J. T. SCHAAFF.

PAPER PERFORATING MACHINE.

APPLICATION FILED NOV. 17, 1916.

1,300,491.

Patented Apr. 15, 1919.

5 SHEETS—SHEET 1.

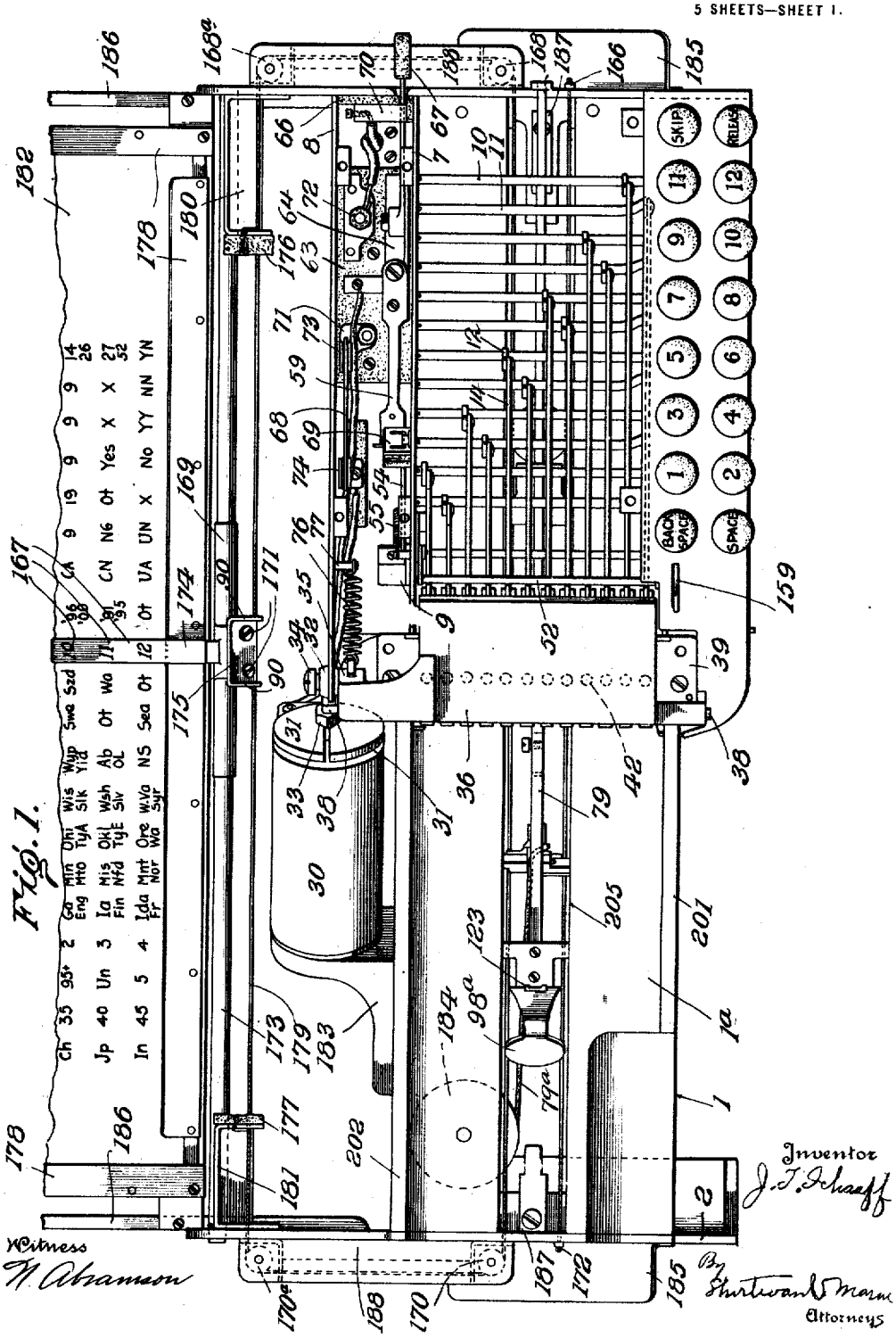


Fig. 1.

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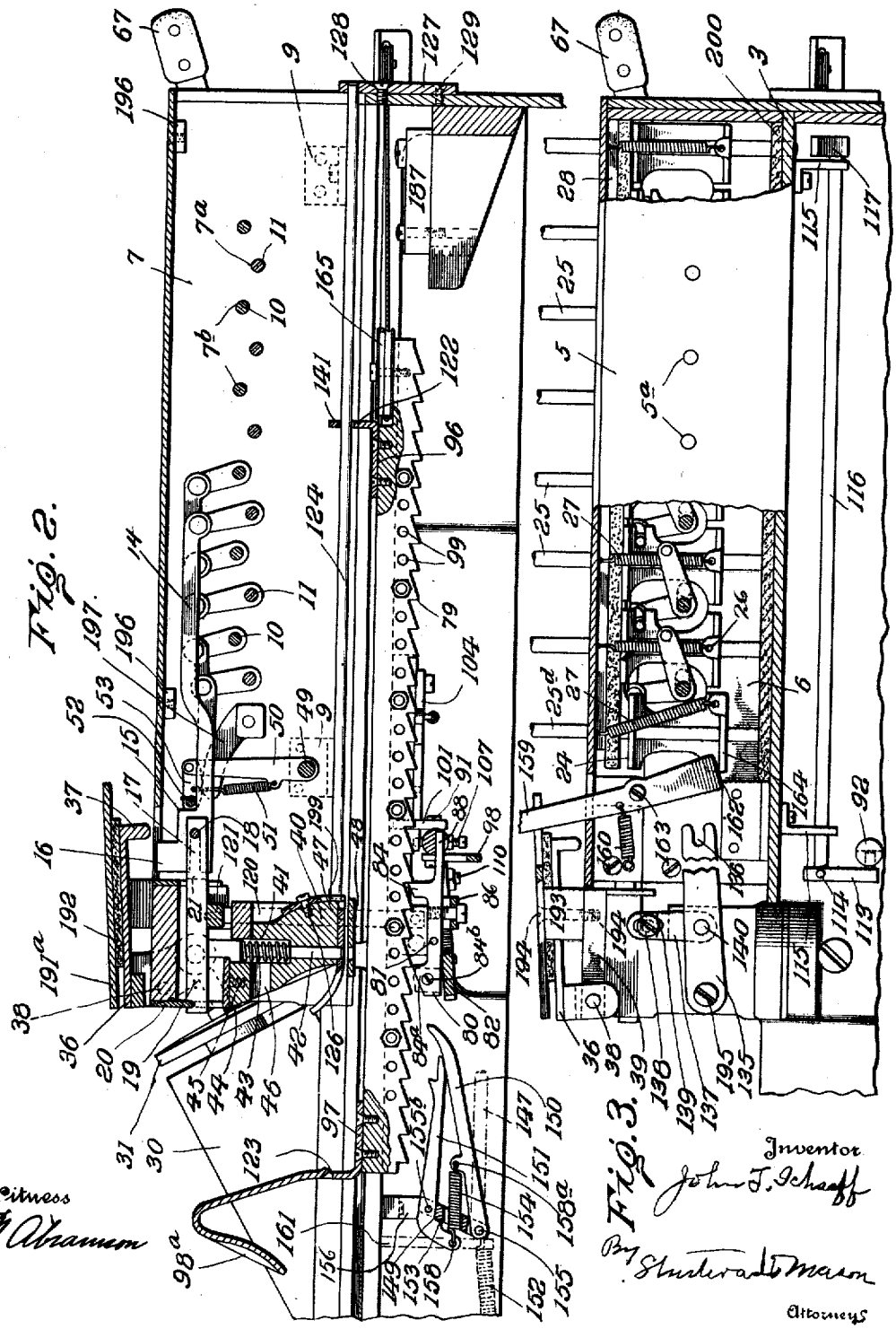


Fig. 2.

