

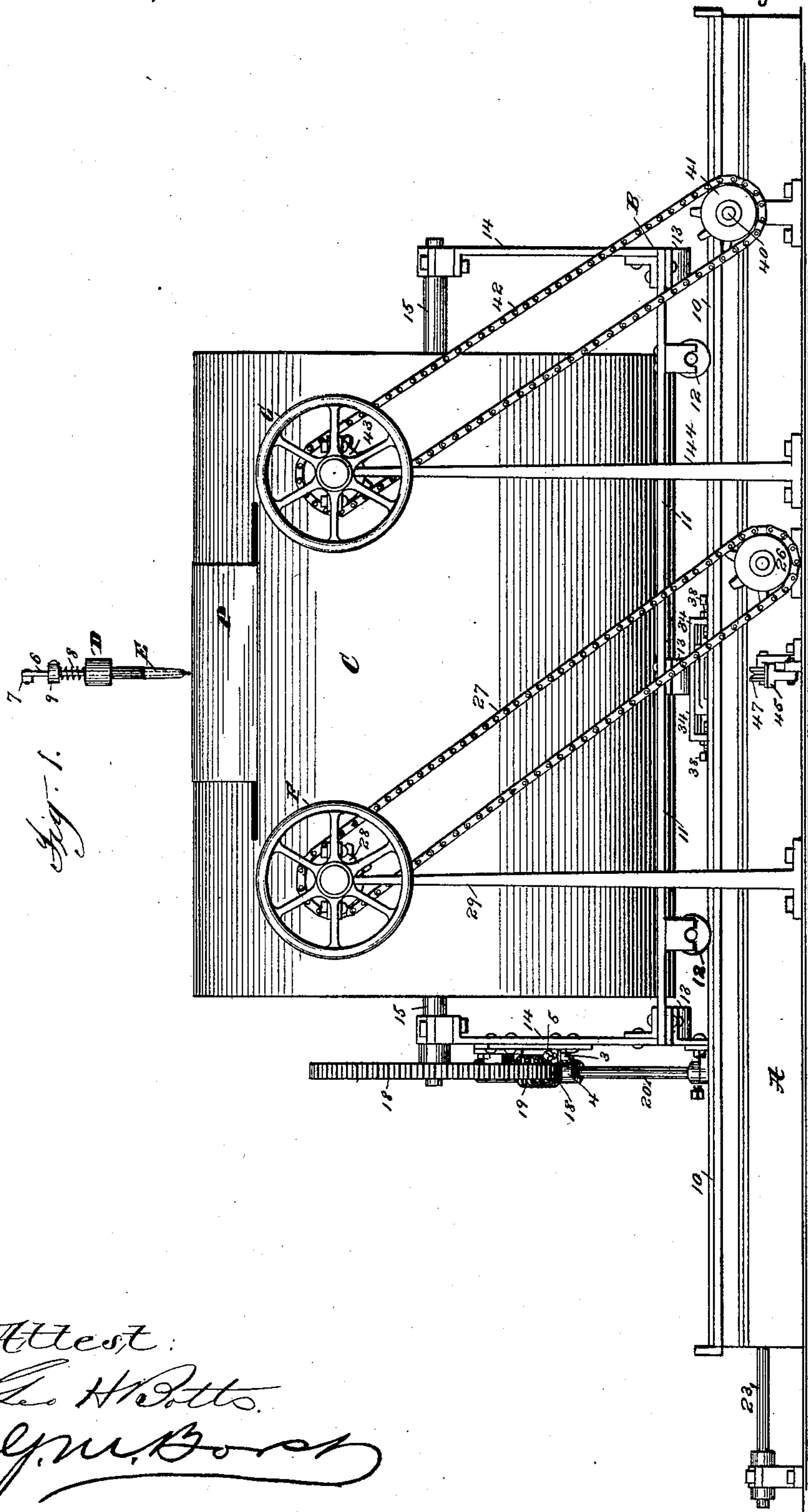
(No Model.)

18 Sheets—Sheet 1.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.



Attest:
Geo. H. Potts.
J. M. B. [Signature]

Inventors
Joseph Irish
and
Samuel J. Briden
By
Philip Phipps
Attorney

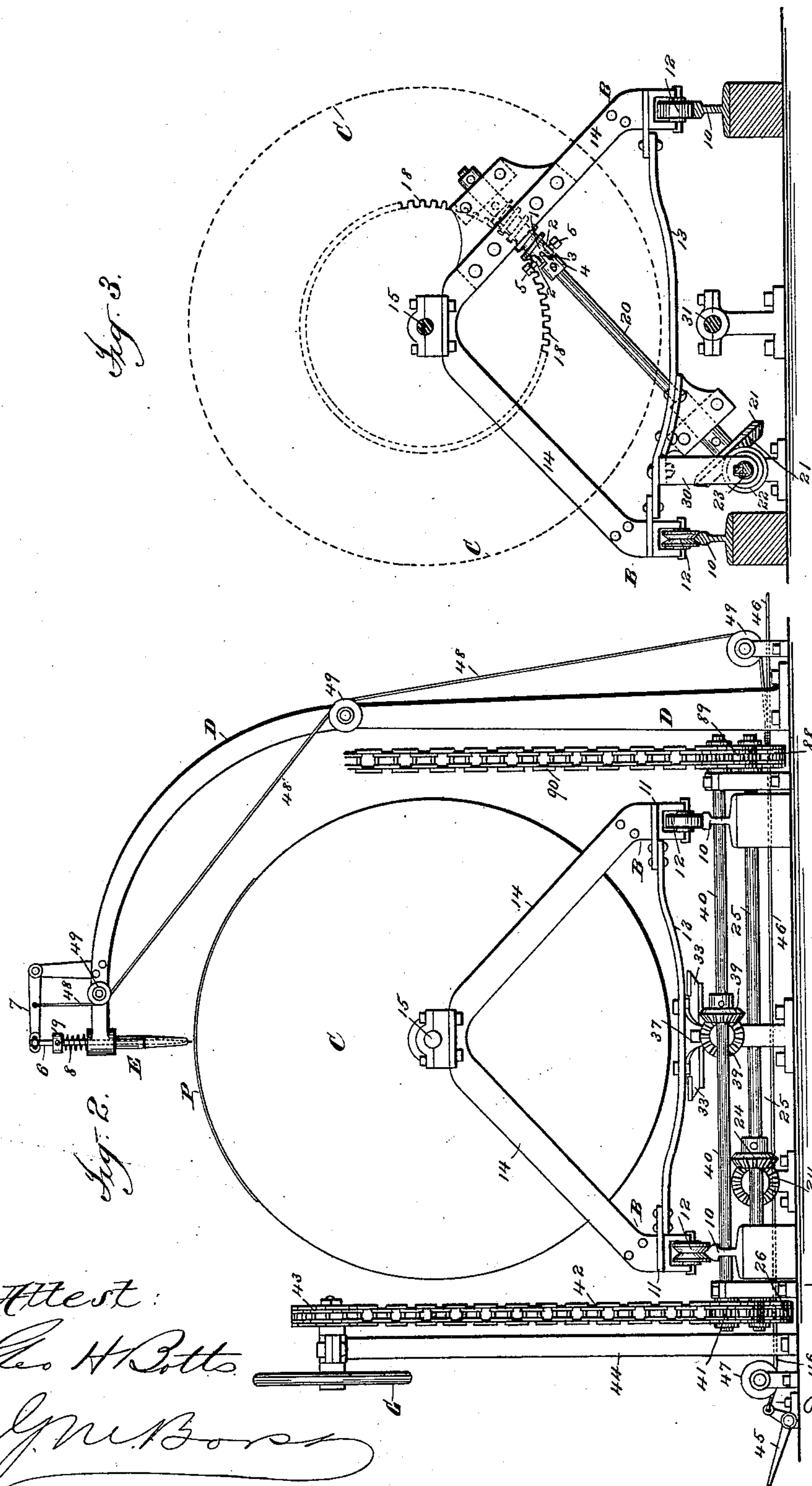
(No Model.)

18 Sheets—Sheet 2.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.



Attest:
Geo. H. Botta
J. M. Borer

Inventors
Joseph Irish
and
Samuel J. Briden
By
Philip Phelps Attorney
Attys

(No Model.)

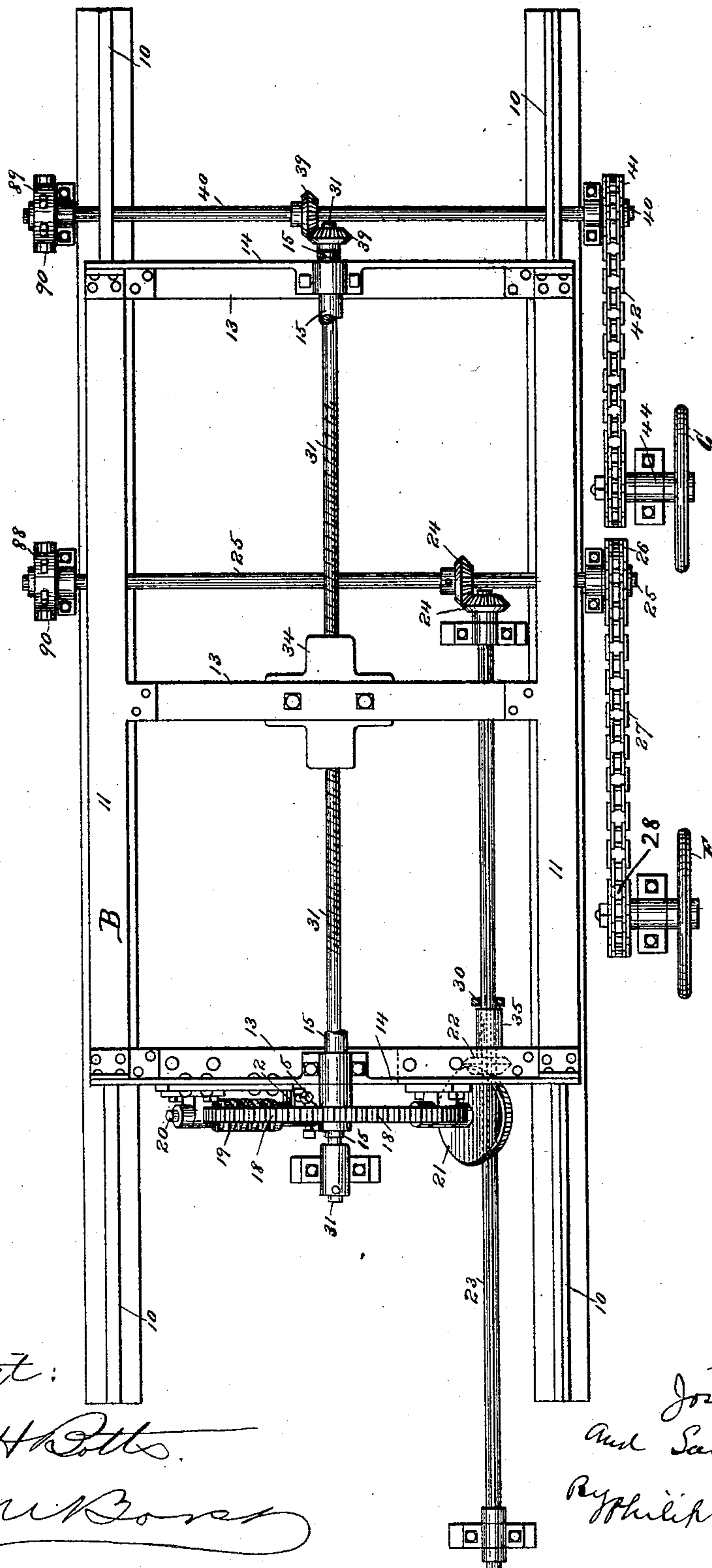
18 Sheets—Sheet 3.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.

Fig. 4.



Attest:

Geo H. Bots.
John B. Bots.

Inventors
Joseph Irish
and Saml J. Briden
By Philip Phelps Horn
Attys

(No Model.)

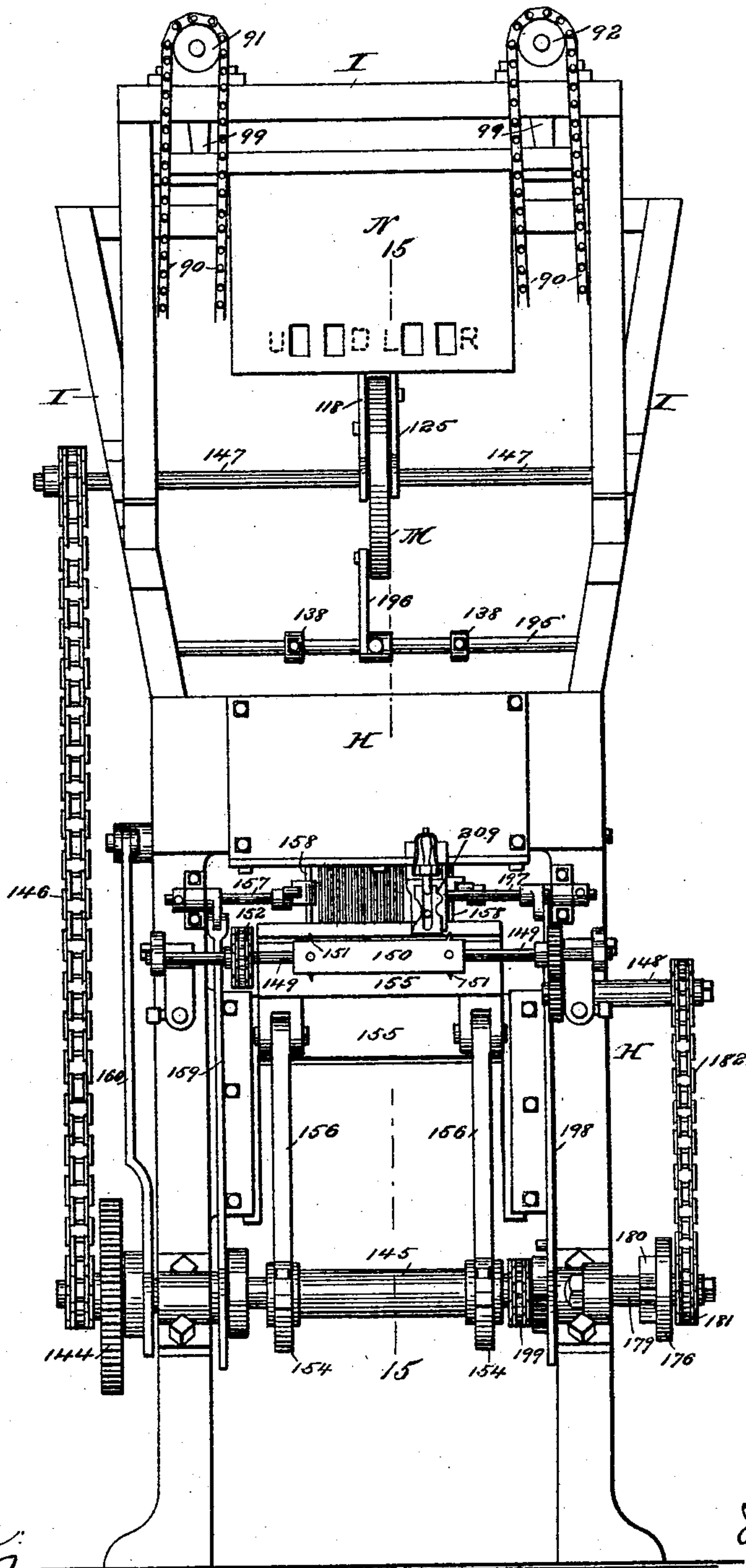
18 Sheets—Sheet 4.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.

Fig. 5.



