No. 698,347. Patented Apr. 22, 1902.

O. ZERKOWITZ.

JACQUARD CARD PUNCHING MACHINE.

(Application filed June 14, 1901.)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

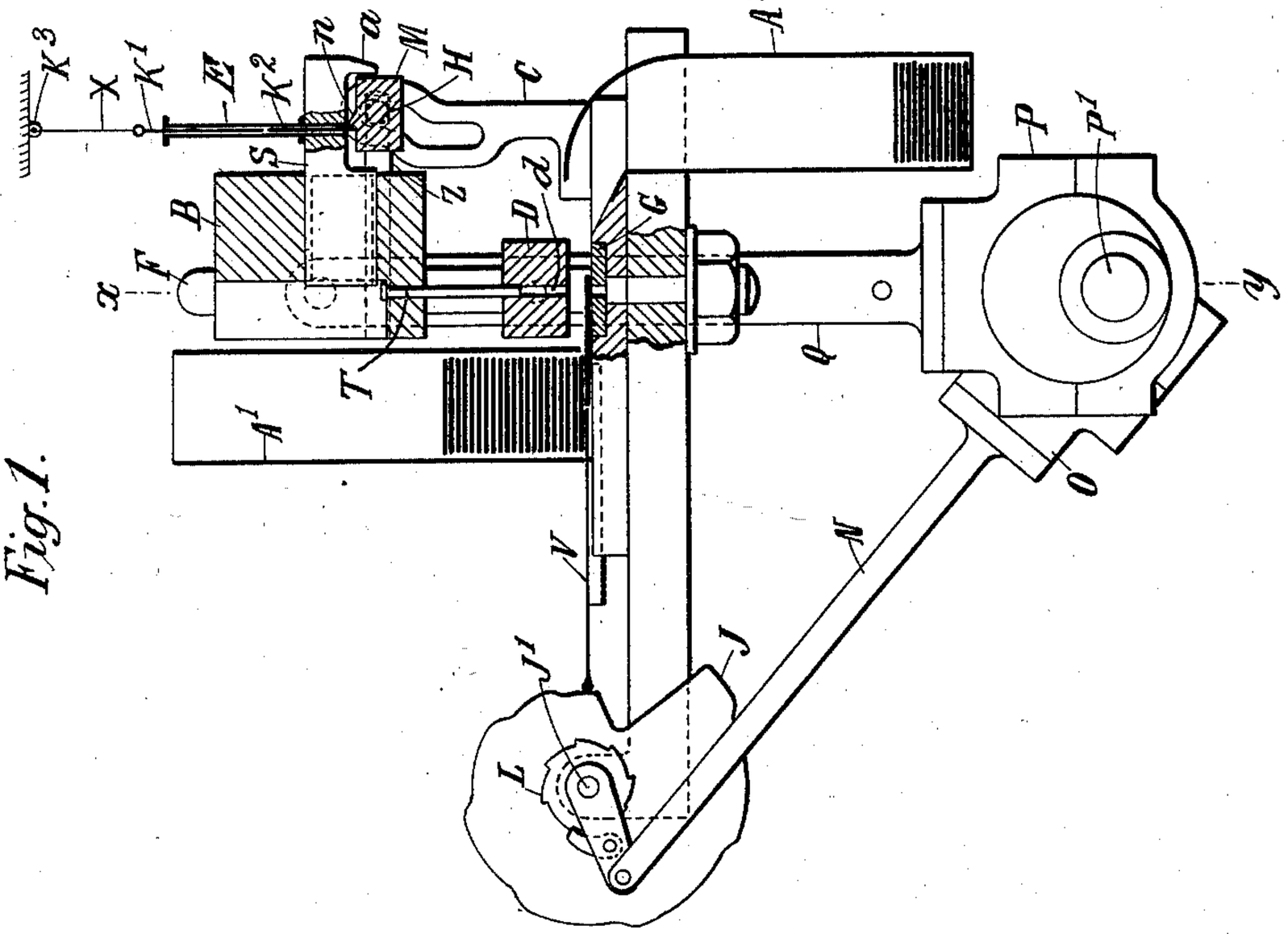
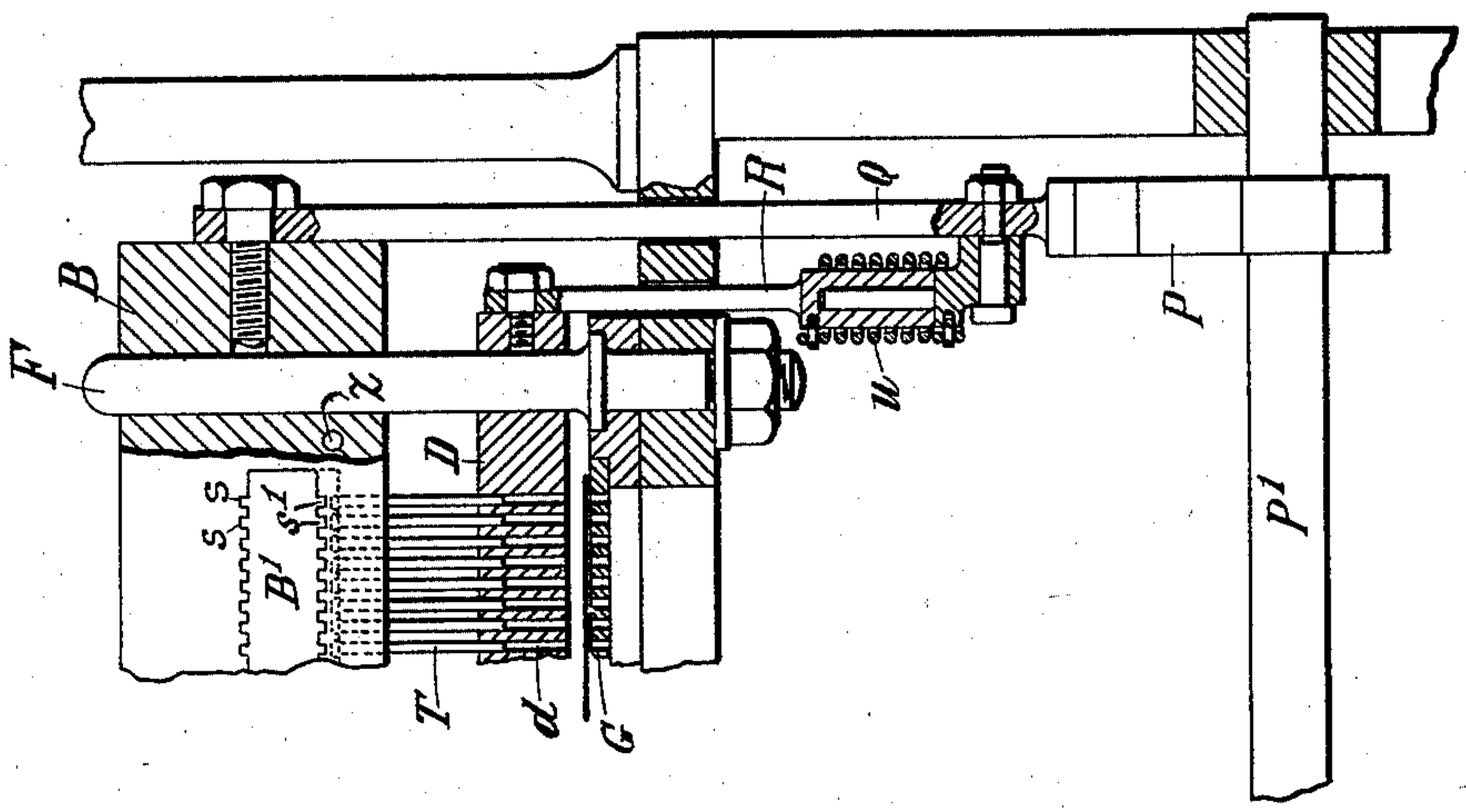


