C. W. SPICER.

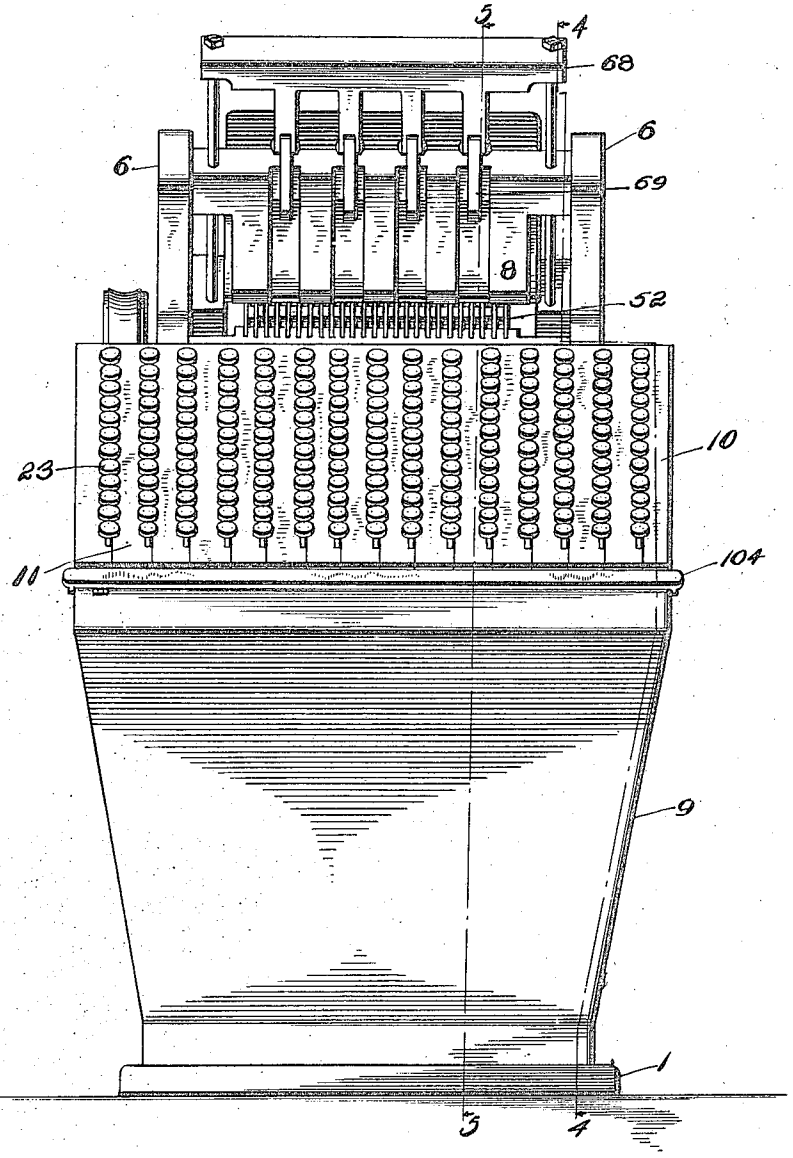
PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 1.

FIG. 1.



Witnesses:
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Fr. Ackmann Jr

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By Hutchinson & Edmonston
Attorneys

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PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 2.

FIG. 2.

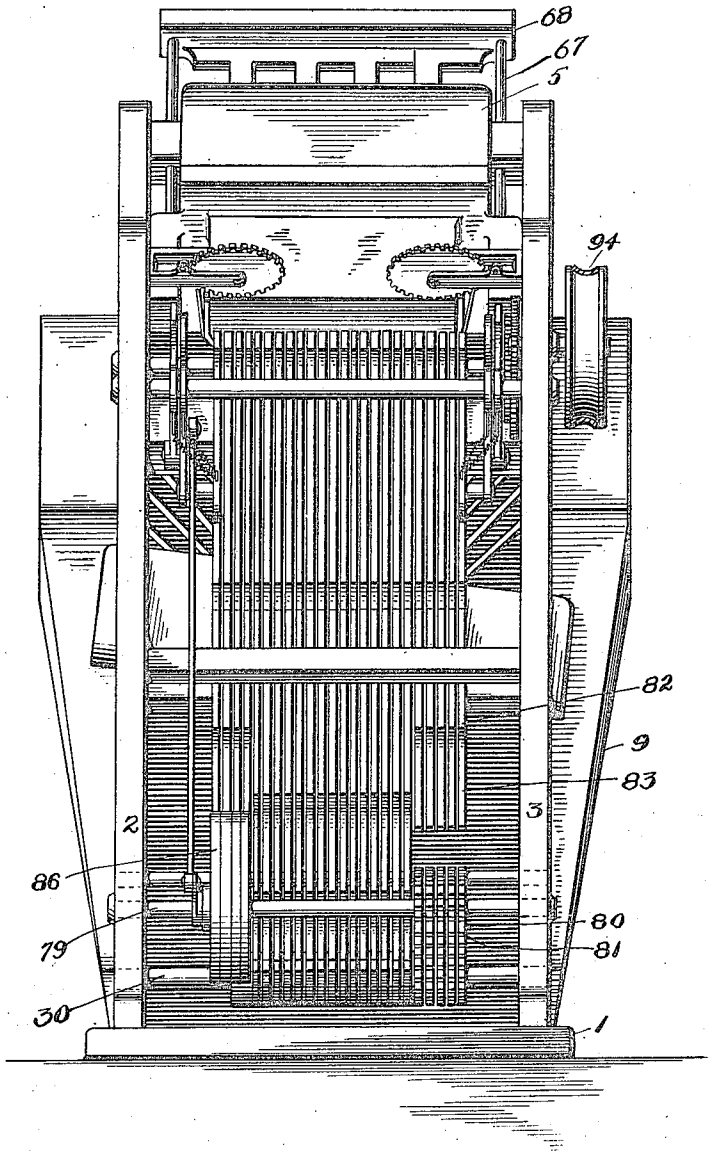
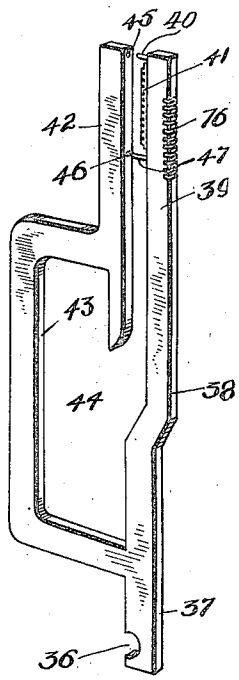


FIG. 14.



Witnesses
W. F. Kay &c.
Geo. Ackman Jr

Inventor
Charles W. Spicer
By Hutchinson & Edmonton
Attorneys

C. W. SPICER.

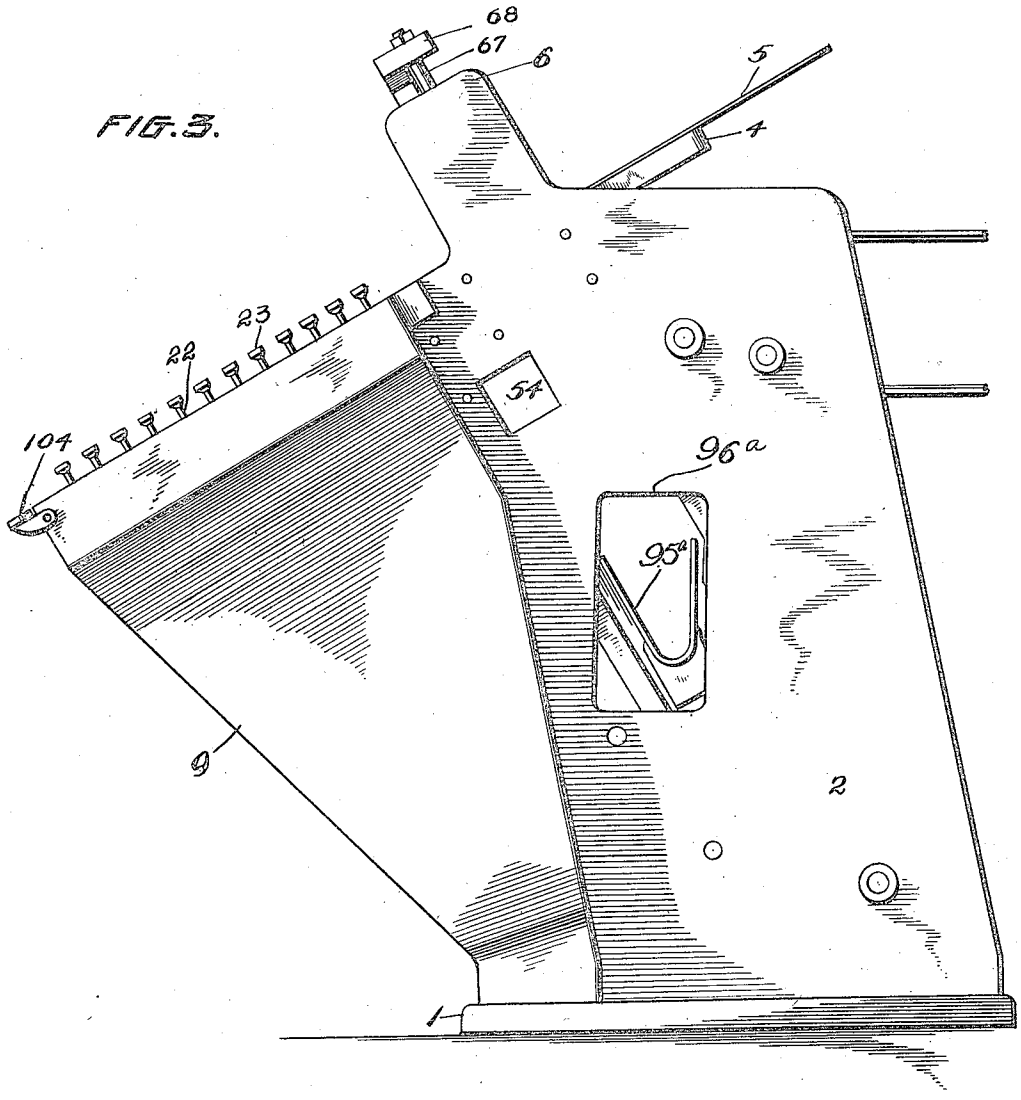
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1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 3.

FIG. 3.



Inventor

Charles W. Spicer

By Hutchinson & Edmonston

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Witnesses

H. F. Hoyt Co.

Ea. Ackerman Jr.

C. W. SPICER.

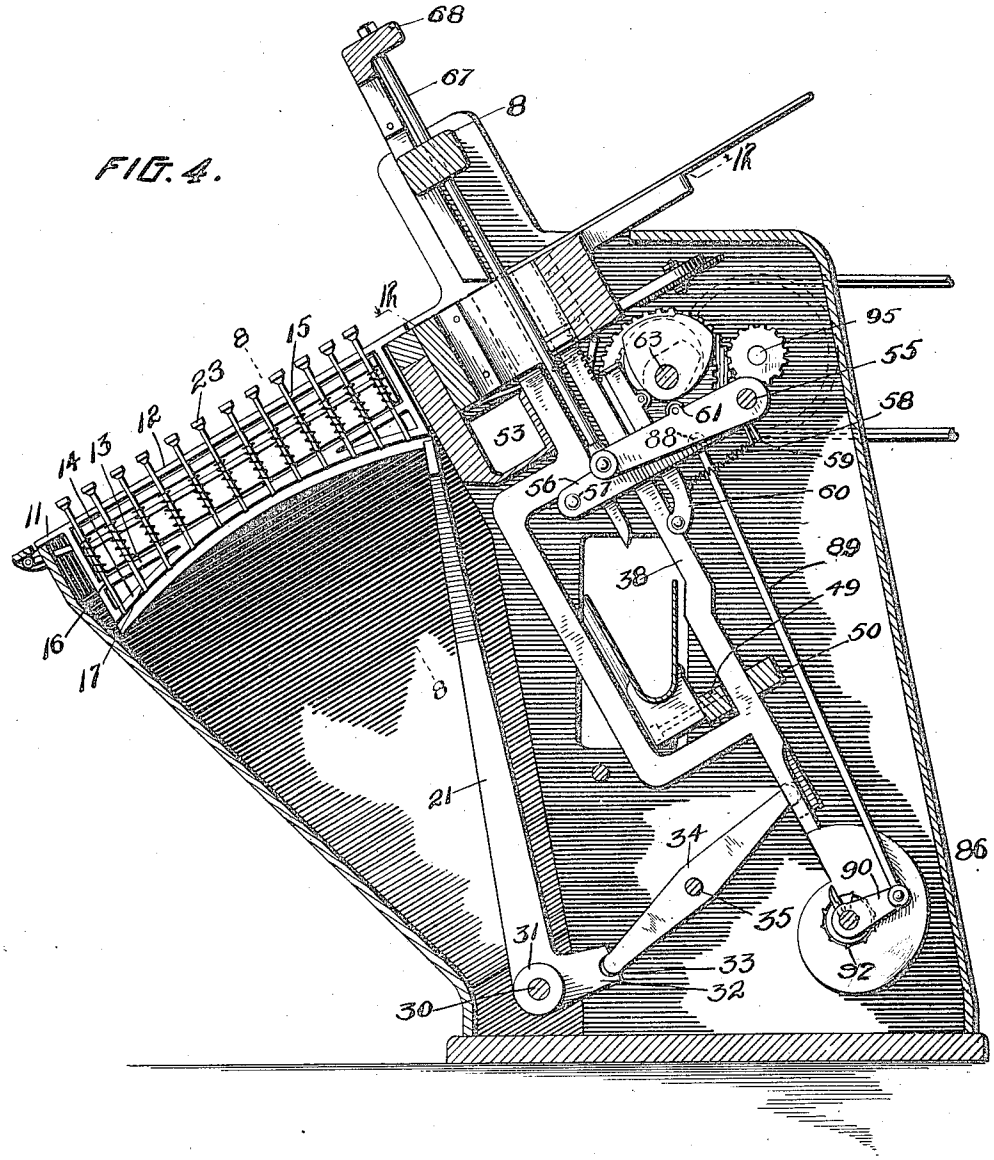
PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 4.

FIG. 4.



Witnesses:
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Inventor
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PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 5.

FIG. 5

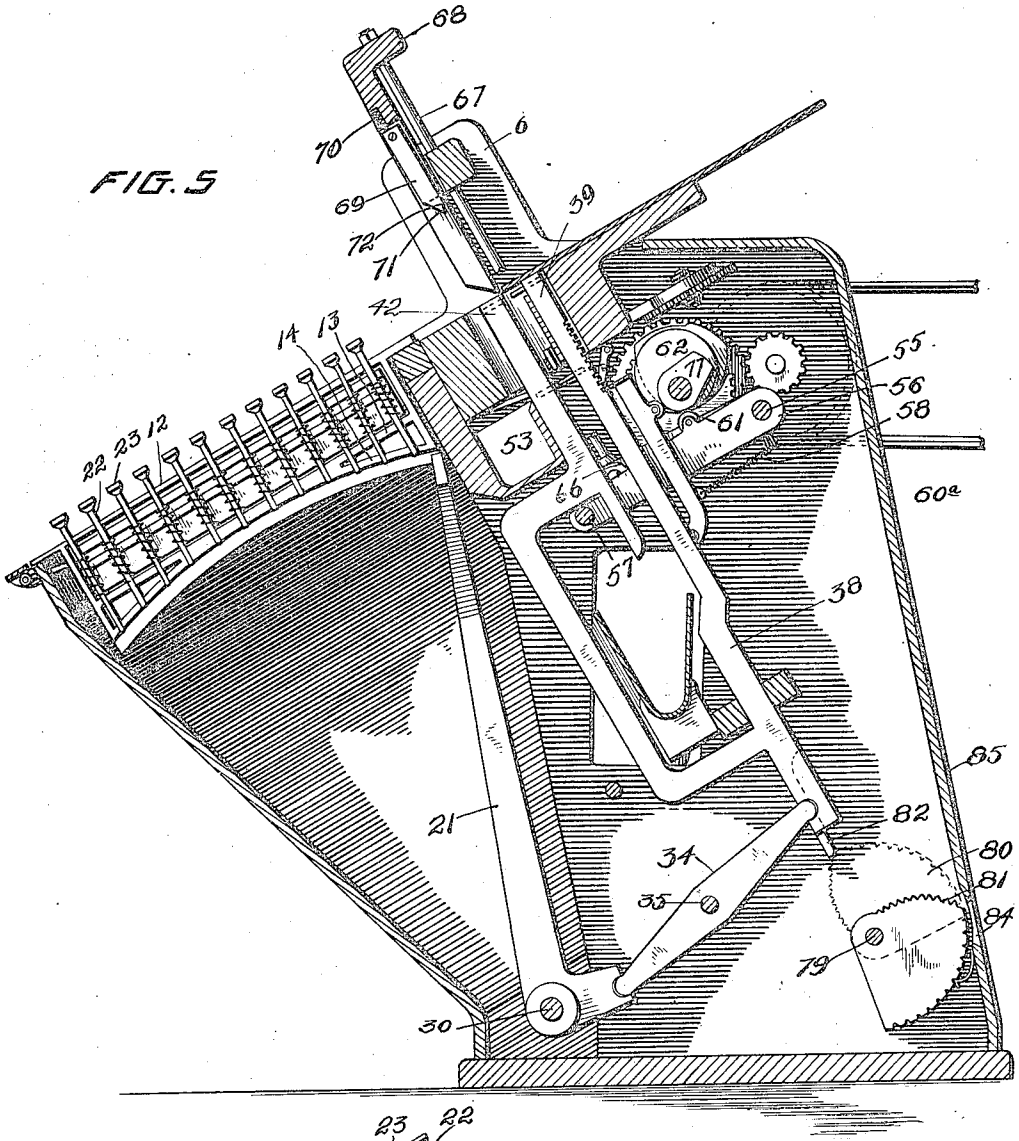
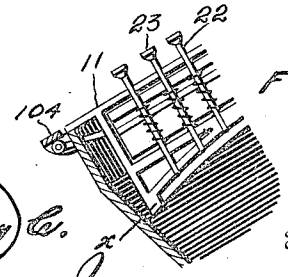


FIG. 6.