Fig. 3.

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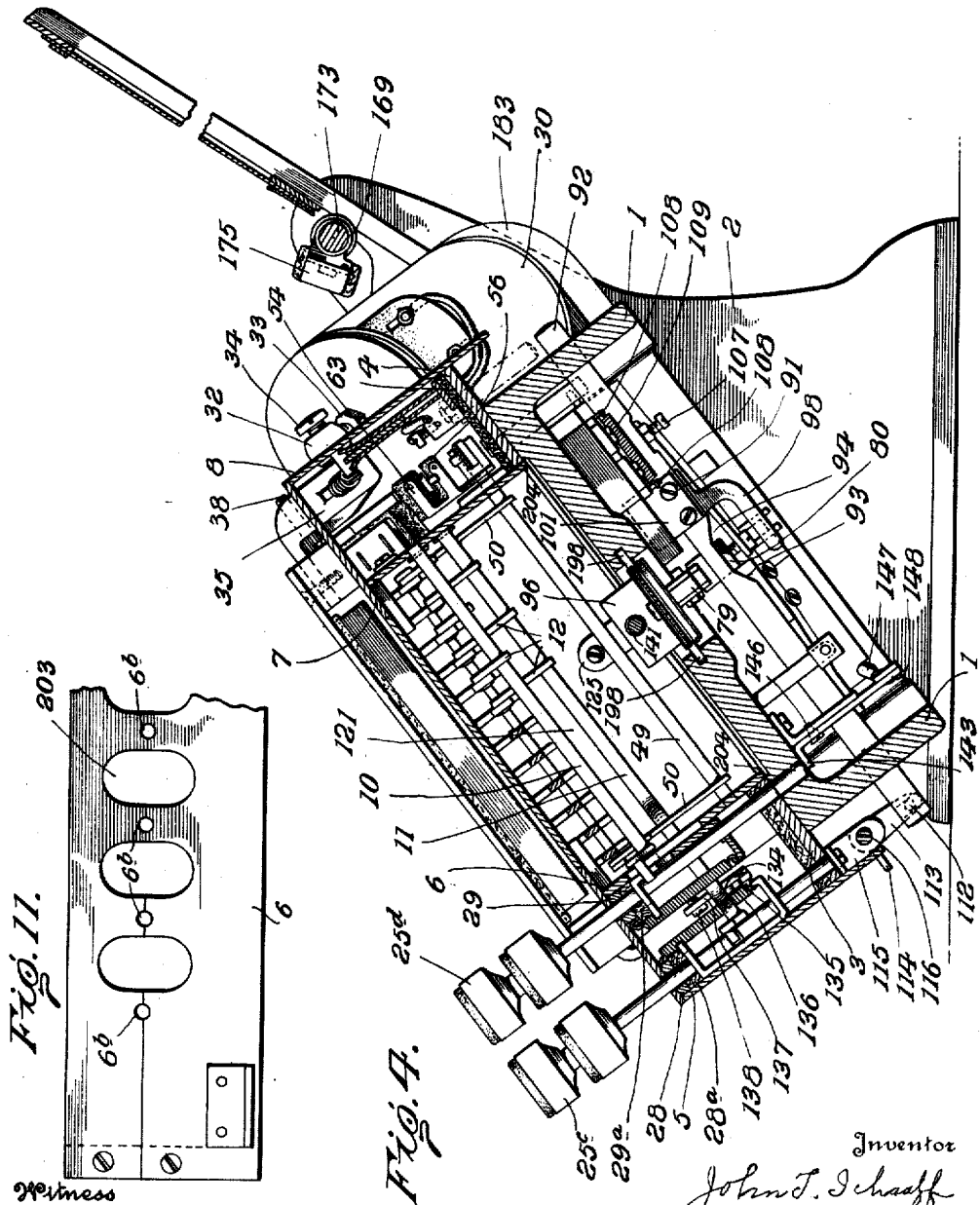


Fig. 4.

Fig. 11.

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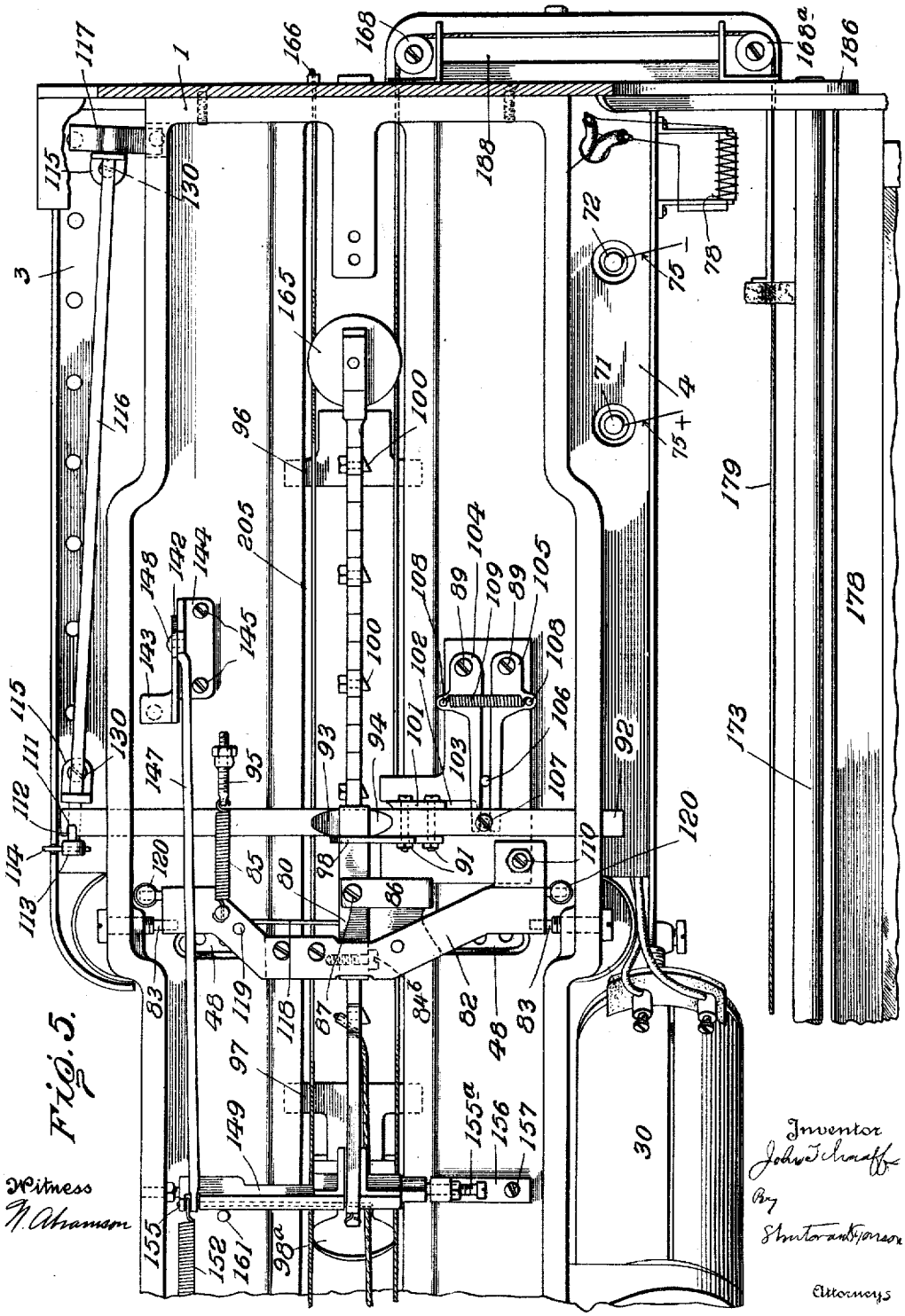


Fig. 5.