Fig. 2.



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(No Model.) 2 Sheets—Sheet 2.

Fig. 4.

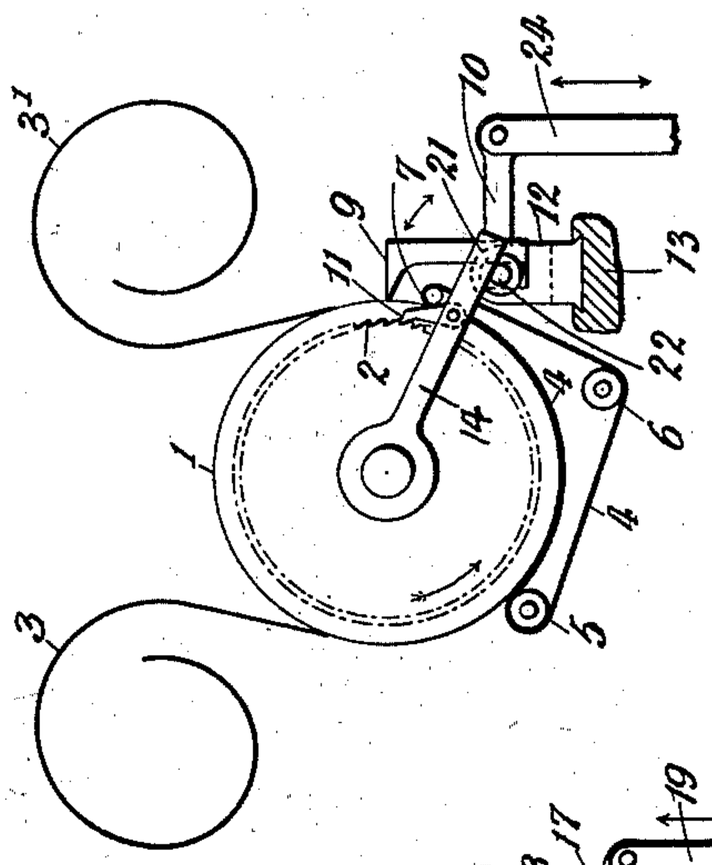
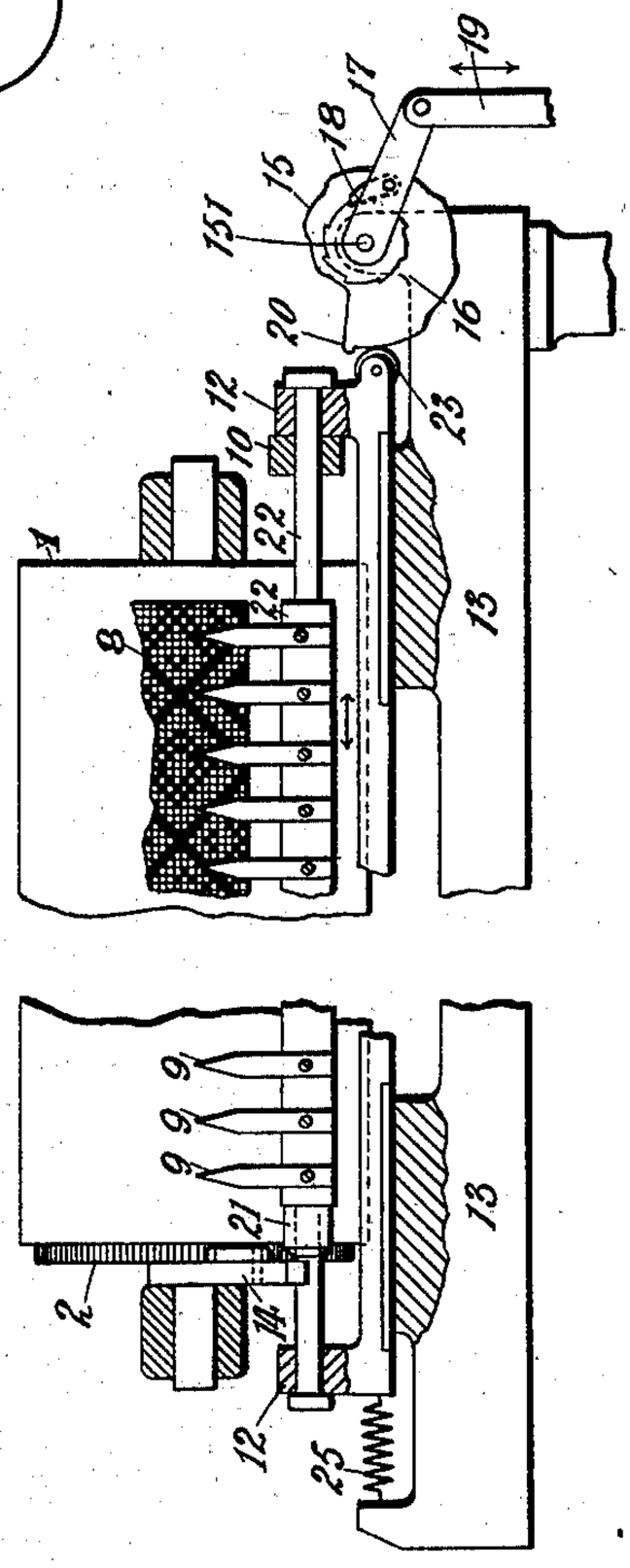