Witnesses
W. F. Roy
Geo. Ackmann Jr.

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By Hutchinson & Edmonston
Attorneys

C. W. SPICER.

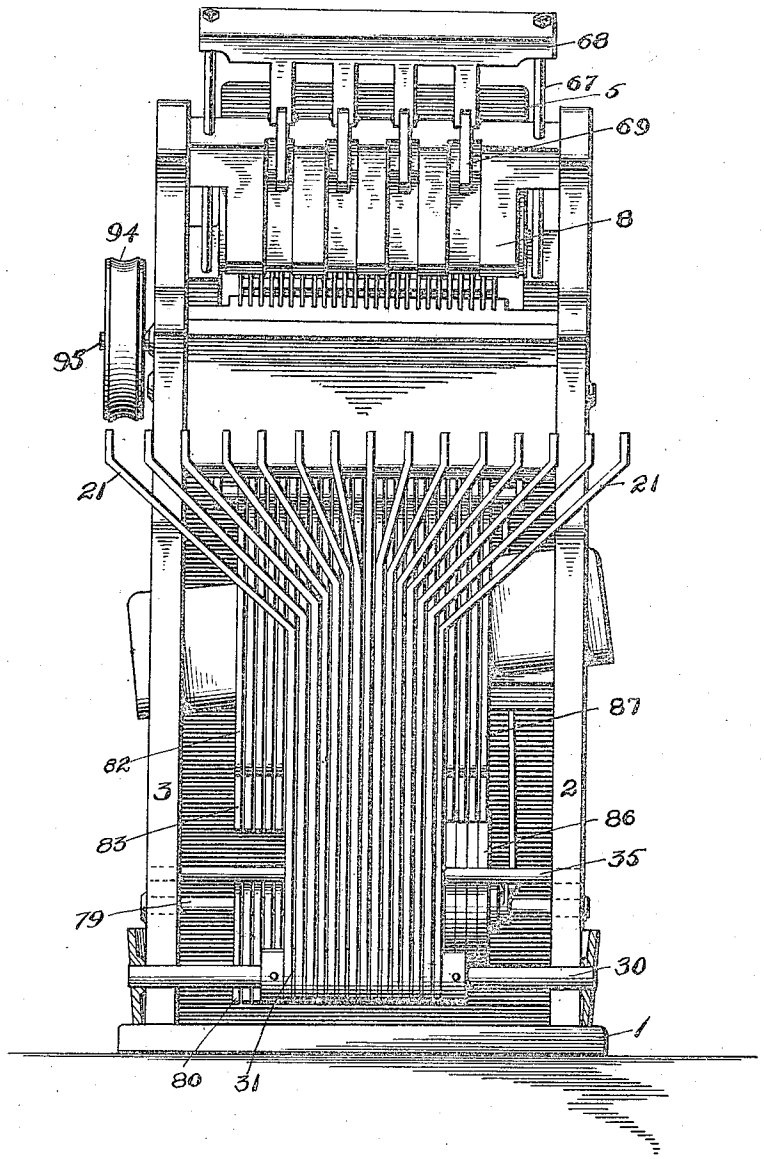
PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 6.

FIG. 7.



Witnesses
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Geo. Ackmann Jr.

Inventor
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PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 7.

FIG. 8.

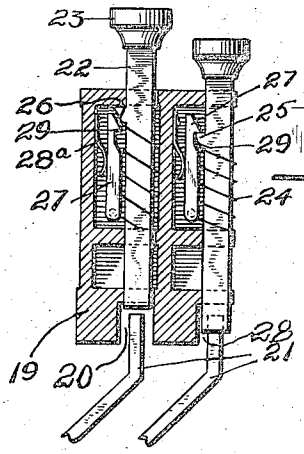


FIG. 9.

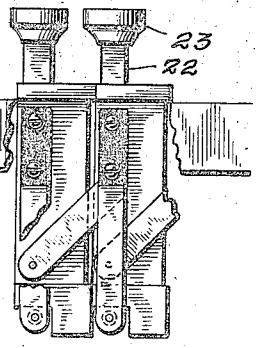


FIG. 10.

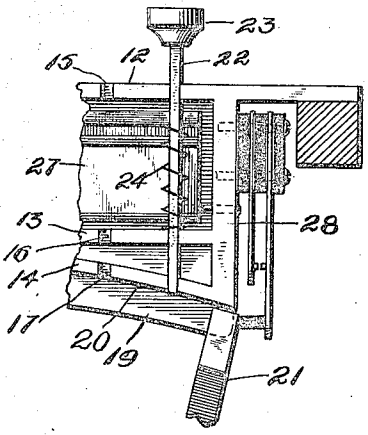
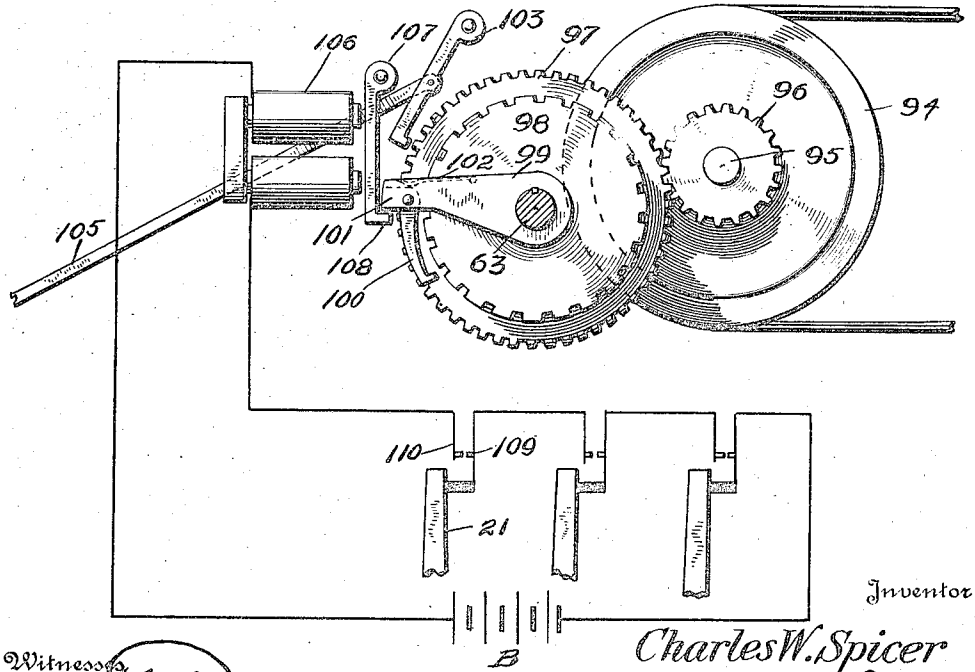


FIG. 11.



Witnesses:
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PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 8.

FIG. 12.

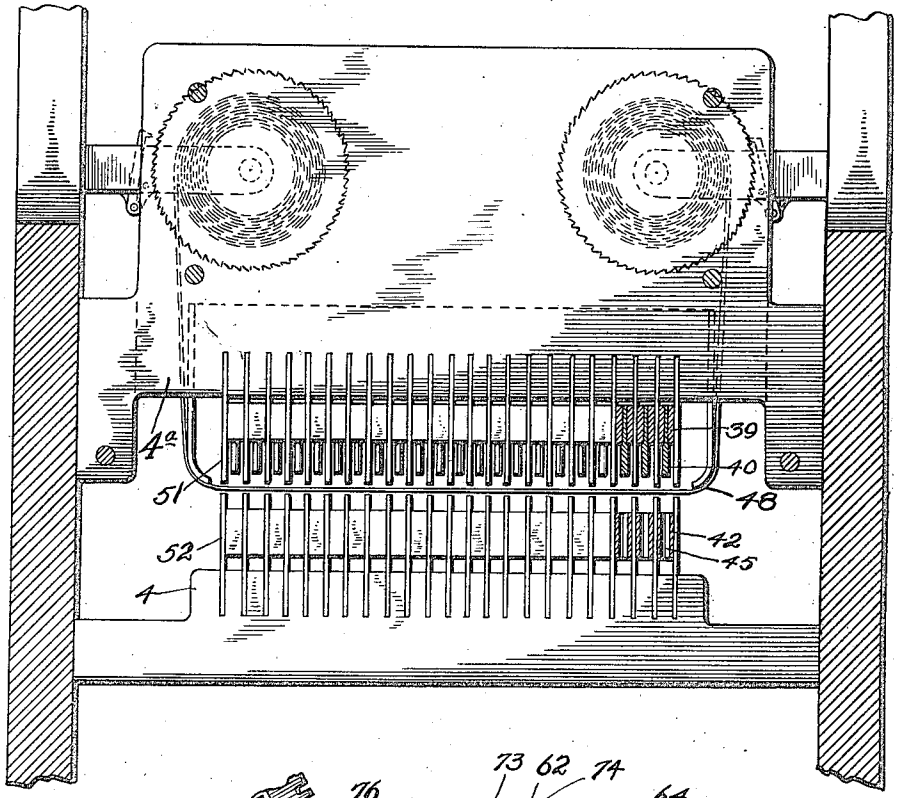
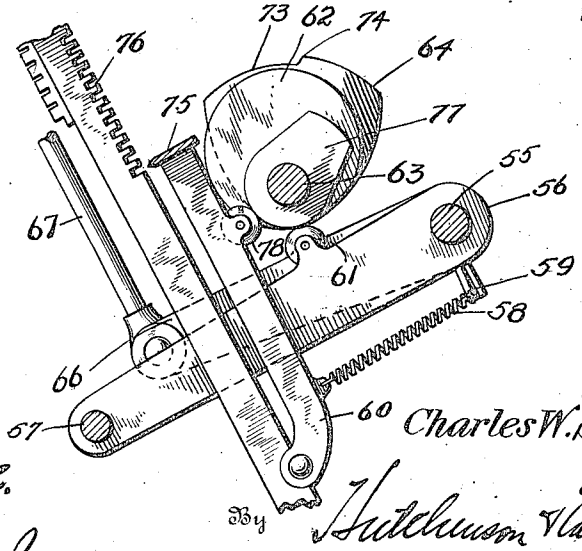


FIG. 13.



Witness
W. F. Roberts.
Geo. Ackmann,

Inventor
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Attorneys

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PUNCHING MACHINE.

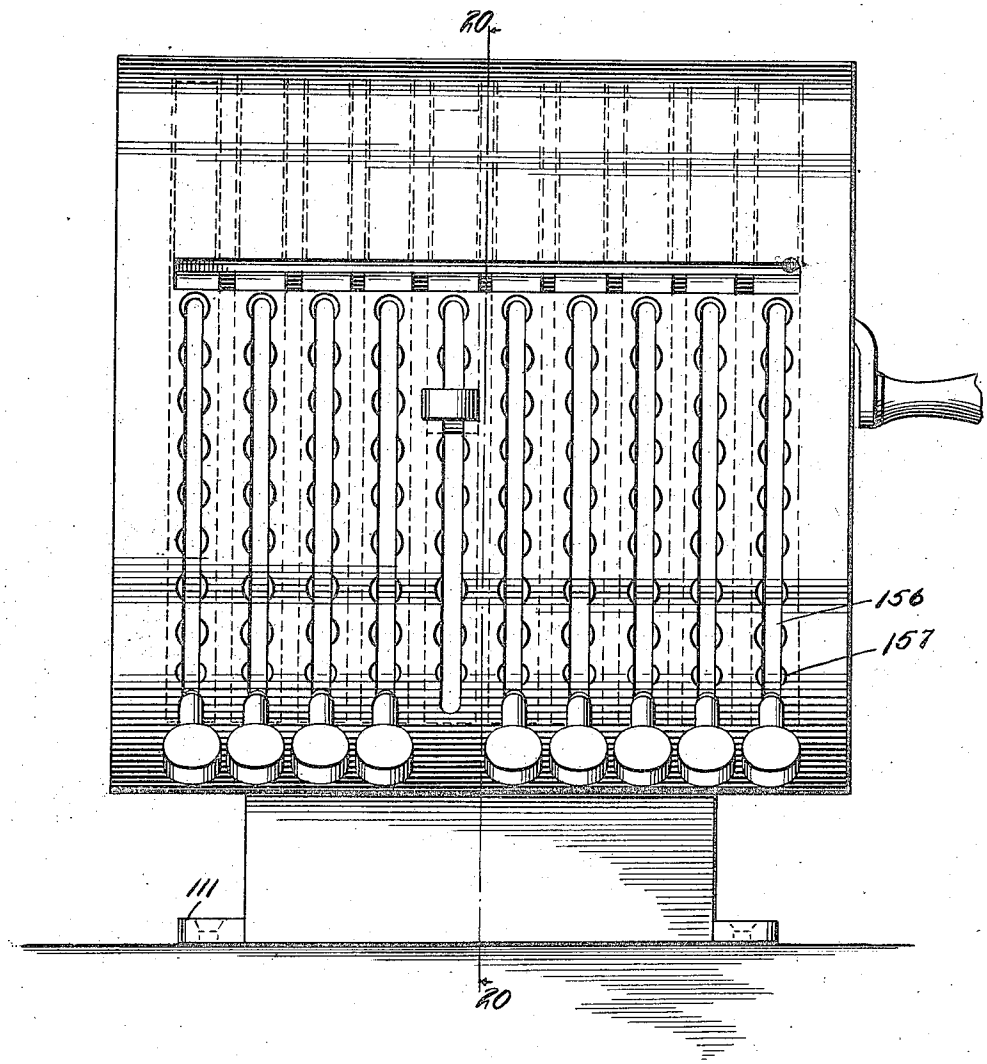
APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856.

Patented Aug. 8, 1922.

26 SHEETS—SHEET 9.

FIG. 15.



Witnesses
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APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 10.

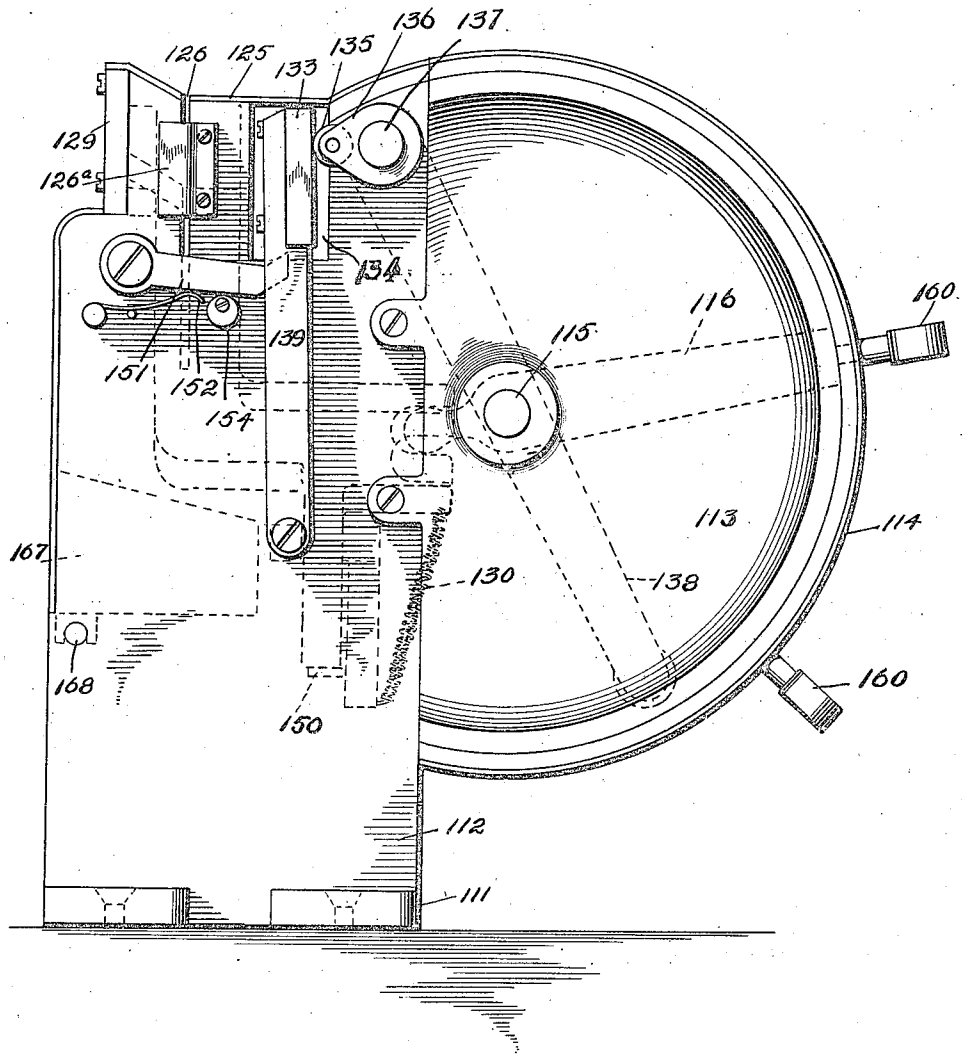


FIG. 16.

Witnesses:
Wm. F. Foy &c.
Fr. Ackmann Jr.

Inventor
Charles W. Spicer
By Hutchinson & Edmunds
Attorneys

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PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 11.