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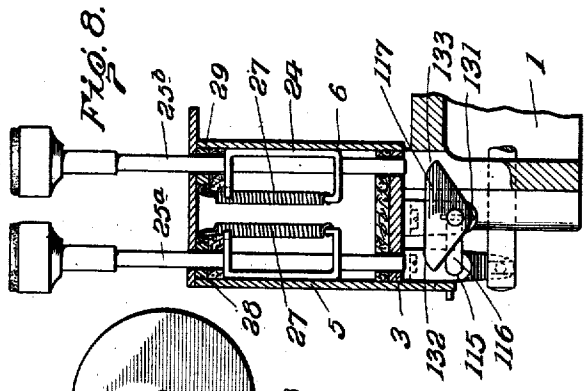
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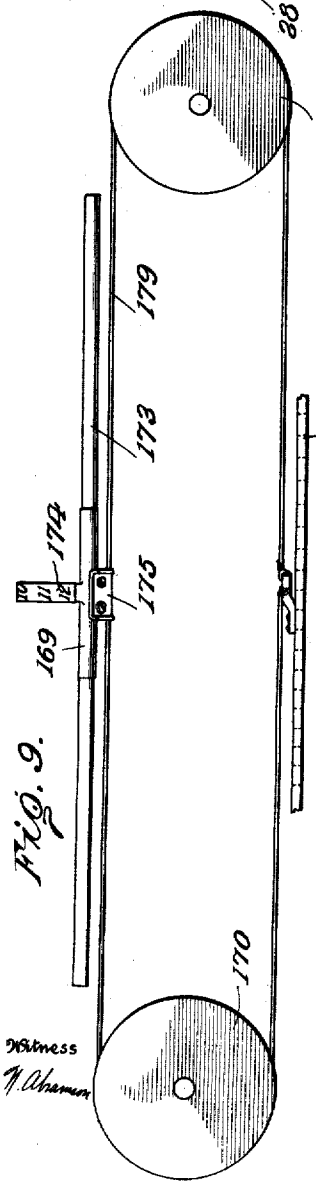
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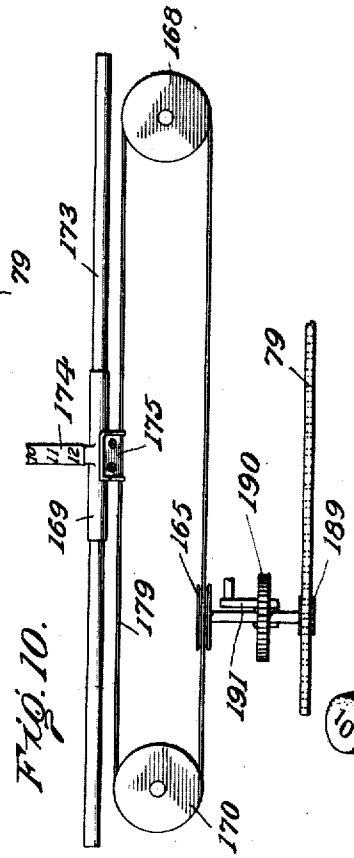
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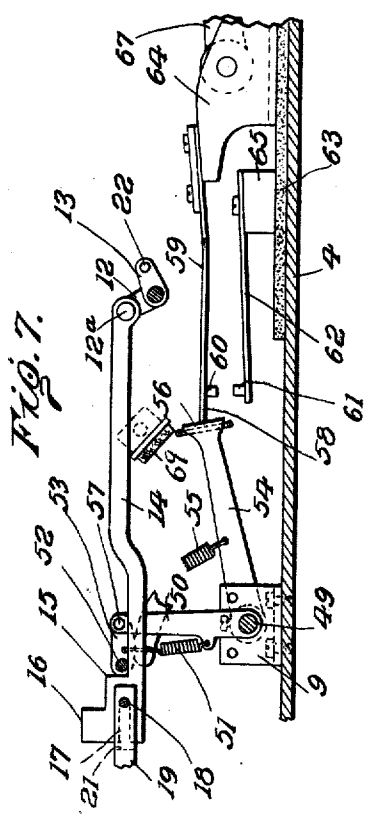
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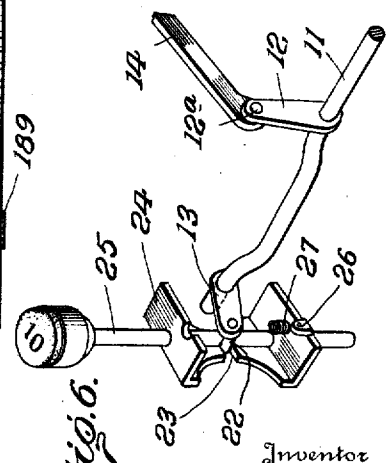
5 SHEETS—SHEET 5.











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UNITED STATES PATENT OFFICE.

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PAPER-PERFORATING MACHINE.

1,300,491. Specification of Letters Patent. Patented Apr. 15, 1919.

Application filed November 17, 1916. Serial No. 131,934.

To all whom it may concern:

Be it known that I, JOHN T. SCHAAFF, a citizen of the United States, residing at Washington, District of Columbia, have invented certain new and useful Improvements in Paper-Perforating Machines, of which the following is a description, reference being had to the accompanying drawing and to the figures of reference marked thereon.

Among the main objects of this invention is to provide a machine for perforating all kinds of record cards, but especially those of the more complex kinds which it is very difficult, if not practically impossible to punch out of sight without outside guidance.

A further object is to provide a machine in which the power for perforating the card is supplied through an electromagnet instead of by the fingers of the operator.

A further object is to provide simple and improved means for making and breaking the electric circuit.

A further object is to provide means with the aid of which perforations may be made in the reverse order—that is from right to left when desired.

A further object is to provide means which will enable the operator to make several perforations in the same vertical column, the escapement mechanism remaining inactive the while.

A further object is to provide simple, positive and adjustable means for first releasing the card carrier and then arresting its movement at any predetermined point in its travel toward the left by the depression of a single finger key.

I also provide means for moving the card carrier forward, or toward the left, by a step-by-step movement without perforating the card at each step.

A further object is to provide an indicator of special design which will at all times show the column then under the punches, and at the same time indicate the particular key to be depressed to perforate the desired symbol in that column.

A further object is to provide means for moving the indicator across the index card by steps equal in number to, and coincident with the steps of the card carrier but of different lengths from those of the card carrier.

Another object is to provide means which, while holding firmly the card being perforated against buckling, offers the least amount of friction and is easily and quickly removable to free the card should one become jammed in the machine.

Of the drawings herewith, Figure 1, is a top plan view with the front of the cover removed and showing part of the index card. Fig. 2, is a vertical section, from right to left through the machine, forward of the center line. Fig. 3, is a front elevation, with part of the housing broken away. Fig. 4, is a fore and aft section, just to the right of the row of punches. Fig. 5, is a bottom plan view. Fig. 6, shows details of one of the punch keys. Fig. 7, shows details of the contact mechanism. Fig. 8, shows details of release and back step keys. Fig. 9, shows means for moving the indicator by steps equal in length to those of the card carrier. Fig. 10, shows means for moving the indicator in steps of any length desired, in their relation to those of the card carrier. Fig. 11, is a detail of plate 6.