Attest:
Geo H. Botts
Geo. B. Ross

Inventors
Joseph Irish & Co.
Samuel J. Briden
By Philip Phelps Hovey
Attys

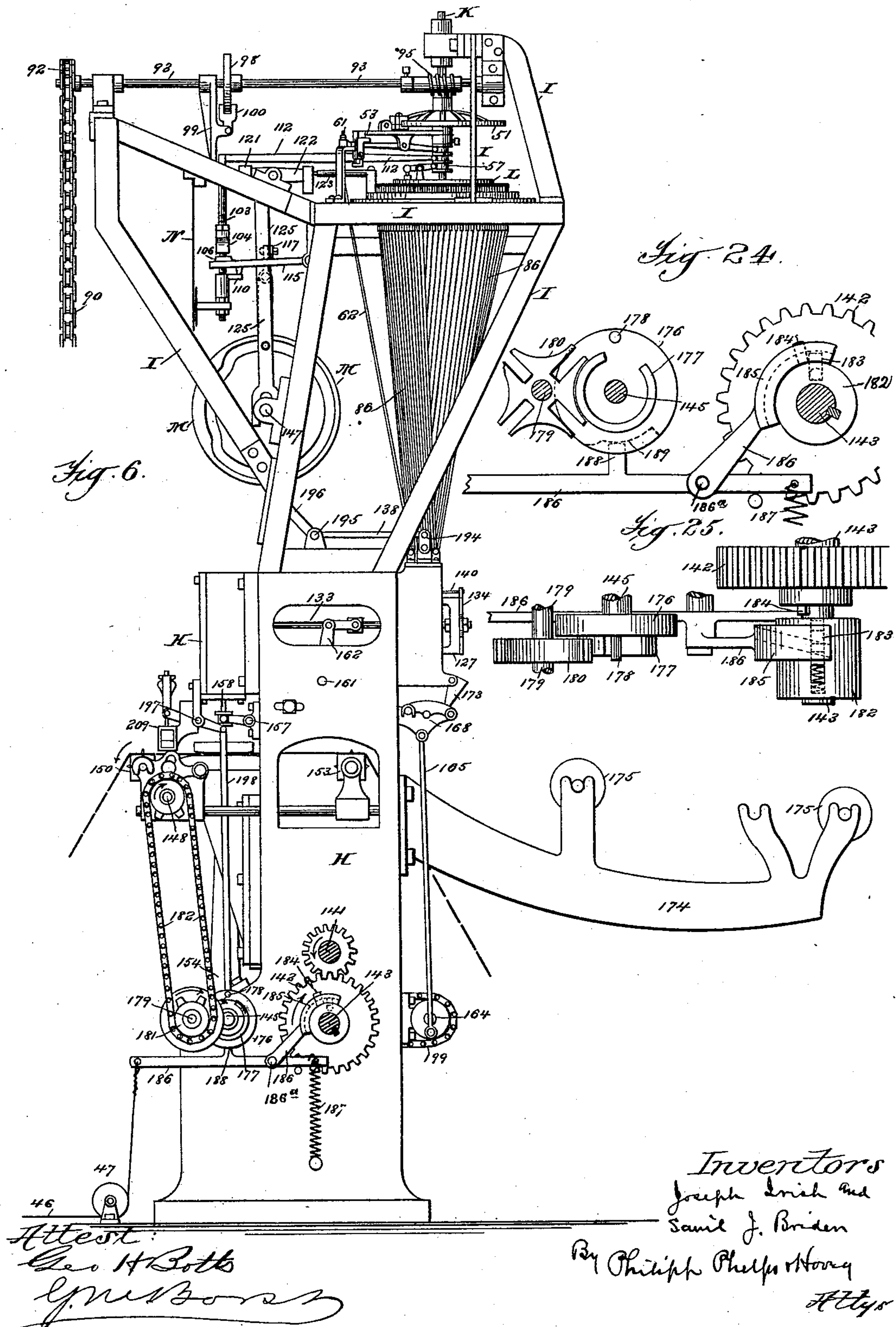
(No Model.)

18 Sheets—Sheet 5.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.



Attest:
Geo. H. Bots
Lynne Bots

Inventors
Joseph Irish and
Samuel J. Briden
By Philip Phelps Henry
Atty

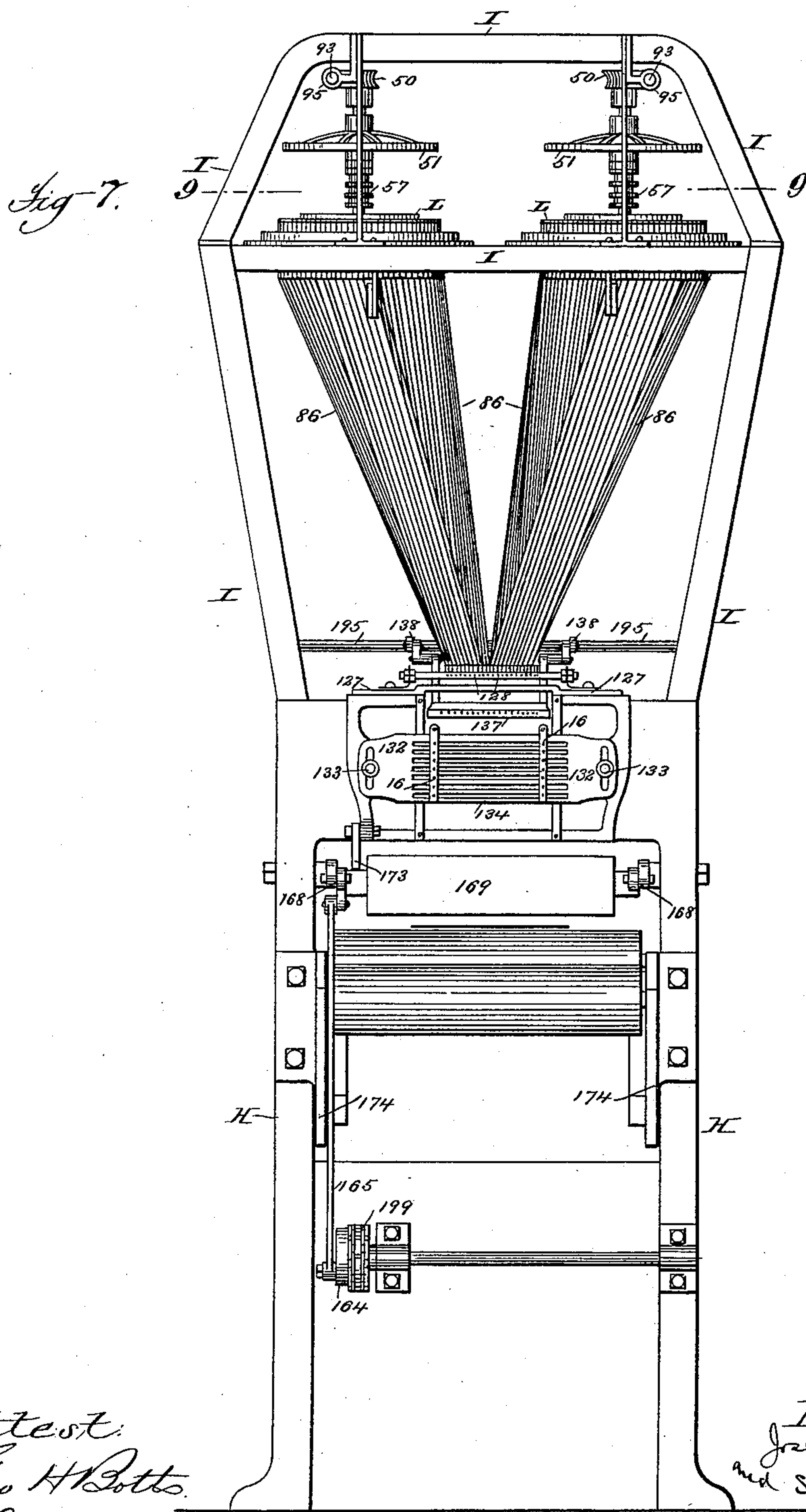
(No Model.)

18 Sheets—Sheet 6.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.



Attest:
Geo H. Bots.

Geo H. Bots.

Inventors:
Joseph Irish
and Saml J. Briden

By Philip Phelps Hoovey
Attys

18 Sheets—Sheet. 7.

Patented May 26, 1891.



Attest
C. H. Botto.
Jm Boro

Inventors
Joseph Trish
and Saml J. Briden
By Philip Phelps Esq
Attys

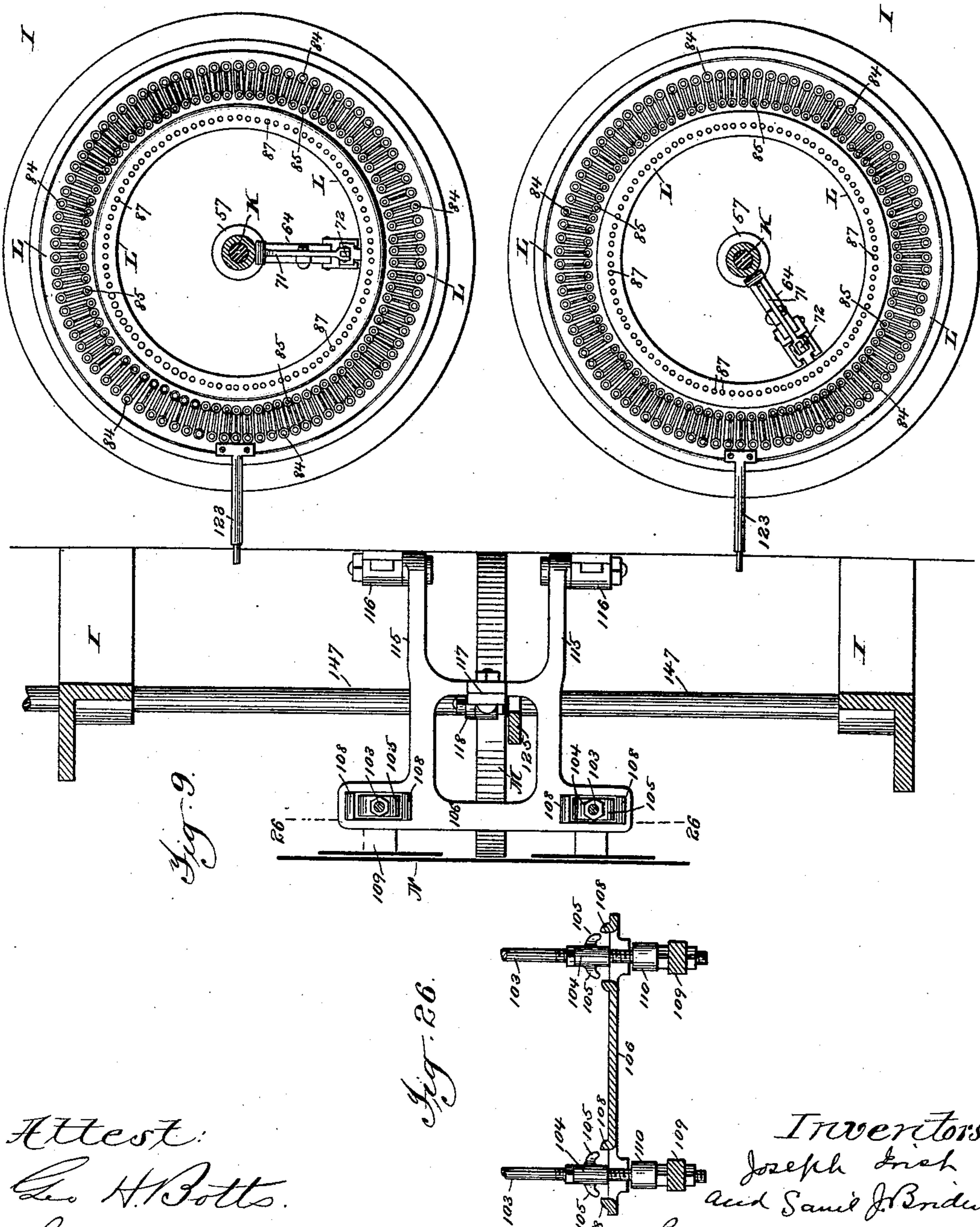
(No Model.)

18 Sheets—Sheet 8.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.



Attest:
Geo. H. Botts.
J. M. Bore

Inventors
Joseph Irish
and Saml J. Briden
By Philip Phelps
Attys

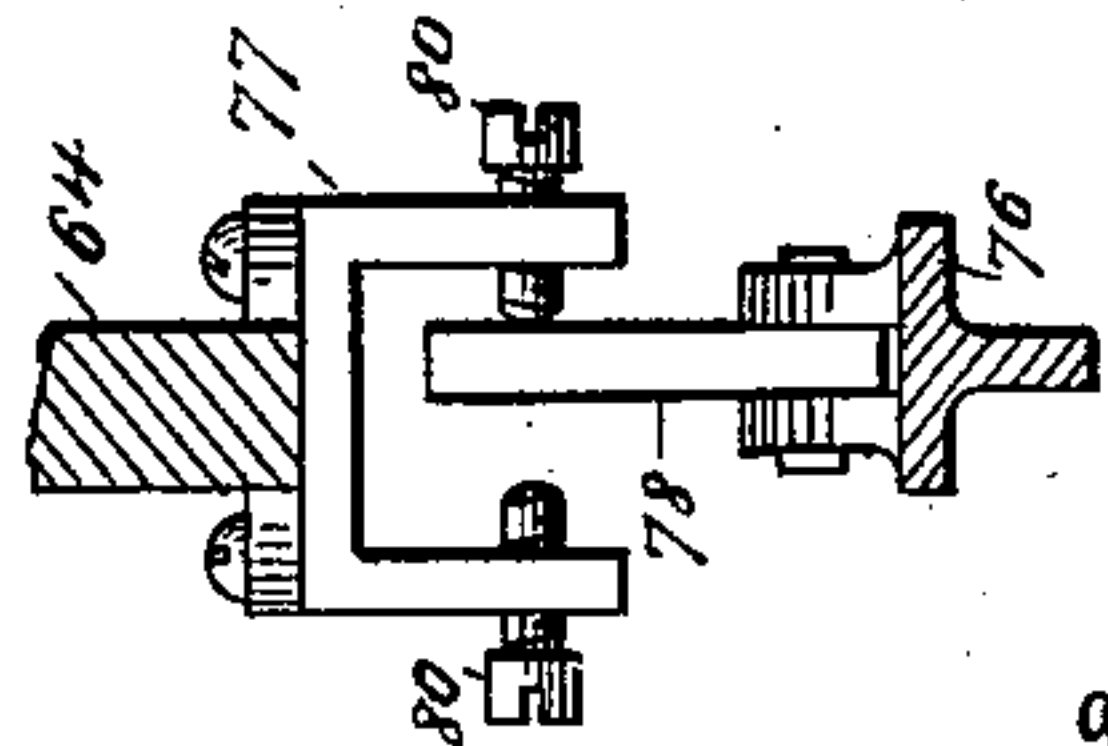
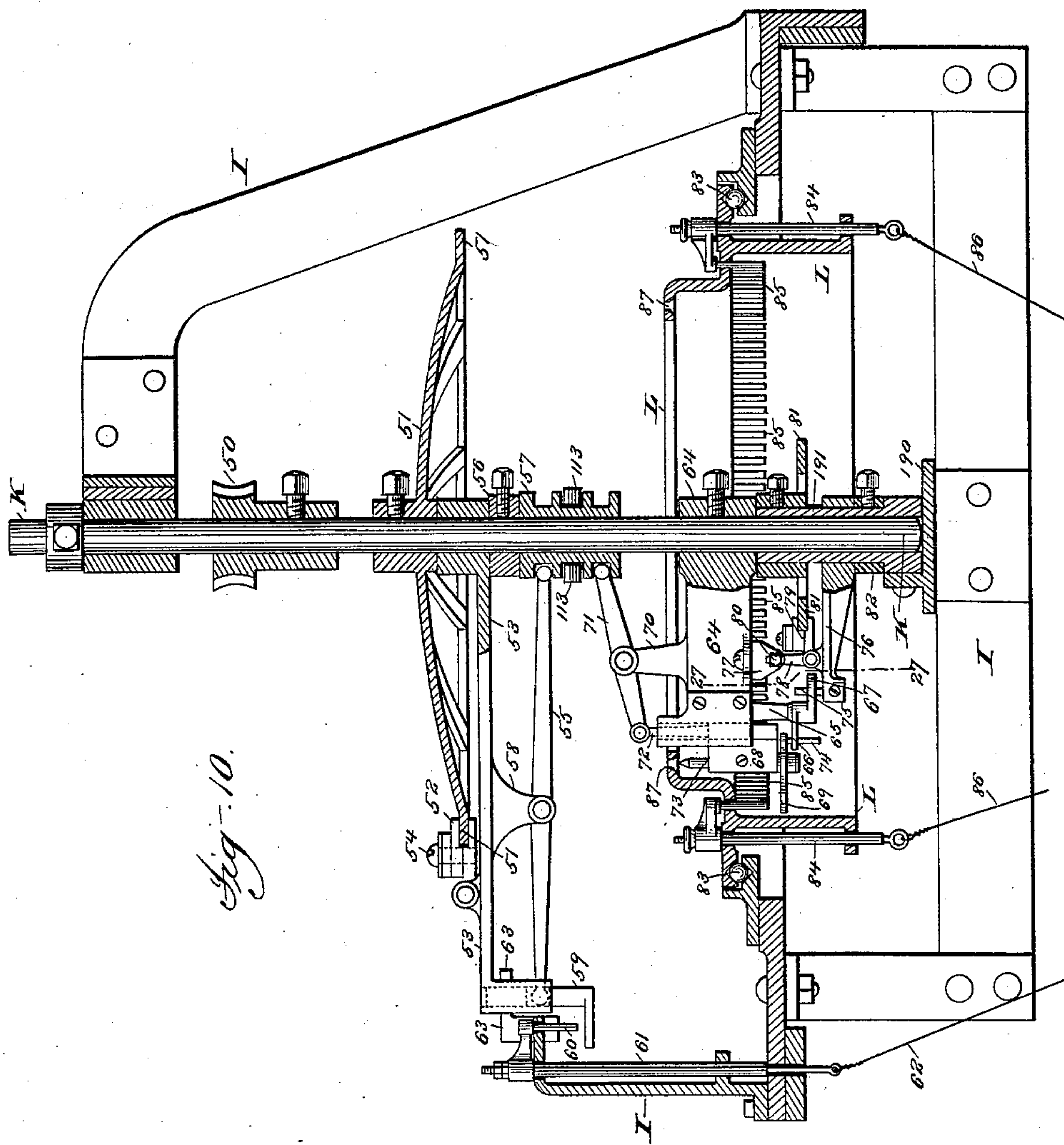
(No Model.)