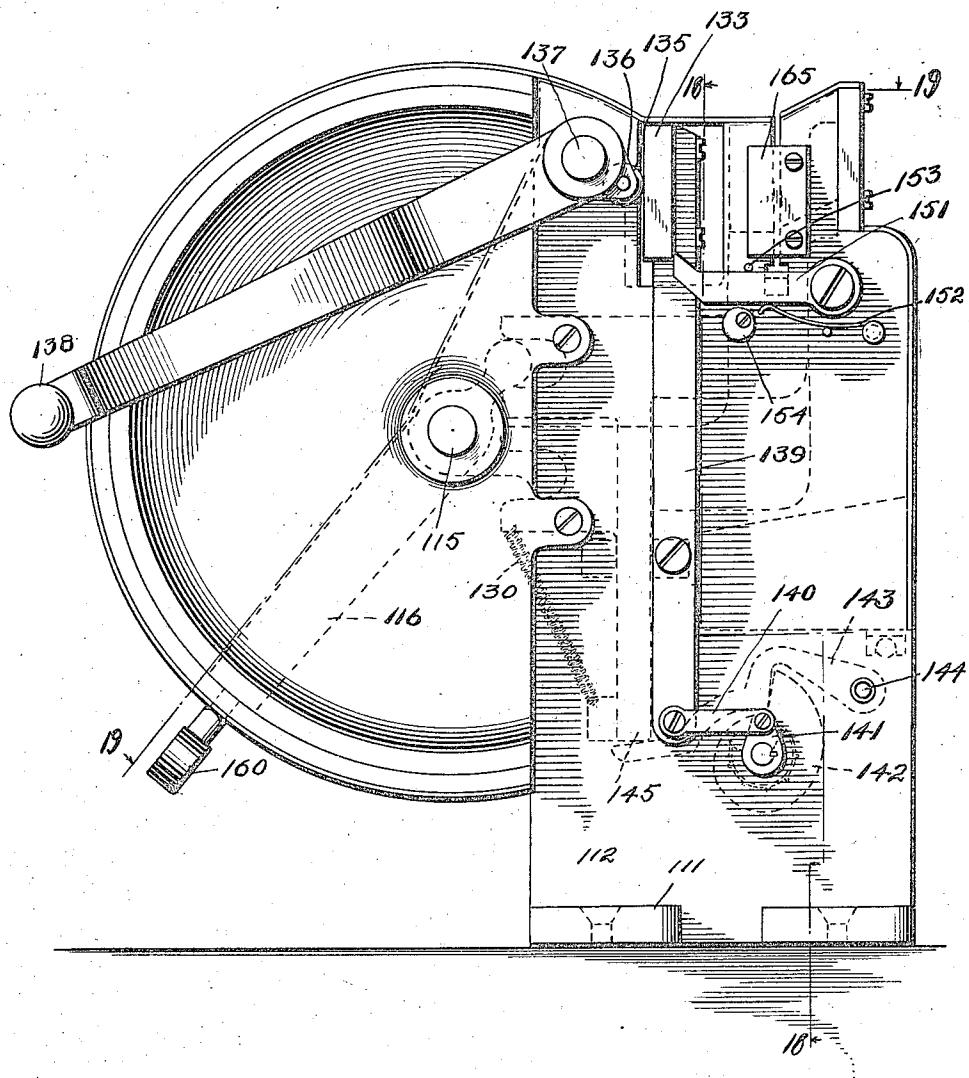


FIG. 17.

Inventor

Charles W. Spicer

By Hutchinson & Edmonds

Attorneys

Witnesses

W. F. Rogers.

Ed. Ackman Jr.

C. W. SPICER.

PUNCHING MACHINE.

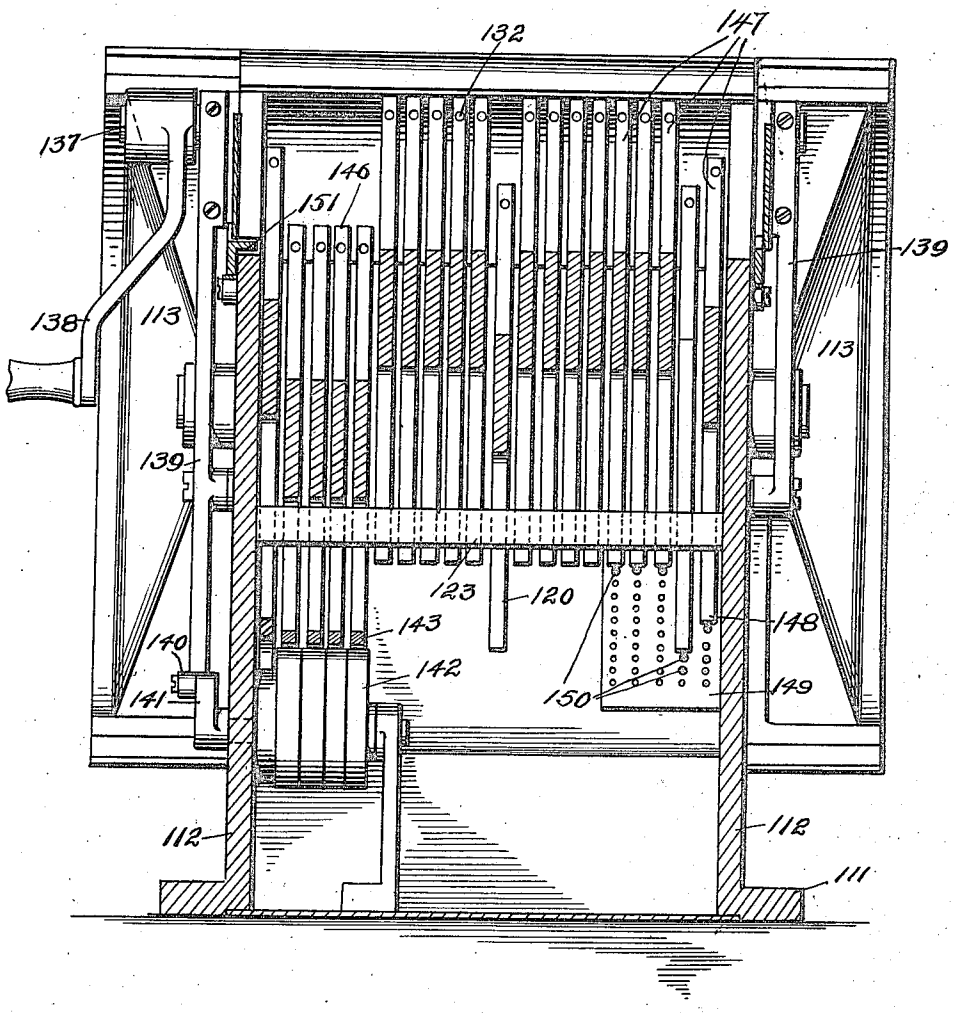
APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856.

Patented Aug. 8, 1922.

26 SHEETS—SHEET 12.

FIG. 18.



Witnesses

Wm. F. Hoyt Co.

Jos. Ackermann Jr

Inventor

Charles W. Spicer

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PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856.

Patented Aug. 8, 1922.

26 SHEETS—SHEET 13.

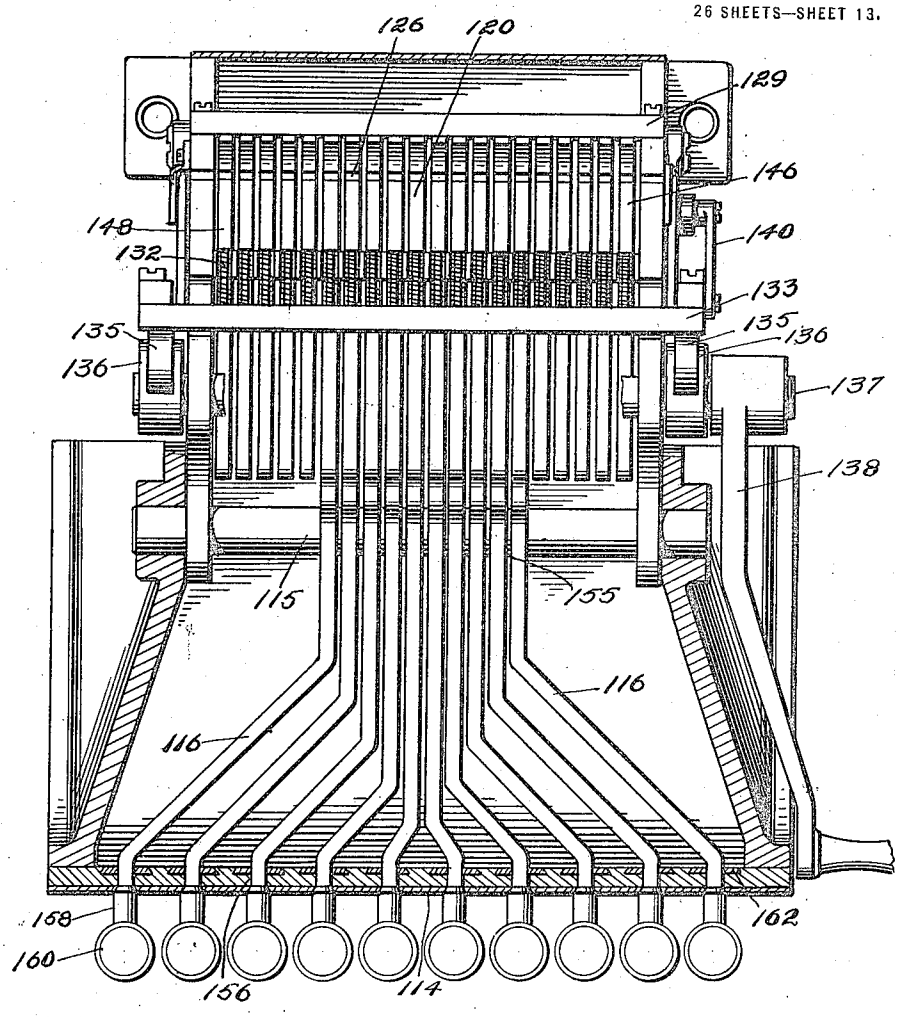


FIG. 13.

Witnesses:
W. F. Ney Co.
Ed. Ackman Jr

Inventor
Charles W. Spicer
By Hutchinson & Edmonston
Attorneys

C. W. SPICER.

PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856.

Patented Aug. 8, 1922.

26 SHEETS—SHEET 14.

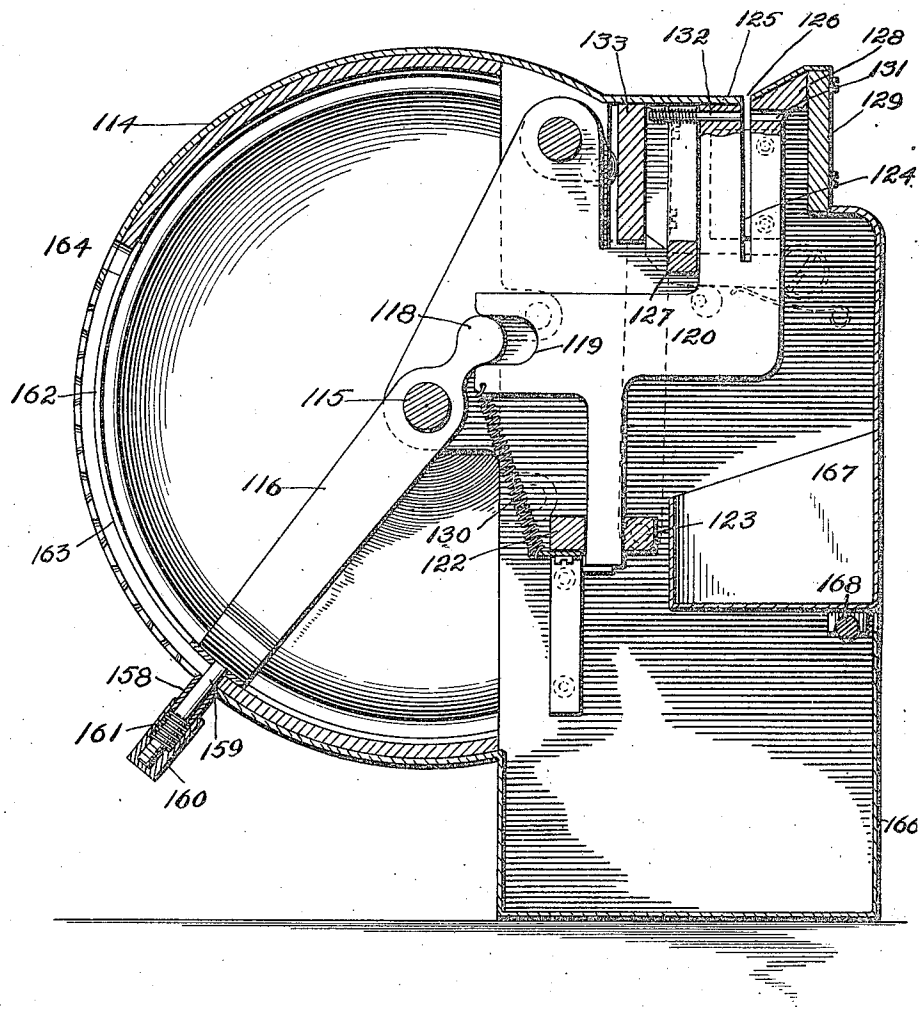


FIG. 20.

Witnesses
W. F. Hoge
F. W. Ackmann Jr.

Inventor
Charles W. Spicer
By Hutchinson & Alexander
Attorneys

C. W. SPICER.

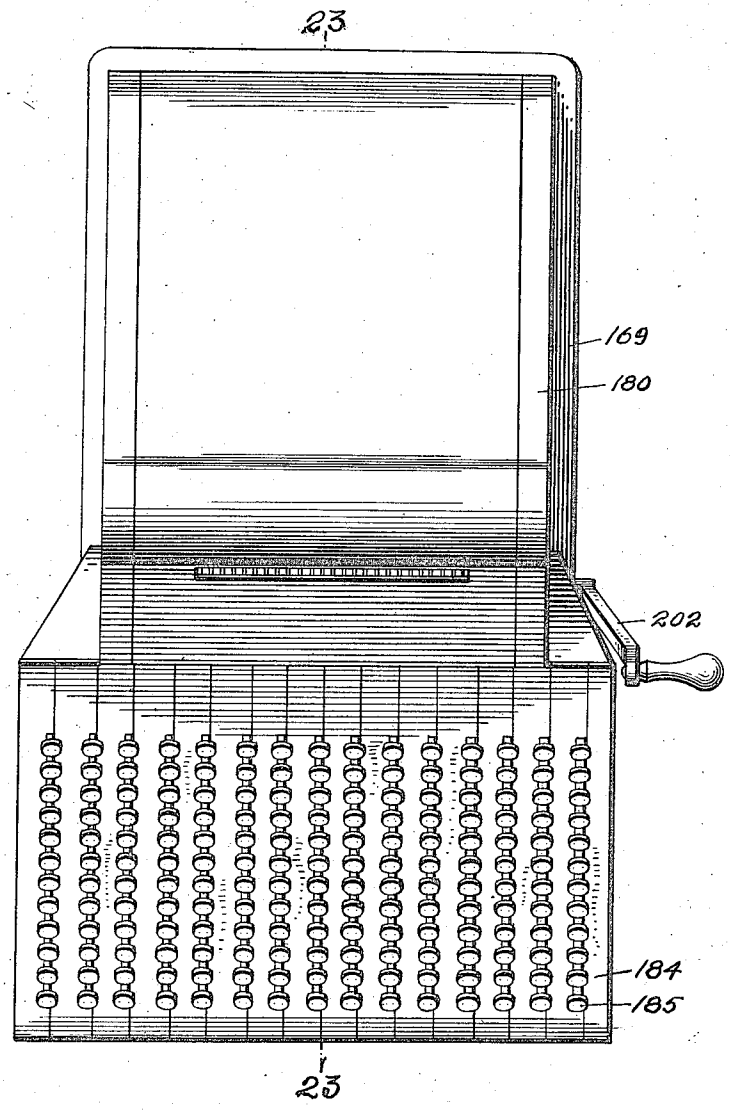
PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 15.

FIG. 21.



Witnesses:
W. F. Roy Co.
F. W. Ackmann Jr.

Inventor
Charles W. Spicer
By Hutchinson & Edmonston
Attorneys

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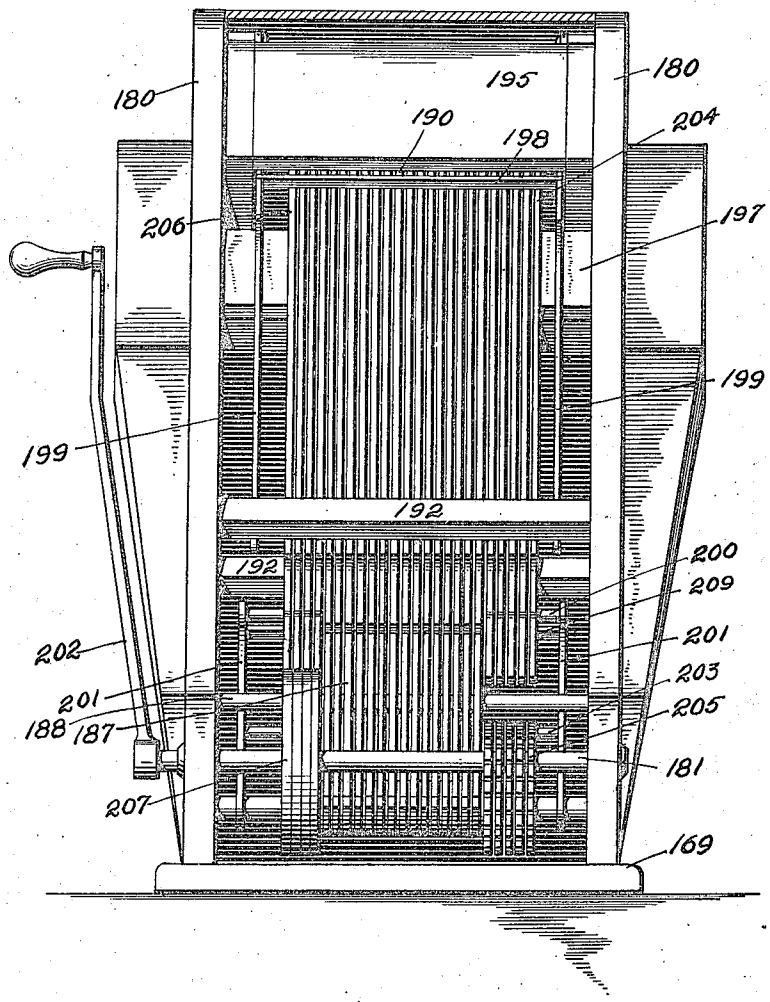
PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 16.