The invention consists broadly in a paper perforating machine wherein a series of punches are operated selectively and at the will of the operator by electric power. The machine includes a suitable supporting base on which a card, such as a record card is placed for perforating. The card is moved back and forth on the supporting base by a shifting carriage or carrier which is controlled by an escapement mechanism or by a back stepping mechanism. Suitable releasing means is provided for the escapement so that the card may be moved step by step or may be shifted bodily from one column position to another or entirely released and withdrawn from beneath the operating punches. A series of punches is arranged in a line transversely to the movement of the card and each punch is controlled by a finger key and suitable devices operated thereby. A motor frame moved by a magnet operates upon an interposing member controlled by the key for actuating the punch, associated with the particular key depressed. This interposing member also controls the electric circuit for the magnet and operates to close the contacts and to release the contacts while the key is depressed so that the electromagnet is only momentarily energized

and the punch is widthdrawn just as soon as it has performed its work whether or not the key is released.

Associated with the perforating machine is an index card, and an indicator which is shiftable with the record card being punched, so as to indicate to the operator the particular column of the record card directly underneath the punches which is, of course, hidden from the operator.

With this general statement of the parts of the machine a detail description of the present embodiment of the invention will be given.

Card support and shifting carriage.

The machine consists of a supporting base or main frame 1 carried by supporting feet 2. The feet 2 are so shaped that the upper surface 1^a of the supporting base is inclined at an angle of about 40° to the horizontal plane to facilitate the insertion and removal of the cards from the machine. The cards are placed on this supporting surface 1^a. The supporting base has guiding flanges 201 and 202 at each side of the supporting surface 1^a for the card and the card is moved in an endwise direction between these guiding flanges. Extending lengthwise of the base 1 and near its center is a slot 205 through which the upturned ends of the card supporting plates 96 and 97 move. These supporting plates are secured by suitable screws to the rack bar 79 of the escapement mechanism and the rack bar together with the supporting plates form the carriage for shifting the cards back and forth in an endwise direction on the supporting surface 1^a and underneath the punches. Along the inner edges of the slot 205 are guide ways 198 in which the lower edges of the supporting plates 96 and 97 move. Blocks 187 are rigidly secured to the base 1 and limit the endwise movement of the rack bar. This bar is moved in one direction by a spring and is controlled by an escapement mechanism as will hereinafter be more fully described. The plate 96 is provided with an upturned member 122 and one end of the card is placed against this upturned member while the other end of the card is placed against the upturned member 123 of the end plate 97. The upturned portion 123 is extended to form a thumb piece 98^a for moving the carriage or card carrier when placing the card underneath the punches. It is important that the card should be held from buckling as it is shifted on the supporting surface 1^a therefor and this is accomplished by having the edges of the card extending into guiding grooves 204. A plate 3 is secured to the guiding ledge 201 while a plate 4 is secured to the guiding ledge 202. The plate 3 carries upstanding plates 5 and 6 which are secured thereto by angle pieces 9 while the plate 4 carries upstanding plates 7 and 8 secured thereto in a similar manner. These plates are for supporting the finger keys and the operating mechanism controlled thereby, as will be hereinafter more fully described. The plates 6 and 7 are spaced at their lower edges from the surface 1^a so as to form these guiding grooves 204. I also provide a plate 125, which is secured by a screw 126 to the punch socket bar. This plate has a hole 199 to receive one end of a card holding rod 124 and the other end of this rod extends through a hole 141 in the end plate 96. The rod is fastened to a plate 127 held to the end of the base by a screw 128 and a dowel 129. The plate 96 slides along this rod and the rod is located just above the card so as to present that portion of the card which is underneath the operating parts of the machine from buckling. Ordinarily, the cards will move along the supporting base freely without touching the plates 6 or 7 or the rod 124, but should a card tend to buckle, then these parts will hold the card flat and if by any reason the card should be wedged in the machine the screw 128 can be quickly taken out and the rod 124 withdrawn and the card removed.

Punches and supporting devices therefor.

As clearly shown in Figs. 1 and 2 of the drawings, I have provided a series of punches indicated at 42 which are arranged in a line extending transversely of the direction of movement of the cards underneath the punches. The punches are mounted in suitable sockets 41 and are normally pressed in an upward direction or held retracted by springs 43. Each punch is provided with a spring which surrounds the punch and bears at its upper end against a shoulder on the punch while the spring at its lower end bears against a shoulder at the lower end of the socket in which the spring is housed. The punches are held from turning in their sockets by a punch guide plate 44 which engages the flat side of the shank of each punch and this plate is held on the supporting frame by screws 45. The supporting frame 40 is provided with holes 46 intersecting the punch sockets through which an instrument may be inserted to free choked punches. Beneath the punches is a die 48, it being understood, of course, that there is a female die for every punch. A punch stripper plate 47 is secured to the frame carrying the punches and the card passes between this punch stripper plate and the die 28. It will be understood from the above description that the card which is placed on the supporting surface 1^a is slid along the surface by the end plates 96 and 97 and that the card will pass between the stripper plate 47 and the die 48, the stripper plate at the receiving side being turned up to insure

the card passing underneath the same. The stripper plate insures the punches being withdrawn from the card. It sometimes occurs that when the punches become dulled that a bur is left around the hole punched which is liable to catch in the die and considerable pressure is necessary to be exerted to push the card forward. This, however, may be readily done without any danger of the card buckling by reason of the grooves 204 receiving and guiding the edges of the card and the rod 124 which is directly above the card. It is understood that the card during a greater portion of the punching thereof, at least, is moved from the right to the left as viewed in Fig. 2. In other words, the card is placed on the supporting surface and moved to the right underneath the punches to its extreme position and then as the punching operation occurs it will be stepped to the left through the action of the escapement for the carriage. Through a back stepping mechanism, however, it may be stepped to the right as will be described more fully hereinafter.

Electromagnetic motor device.

The punches are moved to perform their work of punching the card by an electromagnetic motor device including a motor plate 36. This motor plate is pivoted at 38 to the fulcrum plate supporting bar 39. A spring 76 secured at one end to a pin 77 and its other end to an arm 35 on the motor plate 36, normally tends to hold said motor plate raised and against a felt pad 192 secured to the under face of the motor plate stop 191^a. Said motor plate stop 191^a is secured on supports 193 by screws 194 which pass through the supports and are threaded into the fulcrum plate supporting bar 39, (see Fig. 3). This motor plate 36 is moved downward by the magnet 30 when said magnet is energized. The magnet 30 is secured to a bracket or lug 183 made integral with the base 1. Said magnet has an armature 31 carrying a screw eye 32. This screw eye 32 is connected to the crank pin 34 which is threaded into the depending arm 35 of the motor plate 36. The shank of the screw eye is adjustably connected to the armature and is held in adjusted position by a lock nut 33. From the above it will be apparent that when the magnet 30 is energized the armature will be drawn down and in, thus swinging the motor plate 36. This motor plate is common to all of the punches and operates the punches through an intermediate mechanism controlled by the finger keys.

Finger keys for the punches and devices controlled thereby.

Associated with each punch is a finger key controlling the same. These finger keys, as shown in Fig. 1, are numbered 1 to 12 inclusive, as in the present illustration of the invention there are twelve punches.

These punch-controlling finger keys are indicated at 25 in Fig. 3 of the drawings, and each finger key is attached to a rod which slides endwise in suitable guideways in the framework of the machine. The finger keys are arranged in two banks and the rods or stems of the finger keys of the lower bank slide in a guide 28, which is a part of the machine, while the rods or stems on the upper bank of keys slide in a guide 29. Each rod or stem of the finger keys carries a frame 24, which is provided with a lug 26. A spring for each finger key is secured at one end to the lug 26 and at its other end to one of the guides for the rods or stems of the finger key. These springs tend to hold the keys normally raised and with the frames 24 pressed against felt stops 28^a and 29^a respectively for the upper and lower banks. These frames also engage a felt stop 200 and limit the downward movement of the keys.