Fig. 3.



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UNITED STATES PATENT OFFICE.

OSKAR ZERKOWITZ, OF BRADFORD, ENGLAND.

JACQUARD-CARD-PUNCHING MACHINE.

SPECIFICATION forming part of Letters Patent No. 698,347, dated April 22, 1902.

Application filed June 14, 1901. Serial No. 64,572. (No model.)

To all whom it may concern:

Be it known that I, OSKAR ZERKOWITZ, a subject of the Emperor of Austria-Hungary, residing at 155 Little Horton Lane, Bradford, in the county of York, England, have invented new and useful Improvements in and Relating to Jacquard-Card-Punching Machines, of which the following is a specification.

In jacquard-card-punching machines operated electrically the whole card has hitherto been punched at a single stroke, and inasmuch as each hole requires its own electric circuit and connections these machines are complicated and expensive.

This invention has for its object to punch the cards in longitudinal rows, as against the ordinary treadle-machine, in which the card is punched in cross-rows.

The main principle on which the improved machine is constructed is well known and involves the employment of a metallized paper, upon which the pattern is set out, electrical terminals and solenoids being arranged in connection therewith to operate the respective punches or not, according to the determined design.

It will be understood that if the whole card is punched by one stroke, as is generally effected, the electric terminals upon the design must cover a whole weft-field. For example, if the card to be punched has eight longitudinal rows and sixty cross-rows such a card would necessitate the employment of four hundred and eighty electric terminals upon the design, one by the side of the other. According to the apparatus which is the subject of the present invention, however, only sixty terminals, for example, are required, inasmuch as only the longitudinal rows are punched at one operation. It is necessary that the terminals should be arranged at a distance apart from one another equal to the width of, for example, eight squares—that is, corresponding in number to the number of the longitudinal rows on the cards.

The improved machine consists of two main parts—namely, an electromagnetic apparatus for punching the cards and an apparatus by which the electric circuits are completed or broken in accordance with the design.

The invention is illustrated in the accompanying drawings, in which—

Figure 1 represents a partial vertical sectional side elevation of the punching apparatus provided according to the invention. Fig. 2 is a partial vertical sectional front elevation on the line $x\ y$, Fig. 1. Fig. 3 is a front elevation of the apparatus for completing and breaking the electric circuits, and Fig. 4 is an end elevation corresponding to Fig. 3.

As illustrated in the drawings, the sliding frame B is provided with longitudinal series of punches T—for example, sixty in number—corresponding with the number of holes to be punched in one longitudinal row of the card. This sliding frame B is mounted upon two guide-rods F, respectively secured upon each side of the frame of the machine, and is capable of being moved vertically thereupon by means of the eccentric P and connecting-rod Q. The eccentric P is mounted upon a counter-shaft P′, arranged beneath and parallel to the sliding frame B, being suitably carried in bearings in the side frames of the machine.