FIG. 22.



Witnesses:

Inventor

Charles W. Spicer

By Hutchinson & Edmonston

Attorneys

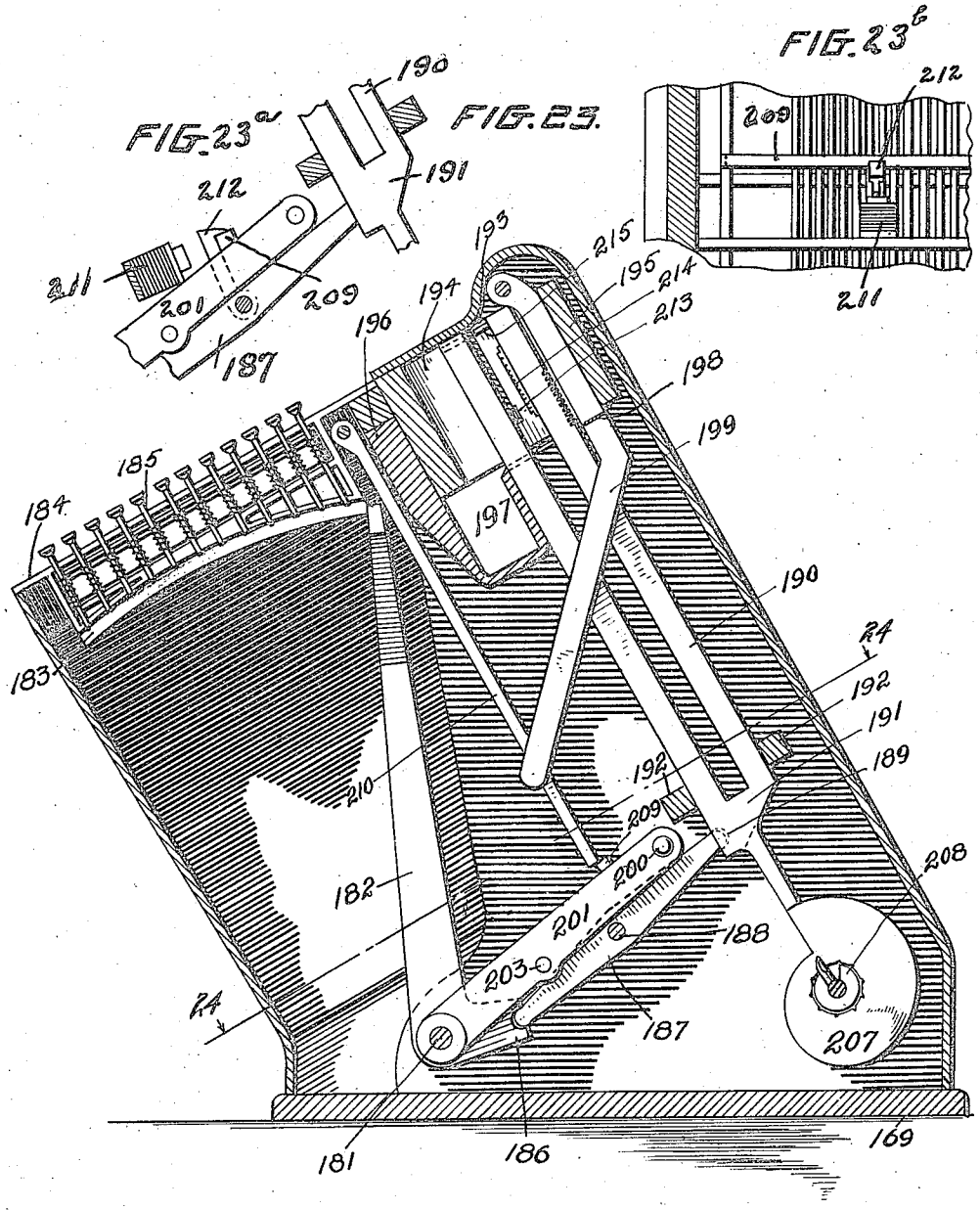
C. W. SPICER.

PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 17.



Witnesses
W. F. Roe
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PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 18.

FIG. 24.

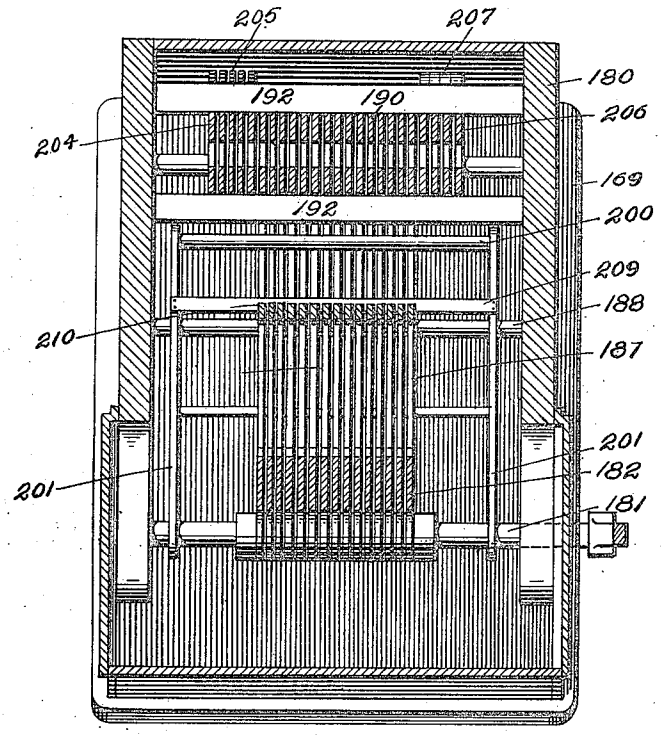
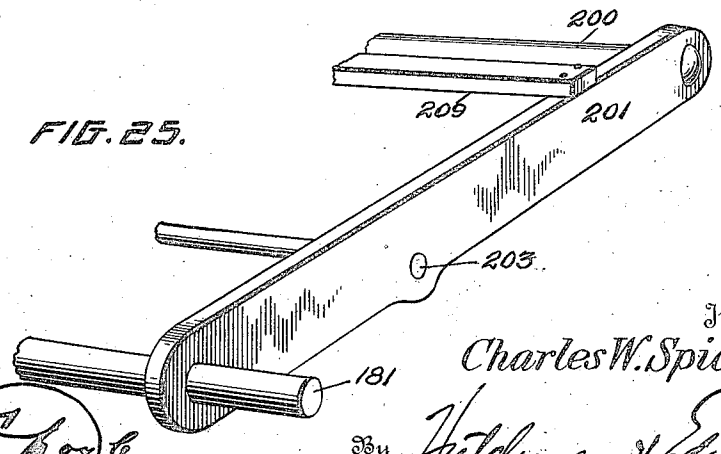


FIG. 25.



Witnesses

Inventor

Charles W. Spicer

By Fitzgerald & Edmonston

Attorneys

C. W. SPICER.

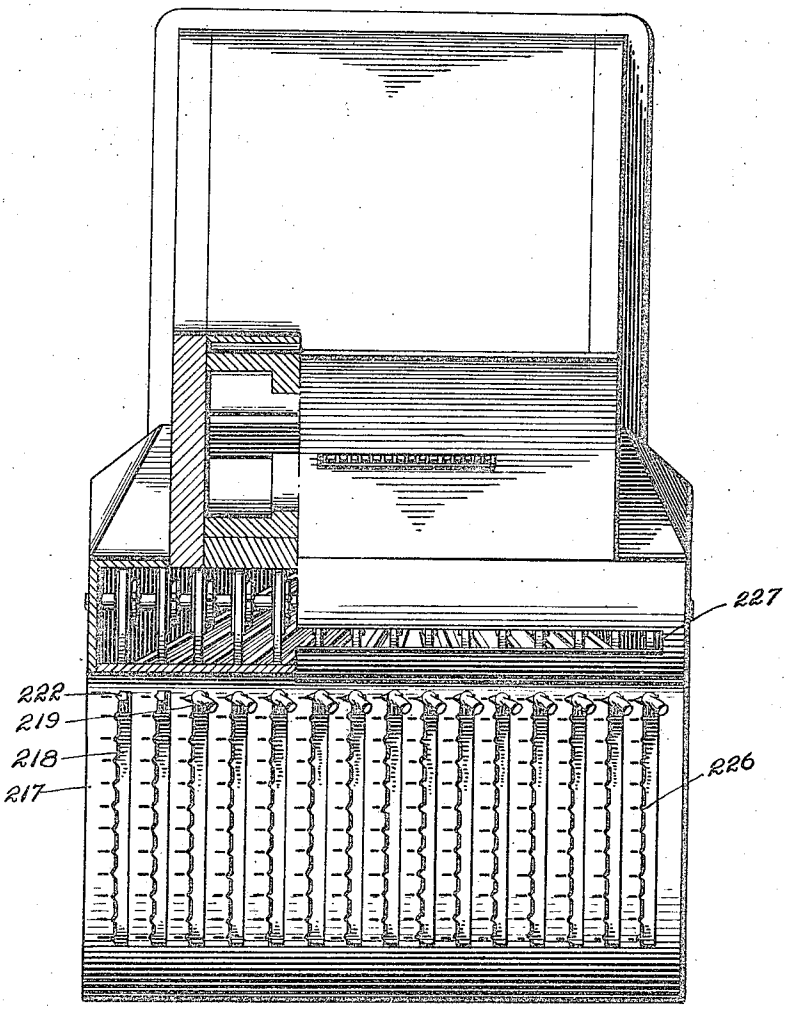
PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS--SHEET 19.

FIG. 26.



Witnesses
H. F. Hoyle.
E. W. Ackeman Jr.

Inventor
Charles W. Spicer
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C. W. SPICER.

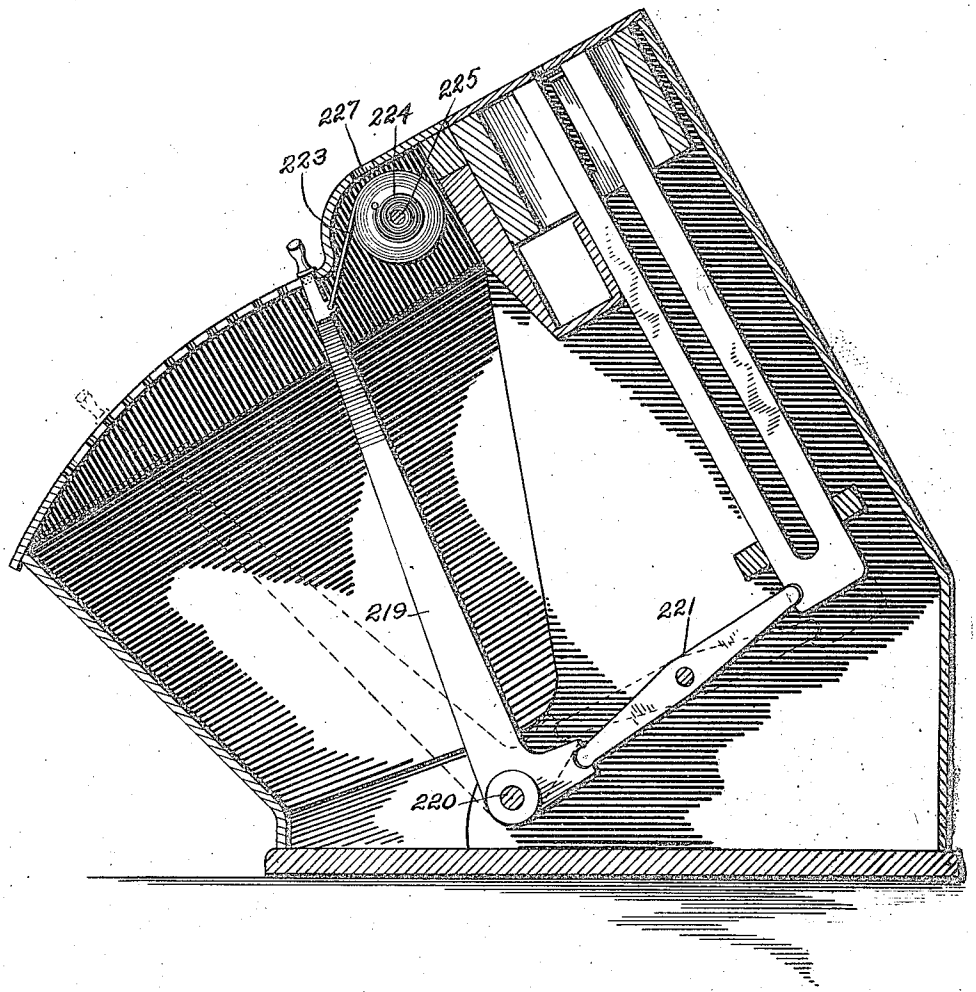
PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 20.

FIG. 27.



Witness:
Wm. F. Hoge
Geo. Ackermann Jr.

Inventor
Charles W. Spicer
By Hutchinson & Edmunston
Attorneys

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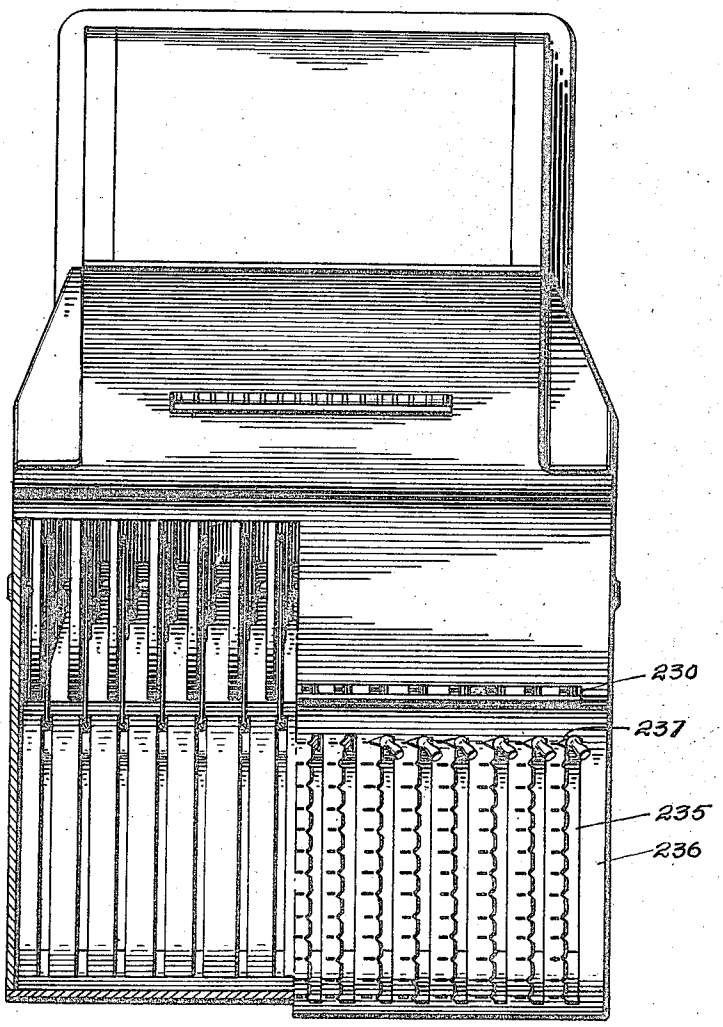
PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 21.

FIG. 28.



Witnesses
W. F. Ross Co.
Geo. Ackermann Jr.

Inventor
Charles W. Spicer
By Hutchinson & Edmonston
Attorneys

C. W. SPICER.

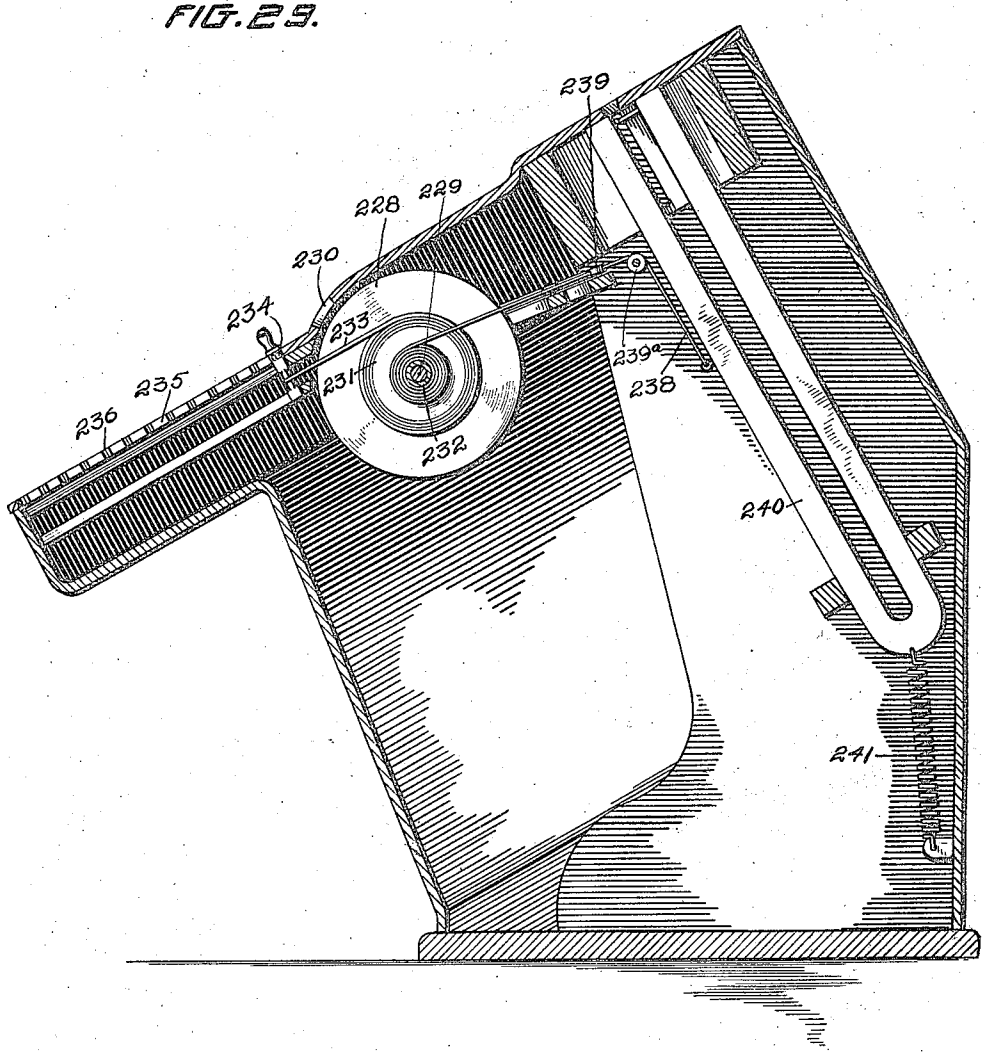
PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 22.