As clearly shown in Fig. 6, the frame 24 is provided with a slot 23 which is adapted to engage a crank 22 on the end of an arm 13 mounted on a rock shaft. There is a rock shaft for each key, the rock shafts for the upper bank of keys being numbered 11 in the drawings (see Fig. 1) and the rock shafts for the lower bank of keys being numbered 10, and these rock shafts are mounted in suitable perforations 5^a and 7^a respectively of the plates 5 and 7 and also 6^b and 7^b respectively of the plates 6 and 7. The plate 6 has openings 203 through which the rock shafts 11 pass. Each rock shaft 11 carries a second arm 12 and pivoted to each arm 12 at 12^a is an interposing member 14. This interposing member 14 is formed at its left hand end, as viewed in Figs. 1 and 7, with shoulders 15 and 16 which are disposed at relatively different heights. When a finger key is depressed, the interposing member 14 controlled by such key will be moved to the right, as viewed in Fig. 2, and this will bring the shoulder 16 underneath the engaging bar 37 of the motor plate 36.

Each interposing member is provided with a slot 17 which engages a pin 18 at the outer end of a punch lever 19, which overlies the punch 42 with which it is associated. The outer end of the punch lever 19 has also a slot 21 in which the slotted end of the interposing member 14 moves. The inner end of this punch lever is fulcrumed on a plate 20 secured to the support 39. When the interposing member therefore, is moved to its extreme right, so as to bring the shoulder 16 underneath the engaging bar 37, a downward movement of the engaging bar 37, when the electromagnet is energized, will force the interposing member downwardly

and through the slot and pin connections 17 and 18 the punch lever 19 will be forced downwardly at its outer end, thus forcing the punch down with which it is associated and causing the same to perforate the card. When the motor plate releases the interposing members, they are returned to their normal raised position through the action of the springs 43 lifting the punches.

Circuit-controlling devices.

This interposing member 14 which becomes the means of conveying the power of the motor bar to the punch, also serves as a part of the means for controlling the circuit which energizes the electromagnet. The circuit is controlled by the two contacts 60 and 61, (see Fig. 7). The contact 60 is carried by a spring 59 fixed to a bracket 64. The contact 61 is carried by a spring 62 which is relatively stronger than the spring 59. This spring 62 is secured to a bracket 65. Both the brackets 64 and 65 are mounted on a fiber plate 63. When the contacts 60 and 61 are closed, then the circuit is closed through the electromagnet, and when these contacts are separated, then the circuit is broken. An arm 54 carries a fiber plate 56, which is slotted to receive the end 58 of the contact spring 59. This arm 54 is carried by a shaft 49 journaled in plates 6 and 7.

The shaft 49 also carries arms 50. Pivotally supported at 57 on the arms 50 are arms 53, which carry a bail 52. One of the arms 53 rests normally upon an adjustable bracket or stop 197, which is fastened to the plate 7 and limits the downward movement of the arm 53. The bail 52 extends across all the interposing members. A spring 51 normally tends to press the bail-carrying arm 53 down against the stop 197. This spring, of course, is much lighter than the springs which raise the punches.

On the depression of the finger key 25, the interposing member connected thereto will be moved to the right, as viewed in Fig. 2, the shoulder 16 be brought under the motor plate bar 37 and the shoulder 15 engage the bail 52. This movement of the interposing member also swings the arm 50 to the right, rocking the shaft 49 and lowering the arm 54 which brings the contact 60 into engagement with the contact 61, thus closing the electric circuit and the motor thereupon becomes energized. As the end of the interposing member 14 is moved downward by the motor bar, the shoulder 15 is carried below the contact bail 52 thereby releasing the bail. As soon as this bail is out of engagement with the shoulder 15, the spring 55 lifts the arm 54, forcing the bail 52 to the left on top of shoulder 15. This lifting of the arm 54 also separates the contacts 60 and 61. This separating of the contacts deënergizes the magnet and releases the motor plate, so that its controlling spring raises the same and permits the punch lever and interposing member depressed by the motor plate, to return to their raised positions. The upward movement of the interposing member carries the bail, now resting on top of shoulder 15 with it, and when the finger key is released, then the interposing member is moved to the left and the bail 52, under the influence of spring 51 will again fall in behind shoulder 15. It will also be seen that the adjustable stop 197 controls in large measure the duration of the electric action, as the higher up the bail 52 is held by the stop 197, the sooner will the bail be released from the shoulder 15, as that is being depressed by the motor plate.

The circuit to the contacts 60 and 61 includes a switch which is provided with a movable member 67 pivoted to the bracket 64 and which contacts with the switch block 70 mounted on the fiber plate 66. This switch is in electrical connection with resistance 78 (see Fig. 5), and a suitable source of electrical energy indicated by the lines 75, 75.

A binding post 71 connects with a clip 73 which holds one end of a fuse 68, the other end being held by a clip 74 which is connected with the electromagnet. The other terminal of the electromagnet is connected with the bracket 65 and thence through the contacts 61 and 60, carried by springs 62 and 59 respectively, to the bracket 64, and through the switch member 67 and switch block 70 and resistance 78 to the other binding post 72.

When the switch is closed, then the source of electric current is connected with the system and will be controlled by the contacts 60 and 61. When, however, the switch is open, the current is cut off from the machine. 69 is a felted stop secured to the plate 7 and limits the upward movement of the contact arm 54.

Escapement mechanism.

As noted above, the card is mounted on a movable carriage which includes a rack bar 79. This rack bar is moved to the left, as viewed in Fig. 2, by suitable spring mechanism attached to the cord 79^a. This spring mechanism 184 is of the usual type for moving carriages and has not been shown in detail.

Coöperating with the rack bar 79 is an escapement dog 80 having lugs 84 and 84^a. This escapement dog is pivoted at 84^b to the dog rocker 82. This dog rocker 82 is supported by pivot pins 83 (see Fig. 5). A spring 85 secured at one end to the dog rocker and at the other end to an adjusting screw 95, normally tends to swing the dog rocker so as to hold the lug 84 in engagement with the teeth of the rack bar 79. The piv-

otal axis of the dog rocker is disposed between the lugs 84 and 84ª so that when the lug 84 is withdrawn from engagement with the teeth of the rack through a swinging of the dog rocker against the action of the spring 85, the lug 84ª will be caused to engage a tooth in the rack bar, (see Fig. 2.)

The dog rocker 82 is swung on its pivotal axis by links 120 which are connected to the universal bar 121 extending from one side of the machine to the other underneath the punch levers 19. When a punch lever is depressed it will engage this universal bar 121, forcing the same downwardly, thus rocking the dog rocker 82 against the action of the spring 85, withdrawing the lug 84 from engagement with a tooth in the rack bar 79, and causing the lug 84ª to engage a tooth in the rack bar 79. At this time there is but a slight movement of the carriage. When the universal bar 121 is released and the dog rocker is returned to its normal position through the action of the spring 85, then the lug 84ª will be withdrawn from engagement with a tooth in the rack bar 79 and the lug 84 will be moved into the path of the next tooth on the rack bar and the carriage will shift to the left one step. As above noted, the escapement dog 80 is pivoted at 84ᵇ to the dog rocker. A spring 118 (see Fig. 5) fixed to the dog rocker by a screw 119, engages at its free end the dog 80 at 81. This spring normally tends to swing the dog 80 upward at its free end. A bracket 86 is rigidly attached to the dog rocker and a screw 87 carried by the escapement dog 80 extends through an opening in this bracket and the head of the screw contacting with the bracket limits the upward movement of the dog.