18 Sheets—Sheet 9.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.



Attest:
L. H. Potts.
G. M. Bore

Inventors
Joseph Irish
and Saml J. Briden
By Philip Phelps Porter
Attys

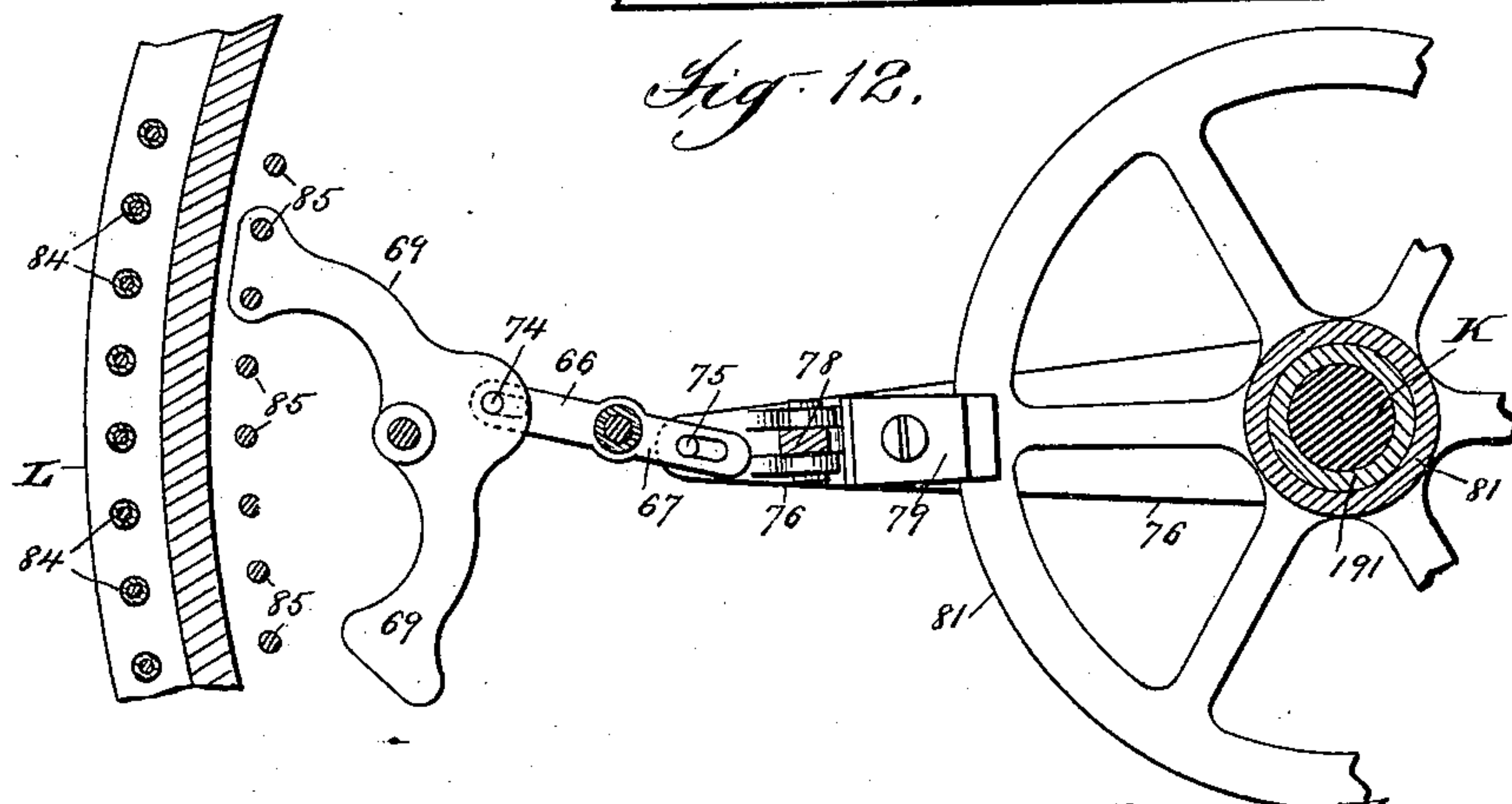
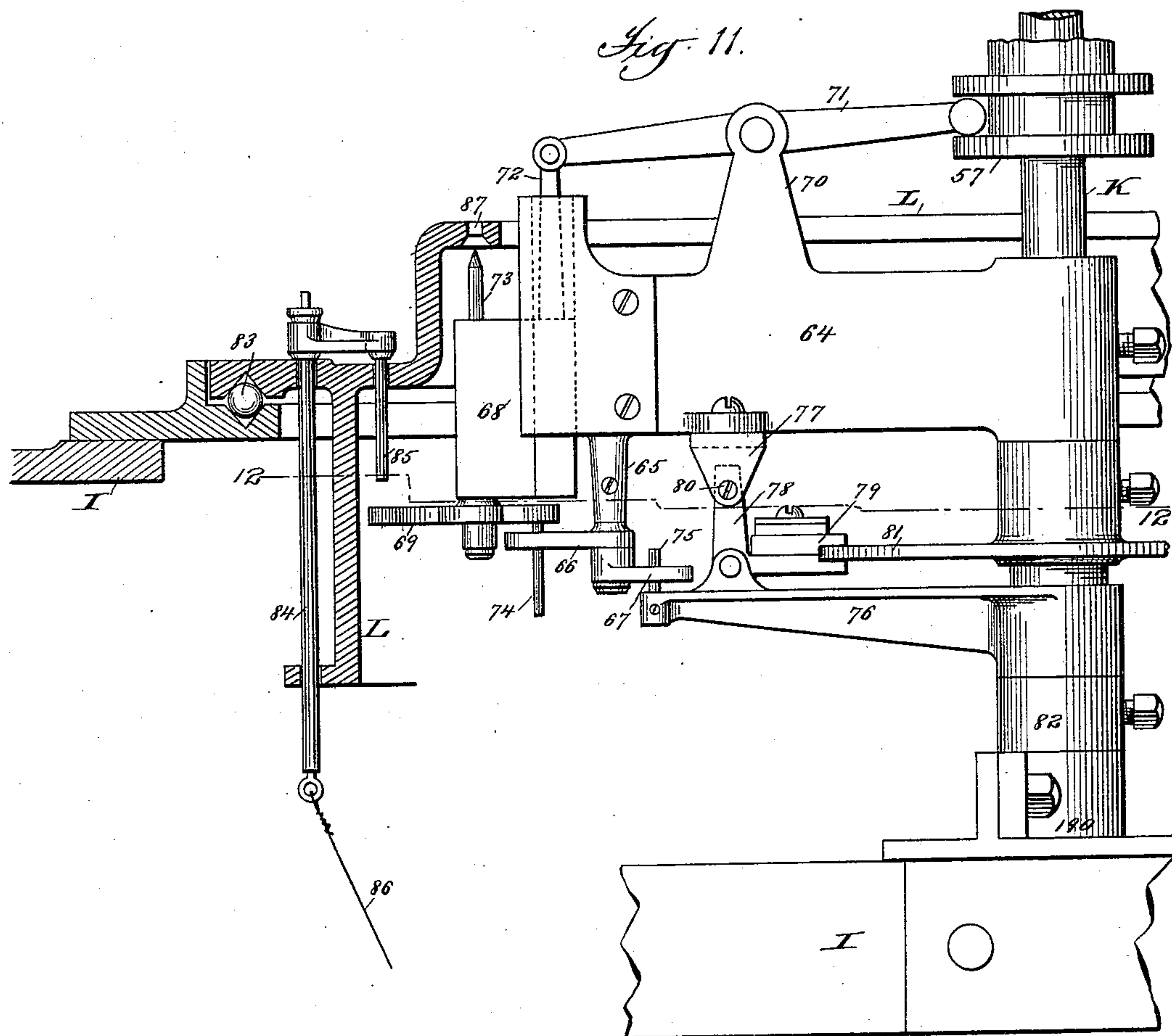
(No Model.)

18 Sheets—Sheet 10.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.



Attest:

Geo. H. Botts

John B. Brown

Inventors

Joseph Irish

and Saml. J. Briden

By Philip Phelps Hoovey

Attys.

(No Model.)

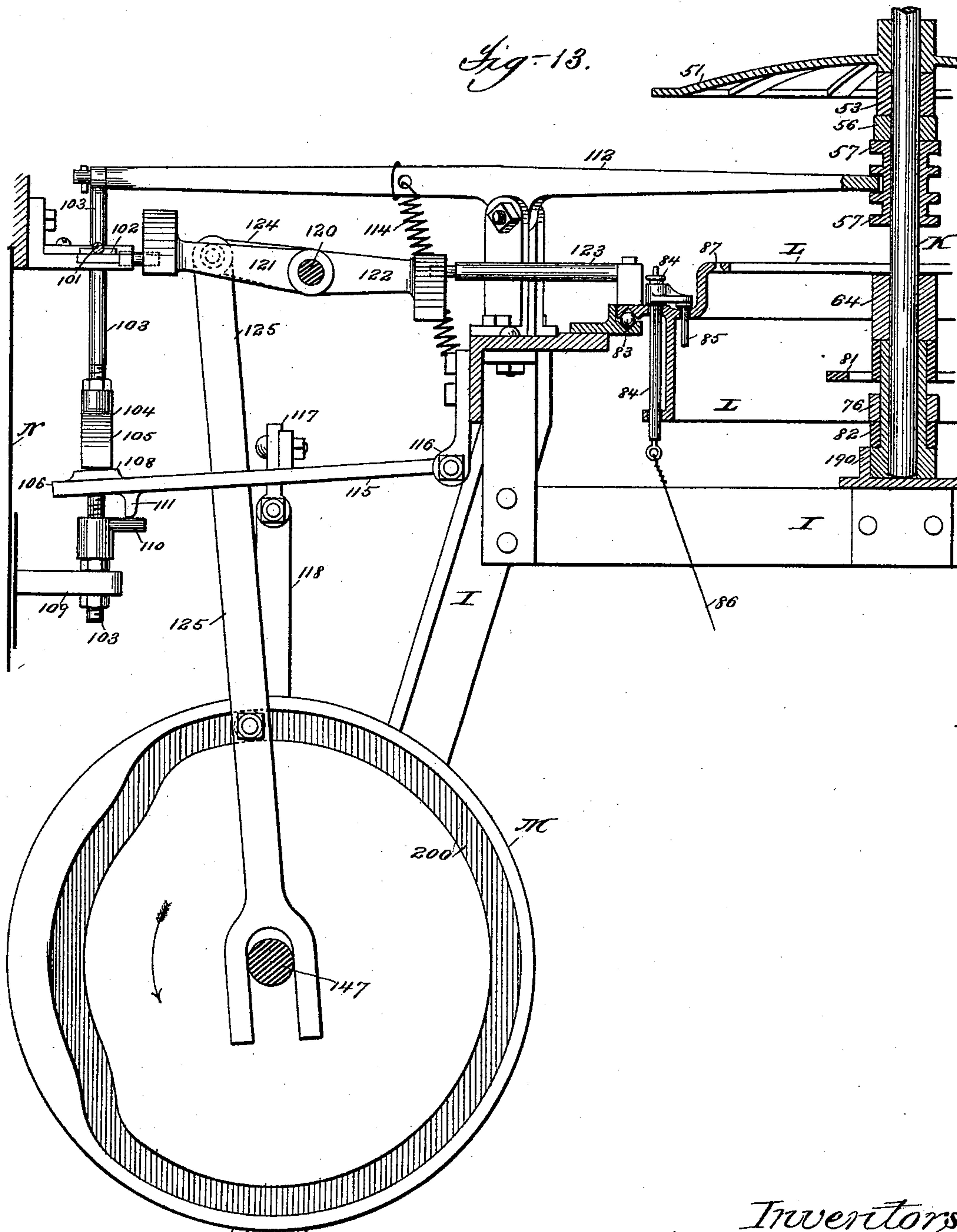
18 Sheets—Sheet 11.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.

Fig. 13.



Attest:
Geo. H. Potts
J. M. Gove

Inventors
Joseph Irish
and Saml. J. Briden
By Philip Phelps & Hoovey
Attys

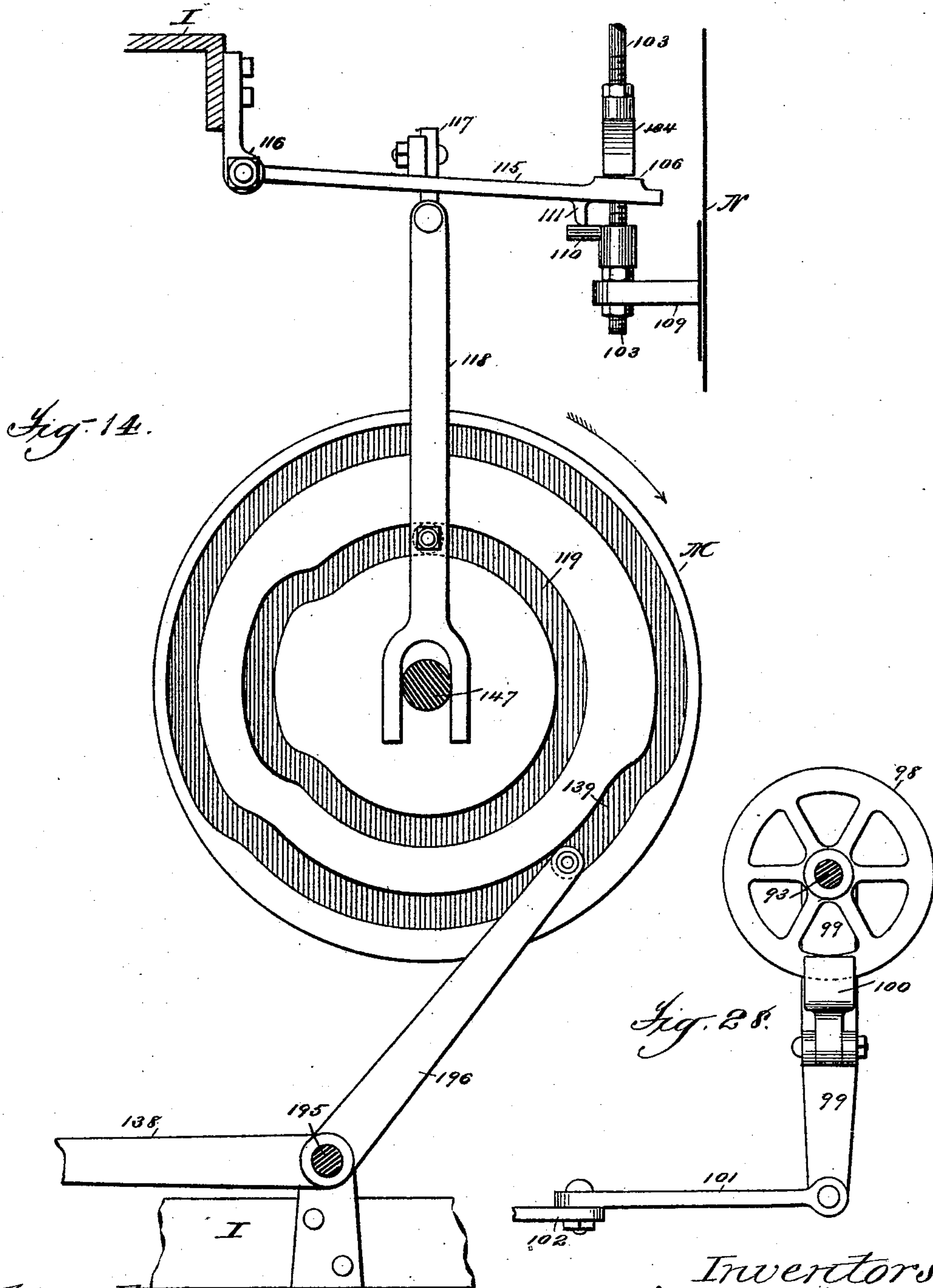
(No Model.)

