No. 608,473. Patented Aug. 2, 1898.

R. G. McCRUM.

APPARATUS FOR PREPARING CARDS FOR USE IN JACQUARD MACHINES.

(Application filed June 2, 1897)

(No Model.) 2 Sheets—Sheet 1.

Fig. 1.

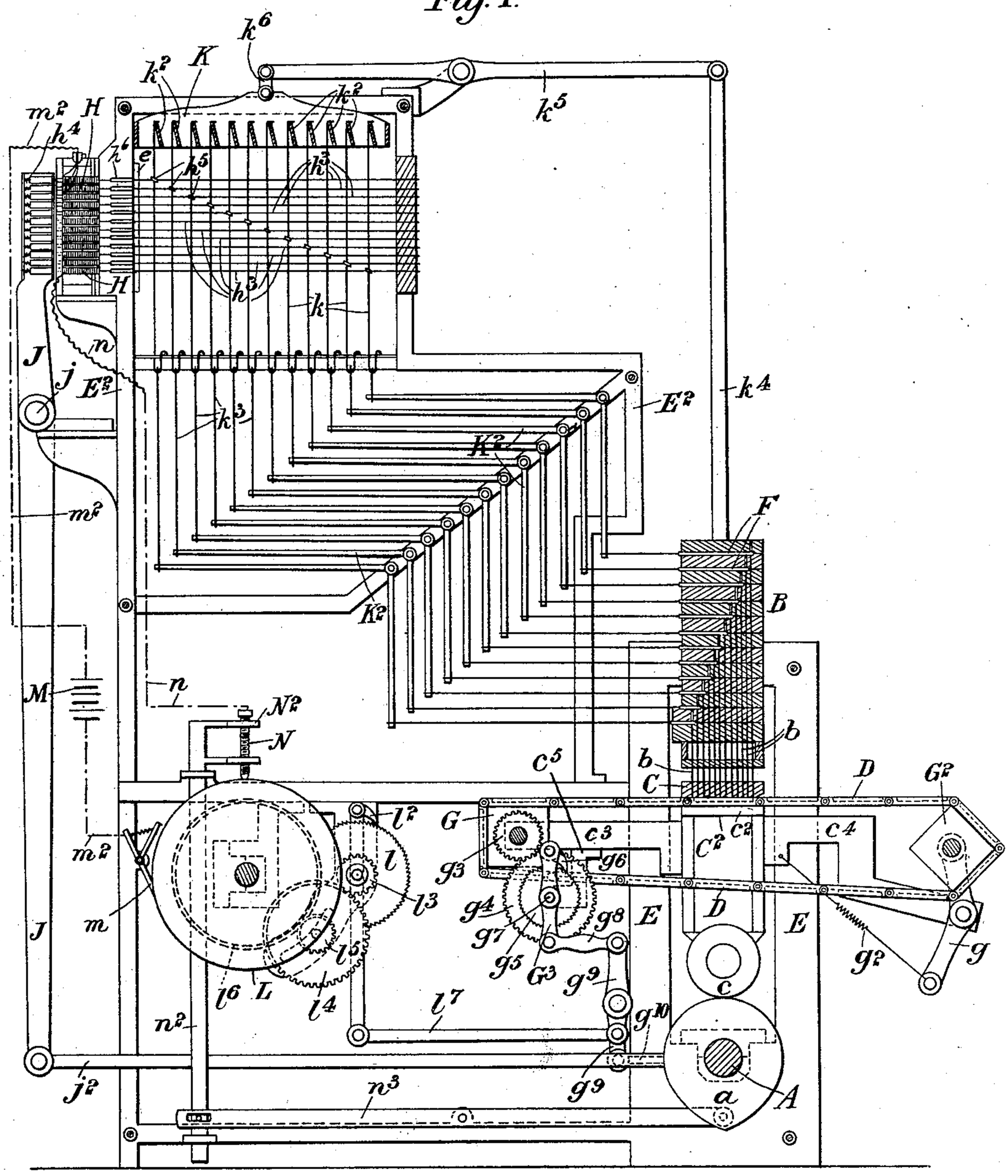

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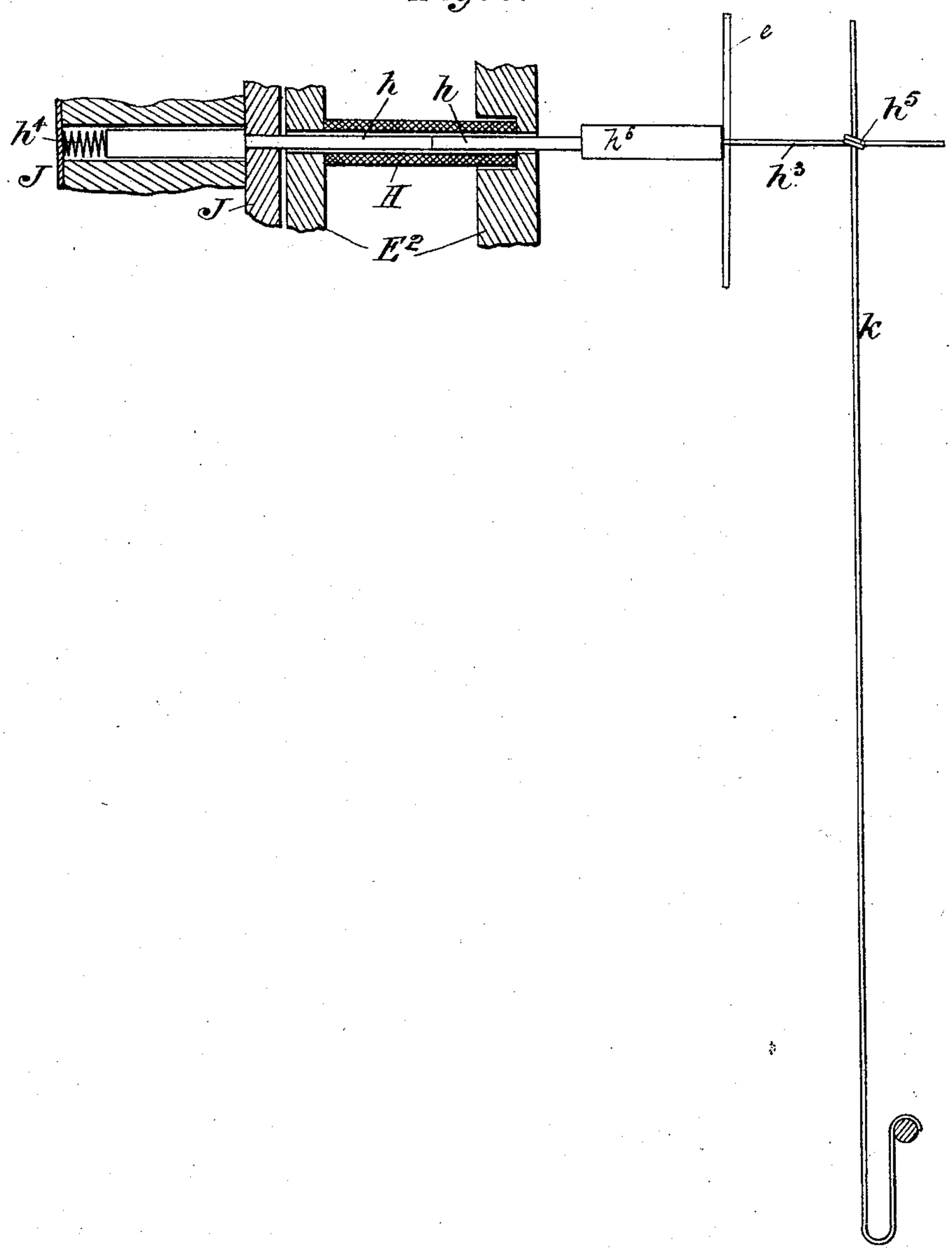
Fig. 2.



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UNITED STATES PATENT OFFICE.

ROBERT G. McCRUM, OF ARMAGH, IRELAND.

APPARATUS FOR PREPARING CARDS FOR USE IN JACQUARD-MACHINES.

SPECIFICATION forming part of Letters Patent No. 608,473, dated August 2, 1898.

Application filed June 2, 1897. Serial No. 639,161. (No model.)

To all whom it may concern:

Be it known that I, ROBERT GARMANY McCRUM, manufacturer, a subject of the Queen of Great Britain and Ireland, residing at Milford, Armagh, in the county of Armagh, Ireland, have invented certain Improvements in Apparatus for Preparing Cards for Use in Jacquard-Machines, of which the following is a specification.

