing the punching means before operating said retracting rod.

19. A machine of the class described including in combination recording devices, a set of carriers carrying said devices, springs for moving said carriers to operative positions, a retracting rod for said carriers, key-controlled mechanism for limiting the movement of said carriers by their springs, an operating shaft and means actuated thereby for releasing said carriers, causing the operation of said recording devices and operating said retracting rod, and means for preventing said carriers from advancing beyond the limit set by said key-controlled mechanism when the latter is withdrawn.

20. A machine of the class described having a single set of keys numbered from zero to 9, recording devices adapted to be operated under control of said keys, an intermediate mechanism for transmitting the control of said keys to said recording devices, means operated by each of said keys for shifting said intermediate mechanism step by step along said recording devices, and means for operating a plurality of said recording devices at once.

In witness whereof, I have hereunto signed my name in the presence of two subscribing witnesses.

JOHN ROYDEN PEIRCE.

Witnesses:
D. ANTHONY USINA,
LULU STUBENVOLL.