Above each of the punches T a bolt S is arranged, serving as a support for an electromagnet E, provided with two movable cores K′ K^2, one core, K′, being suspended by a thread X from a fixed bracket K^3, while the other is free. The sliding frame B is recessed at B′, and grooves $s\ s'$ are provided within which the bolts S may slide. Underneath the bolts S a bar M is arranged the length of the sliding frame B and is capable of movement in a horizontal direction upon two guide-rods Z, sliding within holes bored at each end of the sliding frame B. The bar M is provided at each end with a pin H, which engages within a slot provided in bracket C. The slots provided in the brackets C are crooked—that is to say, their direction changes. The direction at the top is vertical. It is then oblique and inclines toward the sliding frame B, being finally vertical. With these three parts of the slots of the brackets C correspond three periods in the downward movement of the sliding frame B. Previous to the downward movement of the sliding frame B the metallic design is connected with the terminals. If there is no color upon a part or square of the design, the electric circuit through it is completed and the corresponding solenoid

E within the same circuit is energized and both cores K′ K² are magnetized. The first period corresponding to the movement of the pins H in the first part of the slot of the brackets C commences. The sliding frame B moves downward, both cores being at rest, core K′ hanging by the thread X, core K² being no longer in front of the ridge or projection *n*, which is provided on the upper part of the bar M. The second period corresponding to the oblique direction of the pins H within the slots of the brackets C commences, the bar M being caused to advance toward the sliding frame B. Inasmuch, however, as the core K² does not pass downwardly, the bolt S remains at rest and is not moved over its punch T. The third period corresponding to the final movement of the pins H in the slots of the brackets C commences and no punching of the card results. Should, however, color be found upon a particular part or square of the design, the electric circuit would not pass through the solenoid and the core K² would remain upon the bar M in front of the ridge or projection *n*, so that in the second period of movement of the sliding frame B corresponding to the movement of the pins H in the center of their slots the bolt S would be advanced into a position immediately over its punch T, and in the final third period of movement of the sliding frame the punch would be operated to pierce a hole in the card. When the sliding frame B moves upward and the bar M moves outward, it engages with a projection *a* behind the bolt S, thus causing it to return to its original position.

Upon the guide-rods F a presser-foot D is mounted, so as to slide thereon, such presser-foot lying parallel to the sliding frame B and being provided with holes *d* coincident with those provided in the sliding frame for the reception of the punches T. This presser-foot D is connected at each side by means of a connecting-rod R with the connecting-rod Q, and a spiral spring *u* is interposed, so that a spring-pressure may be exercised by the presser-foot upon the card during the punching operation.

Upon one side of the sliding frame B a casing A′ is provided for the reception of the cards to be punched, and a receptacle A² is provided upon the opposite side, into which the cards may pass in the operation of the machine after being punched.

The feed of the machine is effected according to the number of longitudinal rows in the cards, so that in this case the cards are fed forward eight times by means of the eccentric-cam J, which is arranged upon spindle J′, mounted in the frame of the machine, and upon this spindle a ratchet-wheel L is secured, by means of which periodic motion is communicated by the connecting-rod N from an eccentric mounted upon the shaft P′, previously referred to. The eccentric-cam J has eight steps or graduations to feed forward the respective cards the corresponding number of times by means of a sliding pusher-plate V, which is constantly pressed toward the eccentric-cam by means of a spring, which is not shown in the drawings. The eccentric-cam is so shaped that in its periodic rotary movement the sliding pusher-plate retires momentarily from beneath the casing A′, whereby one card is allowed to drop in front of it, and immediately thereafter this card is pushed forward until the first longitudinal row of holes is reached, and this movement is repeated eight times until the sliding pusher-plate V is again caused by the eccentric-cam J to retire to permit of another card dropping in front of it. In the further movement of the pusher-plate the perforated card is forced forward and passes into the receptacle A². If instead of one card more than one is required to be punched at the same time, the pusher-plate V may be made of a corresponding thickness, so as thereby to permit of more than one card dropping in front of it, and in such a case the casing A′ is set at a correspondlng higher level.