FIG. 29.



Witnesses
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PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 23.

FIG. 30.

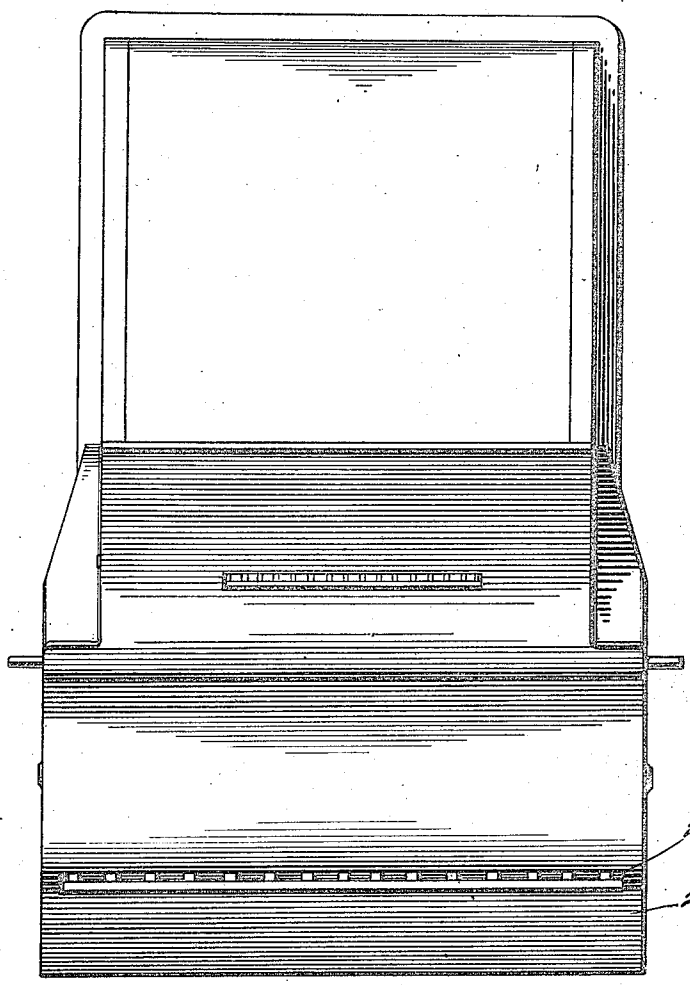
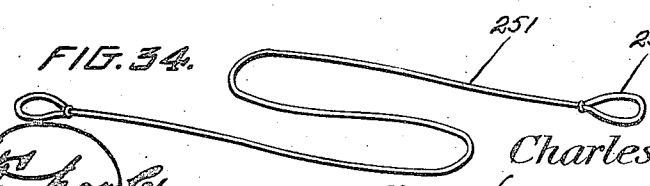


FIG. 34.



Witnesses
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Geo. Ackmann Jr.

Inventor
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By Hutchinson & Edmonston
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C. W. SPICER.

PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 24.

FIG. 33.

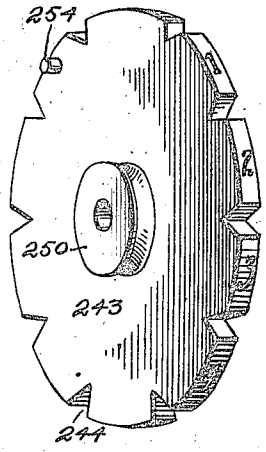
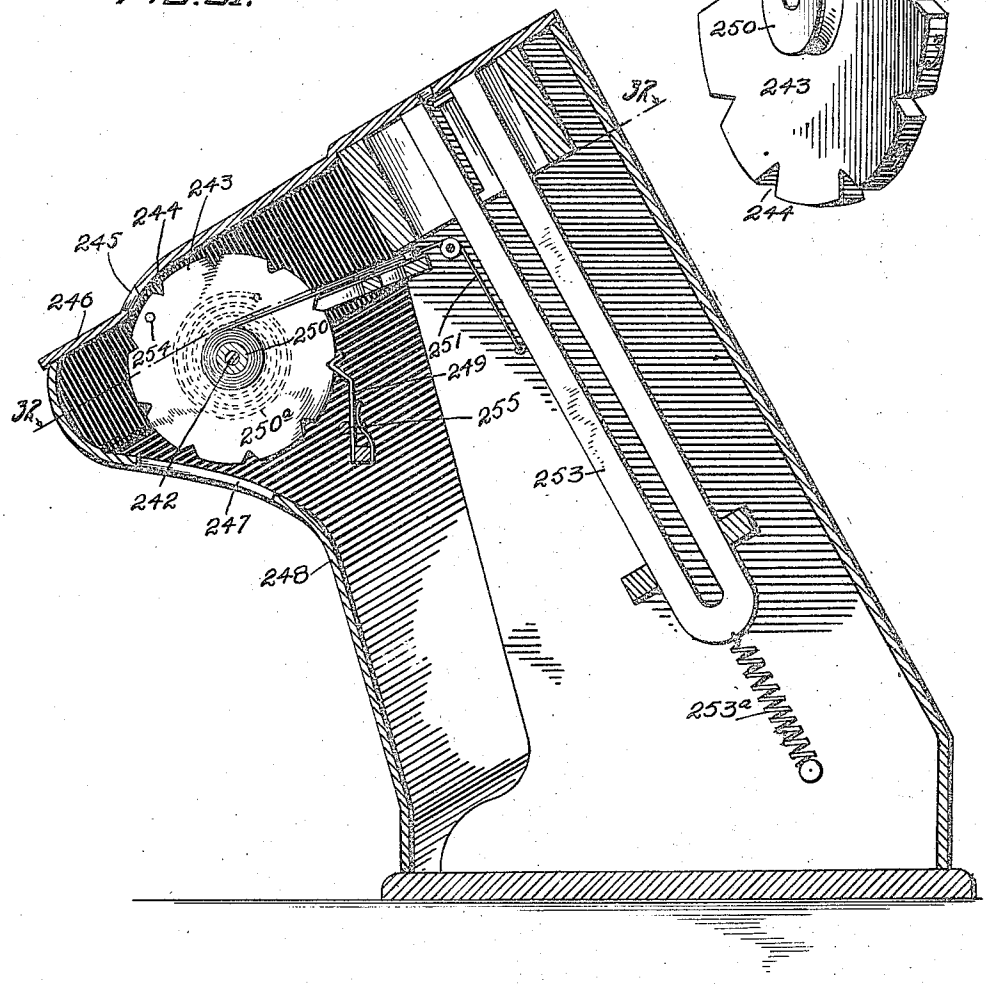


FIG. 31.



Witnesses:

H. F. Hoyle.

Fred. Ackman Jr.

Inventor

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By Huldmeson & Edmonston

Attorneys

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PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 25.

FIG. 32.

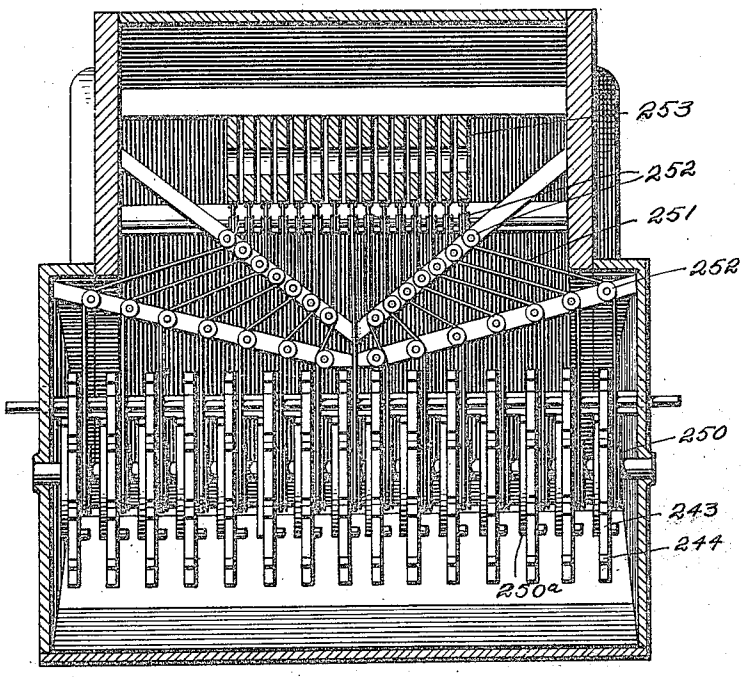
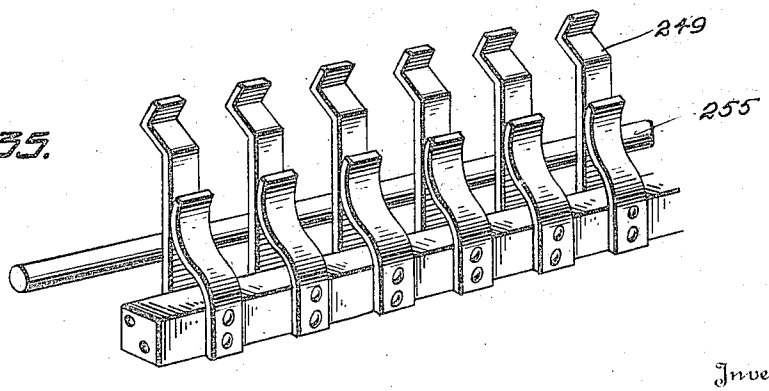


FIG. 35.



Inventor

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By Whitelaw & Edmonds

Attorneys

Witness

W. F. Roe.

Ed. Aikman Jr.

C. W. SPICER.

PUNCHING MACHINE.

APPLICATION FILED MAR. 20, 1915. RENEWED DEC. 31, 1921.

1,424,856. Patented Aug. 8, 1922.

26 SHEETS—SHEET 26.

FIG. 36.

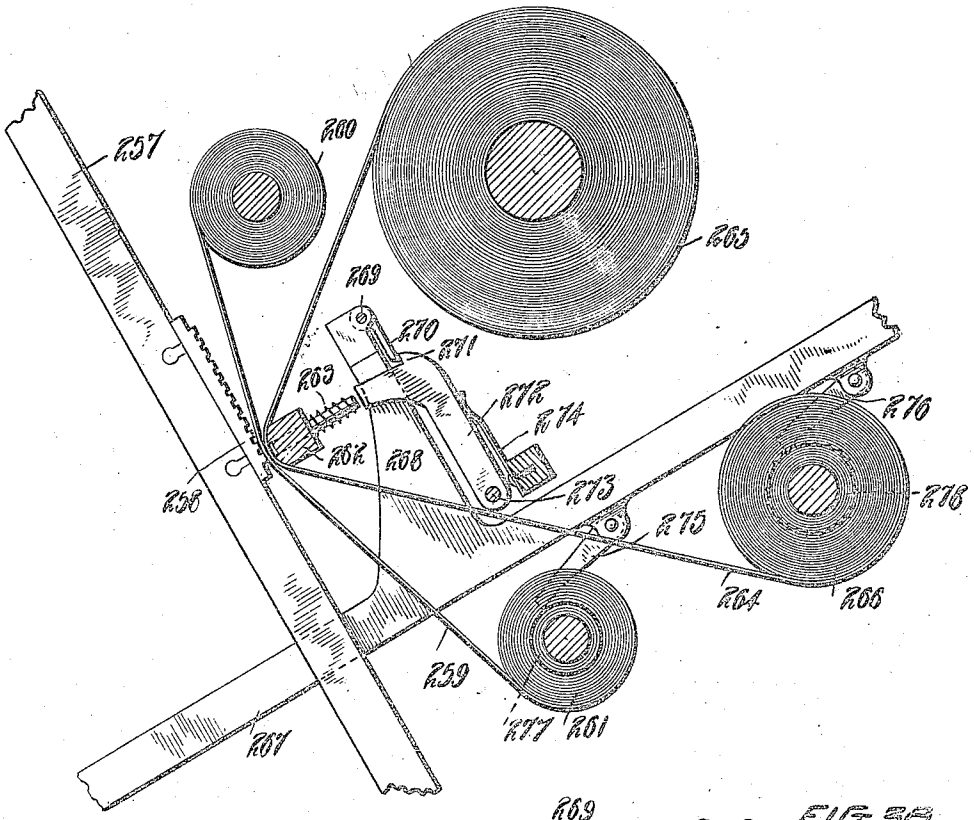


FIG. 37.

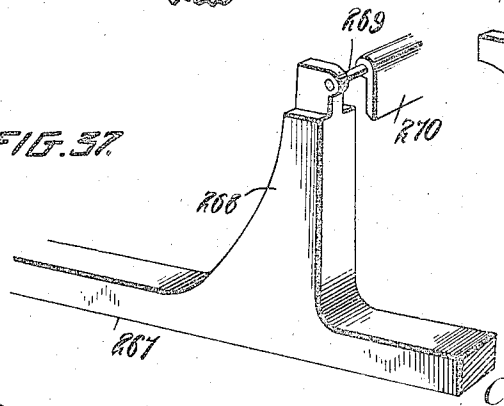
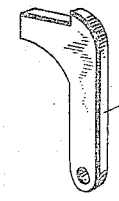


FIG. 38.



Witnesses:
W. F. Hoge.
Fred. Ackman Jr.

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UNITED STATES PATENT OFFICE.

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PUNCHING MACHINE.

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To all whom it may concern:

Be it known that I, CHARLES W. SPICER, a citizen of the United States, residing at Towson, Maryland, have invented certain new and useful Improvements in Punching Machines, of which the following is a specification, reference being had therein to the accompanying drawing.

This invention relates to punching machines and particularly to card punching machines, the present embodiment being specifically adapted for producing cards for use in connection with tabulating machines, cost accounting systems, and other statistical work.

One of the essential objects of the invention is to provide a simple and efficient structure embodying a plurality of key controlled punch levers, a feeding mechanism for transferring cards from the hopper into punching position and a discharge mechanism for removing the cards and discharging them after being punched.

Another object of the invention resides in the provision of novel mechanism for feeding the cards into punching position and for holding the cards while being punched, said holding mechanism being a portion of the feeding mechanism and arranged to operate in such a manner that the cards are held with a portion thereof in the hopper while being punched.

In mechanism of this character, where cards are punched for use in cost accounting systems and where the tabulatable items are punched in columns or fields, it is necessary to insure correct tabulation that each column have a perforation of some character. Therefore it is necessary to ascertain before punching, that a punch lever for each column is properly set or to lock the machine against operation so that the operator cannot inadvertently punch a card incorrectly.

Another object of the invention is the provision of a machine of this character wherein the items of indicia being punched will be simultaneously printed upon one margin of the card whereby the card will contain two readable items one of which is tabulatable and the other of which is utilized for convenient sight reading.

Still another object of the invention is to provide a machine of this character embodying a plurality of key controlled punches, a plurality of gang or identification and dating punches independent of the keys and a plurality of punches controlled automatically and independently of the keys to imprint or punch out indicia on the card in serial order, numerically or alphabetically.

A still further object of the invention is to provide a machine of this character for punching key controlled tabulatable items on cards and to provide a plurality of punches which are controlled entirely independently of the key controlled punches by a series of serial numbering mechanism, each of which are adapted to independently control the punches at each operation of the machine whereby each succeeding card punched will bear consecutive serial numbers.

Further objects of the invention will appear as the following specification is read in connection with the accompanying drawings which form a part of this application, and in which:

Figure 1 is a front elevation showing the preferred embodiment of my invention.

Figure 2 is a rear elevation thereof with the casing plate removed.

Figure 3 is a side elevation showing the card discharge opening.

Figure 4 is a vertical sectional view on the line 4—4 of Figure 1.

Figure 5 is a vertical sectional view on the line 5—5 of Figure 1.

Figure 6 is an enlarged transverse vertical section of the key board and showing elimination of the cipher stop key.

Figure 7 is a detail elevation with the key board and front plate removed.

Figure 8 is an enlarged sectional view on the line 8—8 of Figure 4.

Figures 9 and 10 are detail vertical sectional views of the electrical checking device.

Figure 11 is a diagrammatic view illustrating the method of controlling the operation of the punches and for preventing their operation of the machine upon failure of any of the punch bar controlling levers to move from initial position.

Figure 12 is a longitudinal section on the line 12—12 of Figure 4.

Figure 13 is an enlarged detail elevation showing the manner of shifting the punches and their locking and actuating mechanism.

Figure 14 is a perspective view of punch bar.

Figure 15 is an elevation of a modified type of punch.

Figure 16 is a side elevation of the type of punch shown in Figure 15 with parts in dotted lines illustrating some of the interior mechanism.

Figure 17 is a similar view of the opposite side of the machine.

Figure 18 is a vertical sectional view approximately on the line 18—18 of Figure 17.

Figure 19 is a horizontal section on the line 19—19 of Figure 17.

Figure 20 is a vertical sectional view taken approximately on the line 20—20 of Figure 15.

Figure 21 is a top plan view of a further modification.

Figure 22 is a rear elevation thereof with the back plate removed.