18 Sheets—Sheet 12.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.



Attest:
Geo. H. Botts.
J. M. Bost

Inventors
Joseph Irish
and Samuel J. Briden
By Philipp Phelps Hovey.
Attys:

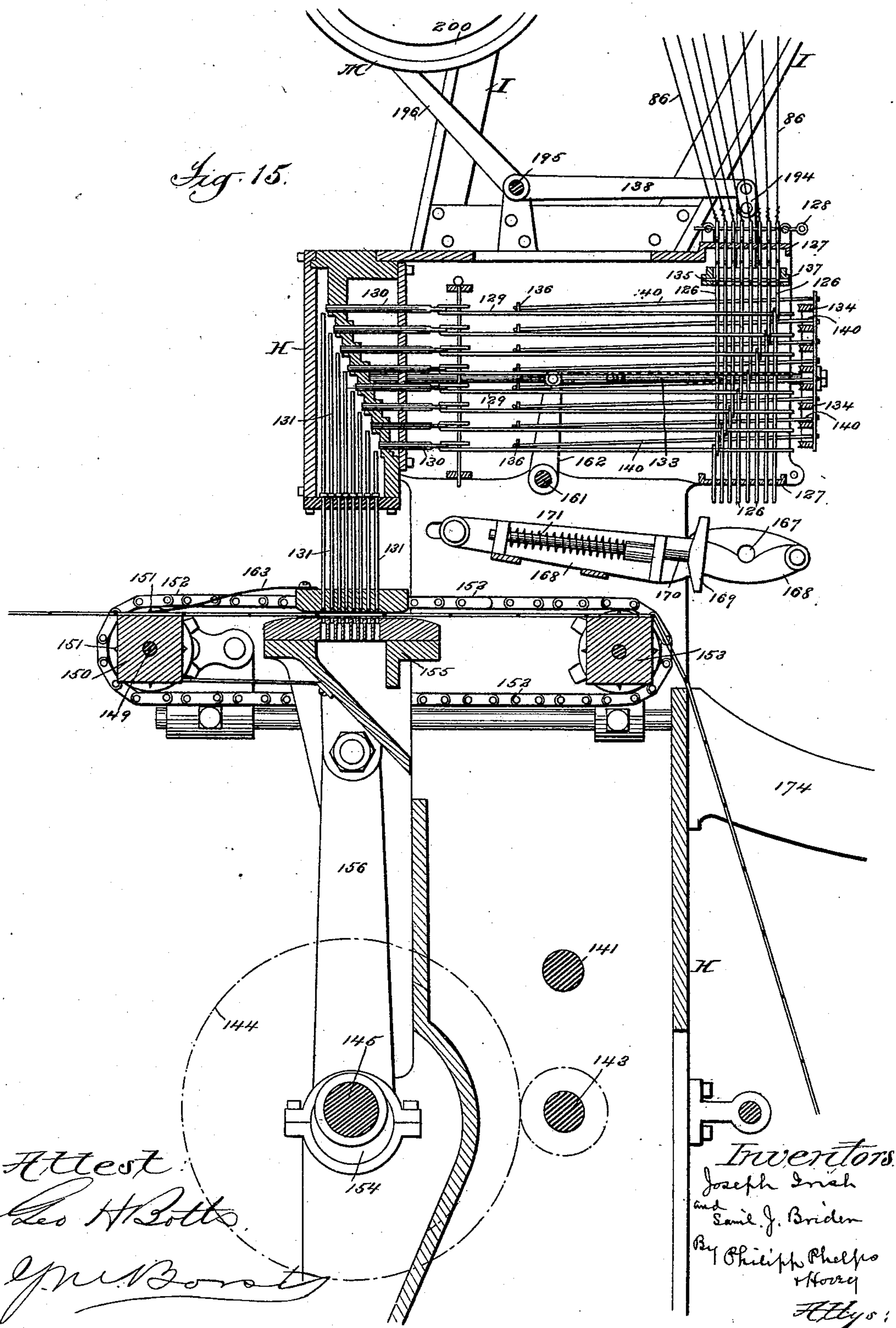
(No Model.)

18 Sheets—Sheet 13.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.



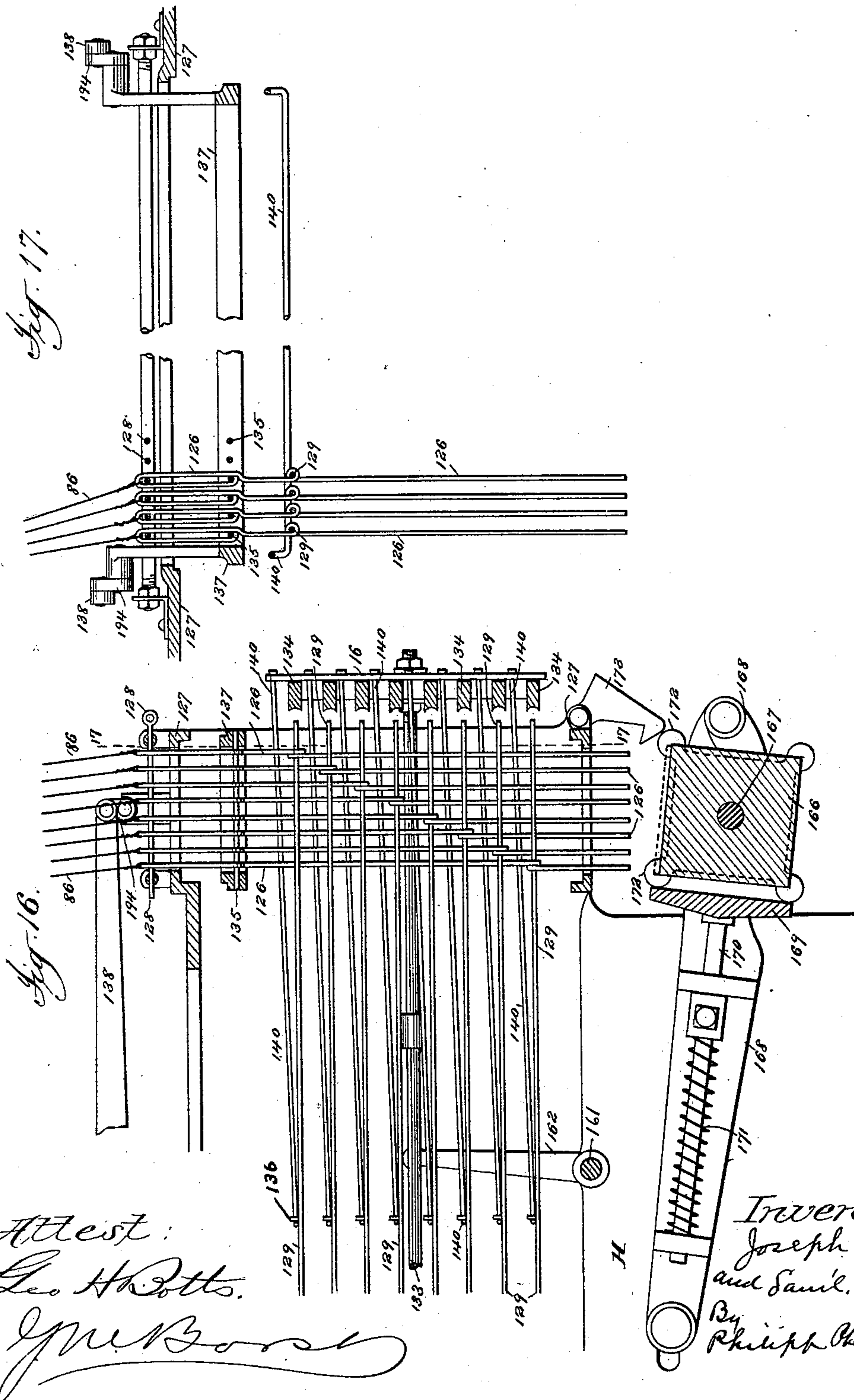
(No Model.)

18 Sheets—Sheet 14.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.



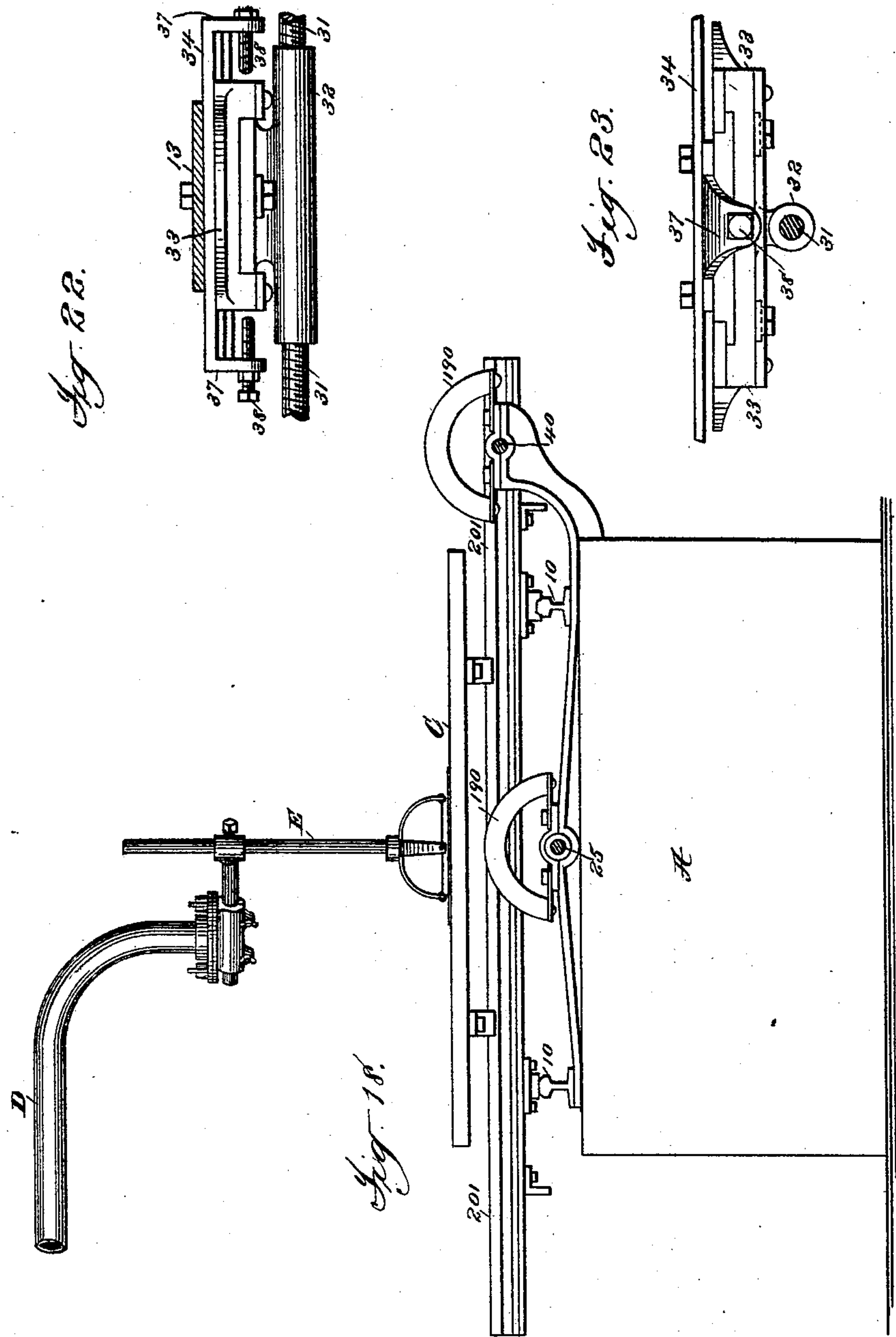
(No Model.)

18 Sheets—Sheet 15.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.



Attest:
Chas. H. Botta
Jm. B. Botta

Inventors:
Joseph Irish
and Saml. J. Briden
By Philipp Phelps & Henry
Attys

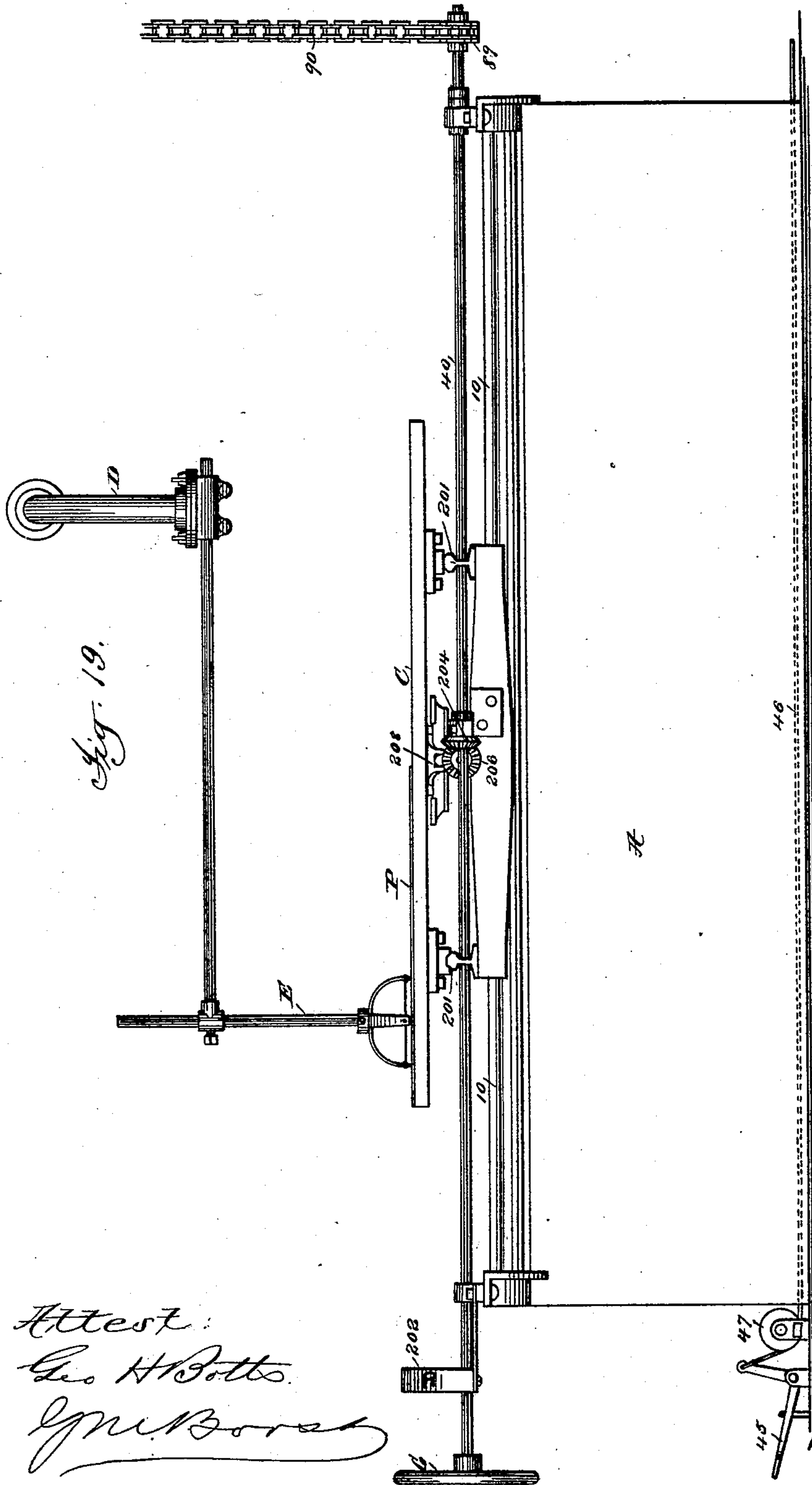
(No Model.)