The purpose of this pivoting of the dog on the dog rocker is to permit the dog to be entirely released from the rack when shifting over several spaces to a set position, or when it is desired to release the rack and withdraw the card from underneath the punches. The normal position of the dog rocker 82 is determined by the adjustable stop 110.

From the above description, it will be apparent that whenever a finger key is depressed, the interposing member 14 performs three functions; first, it closes the contacts 60 and 61 and causes the magnet to be energized; second, it transmits the downward movement of the motor plate to the punch levers; and, third, it moves the universal bar 121 downwardly, thus operating the escapement. This interposing member also in its downward movement releases the control of the contacts, so that the circuit is broken and this permits the motor plate to return to its extreme upper normal position and the universal bar 121 to rise and the feed of the carriage to take place, all of which may occur before the finger key is released.

The feed of the carriage is also controlled by a spacing key indicated at 25ᶜ in the drawing. This key is of the general construction of the finger keys for controlling the punches, and carries a frame 24 having fixed thereto a stud 134. This stud engages a slot 136 in a lever 135 which is pivoted at 195 to the framework of the machine. A link 137 pivoted at 140 to the lever 135, is connected at its upper end to the universal bar 121. Said link 137 is slotted at 139 and a shouldered screw 138 extends through the slot and is threaded into the end of the universal bar 121.

From the above it will be apparent that by depressing the key 25ᶜ, the lever 135 may be moved downwardly, which moves the universal bar 121 downwardly and operates the escapement dog. When the key is released, the carriage will be fed one step. It will be noted that if this key is held depressed, then the universal bar 121 is out of range of the punch-operating levers and the punches may be actuated one after the other without any feed of the carriage, and this enables any or all of the punches to be operated to punch perforations in the card in the same column.

Skip key and releasing mechanism.

It is sometimes desirable to release the carriage so that it may be moved to various set positions, or entirely released, to withdraw the card from underneath the punches. This is accomplished in the first instance by a skip key, and in the second instance by a release key. These keys are indicated at 25ᵇ and 25ª in the drawings (see Fig. 8). These keys are of the usual construction of the finger keys and are so positioned as to engage respectively a triangular plate 117. The key 25ª engages the end 132 of this triangular plate, while the key 25ᵇ engages the end 133 of the triangular plate. The triangular plate is fixed to a shaft 116. The triangular plate 117 is secured by a pin 131 to this shaft 116. The shaft is journaled in bearings 115 secured to the base by suitable screws 130. An arm 113 is fixed to the shaft 116 by means of a pin 114. This arm 113 carries a pin 112 which engages the slot 111 in the releasing bar 92. The releasing bar has cam faces 93 and 94 which are adapted to engage the end 88 of the dog 80 and thereby move the dog 80 about its pivot 84ᵇ, withdrawing the lug 84 from engagement with the teeth of the rack bar 79.

This releasing bar 92 is controlled by arms 104 and 105. These arms are pivoted respectively at 89 to a plate 103 which is attached to the base of the machine. Each of the arms 104 and 105 is provided with a pin 108 and a spring 109 connects these pins,

normally pressing the arms toward each other. A limiting stop or pin 106 is secured to the plate 103, and the arms 104 and 105 are respectively normally pressed against this stop.

The releasing bar 92 carries a pin 107 extending between the arms 104 and 105. When the releasing bar is moved in one direction, one of the arms 104 will be carried away from the stop 106, and the spring 109 will return the releasing bar to normal position as soon as released. When this releasing bar is moved in the other direction, then the other arm returns the releasing bar so that it is normally held in the position shown in Fig. 5 of the drawings.

When the key 25^a is depressed, the releasing bar is moved toward the rear of the machine until the cam face 93 has forced the lug 84 from the rack 79. Then the spring in the spring box 184, operating through the cord 79^a moves the carriage to its extreme position to the left. When this key 25^a is released, then it is raised by the spring 27, carrying the same up against the felt stop 28^a (Fig. 4) while the arm 105 responding to its spring 109 and acting on the pin 107, restores the releasing bar 92 to its central position.

When it is desired to skip certain of the columns or spaces without making perforations therein, the releasing bar is moved in the opposite direction by depressing the key 25^b. The rack bar 79 is provided with threaded holes 99, one for each tooth, into which stops 100 may be inserted as desired. The releasing bar 92 carries a stop intercepter 101 which moves freely in slot 102 into the path of the stops 100, so that when the releasing bar is moved in a direction so that the cam 94 releases the lug 84 from the rack, the stop intercepter 101 is brought into the path of travel of the stop 100 and arrests the carriage in this predetermined position. This time, when the key 25^b is released, the arm 104 acting on the pin 107 restores the releasing bar to its central position. The dog stop-bracket 98 and the stop intercepter 101 are secured to the releasing bar by screws 91. The bracket 98 prevents an overthrow downward of the end 88 of dog 80, as seen in Figs. 2 and 5.

Back stepper.

In certain classes of work it is desirable to feed the carriage step by step to the right as well as to the left, in positioning the card for the action of the punch or punches. This is accomplished by a back stepper key 25^d, which has its lower end resting normally on an ear 143 of a bell crank 142. This bell crank is pivoted at 146 to a bracket 144 (see Figs. 4 and 5). The bracket 144 is secured to the base 1 by screws 145. A link 147 is pivoted at 148 to this bell crank 142, and the other end of the link engages a pin 155 on a back step dog rocker 149, which is pivoted in brackets 156 secured to the base by screws 157. A holding dog 151 is pivoted to this dog rocker at 155^b, which is in alinement with the dog rocker pivots indicated at 155^a. A pushing dog 150 is pivoted to the dog rocker in line with the pin 155. A spring 152 connected to this pin 155 normally tends to move the back stop dog rocker to the left, as viewed in Fig. 2, bringing the same into engagement with the stop rod 161.

The holding dog 151 is provided with a shoulder 153 which is adapted to engage the back stepper dog rocker 149 and is normally held in engagement therewith by a spring 154 connected at 158 to the holding dog and at 158^a to the pushing dog. This spring also tends to move the pushing dog toward the rack bar 79. When the back stepper dog rocker is against the stop 161, the free end of the holding dog 151 comes against the pushing dog 150, withdrawing the same from the rack and leaving the carriage free to be moved by the regular feeding mechanism.

When the key 25^d is moved slightly downwardly from its upper position, the lever 159 swinging on its pivot 163 under the tension of spring 160, swings the end 162 of the lever over the lower edge 164 of the frame 24 connected to said key 25^d, thus holding the key slightly depressed. In this position the link 147 holds the dog rocker 149 a sufficient distance away from its stop 161, so that the dog 150 is free to engage one tooth after another of the rack bar 79 and the holding dog 151 is held in engagement with said rack bar. By a further downward movement of the key 25^d, through the manipulation of the holding dog and the pushing dog, the rack is moved to the right, as viewed in Fig. 2, one step at a time, it being understood that the key is not released a sufficient distance so as to release the dogs, but comes up against the stop or locking lever 162, which does not throw these dogs out of operation. At this time the downward movement of the universal bar is ineffective, for the reason that although the escapement dog 80 may be drawn from the teeth of the rack, the spring moving the carriage is ineffective, the carriage being held by the holding dog 151 and the pushing dog 150. This enables the card to be moved step by step to the right and perforated. The card is positioned by the back stepper key, and when it is punched the automatic escapement is ineffective to feed the card until key 25^d has been released from the locking lever 162.