My invention relates to apparatus for preparing cards of paper, cardboard, metal, or other suitable substance, such as are used in jacquard-machines for weaving; and the object of my invention is to provide an arrangement whereby electricity can be efficiently and practically used as the motive power for selecting the punches in the proper order for making the required perforations in the said cards. I have heretofore endeavored to attain this result by employing movable electromagnets the cores of which were fixed in the said electromagnets and were energized to attract armatures adapted to control the operation of the punches; but owing to the limited space which is available in card-punching machines I found it impossible to use electromagnets of a size sufficient to exert the necessary power, as they would have occupied a prohibitive amount of space. I have found, however, that if in place of such electromagnets fixed solenoids be employed which act upon movable cores passing through them and connected to the punch-controlling devices ample electrical force can be obtained in the very limited space which is available. According to my invention, therefore, I construct the selecting devices of a series of stationary solenoids the core of each of which is formed in two parts in operative connection, one with a swinging frame and the other with one of the bolts which lock and release the punches, the arrangement being such that the perforation or non-perforation of the card at any particular part or parts will depend upon the particular solenoid or solenoids energized, this selective energization being primarily controlled by a movable electrically-conductive pattern-surface.

In the accompanying drawings, Figure 1 is a sectional elevation of a machine embodying my invention; and Fig. 2 represents, on a larger scale, one of the solenoids and its adjuncts and a connecting needle and hook.

A, Fig. 1, is the main driving-shaft, on which are fixed the cam *a* and other cams or eccentrics hereinafter referred to, but not shown in the drawings, for working the various parts of the machine.

B is a fixed punch-block holding and guiding the punches *b* for perforating the cards.

C is a perforated plate through which the lower ends of the punches *b* pass and which is carried at the upper part of a frame C^2, provided at its lower part with an antifriction-roller *c*, which bears upon the cam *a*. The frame C^2 is provided with either two ribs or projections c^2 (only one of which is shown in Fig. 1) or a second perforated plate or frame for supporting the upper portion of an endless chain D, each link of which is adapted to receive one of the cards to be punched. The frame C^2 is mounted so as to be capable of reciprocating vertically in a fixed frame E, which at its upper part supports the before-mentioned punch-block B.

To the rising-and-falling frame C^2, I secure brackets c^3 c^4, the former carrying a square roller G and the latter carrying a pivoted frame *g*, in which is mounted a second square roller G^2. The before-mentioned endless chain D passes over the two rollers G G^2 and is maintained in proper tension by a spring g^2, which by acting on the pivoted frame *g* always tends to move the roller G^2 away from the roller G.

On the shaft of the roller G is secured a spur-pinion g^3, which gears with a wheel g^4, rotated by a ratchet-wheel g^5 and pawl g^6, the latter of which is pivoted to a lever G^3, capable of rocking on the shaft g^7, on which the wheels g^4 and g^5 are carried. The shaft g^7 is carried by an arm c^5, secured to the above-mentioned bracket c^3, so that this shaft, together with the gearing g^3 g^4 g^5 g^6, rollers G G^2, and chain D, will as one body ascend and descend in company with the rising-and-falling frame C^2. The lower end of the lever G^3 is connected by a link g^8 to a lever g^9, to which at suitable times a rocking motion is imparted through a rod g^{10} and a cam (not shown in the drawings) secured on the shaft A. The lever g^9 is pivoted to the fixed frame

E, and the link g^8 allows of the frame C^3 and the parts connected therewith being raised and lowered without the chain and consequently the cards contained in the chain being moved in relation to the perforated plate C.

Within the punch-block B, I provide a series of bolts F, one for each of the punches *b*. These bolts are adapted to move longitudinally, so that they may either extend over the upper ends of the punches to prevent the ascent of the said punches, and thereby cause them to perforate the card when it is raised, or be withdrawn from above the punches, so that these latter may be lifted by the card, and thereby be prevented from perforating the card.

H are the before-mentioned solenoids, which are suitably secured to and insulated from the fixed framing E^2, and each of which, as shown more particularly in Fig. 2, is provided with a core formed in two parts $h\,h^2$, of which the part *h* is secured to a brass or other non-magnetic or suitably-insulated needle h^3, and the part h^2 is mounted in the upper end of a swinging frame J, pivoted at *j* to the framing E^2. The lower end of the swinging frame J is pivoted to a rod j^2, through which it receives a swinging motion derived from a suitable cam (not shown in the drawings) secured on the shaft A.