18 Sheets—Sheet 16.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

Patented May 26, 1891.



Attest:
Geo. H. Botts.
Jm. B. Bore

Inventors
Joseph Irish
and
Samuel J. Briden
By
Philip Phelps Thony
Attys

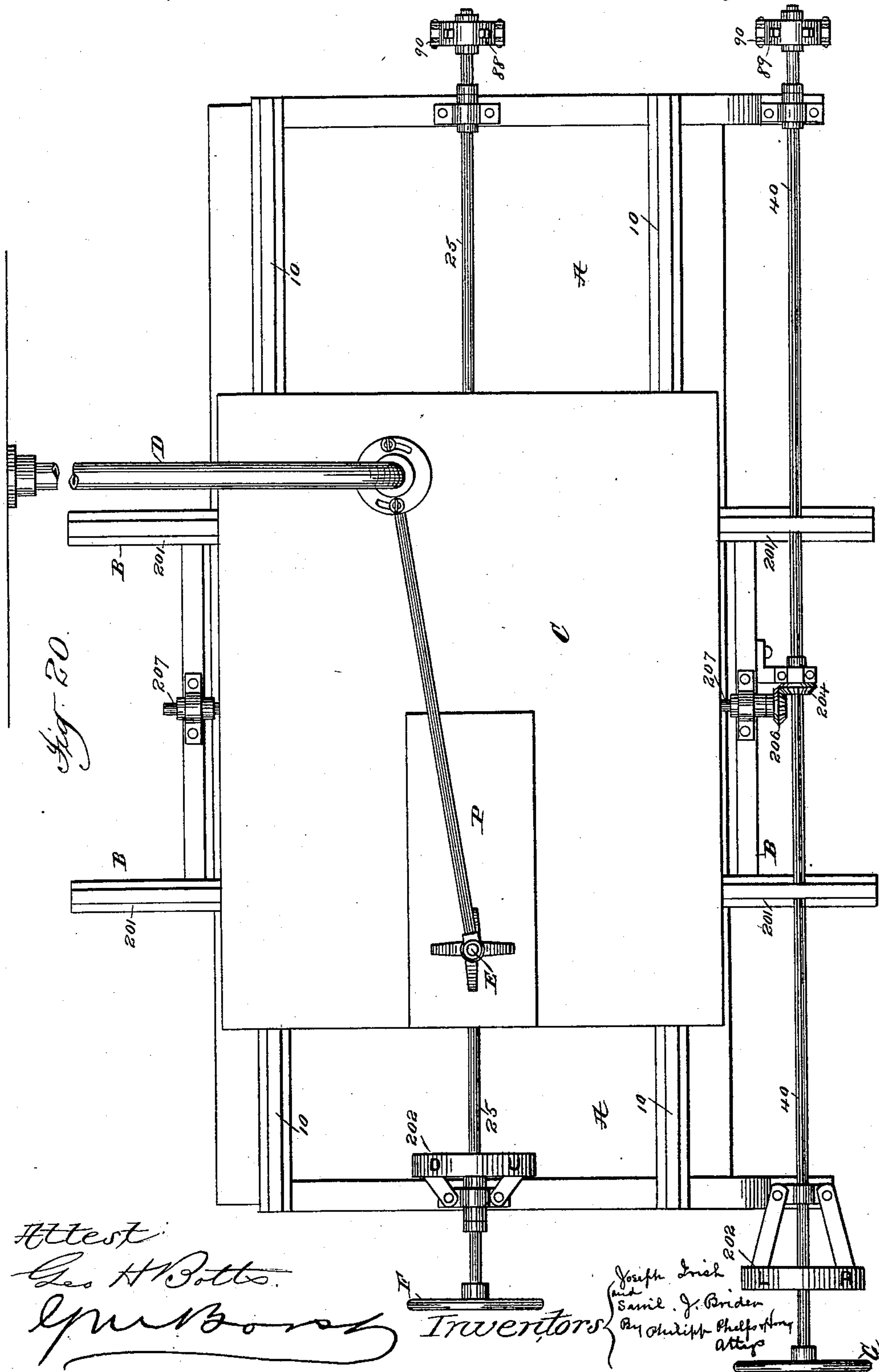
(No Model.)

18 Sheets—Sheet 17.

J. IRISH & S. J. BRIDEN.
MACHINE FOR PUNCHING JACQUARD CARDS.

No. 453,170.

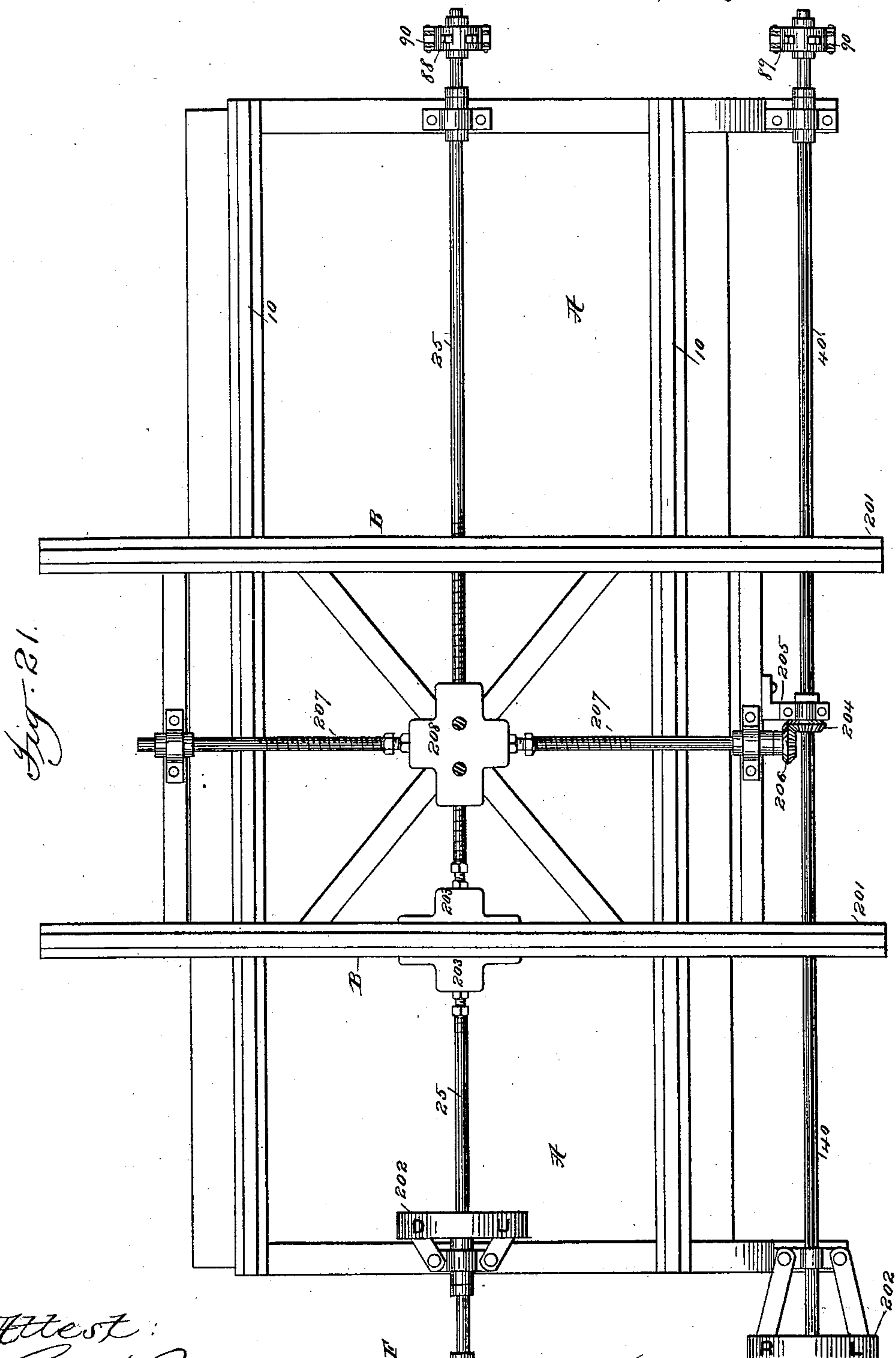
Patented May 26, 1891.



18 Sheets—Sheet 18.

No. 453,170.

Patented May 26, 1891.



Attest:
Chas. H. Bots
Clerk

Inventors:

Joseph Irish
and
David J. Biden
By Philip Phelps & Hoopes, Attys

UNITED STATES PATENT OFFICE.

JOSEPH IRISH AND SAMUEL J. BRIDEN, OF BRIDGEPORT, CONNECTICUT.

MACHINE FOR PUNCHING JACQUARD CARDS.

SPECIFICATION forming part of Letters Patent No. 453,170, dated May 26, 1891.

Application filed January 21, 1890. Serial No. 337,649. (No model.)

To all whom it may concern:

Be it known that we, JOSEPH IRISH and SAMUEL J. BRIDEN, citizens of the United States, residing at Bridgeport, county of Fairfield, State of Connecticut, have invented certain new and useful Improvements in Machines for Punching Jacquard Cards, fully described and represented in the following specification and the accompanying drawings, forming a part of the same.

Our invention relates to machines for punching Jacquard cards, its general object being to improve the construction of such machines, rendering them more convenient for use and more rapid and efficient in operation. In machines of this class as heretofore constructed the selecting mechanism by which the desired punches are locked or otherwise rendered operative has been actuated for different points upon the pattern for which cards are to be punched by other means than a mechanical reading of the pattern. The method in most general use consists in providing a key to the pattern corresponding with the arrangement of the punches and selecting mechanism and then selecting and actuating successively the parts of the selecting mechanism indicated by the key as corresponding to the points of the pattern for which the cards are to be punched, this process consuming much time and being especially liable to error.

It is one of the specific objects of our invention to provide means whereby the selecting mechanism of the punching-machine may be actuated directly from a reading of the pattern, and we attain this object and greatly increase the accuracy and speed of the machine by providing a tracing mechanism connected to the selecting mechanism by suitable devices, so that the movement of the tracing mechanism in reading or following the pattern from one point to another for which cards are to be punched positions the selecting mechanism to determine what punches shall be rendered operative.

Another object of our invention is to provide a machine which by a slight adjustment shall be adapted for use either as a producing or a repeating machine.

A further object is to provide an improved means for securing a positive return of the

needles and stop-rods and avoiding the use of springs for returning these parts to position.

With these and other objects in view our invention consists, primarily, in the combination, with a punching-machine of the class described and its selecting mechanism, of a tracing mechanism for determining the punches to be selected, and in various constructions and combinations of parts, which will be more particularly described in the specification and pointed out in the claims.

The machine herein shown and described has been constructed and is especially designed for perforating cards for use in embroidering-machines of the class shown and described in Letters Patent No. 407,352, granted to Joseph Irish July 23, 1889, and a reference is herein made to that patent for a fuller understanding of the purpose of the details of construction of our machine. It will readily be seen, however, that the invention is of general application in Jacquard-card-punching machines, and that the construction of machines embodying the invention will differ widely in accordance with the class of mechanism for use in which cards are to be produced. In the patent above referred to the tambour-frame may move in any direction in a single plane and within certain limits to any extent, the direction and extent of movement of the frame being determined by a Jacquard mechanism employing the usual series of perforated cards. To control the various movements of the tambour-frame, these cards are provided with two series of perforations for each end of the card, one series determining the direction and the other the extent of movement of the frame, and the perforations at one end of the card controlling the upward and downward movements and their length and those at the other end the right and left movements and their length. For the production of these perforated cards it is necessary, therefore, to provide at each end of the card punches for the perforations, determining the direction and extent of movement of the tambour-frame, and these two series of punches at each side of the machine will be hereinafter referred to as the "direction" and "extent" punches.

For a full understanding of our invention a full description will now be given, reference

being had to the accompanying drawings, forming a part of this specification, in which like letters and figures of reference indicate like parts.

5 Figure 1 is a front end elevation showing one form of our tracing mechanism employing a cylindrical pattern-carrier. Fig. 2 is a side elevation of the same. Fig. 3 is a side
10 elevation showing the opposite end of the cylinder. Fig. 4 is a plan view of the carriage and actuating mechanism for the cylinder, the latter being removed. Fig. 5 is a front elevation, looking from the rear of the tracing mechanism and showing the punch-
15 ing-machine. Fig. 6 is a side elevation of the same. Fig. 7 is a rear elevation. Fig. 8 is a plan view taken below the top frame, showing the connections between the tracing mechanism and the selecting mechanism. Fig. 9
20 is a plan view, partly in section, taken on the line 9 9 of Fig. 7 below the selector for the direction-punches. Fig. 10 is a section on line 10 10 of Fig. 8, showing the mechanism for positioning the selectors. Fig. 11 is an en-
25 larged detail elevation, partly in section, showing the mechanism for positioning the selector for the extent-punches. Fig. 12 is a horizontal section taken on the line 12 12 of Fig. 11. Fig. 13 is an enlarged vertical section taken on the line 13 13 of Fig. 8 with
30 parts removed, showing the centering-cam and connections. Fig. 14 is a detail elevation showing the opposite side of the cam-wheel and cams for moving the selectors and the frame for returning the needles to
35 position. Fig. 15 is an enlarged section taken on the line 15 15 of Fig. 5 with parts removed, showing in detail that part of the selecting mechanism next the punches. Fig. 16 is a similar view, on a larger scale, showing the position of the stop-rods and griff when the machine is used as a repeater. Fig. 17 is a vertical section on the line 17 17
40 of Fig. 16, showing in detail the means for guiding and positively returning the needles. Fig. 18 is a front elevation of the tracing mechanism, with the pattern carried by a table. Fig. 19 is a side elevation of the same. Fig. 20 is a plan view of the table and sup-
50 porting-frame. Fig. 21 is a plan view of the supporting and operating mechanism for the table, the latter being removed. Fig. 22 is a detail showing the lost-motion-adjusting means for the pattern-carrier. Fig. 23 is a view at right angles to Fig. 22. Figs. 24 and
55 25 are detail views of the mechanism for feeding the cards and for throwing the machine in and out of operation. Fig. 26 is a detail on the line 26 26 of Fig. 9. Fig. 27 is a detail on line 27 27 of Fig. 10. Fig. 28 is a detail hereinafter referred to.

Referring now to Figs. 1 to 4, the base A of the tracing end of the machine has mounted upon it a carriage B, supporting a pattern-carrier, which in this embodiment of the inven-
65 tion consists of a cylinder C. The carriage B consists of a suitable base-frame formed of

side pieces 11 and cross-pieces 13, the former being provided with anti-friction wheels 12, moving upon rails 10 on the base A, and has
70 at each end supporting-standards 14, in which is mounted the shaft 15, carrying the cylinder C. The cylinder C is shown as slotted to receive the end of the pattern P, and may be provided with an interior drum on which
75 the pattern is reeled; or the pattern may be secured to the surface of the drum in any other suitable manner.

Supported on a standard D, fixed to the floor or to the base of the machine, preferably at the rear of cylinder C, is a tracer E, which consists in its simplest form of a fixed
80 rod terminating in a point and adapted to indicate the point upon the pattern brought below it by the movement of the cylinder.