Index card and operating mechanism therefor.

The operating parts of the machine are inclosed within a casing formed by the side

plates referred to and the cover plate which is secured thereto by lugs 196. When the card to be perforated is placed on the surface 1ª and moved underneath the punches, it will be noted that the card, where it is being operated upon, is hidden from the sight of the operator. In the case of a card like that indicated at 182 in the drawing, which is the population record card of the United States Census Bureau, the card has 288 symbols, all of which are at times punched, but never, of course, on the same card. It will be apparent that some means is necessary for indicating the location of the symbols relative to the punches, and I have, therefore, provided an index card for this purpose. This index card, as shown in part in Fig. 1 of the drawings, is twice as long and twice as wide as the card which is to be punched, and the symbols are correspondingly increased in size, so they may be readily seen by the operator. I also provide an indicator of special design which travels across the card in steps equal in number, but greater in length than the coinciding steps of the card-carrier or carriage.

The position of the card being perforated in its relation to all of the punches, is shown by the indicator upon the index card. In other words, the column then under the punches contains exactly the same symbols as the column of the index card standing immediately to the right of the indicator.

The index card 182 is carried by a frame supported by arms 186 fixed to the frame of the machine. A rod 173 is supported by the frame of the machine and extends lengthwise of the card the full length thereof. A tube 169 is mounted to slide on the rod and carries the indicator 174. Also mounted on the tube 169 is a clip 175 having turned up edges 90, 90, adapted to contact with felt buffers 176 and 177 secured to the brackets 180 and 181, respectively. The indicator is moved along the rod by a flexible cord 179. The cord is secured to the indicator by being passed between the plates of the clip 175 and clamped therebetween by screws 171. This cord is secured at 166 to the base 1 of the machine. From this point of attachment the cord passes inward and half around the pulley 165 which is attached to the rack bar 79 forming a part of the carriage or carrier for the card. After leaving the pulley, this cord 179 passes over pulleys 168 and 168ª, then through the clip 175, where it is firmly clamped to the indicator; and thence around pulleys 170ª and 170 and again inward and half around the pulley 165, but in the opposite direction, and then back to the base, where it is attached at 172.

It is to be seen, therefore, that the indicator will be moved by the carrier across the index card step by step coincident therewith, but in steps double the length of those by which the carrier is advanced. Should it be desired to give the indicator any other rate of movement than the two-to-one of the card carrier or carriage, this may be accomplished by the modified mechanism which operates the cord, as shown in Figs. 9 and 10.

In Fig. 9, I attach the ends of the cord to the rack bar 79, then pass it around grooved pulleys 168 and 170 which are mounted on the frame of the machine and secure the cord between the pulleys 168 and 170 to the clip 175. When so arranged, the indicator will be moved by steps equal in number and length to those of the card carrier. Should any other relative rate of movement of the indicator and carrier be desired, this may be accomplished by the arrangement shown in Fig. 10. In this Fig. 10 I employ the well known rack, pinion and star wheel mechanism, indicated at 79, 189, 190 and 191. The cord is secured at one end to the grooved pulley 165. The cord is wound several times about this pulley and then carried around the pulley 168 to the clip 175, where it is fastened, and thence around pulley 170 and back to the grooved pulley 165, being wrapped several times again around this pulley in the opposite direction and the end secured thereto. By varying the diameter of the pulley 165, it will be apparent that any desired rate of travel of the indicator relative to the card carrier may be obtained.

The card-holding frame 178 is so constructed that the index card 182 may be readily removed therefrom and one substituted therefor, bearing different symbols. The frame of the machine is provided with suitable cover plates 188 for protecting the pulleys over which the cord runs. The frame is also provided with suitable handles 185 to facilitate the moving of the machine.

Operation.

The operation of my improved machine will be apparent from the above description. The card which is to be punched is placed on the support surface 1ª between the upturned ends 122 and 123 of the plates 96 and 97, and it is then moved underneath the punches to the extreme right hand position. This brings the indicator 174 to the extreme left hand position on the card 182. The indicator is provided with numbers shown at 167 which correspond to the numbers on the finger keys and it is understood that if the finger key indicated at 12 be depressed, the symbol on this card corresponding to that at the right of the numeral 12 on the indicator will be punched out.

When a controlling key is depressed, the interposing member moved thereby is brought under the motor plate and the bail controlling the circuit-making contacts is

shifted to close the contacts. The energizing of the electromagnet moves the motor plate downward and through the interposing member the punch lever is depressed and the punch caused to perforate the card. This downward movement of the interposing member releases the bail and this breaks the circuit, so that the motor plate rises, releasing the interposing member and thus releasing the punch which is at once raised by its spring, and, therefore, the punching operation is completed electrically whether the finger key is released or not.

This downward movement of the interposing member and punch lever acting on the universal bar also shifts the escapement mechanism and effects a feeding of the card carrier or carriage one step to the left, when the punch lever and the punch are raised through the action of the spring operating upon the punch. This brings the next column under the punches and shifts the indicator to the next column on the index card. The operator may now depress another finger key or the same finger key which will operate a punch. At times it may be desirable to skip a column, and this may be accomplished by operating the space key which will feed the carriage step by step underneath the punches. Or it may be operated by the skip key which releases the escapement dog lug 84 and permits the carrier for the card to be moved until one of the stops 100 on the rack bar engages the stop intercepter 101.

Then again, it may be desirable to punch two or more of the symbols in a single column, without any shifting of the card. This may be readily accomplished by holding down the space key, as this holding down of the space key holds the universal bar 121 down, and as long as this bar is down there will be no releasing of the lug 84^a of the escapement dog from the rack bar, and consequently no feed of the card carrier or carriage. As soon as the space key is released, then the carriage is fed in the usual way.

There are other times when it is desirable to punch certain of the symbols in the reverse direction, and this is accomplished by my improved back stepping mechanism. During the back stepping the normal escapement mechanism is idle and the back stepping is brought about by an independent holding dog and pushing dog. This enables the card carrier to be shifted one step to the right and when the punch is operated, although the universal bar may be depressed, it will be ineffective to release the carriage or card carrier as it is now held by the holding dog 150.

I am thus able to shift the card carrier one step and perforate the card without any forward stepping of the card through the normal releasing of the escapement mechanism. Through this back stepping mechanism the card may be shifted step by step and perforated by a movement of the card in the opposite direction from that in which it is normally moved by the escapement mechanism. After the card has been perforated to the desired extent, the card carrier or carriage may be released by first releasing the key 25^d from control of the locking lever 162, and then by depressing the releasing key which moves the escapement dog entirely out of engagement with the rack bar and permits the carriage or carrier spring to return the carrier to the extreme left for the withdrawal of the card from underneath the punches.

It will be obvious that minor changes in the details of construction and arrangement of parts may be made, without departing from the spirit of the invention as set forth in the appended claims.

I claim, as follows:—

1. In a perforating machine the combination of a base, a finger key suitably supported and means for restoring said key, when displaced, to its normal position of rest, a spring supported punch, a punch guide and a stationary die registering with the punch, a normally inactive electromagnetic motor device arranged in a normally open circuit, a source of electric supply in said circuit and a pair of contacts normally spaced apart also in said circuit, means including an interposing member movable from its normal position of rest upon the depression of the finger key for closing the said circuit at the said contacts whereupon the said motor device becomes energized; means including said interposing member movable by the said motor device for actuating the punch and for effecting the deënergization of the said motor device immediately thereafter and in advance of any return movement of the finger key toward its normal position of rest, whereupon the said motor device becomes inactive and remains inactive till another key depression whether the then pressure of the finger upon the key be maintained or not.