The design 8, Fig. 3, drawn upon metallized paper is at the commencement of the operation rolled within the holder 3, arranged parallel to the cylinder 1, whence it is brought round the cylinder and pressed thereon by means of india-rubber bands 4, running over pulleys 5, 6, and 7. From the cylinder the metallized paper passes into the holder 3′, arranged parallel to the cylinder. Beneath the holder 3′ and also parallel to the cylinder 1 a terminal-holder 22 is slidably mounted, and the terminals 9 are mounted thereon, so as to be insulated from one another. The terminal-holder rests at each end in bearings 12 in a sliding frame, and at one end of the frame a roller 23 is mounted in such a position as to make contact with an eccentric-cam 15, which is secured upon a shaft 151, mounted in the machine-frame, upon which shaft is also secured a ratchet-wheel 16, to which motion is communicated by means of a pawl 18, secured to a lever 17, and a rod 19, the latter being connected with a crank or eccentric on the main driving-shaft. In order to prevent the design from being scratched by the terminals, the terminal-holder 22 is lifted from the design by means of the lever 10 and rod 24, which latter is connected with an eccentric on the main shaft and is operated each time the circuit is to be completed and drawn down again after the completion of the circuit is effected. The terminals 9 are arranged, as before stated, at a distance apart from one another equal to the total width of the eight squares or parts of the design—that is to say, corresponding to the number of the longitudinal rows on the cards.

At the left-hand side of the cylinder and secured to it is a ratchet-wheel 2, which is provided with very fine teeth and is operated so that the cylinder may be rotated through a very small angle corresponding to one weft

square after a whole row of holes has been previously punched by the completion of the electric circuit eight times. This is effected in such a manner that the eccentric-cam 15 causes the terminal-holder 22 to move longitudinally eight times from one square to another in the same line. Previous to this, however, the terminal-holder returns to its original position by the action of the compression-spring 25, which presses against the frame carrying the bearings 12, within which the terminal-holder 22 is mounted, the nose 20 of the eccentric-cam 15 thereby forcing the terminal-holder so that the ring 21 at the opposite end strikes against the lever 14, mounted upon the spindle upon which the ratchet-wheel 2 and the cylinder 1 are secured, and by means of the pawl 11, mounted upon the lever 14, the cylinder 1 is rotated to an extent corresponding to the pitch of one tooth, and thus the next weft-row of the design is brought before the terminals.

What I claim as my invention, and desire to secure by Letters Patent, is—

1. In a card-punching machine, the combination, with a vertically-slidable frame, and a series of punches carried by the said frame; of a vertically and horizontally slidable bar, a series of slidable bolts arranged side by side in the said frame and operating to couple the said punches to it when moved over the said punches, and a series of electrically-controlled cores for connecting the said bolts with the said bar, substantially as set forth.

2. In a card-punching machine, the combination, with a vertically-slidable frame, and a series of punches carried by the said frame; of a bar arranged to one side of the said frame, guides constraining the said bar to move horizontally and vertically, a series of slidable bolts arranged side by side in the said frame and operating to couple the said punches to it when moved over the said punches, a series of cores arranged in holes in the said bolts and normally coupling them to the said bar, and electric controlling devices for preventing the said cores from moving vertically with the said bar when required, substantially as set forth.

3. In a card-punching machine, in combination, a punching mechanism consisting of a sliding frame, punches and punch-operating bolts within said frame, a bar having a movement transverse to said sliding frame, solenoids and cores to respectively connect said bolts and bar, means for reciprocating said sliding frame, a receptacle for the cards to be punched, a pusher-plate for carrying forward the lowermost card therefrom, a stepped cam operating said pusher-plate, and means for rotating said stepped cam for progressively moving the card forward to punch the respective rows of holes; and coöperating electric selecting apparatus for energizing said cores, substantially as described.

4. In a card-punching machine, in combination, a punching mechanism consisting of a sliding frame, punches and punch-operating bolts within said frame, a bar having a movement transverse to said sliding frame, solenoids and two cores for each solenoid, one of said cores serving to respectively connect said bolts and bar; and a coöperating electric selecting apparatus for energizing said cores, substantially as described.

5. In a card-punching machine, in combination, a punching mechanism consisting of a sliding frame, punches and punch-operating bolts within said frame, a bar having a movement transverse to said sliding frame, a ridge provided on said bar, solenoids on said bars and cores within said solenoids, said cores lying in front of said ridge when the respective solenoids are deënergized for connecting the bolts to the bar; and a coöperating electric selecting apparatus for energizing said cores, substantially as described.