For the purpose of rotating the cylinder to move the pattern below the tracer E, the shaft 15, carrying the cylinder, is provided at one end with a gear 18, with which engages a worm 19, carried on the end of a shaft 20,
90 which extends upward from the base of the carriage B and is mounted to rotate in bearings in a cross-piece 13 and standard 14. This shaft is provided at its lower end with a bevel-gear 21, meshing with a similar gear 22, carried by a sleeve 35, splined to a shaft 23, extending longitudinally of the carriage and mounted in standards attached to the floor or base of the machine. This shaft 23 is geared through bevel-gears 24 with a trans-
95 verse shaft 25, also supported from the floor or base, and provided at its front end with a sprocket-wheel 26, from which an endless belt 27 extends upward to a similar wheel 28, carried by a short shaft provided with the hand-wheel F and mounted upon a standard 29 at the front of the machine. The sleeve 35 is carried on shaft 23 in one direction during the movement of the carriage B by the gear 21 engaging gear 22, and a lug 30, depending
100 from the carriage, encircles the shaft 23 and carries the sleeve in the opposite direction, retaining the gears in mesh.

For the purpose of securing accurate adjustment between this rotary movement of the cylinder and the movement of the mechanism for positioning the selecting mechanism, I provide the shaft 20 with the following means of adjustment: The worm 19 is not attached directly to the shaft 20, but is carried by a
105 sleeve 1, provided with lugs 2, between which moves an arm 3 of a collar 4, adjustably secured to shaft 20 by a set-screw, as shown in Fig. 3. The lugs 2 are each provided with a set-screw 5, by which the movement of the arm 3 independently of the sleeve 1 is adjusted. The operation of this lost-motion-adjusting means will be described hereinafter in connection with similar devices in other parts of the machine.

For the purpose of moving the carriage B and cylinder C to the right or left a screw-shaft 31 is provided, which is supported in standards secured to the floor or base of the
130

machine and engages with the central cross-piece 13 of the carriage by means shown in detail in Figs. 22 and 23. The shaft 31 is surrounded by a collar 32, which carries a block 33 dovetailed to but sliding freely on the under side of a plate 34, secured to the cross-piece 13 of the carriage by nuts or bolts, as shown, or in any other suitable manner. The plate 34 is provided with depending lugs 37 at each end, in which move the set-screws 38, adapted to limit the movement of collar 32 and block 33, this connection forming a means for adjusting accurately the side movement of the carriage corresponding to that previously described for adjusting the rotary movement of the cylinder. The screw-shaft 31 is geared at one end by means of bevel-gears 39 with a transverse shaft 40, supported in the base-frame and carrying at its front end a sprocket-wheel 41, from which a chain 42 extends upward to a similar wheel 43, carried by a short shaft provided with a hand-wheel G and mounted in front of the cylinder on standard 44. The hand-wheels F G, as shown, are placed in such position as to be convenient for use in moving the pattern-carrier and to permit the operator to observe the position of the pattern relatively to the tracer.

To enable the operator to set the punch selecting and punching mechanism in operation when the selecting mechanism has been properly positioned through the movement of the pattern-carrier, a treadle 45 is provided at the front of the machine in convenient position for use, the treadle being connected by a cord 46, passing under pulleys 47, with a clutch for throwing the machine into operation, as will be hereinafter described.

For the purpose of indicating to the operator the point upon the pattern for which cards have already been punched in the operation of the machine, we provide the following device: The tracer E is hollow to permit the movement inside thereof of a needle 6, which is supported by a lever 7, attached to a suitable arm extending from the support D and held normally in position out of contact with the pattern by a spring 8, pressing against a collar upon the needle, as shown, or against the lever 7. To the lever 7 is attached a cord 48, running over pulleys 49 to the base of the machine, where it is attached to cord 46 in such a way that the movement of the latter in setting the machine in operation for punching a card will draw upon the lever 7 through the cord 48, thus forcing the needle 6 through the tracer E into contact with the pattern. The pattern will thus show by a series of punctures the points for which cards have been punched. It is obvious that other similar devices may readily be constructed for this purpose, and that such a device, although convenient, is not absolutely essential, as the same result may be attained by the slower process of numbering the different points upon the pattern to correspond with the cards to be punched, and in case of doubt

as to the point reached in perforation comparing the numbers upon the pattern with that of the card last punched, a numbering mechanism, as is usual, being carried by the machine.

The mechanism for positioning the selecting mechanism and its connections with the tracing mechanism will now be described. Referring to general views 5, 6, and 7, it will be seen that the main frame H of the punching-machine carries upon its top a supplementary frame I, adapted to support at each side of the machine series of wires and the selectors and operating parts therefor, these selectors and wires forming a part of the selecting mechanism, the wires being attached, as shown in Fig. 15, to the tops of the needles, which raise the stop-rods into position to be actuated by the griff. Referring now particularly to Figs. 8 to 13, K K are two shafts, one at each side of the machine, loosely mounted in the arms of the frame I at their upper ends and supported at their lower ends upon plates 190, mounted upon the frame. As the construction and operation of these shafts and the parts attached thereto is the same on each side of the machine, a description of one shaft and its attached parts will suffice. As shown in Fig. 10, shaft K rotates in a sleeve 191, rigidly attached to the base-plate 190, and carries at its upper end a gear 50, adjustably attached to the shaft by a set-screw or other suitable means. Below the gear 50 is adjustably attached to the shaft K a friction-disk 51, the rim of which is adapted to enter between the forked arms of a lug 52, pivotally supported on an arm 53, mounted loosely upon the shaft K. The forked arms 52 are adjustable by a set-screw 54 and a leather or rubber washer, as shown, to adjust the friction between the disk 51 and the forked lug, and the pivotal support of the latter allows a limited movement at right angles to the line of rotation of the arm and disk, thus compensating for any irregularity of movement or of surface in the disk 51 and preserving a constant and uniform frictional contact. Below the arm 53 and separated therefrom by the adjustable collar 56 is a sleeve 57, loose upon the shaft and free to slide thereon. This sleeve 57 is provided with three circular grooves adapted to receive the ends of levers presently to be described. The arm 53 is provided with a depending lug 58, upon which is pivoted an arm 55, one end of which is provided with a longitudinally-extended bowl, which enters the upper groove in the sleeve 57, and the other end of which carries a selector 59, to which it is pivotally attached. This selector 59 slides vertically in the end of arm 53, and by the movement of the latter is brought into position to raise either one of the two pins 60, each of which is attached to a selecting-rod 61, the latter being connected by two wires 62 to two needles, these wires and needles operating to position the stop-rods for locking the punches. This arm 53

is stopped in proper position to bring the selector 59 under one or the other of the pins 60 by means of stops 63, attached to the frame at each side of the arm, as shown in Figs. 8 and 10. It will be understood that but one needle may be operated by each rod, the second perforation produced by the construction shown being not absolutely necessary, but for the purpose of securing greater certainty in the operation of the embroidering-machine, as described in the patent above referred to. To the shaft K below the sleeve 57 is adjustably attached to rotate with the shaft an arm 64, which carries a vertically-sliding block 68, to which is attached the selector 69, forming a part of the selecting mechanism for the extent-punches. This selector is pivoted to oscillate in a horizontal plane and is provided with two operating-arms, one or the other of which will be thrown into position under the pins 85 as the shaft is rotated in either direction. The arm 64 also carries a standard 70, on which is pivoted a lever 71, one end of which is provided with an elongated bowl adapted to enter the lowest groove in the sleeve 57, and the other end of which is connected to the sliding block 68 by a link 72, the movement of the lever 71 thus raising and lowering the block 68 and selector 69. The block 68 also carries a rigid centering-pin 73, adapted to center the frame carrying the selecting-rods and wires, as will presently be described. The selector 69, as shown in Fig. 12, is provided with two arms for operating the selecting-rods, one arm being in position under the pins when the shaft is rotated in one direction, but the other being thrown into operative position as the movement of the shaft is reversed. The selector is so constructed that three of the pins 85 are skipped in reversing the movement of the selector, this being necessary in order to avoid perforating the card, so that the stops beneath the rotating arms 83 of the patent above referred to shall be operated as the movement of the tambour-frame is reversed. In the present case the selector is shown as skipping three pins, the rotating arms of the embroidering-machine being constructed of a width to cover three stops. It is evident, however, that the relation of the parts in both machines may be varied. Each arm of the selector is preferably constructed, as shown to operate two selecting-rods, this resulting in duplicate perforations, as in the case of the selector 59.

For holding either one of the arms of the selector in operative position and shifting the arms as the movement of the shaft is reversed, the following mechanism is provided: The arm 64 carries a depending lug 65, on which is pivotally mounted to oscillate in a horizontal plane a sleeve, from which extend in opposite directions two slotted arms 66 67. The slotted arm 66 engages with a pin 74, depending from selector 69 on the opposite side of its pivot from the selecting ends, and the

slotted arm 67 engages with a pin 75, carried upon arm 76, which is loosely mounted on the sleeve 191, surrounding the shaft. The arm 64 carries also two depending lugs 77, forming a fork, between which moves the vertical arm 78, pivoted to the arm 76. Each of the lugs 77 is provided with a set-screw 80, by which the free movement of the arm 78 within the fork formed by the lugs 77 is limited. The arm 78 is bent at right angles at its pivot, its horizontal part forming a fork 79, the two arms of which are adjustable by means of a set-screw and washer, as shown in Fig. 11, and are adapted to receive between them the rim of a friction-disk 81, rigidly attached to the sleeve 191, surrounding the shaft. The arm 76 is adjustably supported in position upon the shaft by collar 82, secured to the sleeve 191 by a set-screw. Supported in the horizontal plate carried by frame I are two circular frames L, the construction of which is similar. Each frame L is mounted, as shown in Fig. 10, upon bowls or rollers 83, and carries a circular series of selecting-rods 84, to which are connected the pins 85, adapted to be engaged by the selector 69 for raising the selecting-rods. To each of the selecting-rods 84 is attached a wire 86, connected to one of the needles. The edge of the circular frame L, mounted on the rollers 83, as stated, is perforated with a circular series of holes 87 exactly opposite the pins 85 and selecting-rods 84. These holes 87 are beveled and adapted to be entered by the beveled guide or centering-pin 73, previously described, the result being that if the frame L is not returned exactly to proper position by the other parts of the machine, or the selector 69 is not accurately positioned, the raising of the block 68, carrying selector 69, will, by the beveled surfaces of the pin and hole, rotate the frame L slightly and bring the selecting-rods directly over selector 69 in position to be raised.

Referring now particularly to Figs. 8 to 11, the connections between the tracing mechanism and that just described for positioning the selectors, so that the latter when operated with the rest of the selecting mechanism will select the proper punches, will be described. As shown in Figs. 4, 5, 6, and 8, the shafts 25 and 40 are provided, respectively, with sprocket-wheels 88 89, which are connected by chains 90 to similar wheels 91 92, secured to the end of shafts 93, which are mounted in the upper part of frame I and adapted to rotate shafts K, each shaft being connected with selecting mechanisms for the direction and extent punches, and each controlling the punches in one end of the card. As these shafts and the mechanism connected therewith are the same at each side of the machine, but one set will be described. The shaft 93 has loosely mounted upon it a sleeve 94, carrying a worm 95, adapted to engage gear 50 on shaft K, this sleeve being adjustably held in position longitudinally of the

shaft by means of a collar 96 and set-screw. The sleeve 94 is recessed at the front to receive an arm extending from a collar 97, secured to the shaft and adjustable thereon by means of a set-screw, as shown in Fig. 8, this construction forming an adjusting device corresponding with those heretofore described in connection with the tracing mechanism. The shaft 93 carries also a friction-disk 98, and loosely mounted to swing upon the same shaft is an arm 99, carrying a friction-fork 100, between the arms of which the friction-disk 98 is adapted to rotate, as shown in Figs. 6 and 28. This fork 100 is pivoted to swing at right angles to the plane of rotation of the disk to preserve a uniform frictional contact. The arm 99 has connected to it by a pivoted link 101 a slide 102, adapted to engage a swinging rod 103, which carries at its lower end a collar 104, preferably adjustable longitudinally of the rod, as shown. This collar 104 is provided at each side with an ear 105, adapted to engage projections 108 on a slotted cross-bar 106 when the rod 103 is swung either to the right or left by the motion of the friction-disk 98, the rod 103 extending through the slot in cross-bar 106 and having a limited sidewise movement therein. Each of the rods 103 carries below the cross-bar 106, adjustably connected thereto by nuts, as shown, an arm 109, carrying a piece of card or other suitable material, which as the rod 103 is swung to the right or left is moved past the openings in the large card N, attached to the front of the machine. These cards will be lettered as shown in Fig. 5, those at the left hand of the machine "D U," and those at the right hand of the machine "R" and "L," corresponding to the movements of the pattern-carrier and of the tambour-frame in the patent above referred to, the letters appearing in front of the openings only as the corresponding movement of the pattern-carrier is produced, the operator thus being able by this card to see whether the proper movement of the positioning mechanism has been made to produce the card for the desired point on the pattern. The rods 103 are also provided with pins 110, adapted to engage a projection 111 on the cross-bar 106, by which the swinging rod 103 and parts attached thereto will be positively returned to position in case the spring provided for that purpose fails to operate.

The operation of the mechanism thus far described, covering the movement of the pattern-carrier and the connections between it and the selectors by which the latter are positioned, will now be described. It will be understood that the pattern is to be moved below the tracer E to bring the point of the pattern for which the card is to be punched directly under the tracer. This may require only a rotary movement of the cylinder or a sidewise movement of the carriage and cylinder, or both of these may be necessary, according to the direction in which the next point of the pattern lies from that for which

a card was last punched. This movement of the pattern-carrier corresponds with that of the tambour frame of the patent above referred to, the cards punched producing, when used in the machine, a movement of the tambour-frame corresponding in direction to that of the pattern-carrier. Likewise the extent of movement of the carrier determines the pins of the circular series to be lifted, and thus the length of the stitch in the embroidering-machine. The two movements of the pattern-carriers, when required, may be given either simultaneously or successively, the action of the parts for the two movements and their connections being independent of each other. For a rotary movement of the cylinder the hand-wheel F will be turned in either direction, rotating the cylinder C to bring the point of the pattern for which the card is to be punched under tracer E, this movement being produced by the mechanism previously described, consisting of sprocket-wheel 28, chain 27, and shafts 25 and 23, the latter gearing with worm-shaft 20 through beveled gears 21 and 22, the movement of the shaft 20 being transmitted to cylinder C through the lost-motion-adjusting device, worm 19, and gear-wheel 18. The side movement of the cylinder is produced by turning hand-wheel G in either direction, which slides the carriage B upon rails 10 through the mechanism previously described, consisting of the sprocket-wheel 43, chain 42, and transverse shaft 40, which gears with the screw-shaft 31, engaging the carriage through the lost-motion-adjusting device shown in Figs. 22 and 23.