2. In a perforating machine the combination of a base having guideways, a card carrier movable along the guideways, a punch support rigidly secured to the base and having a series of sockets extending across it transversely to the path of movement of the card carrier, spring supported punches in the sockets one in each socket, means for operating the punches each as required, suitable feeding and escapement mechanism controlled by the punch-operating means for advancing the card carrier by a step-by-step movement along the guideways in one direction, backstepping mechanism independent of the feeding and escapement mechanism and means for operating the same whereby the card carrier may be given a step-by-step

movement along the guideways in the opposite direction.

3. In a perforating machine the combination of a base having guideways, a card carrier movable along the guideways, a punch support rigidly secured to the base and having a series of sockets extending across it transversely to the path of movement of the card carrier, spring supported punches in the sockets one in each socket, means for operating the punches each as required, suitable feeding and escapement mechanism controlled by the punch-operating means for advancing the card carrier by a step-by-step movement along the guideways in one direction, backstepping mechanism and means for operating the same whereby the card carrier may be given a step-by-step movement along the guideways in the opposite direction; said backstepping mechanism including a stepping dog and a holding dog both pivotally mounted in a support pivotally carried by the base of the machine and both said dogs being operable independently of the feeding and escapement mechanism.

4. In a perforating machine the combination of a base having guideways, a card carrier movable along the guideways, a punch support rigidly secured to the base and having a series of sockets extending across it transversely to the path of movement of the card carrier, spring supported punches in the sockets one in each socket, means for operating the punches each as required, suitable feeding and escapement mechanism controlled by the punch-operating means for advancing the card carrier by a step-by-step movement along the guideways in one direction, backstepping mechanism and means for operating the same independently of the said feeding and escapement mechanism and whereby the said carrier may be given a step-by-step movement along the guideways in the opposite direction, said last named means including a locking device whereby the said feeding and escapement mechanism may be rendered ineffective during subsequent operations of the punches.

5. In a perforating machine the combination of a base having guideways, a card carrier movable along the guideways, suitable feeding and escapement mechanism for returning the card carrier toward its normal position of rest, said card carrier including a member adapted to carry one or more adjustable stops intermediate its two ends; a releasing bar suitably supported and extending across the plane of movement of the card carrier, and a stop intercepter movable by the releasing bar; said releasing bar being adapted to be moved to and fro and having a normal position of rest intermediate the extreme limits of its movements, means including a spring for returning the said releasing bar to its normal position of rest when displaced, means whereby the releasing bar may be moved in each direction as desired, said releasing bar adapted when moved in one direction to effect the release of the card carrier from the escapement mechanism and thereby permit the return of the carrier to its normal position of rest, and said releasing bar when moved in the opposite direction adapted to release the carrier and permit its return toward its normal position of rest until the carrier is arrested by one of the adjustable stops coming against the stop intercepter which had been moved by the releasing bar into the path of movement of said stop.

6. In a perforating machine the combination of a base having guideways, a card carrier movable along the guideways, a punch support rigidly secured to the base and having a series of sockets extending across it transversely to the path of movement of the card carrier, spring-supported punches in the sockets one in each socket, a plate having dies registering with the punches, means for operating the punches each as required, suitable feeding and escapement mechanism means for advancing the card carrier by a step-by-step movement along the guideways whereby the card to be perforated is brought within the range of action of the punches; an index card having a horizontal row of characters for each punch carried by a support rigidly secured to the frame of the machine, a movable indicator suitably supported by the frame of the machine and means for effecting a step-by-step movement of the indicator coincident with the step-by-step movement of the card carrier; the indicator being so associated with the index card as that the then position of the card being perforated in its relation to all the punches will be indicated upon the index card.

7. In a perforating machine the combination of a base having guideways, a card carrier movable along the guideways, a punch support rigidly secured to the base and having a series of sockets extending across it transversely to the path of movement of the card carrier, spring-supported punches in the sockets one in each socket, a plate having dies registering with the punches, means for operating the punches each as required, suitable feeding and escapement mechanism controlled by the punch-operating means for advancing the card carrier by a step-by-step movement along the guideways whereby the card to be perforated is brought within the range of action of the punches; an index card having a horizontal row of characters for each punch carried by a support rigidly secured to the frame of the machine, a movable indicator suitably supported by the frame of the machine and means for effecting a step-by-step movement

of the indicator coincident with the step-by-step movement of the card carrier but in the opposite direction.

8. In a perforating machine the combination of a base having guideways, a card carrier movable along the guideways, a punch support rigidly secured to the base and having a series of sockets extending across it transversely to the path of movement of the card carrier, spring-supported punches in the sockets one in each socket, a plate having dies registering with the punches, means for operating the punches each as required, suitable feeding and escapement mechanism controlled by the punch-operating means for advancing the card carrier by a step-by-step movement along the guideways whereby the card to be perforated is brought within the range of action of the punches; an index card having a horizontal row of characters for each punch carried by a support rigidly secured to the frame of the machine, a movable indicator suitably supported by the frame of the machine and means for effecting a step-by-step movement of the indicator coincident with, but by steps greater in length than, the coinciding steps of the card carrier.

9. In a perforating machine the combination of a base having guideways, a card carrier movable along the guideways, a grooved wheel mounted upon and movable bodily with the card carrier, a punch support rigidly secured to the base and having a series of sockets extending across it transversely to the path of movement of the card carrier, spring-supported punches in the sockets one in each socket, a plate having dies registering with the punches, means for operating the punches each as required, suitable feeding and escapement mechanism controlled by the punch-operating means for advancing the card carrier by a step-by-step movement along the guideways whereby the card to be perforated is brought within the range of action of the punches; an index card carried by a support secured to the frame of the machine and a movable indicator slidably connected to a guide rod supported by the frame of the machine; said indicator being attached to a flexible cord which has both its ends fastened to the base and so disposed about said grooved wheel as that the indicator will be moved thereby in steps equal in number to, but greater in length than, the coinciding steps of the card carrier; the indicator being so associated with the index card as that the then position of the card being perforated, in its relation to all the punches, will be indicated upon the index card.

10. In a perforating machine, the combination of a base having guideways, a card carrier movable along the guideways, a punch support rigidly secured to the base and having a series of sockets extending across it transversely to the path of movement of the card carrier, spring-supported punches in the sockets one in each socket, a plate having dies registering with the punches, means for operating the punches each as required, suitable feeding and escapement mechanism controlled by the punch-operating means for advancing the card carrier by a step-by-step movement along the guideways; and means, including a rod extending from the punch support to the rear end of the machine, whereby the card to be perforated is prevented from buckling while being brought within the range of action of the punches.

11. In a machine for perforating record cards, the combination of a base having guideways, a card carrier movable along the guideways, a punch support rigidly secured to the base and having a series of sockets extending across it transversely to the path of movement of the card carrier, spring supported punches in the sockets one in each socket, dies registering with the punches; means, including a series of spring supported finger keys one for each punch, for effecting the operation of the punches; suitable feeding and escapement mechanism for advancing the card carrier by a step-by-step movement along the guideways whereby the card to be perforated is brought within the range of action of the punches; a stationary index card having a horizontal row of characters for each punch supported by the frame of the machine and a movable indicator co-acting with the card carrier; said indicator bearing upon its surface characters which indicate the particular key or keys to be depressed to effect the perforation of the record card at the place or places desired at each operation.

In testimony whereof I affix my signature, in the presence of two witnesses.

JOHN T. SCHAAFF.

Witnesses:
THEODORE DELAIRGNE,
EDWIN B. HESSE.

Copies of this patent may be obtained for five cents each, by addressing the "Commissioner of Patents, Washington, D. C."