Figure 23 is a vertical sectional view on the line 23—23 of Figure 21.

Figure 23[a] is a fragmentary sectional view showing a modified type of control lever lock employing a magnet instead of mechanically controlled locking fingers.

Figure 23[b] is a top plan view of the structure shown in Fig. 23[a].

Figure 24 is a horizontal section on the line 24—24 of Fig. 23.

Figure 25 is a perspective view of the punch lever actuating frame.

Figure 26 is a top plan view of a further modified form with parts in section.

Figure 27 is a vertical sectional view taken therethrough.

Figure 28 is a top plan view of a still further modification with parts broken away.

Figure 29 is a vertical sectional view taken therethrough.

Figure 30 shows a top plan view of a still further modified form.

Figure 31 is a vertical section therethrough.

Figure 32 is a horizontal section on the line 32—32 of Figure 31.

Figure 33 is a perspective view of one of the finger wheels.

Figure 34 is a perspective view of one of the wire connectors.

Figure 35 is a perspective view of the spring bar.

Figure 36 is a detailed view of the listing mechanism;

Figure 37 is a perspective view of the gravity actuated trip dog and its mounting, the same used in connection with the listing mechanism;

Figure 38 is a perspective view of one of the striking hammers used in connection with the listing mechanism.

In the specific embodiment of the invention as illustrated in Figure 1 and corelated Figures, 1 represents a base plate which has secured thereto and extending vertically therefrom in parallel relation the separated side plates 2 and 3. These side plates are connected together at their top by a table supporting plate 4 upon which the card table 5 is secured. This table, with suitable extensions 6 formed integrally with the side plates, produces a card receiving hopper in which the cards to be mounted are held prior to being fed to the punching mechanism. The table is inclined and parallel with the key board, to be hereinafter described, and preferably carries a sliding weight which forces the cards into position against the gate members 8, supported between the extensions 6.

Supported upon the base and attached to the forward edge of the side plates 2 and 3 is an enclosing casing 9 having the key board 10 supported between the sides thereof. This key board comprises a plurality of castings each consisting of a longitudinal body portion 11 provided with horizontally arranged longitudinally extending ribs 12, 13 and 14, the former of which forms the top of the key board and is provided with a plurality of transverse slots 15 to aline with similar slots 16 and 17 formed in the ribs 13 and 14 respectively. The under rib 14 is arranged on the arc of a circle for a purpose to be hereinafter described and merges into the rib 13 as shown in Figure 4. Each casting is also provided with a depending rib 19 whose underside extends parallel with the under side of the rib 14. These ribs 19 form guide ways 20 for punch levers 21.

Slidably mounted in the slots 15, 16 and 17 of each casting is a plurality of stop keys 22 having buttons 23 upon their upper ends and being normally held out of the path of the punch levers 21 by means of spiral springs 24 which surround the bars between the ribs 13 and the latch lugs 25 formed on the bars. These latch lugs are provided with beveled under faces 26, adapted to engage the beveled upper faces of the locking plates 27 which are pivoted in the end plates 28 of each casting and are normally thrown into engagement with the latch lugs by means of springs 28[a]. When any one of the stop keys is depressed the latch lugs thereon will shift the plate 27 laterally against the tension of the spring 28[a] until said lug passes the undercut shoulder 29 formed in the plate at which time the springs 28[a] will force said plate 28 over the latch lug and hold the stop key in depressed position with its lower end projected into the path of the punching lever 21 corresponding with that column. It will be noted that if any other stop key in that column is depressed the initially moved stop key will be released and returned to normal position under the influence of the spring 24, owing to the fact that the locking plates 27 are common to

all stop keys in any one column. It will also be observed that I may connect the locking plates of any two columns by links pivoted to the ends of said plates so that only one punch will operate in any field of two or more columns or in any column of separate fields. The key board has been constructed in the foregoing manner so that each casting and its associated key bars constitutes a unit and thus permits its ready removal or the addition of other similar units whereby the capacity of the machine may be increased or decreased according to the work in hand.

Extending across the machine and mounted in the side plates 2 and 3, is a shaft 30 upon which are pivoted a plurality of punch bar controlling levers 21 equaling in number the number of rows of keys on the key board 10. The levers are all pivoted in the center of the machine as shown in Figure 2, and are flared laterally so that their upper ends will enter and travel in their respective guideways 20. These levers are separated by spacers 31 and are each provided with a laterally extending foot 32 bifurcated as shown at 33 to receive one end of a rock lever 34 which is pivoted upon a shaft 35 also extending across the machine and mounted in the side plates 2 and 3. Each rock lever 34 is connected to a single punch lever 21 and has its opposite end seated in a bifurcation 36 formed in an extension 37 of its associated punch bar 38 as shown in Figure 14. Each of the punch bars comprises a punch carrying member 39 upon which a punch 40 and a type member 41 is carried. The other portion of the punch bar 38 consists of a die carrying member 42 having a rectangular offset 43 which produces a card receiving space 44. The upper end of each die member 42 has a punch receiving die 45 formed therein adapted to receive the punch 40 and also with a recess 46 adapted to receive an aligning pin 47 carried on the punch member 39. The punch member 39 has sufficient resiliency to permit the punch thereon to be forced into engagement with the die after the aligning pin has been gaged with the aperture or recess 46. While the punch bars consisting of the punch carrying members 39 and the die carrying members 42 are practically integral it is found advisable to employ the alining pin and socket 47 and 46 respectively to insure proper engagement of the punch 40 with the die 45 and to this end the alining pin 47 is made somewhat longer or in other words projects further than the punch so that the alining pin will enter the recess 46 prior to the engagement of the card by the punch as will be hereinafter described.

The opening between the portion 39 and 42 of the punch bars extends entirely across the space occupied by the punch bars and passing through said space or opening is a ribbon 48 Figure 12 which is adapted to be engaged by the type members 41 so as to print indicia on the card corresponding to the hole punched in the column. This ribbon may be shifted or indexed at each operation of the machine in any suitable manner as by having the operating shaft 63 control a dog or pawl to move either ribbon spool one point when said shaft is returned to normal or initial position. This shifting may be accomplished in any suitable manner desired and as it forms no part of the invention is not particularly described herein. The type members are only brought into engagement with the ribbon after the punch 40 has perforated the card and entered the die 45 and in this manner the punch member 39 is placed under tension when the punch engages the card, by mechanism to be hereinafter described and as the punch passes through the card the type member will be snapped into engagement with the ribbon or in other words will strike the same an impact blow instead of being pressed gradually into engagement therewith. In such manner a much better impression is assured. Each punch bar is guided in its vertical movement by guide bars 49 and 50 and is held against lateral displacement by guide plates 51 and 52 carried respectively by the bars 4 and 4a. The bar 4 also prevents rearward movement of the punch bars and carried and depending from the bar 4a is a combined guide and chip receiving member 53 which prevents forward movement of the punch bars and is also adapted to receive the clips from the cards, being in the form of an L-shaped trough as shown in Figure 4. An opening 54 is formed in the side plates so that the chips may be removed from either side of the machine.

In order to lower the punch bars into their respective punching positions, there is secured to the opposite side plates a pair of inwardly extending studs 55 upon which are pivoted a pair of arms 56, connected at their free ends by a shaft or bar 57, which extends across beneath the upper portion of the rectangular offset 43 of the punch bars 38 and lies within the card receiving space 4. The arms 56 and their accompanying shaft 57 are normally elevated by means of springs 58 connected at one end to projecting ears 59 on the arms 56 and at their opposite ends to the punch locking bar supporting arms 60. The arms 56 are provided with anti-friction rollers 61 which are engaged by the eccentrics 62 carried adjacent opposite ends of the driven shaft 63 which is intermittently actuated as will be hereinafter described. The shaft 63 also carries a pair of cams 64 which act against anti-friction roll-

ers 65 carried upon a pair of feed rod actuating arms 66 also pivotally mounted upon the studs 55.

The arms 66 have each connected to their outer ends a rod 67, which rods are guided at their upper ends by passing through the gate member 8 and are connected at their terminals by a transverse bar 68. This bar has pivotally mounted thereon a plurality of card feeding fingers 69, spring pressed into contact with the stack of cards on the table 5 by springs 70 as shown. These fingers are each provided with a cam surface 71 at the base of which is formed a card engaging knife edge 72 adapted to engage the card and feed the same downwardly as the arms 66 are lowered by the action of the cams 64. In the first movement of the cams the cards are carried down into punching position and after being punched as will be hereinafter described the cams act to discharge the card into a chute provided for its delivery from the machine. As will be seen and more clearly hereinafter understood the cards will be held with their upper edges still in the hopper and gripped between the fingers 69 and the forward end of the card supporting table 5 while being punched, a dwell 73 being formed on the cams 64 for this purpose. Beyond the dwell 73 a rise 74 is formed which gives the card its final movement for discharge from the hopper into the discharge chute.

During the time the dwell 73 on the cams 64 is in engagement with the rollers on the arms 66, the punch locking bar carrying arms 60 are moved forward to carry the locking bar 75 into engagement with one of the notches 76 of all of the punch bars so as to lock all of the punch bars in operative position, determined initially by engagement of their associated punch levers 21 with one of the stop keys 22. This action is obtained through a pair of cams 77 carried upon the shaft 63 and operating against anti-friction rollers 78 on the arms 60. In this connection, it will be understood that the bar 57 is lowered to its full extent when the dwell 73 is in engagement with the rollers on the arms 66 and remains in this position during the locking and punching operation.

Mounted upon shaft 79, fixed in the side plates 2 and 3 and arranged to one side of the outermost rock levers 34 are a plurality of eccentric disks 80 having notched edges 81 which are adapted to be engaged by the gang punch bars 82 having the attenuated lower ends 83. A portion of the edge of these disks 80 are exposed through an opening 84 in the back plate 85 and are manually set in any suitable manner to control the position of the punch bars 82 which are raised and lowered with each cycle of movement of the arms 56. The disks are preferably numbered on the edge which is exposed through the opening 84 so that the gang number may be readily inspected and these numbers correspond with the notches which form the stop for the lower end of the punch bars 82.

Arranged on the shaft 79 opposite the disks 80 is an ordinary counter similar to that illustrated in Patent #484,391 preferably having disks 86 serially connected and each provided with a plurality of cam surfaces adapted to be engaged by the serial punch bars 87 with each actuation of the arms 56. The unit disk of the counter is connected to be operated with each operation of the machine as follows: One of the arms 56 is provided with a lateral extension which is connected by means of a link 89 with a pivoted and spring pressed dog 90 adapted to engage ratchet teeth in the unit disk of the counter so that with each operation of the arms 56 the unit disk of the counter will be moved one position and when a complete revolution has been made the tens disk will be caused to move one space all as described in the aforementioned Bates patent. It will be readily seen from an inspection of the drawings that the unit disk of the counter is only operated upon a retrograde movement of the arms 56 or in other words upon the restoration of said arms to normal by the springs 58. Therefore, the punch bars engage stationary cam surfaces on the disks of the counter and the disks are only moved after the punch bars have been raised therefrom. Although only one counter has been shown, it will be readily understood that I may provide two or more counters journaled upon parallel shafts carried in suitable spiders which are jointed to rotate upon the shaft 79. Each of these counters could be separately thrown into operative position, to be operated upon by the dog 90 from the outside of the machine but free from control independent of the operation of the machine. This arrangement is particularly advantageous when it is desired to number or serially punch different classes of cards or to give serial numbers of independent series of cards. One of the uses to which this arrangement may be adapted is the operation of numbering audit cards for railway work, and the arrangement is particularly advantageous in this connection where freight and passenger cards having different serial numbers or where different types of freight cars are given different serial numbers.

The machine is preferably driven by a motor, not shown, which is belted to a pulley 94, journaled on the stub shaft 95, keyed in the side plate of the frame. This pulley has secured thereto a pinion 96 which is in mesh with the gear 97, loosely mounted upon the driven shaft 63. The gear 97 car-

ries a notched wheel 98 and adjacent the same there is keyed to the shaft 63 an arm 99 upon which is pivoted a clutch dog 100 adapted to engage the notches in the wheel 98. The dog 100 is provided with a lateral extension 101 and is spring pressed toward the disk 98 by a spring 102 carried on the arm 99. Pivoted to the frame is a trigger 103 which normally lies in the path of the extension 101 so as to throw the dog 100 out of engagement with the notches of the disk 98 and to prevent the rotation of the shaft 63 with said disk. The trigger 103 is operated by means of a thumb bar 104 extending across the front of the machine as shown in Figure 1 and connected to the dog by means of a link or rod 105. Carried upon the side plate of the machine is an electro-magnet 106 whose armature 107 is provided with a lateral projection 108 also lying in the path of the arm 99 and the lateral extension of the dog 100. The magnet is connected in series with a source of current indicated by the battery B, and with a series of contacts 109 arranged to be engaged and separated from their coacting contacts 110 by the punch levers 21. Therefore, unless all of the punch levers 21 have moved from their initial position the circuit through the magnet will not be complete and the projection 108 will remain in the path of the extension 101 so that even after the trigger 103 has been withdrawn and the shaft started to rotate by reason of the dog 100 engaging one of the notches on the disk 98, the said dog 100 will be withdrawn and the rotation of the shaft 63 stopped, until the cause is ascertained and corrected. It will be seen from the foregoing, that unless all of the punch levers start forward promptly toward their stopping position as determined by the stop keys 22 corresponding to their respective columns, that the machine will not operate to punch the card. After the shaft 63 has made a complete revolution the extension 101 of the dog 100 engages the trigger 103 and is withdrawn from the notches in the disk 98. The rotation of the shaft is thereby stopped in position for a second operation.

In Figure 6 I have shown a detail vertical sectional view of a modified type of key board casting having a depending lug or ear extending across the path of the punch levers. By this construction I am able to avoid the use of a zero stop key although it will be clearly understood that instead of arranging the zero in the lowermost position after the 9 I may if preferable, of course, use the zero stop key in front of the 1 in the highest position.

In the operation of the machine just described it will of course be understood that a stack of cards are mounted upon the table 5 in position to be engaged by the card engaging fingers 69 as the machine is operated. The data to be punched on the card with the exception, of course, of the gang and serial numbers which are automatically controlled and operated independently of the keys, is set up upon the key board by pressing downwardly on the buttons 23 in each column or field and thereby projecting the lower end of the stop keys 22 in the path of the punch levers 21. The thumb bar 104 is then depressed which releases the trigger 103 from the lateral extension 101 of the dog 100 permitting the latter member to engage one of the notches in the tooth wheel 98. If all of the punch levers 21 have promptly started to move away from their initial position the circuit of the magnet 106 will be completed and the armature thereof will be drawn up against the cores so as to carry the lateral extension 108 out of the path of the arm 99 and its associated parts. If one of the punch levers 21 fails to move from its initial position then one of the contacts of the electro-magnet circuit will be held in open position and when the arm in rotating comes in contact with the extension 108 the lateral extension 101 of the dog 100 will be operated upon by said extension 108 and the dog 100 withdrawn from the toothed wheel so as to permit the operation of the same loosely upon the shaft 63. If all the contacts are closed and the tooth wheel 98 is locked to the shaft 63 for a complete rotation the following operation will take place. The rotation of the shaft 63 causes the cams 62 to wipe over the anti-friction rollers 61 and lower the arms 56 and their associated shaft thus permitting the punch bars 38 to drop in accordance with the movement of the punch levers 21 or in other words as controlled by the movement of the punch bars 21 which as before has been explained are limited by the stop keys or plungers 22. Immediately subsequent to this action the cams 64 also keyed to the shaft 63 operate against the anti-friction roller on the arm 66 and lower the feed arms 66 which in turn lower through the rods 67 the card feeding fingers 69. As these card feeding fingers are lowered through the action of the cams 64 operating upon the arms 66 their knife edges 72 engage the upper portion of a card and force the same downwardly until the dwell in the cam 73 is brought into engagement with the roller on the arm 66. At this period the punch bars are all in set position and the cams 77 are brought into engagement to force the locking bar 75 into engagement with the punch bars 38 and actuate the same to carry the punches through the cards and to cause the impact of the type members against the ribbon so as to impress a typed numeral or letter upon the card corresponding with the numeral or let-

ter punched therefrom by the punches. The resiliency of the punch bars is such that it will be placed under tension when the punches are brought into engagement with the cards and when forced through will cause the type members to strike the ribbon a sudden blow as distinguished from an even and slowly applied pressure. Immediately after the punching operation and the release of the locking bar by the cams 77 a rise in the cams 64 causes the arms 66 to start downwardly again and discharge the card from the hopper which during the punching operation has been held by the feeding finger against the lower edge of the hopper as may be readily seen. As the card is discharged from the hopper it falls into the chute or trough 95[a] and is discharged through the opening 96[a]. As the shaft 63 continues to rotate, the arms 56 and their associated shaft 57 will be elevated, thus carrying all of the punch bars 38 back to normal position and pressing the punch levers 21 against their contacts 109. At this time the trigger 103 is arranged in the path of the extension 101 and the arm 99 so that upon engagement of the extension 101 with the lateral end of the trigger the dog 100 will be withdrawn from the tooth wheel 98 and the rotation of the shaft stopped. All the contacts 109 being separated from their associated contacts 110 the circuit of the magnet will be interrupted and the armature moved away from the cores thereof by a suitable spring so that it again lies in the path of the arm 99. The springs 58 also act to elevate the rods 67 and the card feeding fingers to a position where the latter members are adapted to engage the next card presented on the table 2. At each operation of the machine the gang punch bars 82 are lowered into engagement with the eccentric disks 80 and are simultaneously locked with the key controlled punch bars by means of the locking bar 75. Also locked at the same time by the bar 75 are the serial counter controlled punch bars 87. As with the serial counters of the class described the unit wheel of the counter is interconnected through certain mechanism to the tens and hundreds wheels of the counter so that the operation of the unit wheel at each operation of the machine is sufficient in itself to control the entire counter and to multiply the figures accordingly. At each retrograde movement of the machine the extension 88 on the arms 60 will control the pivoted and spring pressed dog 90 through the link 89 so as to operate upon the unit disk of the counter and move the same one point. After a complete revolution of this wheel has been made the lug on the unit disk will engage the tooth wheel 92 and move the same one point, which action will simultaneously move the tens wheel an equal distance. The tens wheel after a single revolution controls the hundreds wheel in a similar manner and so on. In this manner the position of one or more of the serial punch bars 87 change position and thereby punch a number of increased value in the card while the gang punches continue to punch the same number in each card until the disks 80 are differently set through manual operation of the same.