As the movement of the mechanism by which the selectors are positioned in accordance with the movement of the pattern-carrier is exactly the same for a rotary or side movement of the cylinder, the side movement alone will be described in detail. The transverse shaft 40, through sprocket-wheels 89 and 92 and endless chain 90, rotates shaft 93 in frame I, which in turn rotates the worm 95, and through the gear 50 the shaft K at the right of the machine. If the direction of movement of the pattern-carrier and shafts be the reverse of that of the preceding movement, there will be a certain amount of backlash in the connections between the hand-wheels and the carrier and shafts. It is necessary, therefore, in order to secure the requisite accurate agreement between the movements of the carrier and shafts to provide some means of compensating for the backlash, and this is the function of the lost-motion adjusting devices between the hand-wheels and the carrier and between the shafts 93 and K. The lost motion in these devices is made sufficient, so that in reversing the backlash of the connections will be fully taken up before the carrier and shafts are operated, and the adjusting means enable the movement of the parts to be so adjusted, that the carrier and shafts shall move in exact accordance for any movement of the hand-wheels. If the direc-

tion of any movement of the parts be the same as that of the preceding movement, there will of course be no backlash and no lost motion in the adjusting devices, the loose parts being already in operative position. The shaft 93 carries with it the friction-disk 98, which at the same time as the shaft K is rotated swings the arm 99 to the right or left, in accordance with the movement of the shaft 93, and moves the slide 102, operated thereby, so that the rod 103 is shifted in the slot in cross-bar 106 to such a position that one of the ears 105 will engage with the corresponding projection 108 on the cross-bar as the latter is raised by mechanism to be described hereinafter. The same movement of the rod 103 carries in front of the opening in card N one of the letters upon the small card attached to the lug 109, either "R" or "L," in accordance with the movement of the pattern-carrier, thus informing the operator that the correct movement has been made. It will be understood that the friction between disk 98 and fork 99 will be so adjusted that the friction-disk 98 will operate the arm sufficiently to throw slide 102 and rod 103 into proper position, but that the disk will turn in the fork for any further movement of the shaft. As the shaft K is rotated through the worm and gear, the friction-disk 51 will be rotated with it, and through the friction between the rim of the disk and the fork 52 will carry with it the arm 53 and parts attached thereto until the arm is stopped by one of the stops 63, this movement of the arm 53 and lever 55 being permitted by the bowl-and-groove connection of the latter with sleeve 57. As the arm 53 strikes the stop 63 the disk 51 is released and rotates forward independently of the arm, the rim of the disk moving between the arms of the fork 52, the friction between the parts being adjusted by screw 54 and the washer, so that it is just sufficient to carry the arm into position, but allows the disk to move forward when the arm is stopped. The selector 59, forming a part of the selecting mechanism, has now been brought into position under that one of the pins 60 of the selecting-rods 61 of the direction series which corresponds with the point of the pattern reached, and any downward movement of the inner arm of lever 55 will raise the selector and the lifting-rod, thus, by mechanism to be described hereinafter, locking the selected punches in operative position. The movement of the shaft rotates also the arm 64, which is rigidly attached thereto, and carries with it the depending lug 65, on which is mounted the collar carrying the two arms 66 67. This arm 64 also carries with it the slide 68 and selector 69, attached thereto, and the lever 71 for operating the slide and selector, the lever being permitted to move freely about the sleeve 57 by the bowl-and-groove connection. If the rotation of the shaft corresponding to the movement of the pattern-carrier be in a direction the reverse of the previous movement,

a certain amount of free movement is allowed to the arm 64 before either of the adjusting-screws 80, carried by the fork 77, comes in contact with the arm 78, carried by the arm 76, this free movement operating to shift the other end of the selector into operative position below the pins, certain of the latter being skipped, as previously described. The arms 66 67 being connected, respectively, to pins 74 and 75 on the rear end of the selector and on the arm 76, the movement of the arm 64 in either direction rotates the arms 66 67, and through these shifts the selector 69, so as to throw the end of the selector last used out of and the opposite end into position under the pins 85, the friction-disk 81, surrounding the shaft, offering sufficient resistance to the movement of fork 79 to prevent the rotation of arm 76, and thus cause the throw of the selector. When, however, in the movement of arm 64 one of the set-screws 80 in the fork 77 comes in contact with the arm 78, the entire construction connected with arm 64, including arm 76, is carried about by the shaft, the selector 69 being retained in position under the pins 85 by the friction of the disk and fork, which is adjusted to be sufficient to rock the selector 69 into position beneath the pins and hold it there, but to be readily overcome to allow the arm 76 to be carried with the arm 64. If the movement of the pattern-carrier and shaft be in the same direction as that of the preceding movement, there will be no free movement of the arm 64, but all the parts connected with this arm will move together as the shaft commences to rotate, an arm of the selector 69 being already under the selecting-rod pins. The sliding movement of the carriage to right or left thus positions the selectors for punching the holes in the cards for the right and left movements of the tambour-frame and the length of the stitch in either of these directions. The rotary movement of the cylinder by similar mechanism on the left side of the machine, operating either with or without the right and left movement mechanism, positions the selectors for the other two series of selecting-rods connected to the punches which produce the holes for the downward and upward movements of the tambour-frame and the length of the stitch in either of these directions. By the operation of the mechanism thus far described it will be seen that the rotary movement of the cylinder in either direction and the side movement of the carriage to right or left are transmitted to the selectors through the positioning mechanism in such a way as to place and hold the selectors for both the direction and extent series of punches and for perforating either or both ends of the card in position to raise the selecting-rods corresponding to the point upon the pattern for which the card is to be punched and that the pattern-carrier and positioning mechanism are so arranged that every point upon the pattern may be successively cov-

ered by the universal movement given the former.

The mechanism for raising the selectors and operating the selecting mechanism will now be described. Referring now particularly to Figs. 8 to 13, the sleeve 57 upon the shaft K is provided, in addition to the grooves previously described, with a central groove with which engages a lever 112, pivoted in the frame of the machine and carrying at its other end the swinging rod 103. The lever 112 is connected to the sleeve 57 by means of the forked arms 113, thus insuring a constant connection between these parts in case of any rotation of the sleeve with the shaft. For the purpose of returning this lever 112 and the collar 57 to position after being actuated as presently to be described, a spring 114 is attached to the frame and to the lever. The cross-bar 106, previously referred to, is carried by two arms 115, pivoted upon lugs 116 in the frame, and carries a central cross-piece 117, to which is connected by a link an operating-arm 118, provided with a bowl, which is actuated by the groove-cam 119 in the cam-wheel M, the arm being held in position to reciprocate vertically by a forked end embracing the cam-shaft 147, which is actuated by means hereinafter to be described. For the purpose of securing the proper positioning of the frames L and the slides 102 with their connected parts, when the card has been punched and the parts are returned to their normal positions prior to another movement of the pattern-carrier, a transverse shaft 120 is supported in the frame and has attached thereto, as shown in Fig. 8, two pairs of cam-arms for each side of the machine, the arms of each pair extending in opposite directions. The forwardly-extending arms 121 engage with pins projecting from the slides 102 and the rearwardly-extending arms 122 with pins 123, projecting from the frames L, which carry the selecting-wires and rods, the cam-surfaces being reversed, as shown, the arms being on opposite sides of the shaft and moving in opposite directions. This shaft 120 is provided with a crank-arm 124, to which is pivotally connected an operating-arm 125, which carries a bowl operated by a groove-cam 200 on the side of the cam-wheel M opposite that of the cam 119, the arm being held in position to reciprocate vertically, as in the case of operating-arm 118. The selecting-wires 62 86, as best shown in Figs. 15 to 17, are attached to the upper ends of needles 126, which are guided in their vertical movement by the upper and lower comb-boards 127 and by the cross-pins 128, passing through elongated eyes or loops in the upper ends of the needles. These needles are provided also with eyes, formed preferably by a turn in the wire of which they are made, through which pass the stop-rods 129, which are attached to and adapted to operate the stops 130 for locking the punches 131, as is usual in this class of mechanism.

In machines of this class in general use at the present time the griff has been so constructed and positioned relative to the stop-rods as to actuate the latter by a direct pull, and the stop-rods have been returned to their normal position by springs, against the tension of which the rods were moved by the griff. The griff in our machine, as shown in Figs. 15 and 16, actuates the stop-rods by means of direct pressure from a solid part attached to the griff, and instead of returning the stop-rods by springs, as heretofore, we provide means for positively returning them to position, the use of springs being very objectionable on account of the difficulty of arranging and retaining in place a large number of small springs and of regulating their tension to secure the certain and uniform return of the different rods.

The griff 132, as best shown in Figs. 7, 15, and 16, consists of a frame adjustably connected to the operating-rods 133 so as to be raised or lowered, for a purpose hereinafter stated, and is provided with a series of inwardly-projecting bars 134, extending longitudinally of the griff and adapted to engage the ends of the stop-rods 129 as the griff is thrown forward, the operating-edges of these bars being preferably concave, as shown, to act as guides to the ends of the stop-rods, insuring the engagement of the bars and rods even if the latter are not in central position. Secured to the frame of the griff, preferably by cross-bars 16, as shown in Fig. 7, and carried by it, are a number of transverse returning-bars 140, one for each horizontal series of stop-rods, and the stop-rods are provided with pins 136, with which the returning-bars engage as the griff returns to position, the returning-bars, as is seen, being free to move over the stop-rods not actuated as the griff is thrown forward, but operating to positively return the stop-rods that have been carried forward by the griff coming in contact with their ends.

For the purpose of returning the needles positively and avoiding the use of springs therewith, as in the case of the stop-rods, we provide a movable frame 137, which is supported by two arms 138, one at each side, to which it is connected by vertical arms and links 194. These arms 138 are rigidly attached to a shaft 195, extending transversely of the frame and having the central rigid arm 196, the other end of which carries a bowl operated by a groove-cam 139 in the cam-wheel M on the same side as the cam 119, the movement of the arm 196 thus rocking the shaft 195 and raising and lowering the frame 137. The movable frame carries a series of cross-pins 135, which are adapted to slide in the loops in the needles 126, but in the normal stationary position of the mechanism are at the lower ends of the loops and hold the needles in their lowest position. The cams 119 and 139, as shown in Fig. 14, are so timed that the arm 196 is actuated by cam 139 to

raise the frame 137 and release the needles for vertical movement at the same time as, or preferably a little before, the cam 119 actuates the arm 118 to move the selectors and
 5 raise the needles, and so that the frame is actuated to return the needles that have been lifted at the same time as, or preferably a little after, the arm 118 is or has been returned to position, releasing the upward draft
 10 of the wires.

Referring now to the general construction and to the mechanism for operating the cam-wheel M and the parts just described, as best illustrated in Figs. 5, 6, 7, and 15, it will be
 15 understood that the machine to which our additions and improvements have been adapted for the construction of a producing machine is in general of the ordinary form of a repeating-machine for Jacquard cards, and the construction and operation of the punches and
 20 punching and card-feeding mechanisms need be described only in a general way, they being well understood by those skilled in the art. Supported in the frame H is a power or
 25 main driving shaft 141, which is provided with a gear meshing with a gear 142, loose upon the shaft 143, but adapted to be engaged with the shaft by the clutch mechanism herein-
 30 after to be described. This shaft 143 is provided at the end opposite the gear 142 with a gear meshing with the enlarged gear 144 on the main operating-shaft 145. At the side of the frame H opposite the gear 144 and above the main shaft 145 is a short shaft 148, pro-
 35 vided with a sprocket-wheel actuated from the main shaft through connections which will presently be described. This shaft gears with a parallel shaft 149, extending across the machine and carrying the square drum
 40 150 for advancing the strip of cards, this drum being provided, as is usual in this class of mechanism, with tapered studs or sprockets 151, adapted to enter holes in the ends of each card for drawing the cards along the tapered
 45 studs, serving to insure the engagement with the cards and to aid in properly positioning them under the punches. The cards are held down upon the drum, so as not to slip off the studs, by springs 163, as shown in Fig. 15.
 50 The shaft 149 is connected by sprocket-wheels and chain 152 to a counter-shaft at the rear of the machine, carrying a second winding-drum 153, provided with studs similar to those on drum 150. These two drums constitute the
 75 feeding mechanism for the strip of cards to be punched, and are actuated by suitable mechanism to make a quarter-revolution after the punching of each card, thus bringing the next card under the punches, which mechanism will now be described. The shaft 145
 60 carries at the end opposite the gear 144 a wheel 176, having on its outer face a pin 178 and a projecting rim 177, of which a portion is broken away, as shown in Figs. 6 and 24.
 65 Parallel with the shaft 145 is a short shaft 179, carrying a wheel 180, which is divided into quadrants by radial grooves, in which

the pin 178 is adapted to enter, thus engaging with the quadrants for rotating the wheel 180 and shaft 179 through a quarter-revolution. 70
 The quadrants of the wheel 180 are concave on their outer surface to form circular surfaces concentric with and adapted to engage the outer surface of the projecting rim 177 on wheel 176, the rim 177 thus holding the wheel 75
 180 and shaft 179 rigidly in position, except when the pin 178 engages the wheel 180 to rotate it, at which time free movement of the wheel is allowed by the opening in the rim being brought opposite the end of the quad- 80
 rant. This shaft 179 carries a sprocket-wheel 181, which engages, through a chain 182, with a similar wheel on the end of shaft 148, which, as previously stated, operates the card-carry- 85
 ing drum 150. This mechanism for giving the card-carrying drum a quarter-revolution at each operation of the punching mechanism is substantially the same as that in general use.

For operating the punching-frame the shaft is provided with eccentrics 154, connected to 90
 the punching-frame 155 through vertical eccentric-rods 156, the movement of these eccentrics raising the punching-frame against the punches and returning them to position at each revolution of the shaft. As shown 95
 in Fig. 15, the cards are led through a slot between the upper and lower horizontal bars of the frame and are carried against the punches in the upward movement of the latter. A shaft 157 above the punching-frame 100
 carries two large punches 158, one at each end of the card, and is operated through pitman 159 by an eccentric on shaft 145, these large punches being driven downward prior to the upward movement of the punching-frame 105
 and through the holes which receive the tapered studs on drums 150 and 153, these punches serving to hold the card rigidly in position during the operation of the punch- 110
 ing-frame 155.

A numbering-machine 209, of ordinary construction, is carried by a short shaft 197 and operated from shaft 145 by an eccentric and connecting-rod 198 at the opposite side of the machine from connecting-rod 159, above de- 115
 scribed. This numbering-machine is operated as each card is punched to impose a number upon one end of the card, as is usual in this class of machines. The griff and stops are operated to lock and unlock the punches by 120
 an eccentric upon shaft 145 and pitman 160, actuated by said eccentric and connected to a crank-arm upon the shaft 161, this shaft being connected by crank-arms 162 and links at each side of the machine to the operating- 125
 rods 133, by which the griff is actuated.

From a sprocket-wheel on shaft 145 a chain 199 extends to a rear shaft, upon which is mounted crank-disk 164, connected to the re- 130
 peating mechanism by a pitman 165. This repeating mechanism in its general construction is the same as heretofore in use and consists of a repeating-drum 166, having each of its four sides perforated to correspond with

the entire series of needles 126 and supported upon a shaft 167, which is carried by two pivoted arms 168, one at each side of the frame, the drum being so mounted as to be readily removed from the supporting-arms when not in use. One of the arms is pivotally connected to the pitman 165, and thus the arms and drum are alternately raised and lowered by crank-plate 164. This drum is provided at each corner with circular lugs 172, pressing against a plate 169, extending across the frame, which plate is carried by arms 170 at each side of the frame, and is pressed forward to hold the drum firmly in position by adjustable springs 171, surrounding arms 170, and held by perforated lugs upon the supporting-arms 168, in which lugs the arms 170 slide. The circular lugs 172 are adapted to engage a beveled hook 173, pivoted to the frame, the construction being such that the drum throws the hook 173 out of its path during the upward movement, but catches upon the hook by the circular lugs during its downward movement, the drum thus being rotated sufficiently to compress the springs 171 and carry the upper lug pressed upon by plate 169 into such a position that the rotation of the drum through an entire quadrant is completed through the recoil of springs 171 acting upon the arms 170 and plate 169, the cards thus being fed forward to bring the next card on the upper side of the drum and under the needles. The frame H carries rearwardly-extending arms 174, provided with rollers 175, over which the perforated cards are passed when the repeating mechanism is in use.

The punching and feeding mechanism thus far described is substantially that of the old repeating-machine. For actuating the cam-wheel M we provide the shaft 145 with a sprocket-wheel outside the frame, from which extends a chain 146 to a similar wheel on the end of the shaft 147, which carries the cam-wheel.

For the purpose of automatically throwing the punching mechanism out of operation after a card has been punched, we have provided the following mechanism. Referring particularly to Figs. 6, 24, and 25, the gear 142, as previously stated, is loose upon the shaft 143, and the latter is provided with a fixed collar 182, within which slides a spring-actuated bar 183, adapted to engage a stud 184, projecting from the side of the loose gear 142. A segment 185, having a cam-groove on its inner surface adapted to engage the spring-pressed bar 183 and retract it from engagement with the stud 184, is carried by an arm upon a lever 186, pivoted to the frame at 186^a and normally held by spring 187 in position with the segment 185 in contact with collar 182. This lever 186 carries an upwardly-projecting stud 188, adapted to engage with the surface of the wheel 176, and is connected at its outer end with the cord extending to the treadle 45 at the front of the machine. The circumference of the wheel 176 upon the in-

ner side is provided with a recess 189, the wheel and recess being so constructed that the front end of lever 186 is held down for the release of clutch-bar 183 when the projection 188 is upon the full portion of the outer surface of wheel 176, but is raised by spring 187 to retract the clutch-bar when the recess is brought opposite the projection. A movement of the treadle by drawing down the lever 186 against the force of spring 187 retracts the segment 185 from the collar 182 and allows the clutch to operate. The stud 188 is thus withdrawn from the recess in wheel 176, and the lever is held down by the outer surface of wheel 176 until the recess 189, again after a revolution of shaft 145 and the punching of the card and return of the parts to their normal positions is completed, comes opposite the stud 188, when the tension of spring 187 returns the lever and the cam-segment to their normal positions, throwing the gear 142 out of engagement with the shaft 143 by the retraction of spring-pressed slide or clutch bar 183.