6. In a card-punching machine, in combination, a punching mechanism, the punches of which are respectively controlled by solenoids and cores, and a coöperating electric selecting apparatus for energizing said cores, consisting of a support for the design, which design is marked out into conducting and non-conducting surfaces, a series of terminals normally lying in contact with said design, said terminals being spaced apart a distance equal to the number of rows of holes to be punched, means for effecting relative progressive movements between said terminals and design corresponding to the number of rows of holes to be punched, and electric circuits within which said terminals and cores are respectively connected, said circuits being completed by the said terminals when lying on the conductive parts of said design, substantially as described.

7. In a card-punching machine, in combination, a punching mechanism, the punches of which are respectively controlled by solenoids and cores, and a coöperating electric selecting apparatus for energizing said cores consisting of a roller for the said design which is marked out into conducting and non-conducting surfaces, a series of terminals normally lying in contact with said design, said terminals being spaced apart a distance equal to the number of rows of holes to be punched, means for effecting relative progressive movements between the terminals and the roller carrying the design, said movements corresponding to the number of rows of holes to be punched, and electric circuits within which said terminals and cores are respectively connected, said circuits being completed by the said terminals when lying on the conductive parts of said design, substantially as described.

8. In a card-punching machine, in combination, a punching mechanism, the punches of which are respectively controlled by solenoids and cores, and a coöperating electric selecting apparatus for energizing said cores consisting of a roller for the said design, which

is marked out into conducting and non-conducting surfaces, a series of terminals normally lying in contact with said design, said terminals being spaced apart a distance equal to the number of rows of holes to be punched, means for effecting relative progressive movements between the terminals and the roller carrying the design, said movements corresponding to the number of rows of holes to be punched, and electric circuits within which said terminals and cores are respectively connected, said circuits being completed by the said terminals when lying on the conductive parts of said design, and means for rotating said roller after said progressive movements, substantially as described.

9. In a card-punching machine, in combination, a punching mechanism, the punches of which are respectively controlled by solenoids and cores, and a coöperating electric selecting apparatus for energizing said cores consisting of a roller for the said design which is marked out into conducting and non-conducting surfaces, a series of terminals normally lying in contact with said design, said terminals being spaced apart a distance equal to the number of rows of holes to be punched, means for effecting relative progressive movements between the terminals and the roller carrying the design, said movements corresponding to the number of rows of holes to be punched, and electric circuits within which said terminals and cores are respectively connected, said circuits being completed by the said terminals when lying on the conductive parts of said design, and means for lifting the terminals off the design before each of said progressive movements, substantially as hereinbefore described.

10. In a card-punching machine, in combination, a punching mechanism, the punches of which are respectively controlled by solenoids and cores, and a coöperating electric selecting apparatus for energizing said cores consisting of a roller for said design which is marked out into conducting and non-conducting surfaces, a series of terminals normally lying in contact with said design, said terminals being spaced apart a distance equal to the number of rows of holes to be punched, means for giving to said terminals progressive movements corresponding to the number of rows of holes to be punched, and electric circuits within which said terminals and cores are respectively connected, said circuits being completed by said terminals when lying on the conducting parts of said design, substantially as described.

11. In a card-punching machine, in combination, a punching mechanism, the punches of which are respectively controlled by solenoids and cores, and a coöperating electric selecting apparatus for energizing said cores consisting of a roller for said design which is marked out into conducting and non-conducting surfaces, a series of terminals normally lying in contact with said design, said terminals being spaced apart a distance equal to the number of rows of holes to be punched, said terminals being carried within a sliding frame, a stepped cam for giving to said sliding frame progressive movements corresponding to the number of rows of holes to be punched, and electric circuits within which said terminals and cores are respectively connected, said circuits being completed by said terminals when lying on the conducting parts of said design, substantially as described.

12. In a card-punching machine, in combination, a punching mechanism, the punches of which are respectively controlled by solenoids and cores, and a coöperating electric selecting apparatus for energizing said cores consisting of a roller for said design which is marked out into conducting and non-conducting surfaces, a series of terminals normally lying in contact with said design, said terminals being spaced apart a distance equal to the number of rows of holes to be punched, said terminals being carried upon a rod mounted within a sliding frame, a stepped cam for giving to said sliding frame progressive movements corresponding to the number of rows of holes to be punched, and electric circuits within which said terminals and cores are respectively connected, said circuits being completed by said terminals when lying on the conducting parts of said design, and means for partially rotating said rod carrying said terminals to lift said terminals from the design before each progressive movement of the sliding frame, substantially as described.