In the modification shown in Figures 15 to 20 the machine illustrated is particularly adapted for use in connection with punching a plurality of cards or slips at one time, such as where it is desired to use an original, a duplicate, and an audit slip or card and the machine may be used for many purposes such as in railroad offices, money order divisions in the postal services, and like places. As shown, the machine embodies supporting feet 111, from which rise a pair of separated side plates 112, upon which is supported most of the mechanism. These side plates have inwardly extending conical extensions 113, projecting forwardly from their front edges which support the arcuate front plate 114, to be hereinafter described. The extensions 113 have passing through their approximate center a shaft 115 which has journaled thereon what may be termed a plurality of punch levers 116, bent as shown in Figure 19, so that their associated ends will be located centrally of the machine, as will be hereinafter understood. Each punch lever is provided with a circular or rounded head 118 adapted to engage a lateral socket 119 formed in the coacting punch carrier 120. All of these punch carriers, there being one for each punch lever, are substantially L-shaped, and I have a depending guide stem formed integrally therewith and which slides between the bars 122 and 123. The vertical extension of each punch carrier is provided with an elongated card receiving slot 124 adapted to receive the card through the top plate 125 which is provided with a registering slot 126 for this purpose. One end of this slot is closed by a stop plate 126[a] which affords a stop for the end of the card or cards when inserted by the operator. This vertical extension bears upon one side upon a transverse bar 127 extending across the machine in the manner of the guide bars 122 and 123 and has a lateral extension upon its rear upper end as shown at 128 to engage the bearing plate or abutment 129. Each punch carrier having its upper vertical end divided into separate parts is normally depressed or drawn downwardly by a spring 130 connected to the horizontal extension of the punch carrier and to the bar 122 as shown in Figure 20 so as to act as a counter balance to the operating levers 116, as will be clearly understood hereinafter. One side of the upper or vertical extension of the carrier is provided with an aperture

or die hole 131 and in the opposite or forward side of the vertical extension is slidably mounted a spring retracted punch 132. One end of these punches is arranged closely adjacent an operating plate 133 extending entirely across the machine and projecting through openings 134 in the side plates 112 where it lies in the path of the anti-friction rollers 135 carried by the cranks 136 which are keyed to the shaft 137 extending across the machine and journaled in the side plates 112. This shaft is operated as will be hereinafter described by the lever 138.

The plate 133 is supported upon a pair of arms 139 pivoted intermediate their lengths upon the projecting ends of the guiding bar 123, and one of them has its lower end connected through a link 140 to the unit wheel actuating lever 141 as shown in Figure 17. This actuating lever is secured in the usual manner to a Bates type counter which is controlled in a well known manner, the lever 141 actuating the unit wheel upon retrograde movement of the plate 133 so that the card must be actually punched before the counter is actuated. Each disk of this counter is provided with a cam 142 upon which rests a lever 143 pivoted upon a shaft 144 and having its free terminal arranged beneath the extension tail 145 of the serial number punch carriers. The Bates counter operates in the usual manner, i. e., upon ten movements of the unit wheel actuating a tens wheel, etc., turns the cams 142 so as to constantly elevate in succession the punch carriers 146. Thus it will be seen that upon every operation of the machine the punch carrier actuated by the cam on the unit wheel of the counter will assume an advanced position and when the tens wheel is again actuated in the customary manner the lever on the unit wheel will drop to zero and the lever on the tens wheel will rise one point, thus a continuous serial counting is produced, all independent of the actuation of the punch levers 116. On the opposite side of the machine there is arranged a plurality of punch carriers 147 which have their elongated tails 148 operating over a plate 149 in which a plurality of manually located pins 150 are placed, there being a sufficient number of apertures alined with the tail of each punch carrier to permit of any adjustment of from one to twelve. These pins 150 are arranged so that the actuating punch carriers 147 may be adjusted to produce any gang number or combination of holes representing a date on the card as will be readily understood.

In this machine, as well as in the automatic type it is desirable that the card be in proper punching position before the punches are actuated, so as to secure accurate positioning of the holes in the card. To secure this correct positioning of the card, there are pivoted to opposite side plates a pair of dogs 151 normally elevated by springs 152 against stops 153. These dogs are arranged across the slot in the punch carriers and are limited in their downward movement by adjustable eccentrics 154 and have their forward upwardly turned ends normally arranged in the path of the plate 133. Upon depression of the card or cards into the slots in the punch carriers, the lower edge of the card or cards will engage the dogs 151 pressing them downwardly against the eccentrics and carrying their forward ends out of the path of the plate 133 so that said plate can be moved forwardly into engagement with the punches 132. As these dogs are independent of one another it will be seen that both ends of the latter have to be forced down equally so as to cause both dogs to engage their limiting eccentrics thereby prohibiting the operation of the bar by the cranks 136, if one end of the card should remain elevated. It will, of course, be seen that the travel of the free ends of these dogs is limited so that only a slight movement thereof is required to carry their forward ends out of the path of the plate, then by depressing the lever 138, the anti-friction rollers in the cranks 136 force said plate into engagement with the punches 132 which are carried through the cards into their dies 131 against the tension of their springs.

Each of the punch levers is held in proper position by spacing disks 155 and have their forward ends passing through slots 156 in the arcuate plate 114. Each slot is provided with a plurality of lateral extending recesses 157 arranged upon each side thereof and adapted to be engaged by the plunger 158 slidably mounted upon the arm 159 connected to the outer end of the punch lever. The outer end of this arm is threaded to receive a thumb button 160 which is recessed to receive a compression spring 161, bearing against a portion of the button at one end and near its opposite end against the plunger sleeve 158 so that as each punch lever 116 is moved in either direction the plunger sleeves will snap into the notches 157 and hold the punch levers in adjusted position. Each punch lever also carries an arcuate strip 162 which travels in a dovetail groove 163 formed on the inner side of the plate 114. These strips move with the punch levers 116 and are provided with suitable indicia which is exposed through an opening 164 formed in the front plate 114 so that a readable item showing the result of movement of the punch levers can always be seen, thereby providing a check upon the operator's movement of the levers.

The setting of these punch levers moves the punch carriers into punching position, the action being assisted by the springs 130.

The card or cards are then inserted through the slot 126 into the slots of the punch carriers and held down upon the dogs 151, lateral movement of the card being prevented by guide plates 165. Pressure on the card or cards carries the dogs 151 down against their eccentric stops 154 and moves their free ends out of the path of the plate 133. While the card is held in this position the lever 130 is depressed, thus carrying the plate 133 rearwardly into engagement with the punches 132 and forcing the punches through the cards and into the dies 131. Upon return of the plate 133 to normal position the link 140 throws the lever 141 which actuates the unit wheel of the counter and moves the cam 142 one space, thus raising the first serial punch carrier 147 one space. Thus it will be seen that I have provided a simple and efficient mechanism in this type of structure which embodies a plurality of manually controlled punch carriers, a plurality of manually adjustable punch carriers adapted to punch a gang or identification number, and a plurality of automatically controlled punch carriers independent of those manually operated, which are provided for punching numbers in serial order.

The back of the machine is covered by a plate 166 and by a hopper 167 which is mounted upon a rod 168 and extends inwardly beneath the punch carriers in the form of a box so as to receive the punchings from the dies 131 as shown in Figure 20. The hopper has a vertical extension turned inwardly at its upper end to bear against the abutment 129 and is held in position upon the rod 168 by the weight of the chip receiving box.

In the modification shown in Figures 21 to 25 inclusive, there is shown a machine quite similar to the one before described but which is especially adapted for simultaneously punching one or more slips or cards which are inserted into the machine by hand. Rising from the base plate 169 are suitable side plates 180 which have journaled therein a shaft 181 having loosely mounted thereon punch levers 182. These punch levers are similar in every respect to the punch levers 21 and have their upper ends arranged to slide in channels 183 formed in the key board castings 184 which are similar to the key board castings shown in Figure 6 and have slidably mounted therein the stop keys 185. The lower end of each lever is provided with a right angular extension 186, bifurcated to receive the end of its corresponding rock lever 187. All of the rock levers 187 are pivoted upon a shaft 188 and have their ends seated in sockets 189 formed in the punch bars 190. Each of the punch bars comprises, as usual, die carrying and punch carrying members connected together at their lower ends as shown at 191 so as to be relatively movable. All of the punch bars are slidably mounted between guide rods 192 and are held in separated relation by means of the punch guiding plates 193 and 194 carried by the castings 195 and 196, respectively. The latter casting forms a trough 197 adapted to receive the chips and also acts as a guide to receive the thrust of the die members of the punch bars. The plates 193 and 194 are arranged in separated series across the machine so as to permit the passage of the cards or slips between the same and between the die and punch carrying members of the punch bars.

After the punch bars have been set in their respective punching positions as will be hereinafter described they are locked in such position and the punch carrying members all moved forward to bring the punches thereon into engagement with the die by means of a locking and punching bar 198. This punching bar is carried by a pair of levers 199 whose lower diagonally extending ends are arranged in the path of a rod 200, extending across between the free ends of the levers 201. These levers 201 are keyed to the shaft 181 and are operated by the handle 202 which is also keyed to the same shaft 181, the end of which extends through one of the side plates. The levers 201 are also connected by a rod 203 which holds the rock levers against operation and when the handle is operated permits the punch bars to be lowered into operative punching position as controlled by the punch levers 182 and the stop key 185.

This type of machine is also provided with a plurality of gang punch bars 204 controlled independently of the key bars by notched cams 205 similar to those indicated at 80, and also with a plurality of counter controlled punch bars 206, controlled by the cam disks 207 of a counter 208 similar to the counter 86 formerly described. The levers 201 may be locked against movement either by suitable mechanical or electrical means whereby, unless all of the punch levers 182 have started from their initial or normal position it will be impossible to operate the machine, thus preventing erroneous punching of the cards. The mechanical locking of the levers 201 is accomplished by extending across the machine between and secured to the levers 201 a bar 209 which is arranged in the path of a plurality of fingers 210 pivoted to the casting 196. These fingers are each adapted to be engaged by their respective punch levers 182 and are adapted to be held over or in the path of the bar 209 by the punch levers when said levers are in their initial position. If each lever 182 moves forward promptly upon the initial movement of the handle 209 all of the fingers will move out of the path of the bar 209 and the rod 200

may be brought into engagement with the levers 199 and the punches operated. If one of the punch levers 182 has failed to move, its associated locking fingers 210 will remain in the path of the locking bar 209 and the levers 201 will be thereby prevented from moving a sufficient distance to operate the levers 199. In other words, the levers 201 only move under these conditions a sufficient distance to permit the punch levers 182 to start on their downward movement.

To electrically control the movement of the levers 201 in accordance with the position of the punch levers 182 there is provided electro-magnet 211 shown in Figs. 23[a] and 23[b], in the circuit of which is included a plurality of contacts or punch lever controlled switches which are normally held in open position by the punch levers as before described in connection with Figure 11. If all of the punch levers have started properly from their initial position the contacts or switches will be closed and consequently the circuit of the magnet 211 will be completed. When this is done the armature 212 will be attracted and carried out of the path of the locking bar 209.

In this type of machine the stop keys are set up as formerly described and the handle 202 then actuated to accomplish the punching. As the handle moves forward the levers 201 which are keyed to the shaft 181 move forward with it and the rock-levers 187 being released by the rod 203 permit the downward movement of the punch bars 190 and the forward swinging of the punch levers 182, the punch bars stopping in accordance with the movement of their respective punch levers 182. As the levers 201 continue their movement the bar 200 is brought into engagement with the levers 199 and the locking bar 198 carried into engagement with the notches upon the punch bars 190 thereby locking the same in punching position. A continued movement of the levers 199 causes the punches on the punch bars to pass through the card, the chips or punchings dropping into the trough or receptacle 197. It is of course understood that the gang punch bars 204 and the counter-controlled punch bars 206 are operated simultaneously with the punch bars 190 and are set up so that the gang number and serial number will be punched in the card or cards in accordance with the position of these members. With this type of machines a plurality of cards or slips may be inserted and held in proper position for simultaneous punching and if desired the machine may embody a printing mechanism which will print a duplicate of the matter punched in the card on one margin thereof. A ribbon 213 and type members 214 are shown and are similar to the type members 41 and the ribbon 48 illustrated in Figure 5, the type members being carried upon the punching bars and movable therewith and consisting either of letters or numerals so as to agree with the indicia punched out of the card by the punches 215.

It will be seen that in both types of the machine described that the punch bars and their associated punch levers drop by gravity to their respective positions as controlled by the stop keys and it will be clearly understood that springs may be attached to the punch bars or to their associated punch levers so that when they are released by the operation of the handle or by the rotation of the shaft 63 that all will be forcibly carried to the positions previously determined for them. It is believed, however, that this course will not be necessary in practice as the position of the punch levers is to one side of the vertical and the natural tendency of the punch bar is to drop when released.

In order to eliminate the key board and to produce a machine which will be considerably cheaper than the foregoing multiple card punching machine the structure shown in Figures 26 and 27 is employed wherein the key board is entirely eliminated and in its place a curved or arcuate plate 217 is provided. This plate is preferably produced from a single stamping and has a plurality of parallel slots 218 which afford guide-ways for the travel of the upper end of the punch levers 219 all of which are pivoted as is usual upon a transverse shaft 220 extending across the machine and mounted in the side plates thereof. These punch levers are connected as is usual to the punch bars through rock levers 221 and have their upper ends extended laterally to produce pointers 222 which travel over suitable indicia placed upon the key board. The upper ends of each of the levers 219 may be provided with a finger hold or knob as is found most desirable and are connected through a tape 223 to a spring drum 224 of which there is one for each lever or punch bar. These spring drums are mounted upon a transverse shaft 225 and are adapted to take up the slack in the tape 223 when the levers are returned to normal or inactive position. Each lever may be held in its operated position by having sufficient inherent resiliency to throw same to one side of the slot 218 this side preferably having its wall notched or serrated as shown at 226 to receive a suitable projection on the punch lever. These notches and the projection on the punch levers serve to hold the parts in operative punching position until the punch carrying members of the punch bars have been forced over so as to carry the punches through the card and accomplish the printing operation. This may be done in the manner described for the structure shown in Figure 23 or in any other suitable manner.

The top of the machine is provided with a

transverse aperture 227 through which the indicia on the tape 223 is exposed. In this manner the operator not only has a reading from the pointers 222 pointing to the indicia on the plate 217 but also has a straight reading showing a duplicate of all indicia punched in the card when the machine is operated to punch the same.

This type of structure is further simplified in the structure shown in Figures 28 and 29 illustrating a type wherein both the key board, the punch levers and their associated levers have been eliminated. In this form a plurality of index wheels 228 are journaled upon the transverse shaft 229 and have their numerals or characters exposed through a slot 230 in the top of the machine. Each of these wheels has a pair of drums 231 and 232 arranged thereon and travelling over the first drum 231 is a tape 233 which is connected to an operating member 234 slidably mounted in a slot 235 in the top plate 236. This operating member is provided with a pointer 237 similar to the pointer of the punch lever 219 and is adapted to operate in a like manner. The other drum 232 is of considerably smaller diameter and has an oppositely wound flexible connector 238 wound thereon. These connectors are passed over pulleys 239 and 239ª and connected directly to the punch bars 240 in such a manner that when the operating members are moved in the slots of the top plate the punch bars 240 will be raised or lowered accordingly. In this instance the punch bars are returned to initial position by springs 241. In this type of construction there is also a double reading given.

In the structure shown in Figures 30 to 32, the side plates have mounted therein a transverse shaft 242 upon which is mounted a plurality of index wheels 243 having numerals upon their faces and interposed notches 244 arranged between each numeral. The numbers on the wheels are exposed through an opening 245 in the top 246 while the bottom or lower portion of the wheels are accessible through an opening 247 formed in the casing 248 and so positioned that the operator may rotate the wheels with the fore finger by engaging the wheels through the opening 247 and pulling forwardly on the same, the wheels rotating in the direction of the arrow indicated in Figure 31. Each wheel is held in operative position by a detent spring 249 which engages the notches 244 and holds the wheel against rotation. Each wheel carries a small drum 250 upon which is wound one of the connecting members 251 illustrated in Figure 34. These connector members pass over suitable pulleys 252 and diverge to their connections with the punch bars 253 and are kept under tension by the springs 253ª. By providing all of the wheels with stops 254 and making each one in the nature of spring drums the springs of which are indicated at 250ª the wheels may all return to the zero position and the punch bars carried back to initial position by providing a releasing means for the springs 249. This may be accomplished by extending a transverse shaft or bar 255 across the machine and projecting the same beyond the side plates so that it can be manually manipulated. By pushing rearwardly upon the shaft or bar all of the detent springs will be carried out of engagement with their respective wheels which will be automatically returned to initial position.

Each connector 251 is preferably constructed from a single strand of wire with loops 256 formed in its ends. This wire, while having practically no stretching capacity, is relatively flexible so as to readily conform to its normal angular position in the machine and to withstand considerable bending. The connectors are made of this form so that they may be easily replaced, it being understood of course that they are of different lengths on account of the divergence between the associated index wheels and their punch bars.

With this type of machine it will be noted that there is only one direct reading straight across the machine but the punch levers, their associated rock levers and even the key board or pointer guiding plate have been eliminated. The same type of punch operating lever as illustrated in Figure 23 may be employed and while no punch bar locking mechanism has been illustrated it will be understood that the same general type as illustrated in Figures 4 or 23 may be employed if desired. While the springs and notches are so constructed that they will be readily disengaged from one another in the positive rotation of the wheel they constitute a sufficiently positive lock to insure accurate punching of the card. In this type of machine as in the type illustrated in Figures 28 and 29 the punch bars may be either lowered or raised as is found desirable by merely changing the direction of wind of the connector on the drums.