To allow for variations in construction and to ease the action, the core parts h^2 are mounted yieldingly in the swinging frame J, as by means of springs h^4, which tend to maintain said core parts in their most forward positions and in contact with the core parts *h*, and also to return them to their normal positions after they may have been temporarily moved back by the inclined griff-bars k^2 on the descent of the griff K.

The core *h* has an enlarged end h^6, which abuts against a plate *c* and serves to limit the length of stroke of the needle h^3.

The eyes h^5 of the above-mentioned needles h^3 engage with hooks *k*, so as to move the upper ends of these latter into or out of the path of the griff-bars k^2, so that when the griff K is raised it will lift only those hooks the solenoids appertaining to which have not been energized. The hooks *k* at their lower ends are connected by links k^3 to bell-crank levers K^2, pivoted to the frame E^2, and each of which levers is connected to one of the before-described bolts F, this arrangement being such that only those punches will be caused to perforate the card the hooks *k* appertaining to which are disengaged from and not raised by the griff K.

The griff K is raised and lowered by means of a suitable cam (not shown in the drawings) secured on the shaft A, the motion being transmitted from this cam to the griff by means of the rod k^1, lever k^5, and link k^6.

L is a cylinder which, through suitable ratchet-and-pawl gearing $l\,l^2$ and spur-gearing $l^3\,l^4\,l^5\,l^6$, a link l^7, and the before-described lever g^9, is partly rotated at each rotation of the shaft A. This cylinder is provided with a metallic conducting-surface which, through a brush *m*, conductors m^2, and battery or source of electricity M, is in constant electrical contact with one end of each of the solenoid-coils H, the opposite end of which is in constant electrical contact through a conductor *n* with a "reader" N, of which latter there are as many as there are solenoids. The readers N, formed, preferably, of copper, are suitably insulated from each other and are all mounted in a frame N^2, which, through a rod n^2, lever n^3, and a cam, (not shown in the drawings,) is raised when the cylinder L is rotated and lowered when the said cylinder is at rest for the purpose of moving the readers N out of contact with the surface of the cylinder L during the rotation of the latter, and thereby preventing the abrasion or damage of the insulating or non-conducting varnish with which the said cylinder is coated. This coating is designed according to the special arrangement of card perforations to be obtained or the pattern to be produced.

When the readers N are let down onto the pattern-surface of the cylinder L, an electric current will pass through those which are for the time being in connection with the unvarnished parts of the said surface, and therefore will excite the corresponding solenoids H, producing magnetism in the two parts $h\,h^2$ of the cores thereof, which parts will then strongly attract each other, so that when the frame J (which at that time should be close to the solenoids H) is next drawn back these magnetic cores will be drawn through the solenoids as far as necessary and through the needles h^3, appertaining thereto, disengage the corresponding hooks *k* from the griff-bars k^2, while the unmagnetized cores will not move their needles h^3, and their hooks *k* will consequently remain on the griff-bars k^2. The griff will then commence to rise, bringing with it those of the hooks *k* which have not been drawn off the griff-bars k^2 by their solenoids H. Each lifted hook *k* will withdraw the bolt F of and consequently release the corresponding punch *b*, so that the said punch will not perforate the card, while all of the hooks *k* not lifted will leave the corresponding punches locked, and when the chain D is raised these locked punches will perforate the card. When the rocking frame J is again returned to its normal position, the hooks *k* will be carried into the path of the griff-bars k^2, so that upon the next descent of the griff the said hooks will reëngage with the griff-bars, while the weight of the bell-crank levers K^2 will serve to move the bolts F over the then-lowered punches, and so everything will be ready for repeated action when a fresh set of electric contacts is made.

I claim as my invention—

In a card-punching machine, the combination with the punches, a griff, means for reciprocating the griff vertically, and a series

of hooks in operative connection with the griff and punches, of a series of stationary solenoids, a core formed in two parts movable in each of the solenoids, a needle connecting one of the core parts of each solenoid with one of the hooks, a pivoted frame carrying the second part of the same core, means for swinging the frame in relation to the solenoids, a source of electricity, a movable electrically-conductive pattern-surface and conductors connecting the solenoids, source of electricity and pattern-surface, substantially as set forth.

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

ROBERT G. McCRUM.

Witnesses:
MALCOLM J. BUIS,
ROBERT B. McCLELLAND.