13. In a card-punching machine, in combination, a punching mechanism, the punches of which are respectively controlled by solenoids and cores, and a coöperating electric selecting apparatus for energizing said cores consisting of a roller for said design which is marked out into conducting and non-conducting surfaces, a series of terminals normally lying in contact with said design, said terminals being spaced apart a distance equal to the number of rows of holes to be punched, said terminals being carried upon a rod mounted within a sliding frame, a stepped cam for giving to said sliding frame progressive movements corresponding to the number of rows of holes to be punched, and electric circuits within which said terminals and cores are respectively connected, said circuits being completed by said terminals when lying on the conducting parts of said design, and means for partially rotating said rod carrying said terminals to lift said terminals from the design before each progressive movement of the sliding frame, and a lever-and-pawl device for rotating said roller after said progressive movements, said device being operated by means of a boss on the rod carrying said terminals, substantially as described.

14. In a card-punching machine, in combination, a punching mechanism, the punches

of which are respectively controlled by solenoids and cores, and a coöperating electric selecting apparatus for energizing said cores consisting of a roller for said design which is marked out into conducting and non-conducting surfaces, a series of terminals normally lying in contact with said design, said terminals being spaced apart a distance equal to the number of rows of holes to be punched, said terminals being carried upon a rod mounted within a sliding frame, a stepped cam for giving to said sliding frame progressive movements corresponding to the number of rows of holes to be punched, and electric circuits within which said terminals and cores are respectively connected, said circuits being completed by said terminals when lying on the conducting parts of said design, and means for partially rotating said rod carrying said terminals to lift said terminals from the design before each progressive movement of the sliding frame, and a lever-and-pawl device for rotating said roller after said progressive movements, said device being operated by means of a boss on the rod carrying said terminals, and a spring to return said sliding frame to its first position, substantially as described.

15. In a card-punching machine, in combination, a punching mechanism consisting of a sliding frame, punches and punch-operating bolts within said frame, a bar carried by said frame, means for giving to said bar a transverse movement on the movement of said sliding frame, solenoids and cores to respectively connect said bolts and bar; and a coöperating electric selecting apparatus for energizing said cores consisting of a support for the design, which design is marked out into conducting and non-conducting surfaces, a series of terminals normally lying in contact with said design, said terminals being spaced apart a distance equal to the number of rows of holes to be punched, means for effecting relative progressive movements between said terminals and design corresponding to the number of rows of holes to be punched, and electric circuits within which said terminals and cores are respectively connected, said circuits being completed by the said terminals when lying on the conductive parts of said design, substantially as described.

16. In a card-punching machine, in combination, punching mechanism consisting of a sliding frame, punches and punch-operating bolts in said frame, a bar having a movement transverse to said sliding frame, solenoids and cores to respectively connect said bolts and bar, a main shaft, means connected to said main shaft for reciprocating said sliding frame; and a coöperating electric selecting apparatus for energizing said cores consisting of a support for the design, said design being marked out in non-conducting and conducting surfaces according to the pattern of the card, terminals in contact with said design, a stepped cam for giving to said terminals progressive movements of a number corresponding to the rows of holes to be punched in the card, and means connected with said main shaft for rotating said cam, substantially as described.

17. In a card-punching machine, in combination, punching mechanism consisting of a sliding frame, punches and punch-operating bolts in said frame, a bar having a movement transverse to said sliding frame, solenoids and cores to respectively connect said bolts and bar, a main shaft, means connected to said main shaft for reciprocating said sliding frame and for progressively feeding the cards under the punches; and a coöperating electric selecting apparatus for energizing said cores consisting of a support for the design, said design being marked out in non-conducting and conducting surfaces according to the pattern of the card, terminals in contact with said design, a stepped cam for giving to said terminals progressive movements of a number corresponding to the rows of holes to be punched in the card, and means connected with said main shaft for rotating said cam, substantially as described.

In testimony whereof I have signed my name to this specification in the presence of two subscribing witnesses.

OSKAR ZERKOWITZ.

Witnesses:
JOHN ATKINSON,
FREDK. HAMMOND.