It has been found advantageous in many instances to couple with either the manually or motor operated punching mechanism a suitable but simple mechanism for listing certain items which are punched upon the card. One embodiment of the listing mechanism contemplated is illustrated herein in Figure 36.

In this figure the punch carrier has been illustrated at 257 and is supplied with a type carrying bolt 258, over which extends an inking ribbon 259 which is unwound from a supply roller 260 onto a take-up roller 261, operated as will be hereinafter described, also any number of the punch carriers 257

may be supplied with the type carriers 258 and the ribbon is of such width as to extend across all of the punch carriers thus supplied. Located immediately back of the ribbon and extending across the machine is a plunger supporting member 262 in which are mounted a plurality of spring retracted type engaging plungers 263. Passing between the ink ribbon 259 and the member 262 is a paper table 264 which is taken from a supply roll 265 and wound upon a take up roll 266, also controlled intermittently as will be hereinafter described. Arranged upon either side of the machine and adapted to be shifted back and forth when the punch operating lever or the machine is operated are a pair of sliding members 267 having standards 268 connected together at their upper ends by a shaft 269 upon which is pivoted a gravity actuated trip dog 270. This dog lies in the path of and forms an abutment which is engaged by shoulders 271 formed upon the striking hammers 272. These hammers are all pivoted upon a common shaft 273 which extends across the machine and each hammer is individually pressed toward its associated type engaging plunger 263 by a spring 274. One of the bars 267 carries a pair of pawls 275 and 276 adapted to engage ratchet wheels 277 and 278 which actuate the tape rolls 261 and 266 respectively.

This operation of the mechanism is as follows:

When the mechanism is actuated or when the machine is operated by the motor the punch bars are lowered in the regular way presenting different printing characters to the printing plungers 263 depending entirely upon the position in which they assume as controlled by the stop keys. These characters correspond to the characters punched in the card and therefore the items listed upon the strip of paper 264 are identical with the tabulatable items punched in the card. Simultaneously with the downward movement of the punch carriers the members 267 are moved, and at a time when the punch carriers are all located in their respective positions, the trip dog 270 slips free of the shoulders 271, allowing the springs 274 to force the hammers 272 into engagement with the printing plungers 263, thus a rapid and effectual printing stroke is obtained and a clear character printed upon the paper strip. Upon the return stroke of the member 267, the pawls 275 and 276 operate the tape rolls 261 and 266 and feed the ribbon and paper over the member 262. The trip dog 270 is always carried back a sufficient distance to engage behind the shoulders 271 of the hammers, thereby placing the mechanism in a position for a second operation.

While I have described and shown the preferred embodiment of my invention it will be clearly understood that many modifications may be resorted to in practice without in any way departing from the spirit or scope of the invention as defined by the appended claims and I, therefore, reserve the right to make these modifications without qualification. It is also to be understood that if desirable I may provide summation wheels for obtaining the totals of amounts punched in different columns. This can be accomplished in any suitable manner such as by mechanism similar to that employed in advertising machines and the like.

If found desirable, each of the stop keys may be provided with a lug which is adapted to engage balls in a ball channel formed within the key frame. The entire length of this channel is filled with balls, except, however, for the thickness of a lug of any one of the stop keys, the balls being freely movable within the channel. This means that any one of the stop keys associated with a ball channel may be depressed, thereby pushing the balls apart so that they entirely fill the channel. It is to be noted, however, that no other key can now be depressed as there is no further room in the channel for movement of the balls, and therefore, a lug on any other stop key will be prevented from passing between any of the other adjacent balls in said channel. It should be borne in mind, however, that releasing means must be provided in the shape of an extra key or other device so as to release the locking bar herein referred to, as with this type of keyboard, if the wrong key is depressed, the right one cannot be set until the first one is released from between the balls.

This principle can be applied so that but one key in any one of two or more columns can be depressed by making a suitable curved channel communication with the channels in two adjacent key frames, these curve connecting channels being, of course, filled with balls in contact with those in the key frame channels, and only enough space for one key lug thickness in all of the connected channels. This connected channel arrangement would be quite necessary on census work where, for instance, four columns are devoted to the record of birthplace, and form one field, where but one hole is required or permissible in such field.

What is claimed is:

1. A punching machine comprising a plurality of shiftable punches, means for simultaneously setting all of the punches, means for simultaneously locking them in operative position, and means for forcing the punches through a blank.

2. A punching machine comprising a plurality of shiftable punches, means for simultaneously setting all of the punches in operative position, and means for simulta-

neously locking and forcing the punches through a blank.

3. A punching machine comprising a plurality of shiftable punches, means for independently moving the punches into operative position, means for simultaneously locking all of the punches in operative position, and means acting on the locking means to force the punches through a blank.

4. A punching machine comprising a plurality of shiftable punches, means for moving the punches into operative position, locking mechanism therefor, and means to actuate the locking mechanism to cause the same to force the punches through a blank.

5. A punching machine comprising a plurality of shiftable punches, controlling means for independently determining the position of the separate punches, locking mechanism for the punches, and means for actuating the locking mechanism which causes the same to lock the punches and to subsequently force the same through a blank.

6. A punching machine comprising a plurality of shiftable punches, means for moving the punches into operative punching position, and automatic means for determining the combination of certain of said punches.

7. A punching machine comprising a plurality of shiftable punches manually controlled means for determining the shifting movement of certain of said punches, means for shifting said punches into operative punching position according to the position of the determining means, and automatic means for determining the combination of other of said punches.

8. A punching machine comprising a plurality of shiftable punches, manually controlled means for moving the punches into operative punching position, and automatic means for determining the combination of certain of said punches.

9. A punching machine comprising a plurality of shiftable punches, manually controlled means for moving the punches into operative punching position, and means for automatically controlling the position of certain of said punches at each operation of the machine.

10. A punching machine comprising a plurality of shiftable punches, manually controlled means for moving the punches into operative punching position, means for automatically controlling the position of certain of said punches at each operation of the machine, together with means to punch a gang number in the blank.

11. In a punching machine the combination with a plurality of shiftable punch members, manually controlled means for setting certain of said punch members in operative position, and means for automatically setting other of said punch members in operative position at each operation of the machine.

12. In a punching machine the combination with a plurality of shiftable punch members, means for setting certain of the punch members in operative position, and automatic means for controlling other of said punch members at each operation of the machine.

13. A punching machine comprising a plurality of shiftable punch carrying members, means for setting certain of the punch carrying members in operative position, means for actuating the punch carrying members to punch a card, and means to change the order of set of other of said punch carrying members automatically with each operation of the machine.

14. A punching machine comprising a plurality of shiftable punch carrying members, means for setting certain of the punch carrying members in operative position, means for actuating the punch carrying members to punch a card, and serial counting mechanism adapted to automatically control the set of other of said punch members at each operation of the machine.

15. A punching machine comprising a plurality of shiftable punch carrying members, means for setting certain of the punch carrying members in operative position, means for actuating the punch carrying members to punch a card, and a plurality of shiftable serial counting mechanisms each adapted to independently control the position of other of said punching members automatically with each operation of the machine.

16. In a punching machine, a plurality of punch carrying members, means to determine the punching position of said members, and means for simultaneously moving all of the punch members into operative punching position subject to the control of said determining means.

17. In a punching machine the combination with a plurality of shiftable punch carrying members, manually controlled means for determining the punching position of certain of said members, automatic means for determining the position of other of said members, and means for moving all of the punch carrying members into operative punching position subject to the control of said determining means.

18. In a punching machine a plurality of shiftable punch and die carrying members, manually controlled means for determining the position of said punch and die carrying members, said means producing a readable item when set, and means for actuating the punch carrying members to force the punches through a card or blank.

19. In a punching machine the combination with a plurality of shiftable punch and

die carrying members, means for determining the punching position of each punch and die carrying member, said means producing a readable item when set, and means for consecutively locking the punch and die carrying members in operative position and forcing the punches thereon through a blank.

20. In a punching machine the combination with a plurality of shiftable punch carrying members, of means for determining the punching position of each punch carrying member, said means producing a readable item, means for simultaneously moving all of the punch carrying members into operative position subject to the control of said determining means, means for locking said moving means against operation and means for releasing the locking means when all of the punch carrying members have started toward operative punching position.

21. In a punching machine the combination with a plurality of shiftable punch and die carrying members, key controlled means for determining the movement of said members, means for operating said determining means, and means for actuating the punch and die carrying members to force the punches through a blank.

22. In a punching machine the combination with a plurality of punch carrying members, key controlled means for determining the movement of said members, means for controlling said determining means and a lock for the operating means which is releasable automatically upon the initial movement of the determining means.

23. In a punching machine the combination with a plurality of punch carrying members, key controlled mechanism for determining the movement of said members and a plurality of serial counter controlled punch carrying members.

24. In a punching machine the combination with a plurality of punch carrying members, key controlled mechanism for determining the movement of certain of said punch carrying members, serial counter mechanism for determining the movement of other of said punch carrying members, and means for moving all of the punch carrying members in accordance with their controlling mechanism.

25. In a punching machine the combination with a plurality of punch carrying members, key controlled mechanism for determining the movement of certain of said punch carrying members, serial counter mechanism for determining the movement of other of said punch carrying members, means for simultaneously moving the punch carrying members in accordance with their controlling mechanism, means for locking the moving mechanism, and means for determining by the movement of the key controlled mechanism the releasing of said locking means.

26. In a punching machine the combination with a plurality of punch carrying members, independent key controlled mechanism for determining the movement of each punch carrying member, means for moving the punch carrying members simultaneously into punching position in accordance with their controlling mechanism, and a locking mechanism independently controlled by each punch carrier controlling mechanism.

27. In a punching machine the combination with a plurality of punch carrying members, individual key controlled mechanism for determining the movement of each punch carrier, means for moving all of the punch carriers simultaneously, and a common locking mechanism therefor which is independently controlled by the individual punch carrier controlled mechanism.

28. In a punching machine the combination with a plurality of movable punch carrier members, means for moving the same and means for independently determining the movement of each punch carrying member which comprises in part a plurality of key plungers and means for locking one of the key plungers in set position.

29. In a punching machine the combination with a plurality of movable punch carrier members, means for moving the same and means for independently determining the movement of each punch carrying member which comprises in part a plurality of key plungers, and means for returning the key plungers to normal when the locking means is released.

30. In a punching machine the combination with a plurality of punch carrying members, means for moving the punch carrying members into operative punching position, means for controlling the individual movement of the punch carrying members which comprise columns of key plungers, means for locking one of the plungers in set position, and means for releasing the locking means when another plunger in the column is actuated.

31. A punching mechanism comprising a plurality of movable punch carriers, independent actuating means for each carrier, means for controlling the movement of the actuators which comprise a plurality of columns of shiftable key plungers, a common lock for the plungers of each column and means for releasing the previously actuated plungers in any column when one plunger is actuated to control the movement of the punch carrier actuators.

32. A punching mechanism comprising a plurality of movable punch carriers, independent actuating means for each carrier, means for controlling the movement of the actuators which comprise a plurality of

columns of shiftable key plungers, a common lock for the plungers of each column, means for releasing the previously actuated plungers in any column when one plunger is actuated to control the movement of the punch carrier actuators, and means for returning the plungers to normal position when released.

33. A punching mechanism comprising a plurality of movable punch carriers, independent actuating means for each carrier, means for controlling the movement of the actuators which comprise a plurality of columns of shiftable key plungers, means carried by each plunger for releasing the lock to previously actuated plungers, and means for returning the plungers to normal when released.

34. In a punching machine the combination with a plurality of movable punch carriers, means comprising in part a plurality of columns of key plungers, punch carrier actuators individual to each column and means for locking one of the key plungers in the path of its associated actuator whereby the movement of the punch carrier may be determined.

35. In a punching machine the combination with a plurality of punch carrying members, independent actuators for each punch carrier, independent columns of controlling devices for the actuators, and a common lock for the controlling device of each column whereby one of the controlling devices may be held in the path of its associated actuator.

36. In a punching machine, a plurality of card punching members, means for shifting said members into punching position, means for simultaneously moving the punches to carry them through the cards, and an automatically reciprocating card feeding mechanism actuated at each operation of the machine.

37. In a punching machine, the combination with card punching mechanism, means for setting said mechanism, reciprocating means for automatically feeding the card into punching position with each operation of the machine, and means for subsequently actuating the punching mechanism.

38. In a punching machine the combination with card punching mechanism, reciprocating means for automatically feeding a card into punching position where it is subsequently punched by the punching mechanism, and means for causing a further movement of the card feeding means for automatically discharging a card.

39. In a punching machine, the combination with card punching mechanism, automatically reciprocating card feeding mechanism adapted to hold the card in punching position, and means for actuating the punching mechanism.

40. In a punching machine, the combination with card punching mechanism, of automatically reciprocating card feeding mechanism adapted to feed a card and hold the same in punching position, and means for actuating the punching mechanism while the card is held by the feeding mechanism.

41. In a punching machine for cards having index point positions arranged in columns, a punch and punch receiving die common to all index point positions in a column, means for determining the punching position of said punch and its die, and means for carrying the punch through a card.

42. In a punching machine for cards having index point positions arranged in columns, a punch and punch receiving die common to all index point positions in a column, key controlled means for determining the punching position of said punch and punch receiving die, and means for carrying the punch through a card.

43. In a punching machine, the combination with card punching mechanism, of automatically reciprocating card feeding mechanism adapted to feed a card to punching position, means for causing said feeding mechanism to dwell and hold said card in such position, means for actuating the punching mechanism while the card is held by the feeding mechanism, and means for continuing the reciprocating movement of the feeding mechanism for discharging the punched card.

44. In a punching machine, the combination with card punching mechanism, of automatically reciprocating card feeding mechanism adapted to feed a card to punching position, means for causing said feeding mechanism to dwell and hold said card in such position, means for actuating the punching mechanism while the card is held by the feeding mechanism, and mechanism for causing said card to be discharged after the punching operation.

45. In a punching machine, the combination with a plurality of shiftable punch carrying members, of means for determining the punching position of each punch carrying member, means for simultaneously moving all of the punch carrying members into operative position subject to the control of said determining means, and means for forcing the punches through a card.

46. In a punching machine for cards having index point positions arranged in columns, a punch and punch receiving die common to all index point positions in a column, means for moving said punch and its die to the desired punching position, and means for carrying the punch through a card.

47. In a punching machine for cards having index point positions arranged in

columns, automatic means for feeding a card to punching position, a punch and punch receiving die common to all the index point positions in a column, means for moving said punch and its die to the desired punching position in a column, and means for carrying the punch through the card.

48. In a punching machine, the combination with card punching mechanism, of an automatic card feeding mechanism, said mechanism comprising feeding fingers adapted to feed a card into punching position, and a cam for controlling the movement of the feeding fingers, said cam being so formed as to cause said fingers to dwell and hold the card in punching position, the continued movement of said cam operating to control mechanism for discharging the card from punching position.

49. In a punching machine, the combination with a plurality of punch carrying members, mechanism for determining the movement of certain of said punch carrying members, serial counter mechanism carrying cams adapted to control the movement of other punch carrying members, and means for moving all of the punch carrying members in accordance with the controlling mechanism.

50. A serial punching machine comprising a plurality of shiftable punches, and serial counter mechanism for automatically controlling the punching position of said punches.

51. A punching machine comprising a plurality of punches, and a serial counter mechanism for controlling means for determining the operative position of said punches.

52. A punching machine comprising a plurality of punches adapted to be shifted to different operative positions, and automatic means for determining the operative position of said punches in combination.

53. A punching machine comprising a plurality of shiftable punch carrying members, punches carried by said members, manually controlled means with which said punch carrying members cooperate for determining the punching position of said punch carrying members, means for shifting the punch carrying members to such cooperative position, and means for actuating the punches to force the same through a blank.

54. A punching machine comprising a plurality of shiftable punch carrying members, punches carried by said members, manually controlled eccentric members with which said punch carrying members cooperate for determining the punching position of the punches, means for shifting the punch carrying members to such cooperative position, and means for actuating the punches to force the same through a blank.

55. In a punching machine, the combination with a plurality of movable punch carrier members, independent actuating means for each carrier, and means for controlling the movement of the carriers to determine the position of the punch carriers for the punching operation.

56. In a punching machine, the combination with a plurality of punch carrying members, means for determining the movement of said members, means for controlling the determining means, and motor operated mechanism for setting the punch carrying members and operating the punches.

57. In a punching machine, the combination with a plurality of punch carrying members, means for determining the movement of said members, means for controlling the determining means, and manually controlled motor operating mechanism for setting the punch carrying members and operating the punches.

58. In a punching machine, the combination with a plurality of punch carrying members, means for controlling and determining the punching position of said members, a normally disconnected motor mechanism for operating the machine, a clutch mechanism for connecting the operating parts of the machine to the motor mechanism, and manually controlled means for operating said clutch mechanism.

59. In a punching machine, the combination with a plurality of punch carrying members, means for controlling and determining the shifting movement of said members, a motor driving shaft, a driven shaft upon which the operating parts for actuating the punch carrying members and their punches are carried, a clutch mechanism between said driving and driven shafts, means for normally holding said clutch mechanism in disconnected relation, and means under the control of the operator for actuating said clutch and thereby connecting the driving and driven shafts for setting the parts and performing the punching operation.

60. In a punching machine, the combination with a plurality of punch carrying members, means for controlling and determining the position of said members for the punching operation, motor actuated means for moving the parts to proper position and performing the punching operation, means for normally holding the motor actuated mechanism in inoperative relation, manually controlled means for releasing said motor actuating mechanism, and electro-magnetic means for preventing the operation of the motor actuated mechanism unless the parts are in proper position for the punching operation.

In testimony whereof I have affixed my signature.

CHARLES W. SPICER.