It is obvious that other forms of mechanism may readily be devised for the purpose of automatically throwing the punching mechanism out of operation when a card has been punched and holding it in this condition till again set in operation by the operator after the parts have been positioned for another card by the movement of the tracing mechanism. The form shown, however, furnishes a convenient and efficient means for this purpose.

The operation of the mechanism for selecting the punches, punching the cards, and returning the parts to position will now be described. The selectors 59 and 69 having been brought into position by the movement of the pattern-carrier C through mechanism the construction and operation of which have already been described, the operator presses upon the treadle 45, thus by needle 6, connected to cord 46, puncturing the pattern-card at the point of the pattern corresponding to that for which the card is to be punched and at the same time rocking the lever 186 to throw the cam-segment 185 out of contact with the collar 182, thus clutching the loose gear 142 to the shaft 143 and setting the actuating mechanism in operation. The cards, suitably fastened together so as to form an extended chain and provided with holes to receive the studs on drums 150 and 153, have previously been placed in position upon the machine, being passed over feeding-drum 153 through the slot in the punching-frame 155 and over the holding and feeding drum 150, as shown in Figs. 6 and 15. The card to be punched now lies within the slotted frame 155 beneath the series of punches 131, which, as shown in Fig. 15 and as is usual in this class of mechanism, extend through perforations in the punching-frame above the card and are held from downward movement by collars bearing against a cross-piece on frame

II. The movement of shaft 143 actuates the main operating-shaft 145, and by means of chain 146, engaging with sprocket-wheels on the shafts 145 and 147, the latter shaft is set in operation, carrying with it cam-wheel M. This movement of the cam-wheel, through groove-cam 119 and arm 118, raises the pivoted arms 115 and cross-bar 106, which, by the engagement of one of the lugs 108 on the cross-bar with one of the ears 105 of collar 104 on rod 103, raises the front end of the pivoted lever 112, attached to the rod 103, and moves the inner end of the lever downward, carrying with it the sleeve 57 on shaft K. It will be understood that the cross-bar 106 operates either or both of the rods 103, levers 112, and sleeves 57 for the two series of selectors and selecting-wires at either side of the machine in accordance with the movement of the tracing mechanism, the slot in the cross-bar 106 allowing the bar to move upward without engagement with the ears 105 on either rod unless swung into position above the cross-bar by the movement of the pattern-carrier transmitted through the friction-disks 98, friction-fork 100, and slide 102.

The operation of the lifting and returning mechanism on both sides of the machine being the same, a description of the operation on one side will suffice. The collar 57, when moved downward by lever 112, carries with it the inner ends of levers 55 and 71, to the outer ends of which are attached the connections for operating the selectors 59 and 69, which, as already described, have been brought under the selecting-rods corresponding to the position of the pattern-carrier and adapted to select the punches for the perforation of a card for the point of the pattern now under the tracer. As the lifters are raised by the movement of the levers there are also raised by their respective selectors one of the selecting-rods 61 for the direction series of punches and two of the lifting-rods 84 for the extent series. The lifting-rod 61 has attached thereto, as previously stated, two cords 62, extending to different needles, and each of the rods 84 is attached to a single needle by the wire 86. As the lifter 69 is raised the sliding block 68 carries with it the conical pin 73, which, by engagement with one of the conical perforations 87 in the frame L, centers the frame, bringing the desired pins exactly over the lifter 69. At the same time as or a little before the operation of the arm 118 by cam 119 the arm 196 is actuated by outer groove-cam 139 on the same side of the cam-wheel M, thus rocking the shaft 195 and raising the movable frame 137. This upward movement of the frame relieves the downward pressure of wires 135 upon the needles at the ends of the loops and allows the needles 126 to be raised by the movement of wires 62 and 86. As these needles are raised, being guided by their loops encircling pins 128 and by the comb-boards 127, they raise with them the outer ends of stop-rods 129 and carry them

into line with the inward concaved projections 134 of the griff 132, thus placing them in position to be operated by the forward movement of the griff, as presently to be described. The arm 160, operated by an eccentric upon the shaft 145, now rocks shaft 161, and through crank-arms 162 and the operating-rods 133 moves the griff 132 inward, thus carrying with it the stop-rods 129, which have been raised, as previously described, the projections 134 sliding above the stop-rods not actuated by the selecting-wires. These stop-rods 129 in their forward movement carry with them stops 130, which are thus brought over their respective punches 131, locking them in position against upward movement when the punching-frame 155 is raised. Meanwhile the large punches 158 have been operated, thus passing through the guiding-holes in the cards and holding them firmly in position for operation of the punching-frame. The punching-frame 155 is now raised by the eccentric-rods 156, operated by eccentrics upon the shaft 145, carrying with it the punches not locked in position and perforating the card by means of the punches thus locked by stops 130. The numbering mechanism 209 is operated at the same time to number the end of the punched card. The card having been punched, the punching-frame 155 is withdrawn, leaving the cards free to move forward through the slot in said frame, the cards being now advanced to bring the next card into position by means of the mechanism previously described, and shown in Figs. 6 and 24. During this forward movement of the card the cross-bar 106 has been lowered by the action of cam 119, thus releasing the rod 103 and lever 112, connected thereto, and allowing these parts to be returned their normal positions by spring 114. As the outer end of lever 112 is lowered the inner end rises, carrying with it the collar 57 on shaft K and returning to their normal positions the selectors 59 and 69. As previously stated, in case the springs 114 fail to return the levers 112 they will be positively returned by the downward movement of the cross-bar 106 through projection 111 thereon and pin 110 on bar 103. The selectors having been withdrawn from contact with the pins 60 and 85, the selecting rods and wires are free to move downward, and the cam 139 at the same time as, or preferably a little after, the operation of cam 119 actuates arm 196 to carry downward the movable frame 137, which engages the lower ends of the loops in needles 126 by wires 135 and positively returns the needles to position, the griff 134 having previously been withdrawn through the operation of the shaft 161 and arms 133, thus positively returning the stop-rods and stops to their normal outer position by means of returning-bars 140 on the griff and pins 136, projecting from the stop-rods. Immediately upon the return of these parts to their normal positions, as above described, the cam 200 on the cam-wheel M rocks the shaft 120

through operating-arm 125 and crank-arm 124, and by the forwardly-extending cam-arms 121 carries the rods 103 back to their normal central positions and by the rear arms 122 centers the frames L, carrying the two series of selecting-rods and wires, the shaft and arms being then returned to their normal positions to allow the movement of the rods and frames when another card is to be perforated. During this entire operation the cam-segment 185 has been held out of contact with the collar 182 by the stud 188 on lever 186, riding upon the outer surface of wheel 176. As the operation of the machine in punching one card and advancing the card for the next operation is completed the stud 188 enters the recess 189 in the wheel 176 and the spring 187 raises the lever 186, throwing the cam-segment into position to retract the spring-slide 183, thus automatically throwing out of operation the entire mechanism, except that operated by the movement of the pattern-carrier, in which condition it will remain until the treadle is again operated. For operating the machine as a repeating-machine the following changes and adjustments are made: The repeating-drum 166, with its shaft 167, is mounted in the supporting-arms 168, and the griff 132 is lowered upon the actuating-arms 133 by the slots and nuts shown in Fig. 7, so that the inward projections of the griff are opposite the ends of all the stop-rods 126, as shown in Fig. 16. The series of perforated cards which are to be repeated are carried over the rollers 175 and the repeating-drum 166, as is usual in this class of mechanism, the card to be repeated lying upon the top of the drum and covering all the perforations therein, except those corresponding to holes in the card. As the machine is to operate continuously, the lever 186 is thrown down and held against the tension of the returning-spring by means of any suitable catch, the gear 142 thus being constantly clutched to and operating the shaft 143. As the rods hang in their central positions and are not actuated by the movement of the pattern-carrier to throw either of their ears 105 in the path of lugs 108 on cross-bar 106, the raising of the cross-bar through cam 119 will not lift the rods 103 to actuate the lifting mechanism; but for the purpose of greater security, as the cross-bar might strike the ears, the arm 118, with its bowl, is preferably removed, and the arm 125, operating the centering mechanism, may likewise be removed, if desired, its operation not being necessary in the repeating movement; but the removal of this latter arm is wholly unnecessary.

The operation of the machine as a repeater is substantially that of the repeating-machine to which my additions and improvements have been applied, and need not be described in detail, it being readily understood that the perforated card on repeating-drum 166 as the drum is raised raises all the needles 126, ex-

cepting those opposite the perforations in the cards, so that the griff in its forward movement actuates only those stop-rods corresponding to the series of perforations in the cards. The operation of the punching mechanism is the same as when the machine is used as a producer, as previously described.

It will be seen that in the operation of the machine as a repeater, as well as when used as a producer, the needles 126 are positively returned by the movable frame 137, actuated by cam 139; also, that the stop-rods carried forward by the griff are positively returned by the backward movement of the griff through returning-bars 140.

In Figs. 18 to 21 a modification of the tracing mechanism is illustrated, in which the pattern-carrier C consists of a table substituted for the cylinder of Figs. 1 to 3, this table being moved to the right or left or forward or backward by means substantially the same as those previously described, excepting that in place of the lost-motion, adjusting device on shaft 20 for regulating the movement of the collar 1 and worm 19 a second adjusting mechanism is employed similar to that used on the central cross-bar of carriage B, and shown in detail in Figs. 22 and 23, previously referred to.

Referring to Figs. 18 to 21, showing the modified construction, it will be seen that the carriage B slides, as in the case of the cylindrical pattern-carrier, upon rails 10 upon the base of the machine A. The carriage B is provided upon its upper surface with rails 201, upon which slides transversely of the machine the pattern-carrier C, consisting of a flat table, as shown, upon which is carried the pattern P. The tracer E is supported, as before, upon arm D, which may extend from the floor or base of the machine or from a side wall, as shown. The shafts 25 and 40, provided, respectively, with the sprocket-wheels 88 and 89 for operating the shafts 93, extend directly to the front of the machine, where they carry the hand-wheels F G. The front of the machine may be provided, if desired, with segments 202, carrying, as shown in Fig. 21, letters for indicating the direction of movement of the pattern-carrier, these segments corresponding with the cards previously described as exposed to view upon the front of the machine through the openings in the card N. The shaft 25, for imparting a longitudinal movement to the carriage B and the carrier corresponding to the rotary movement of the cylinder of Figs. 1 to 4, is screw-threaded, and engages with the carriage B through a lost-motion-adjusting device 203, similar to that shown in detail in Figs. 22 and 23. The shaft 40, for imparting a sidewise movement to the carrier corresponding to the similar movement of the carriage B and cylinder of Figs. 1 to 4, has splined upon it a bevel-gear 204, carried by an arm 205, projecting from the carriage B. This gear 204 engages with a similar gear 206 on a screw-shaft 207, car-

ried by the carriage B and extending transversely of the machine, this screw-shaft engaging and operating the table C through a lost-motion-adjusting device 208, similar to that previously described.

The operation of this mechanism is as follows: The rotation of hand-wheel F imparts a forward or backward movement to the carriage B and pattern-carrier, and the rotation of hand-wheel G in either direction imparts a sidewise movement in either direction to the pattern-carrier C upon the rails 201 on the carriage, any point upon the pattern P thus being brought beneath the tracer E by the single or combined movement of the hand-wheels and connected shafts. The connections from the shafts 25 and 40 and the selecting mechanism are of course the same as with the cylindrical pattern-carrier. It will be seen that this construction is simpler than the construction shown in Figs. 1 to 4; but the latter is preferred, as the pattern P will generally be of a considerable length, necessitating an extended movement of the table C toward the front of the machine, the operator thus being placed at a distance from the tracer, rendering it difficult for him to see whether the point of the tracer is exactly over the desired point upon the pattern. This difficulty is obviated by the use of a cylindrical pattern-carrier, since as the length of the pattern extends around the surface of the cylinder and there is no forward and backward movement of the frame the operator may, as shown by the position of the hand-wheels in Figs. 2 to 4, be placed close to the cylinder in a convenient position for observing the exact point on the pattern indicated by the tracer.

It is obvious that the details of the machine shown and described may be changed in many ways without departing from our invention. Thus while we have shown the pattern-carrier as movable it is evident that the action of the parts of the tracing mechanism may readily be reversed and the tracer carried by the carriage, the pattern being stationary. Such a construction is the full equivalent of that shown, and by the term "tracing mechanism" used in the claims we intend to cover all forms of tracing mechanism consisting, essentially, of a tracer and pattern-carrier, the relative positions of which may be changed so as to bring opposite the tracer successively the different points upon the pattern for which cards are to be punched, whether the relative positions of these parts are so changed by the movement of the tracer or the pattern-carrier.

The machines shown and described, moreover, constitutes but one embodiment of our invention, while the invention, broadly, is applicable to all classes of Jacquard-card-punching machines. As this machine has been constructed for use in perforating cards for embroidering-machines requiring the production of movements in any direction in a single plane and

movements varying widely in extent, the tracing mechanism has been constructed to allow a similar range of movement and a plurality of selecting mechanisms, and a series of punches have been provided for the production of the perforations corresponding to the different movements. For perforating cards to be used in machines requiring movements of more limited range in direction and extent the perforating-machine may evidently be of much simpler construction. Thus in perforating cards for use in a loom in which only an up-and-down movement of the threads may be necessary and the extent of this movement invariable it is evident that but a single series of punches would be required, and that the selecting and tracing mechanisms may be correspondingly simplified.

It is evident, also, that our invention is not dependent upon the special form of punching-machine shown and described, in which the punches are rendered operative by being locked in position and the perforations produced by the movement of the card against the locked punches, this being only one of the common forms of such machines, while our invention is of general application in machines for punching Jacquard cards, whatever be the form of punching mechanism employed.

While we have shown a machine in which the selector is positioned by a horizontal movement and actuated to control the punches by a vertical movement, it will be understood that the movement of this part may be modified as desired in accordance with the special form of the machine in which my invention is embodied, and that the form and movement of the selector and the means by which it operates to select the punches for which it is positioned may be varied within wide limits without departing from our invention.

What we claim is—

1. In a machine of the class described, the combination, with the punches and selecting mechanism therefor, of a tracing mechanism and connections between the tracing mechanism and the selecting mechanism, whereby the movement of the tracing mechanism is transmitted to the selecting mechanism and controls the latter to determine the punches to be selected, substantially as described.

2. In a machine of the class described, the combination, with the punches and selecting mechanism therefor, of a tracing mechanism having a universal movement, and connections between the tracing mechanism and the selecting mechanism, whereby the movement of the tracing mechanism in any direction is transmitted to the selecting mechanism and controls the latter to determine the punches to be selected, substantially as described.

3. In a machine of the class described, the combination, with the punches and a plurality of selecting mechanisms therefor, of a tracing mechanism and connections between the tracing mechanism and the selecting mechanisms,

whereby the movement of the tracing mechanism is transmitted to one or more of the selecting mechanisms and controls the latter to determine the punches to be selected, substantially as described.

4. In a machine of the class described, the combination, with the punches and a plurality of selecting mechanisms therefor, of a tracing mechanism and independent connections between the tracing mechanism and selecting mechanisms, whereby the movement of the tracing mechanism is transmitted to one or more of the selecting mechanisms and controls the latter to determine the punches to be selected, substantially as described.

5. In a machine of the class described, the combination, with series of direction and extent punches and selecting mechanism therefor, of a tracing mechanism and connections between the tracing mechanism and the selecting mechanism, whereby the movement of the tracing mechanism is transmitted to the selecting mechanism and controls the latter for the selection of both direction and extent punches, substantially as described.

6. In a machine of the class described, the combination, with a plurality of series of direction-punches and a plurality of series of extent-punches and a plurality of selecting mechanisms therefor, of a tracing mechanism and connections between the tracing mechanism and the selecting mechanisms, whereby the movement of the tracing mechanism is transmitted to one or more of the selecting mechanisms and controls the latter for the selection of both direction and extent punches from one or more of the series, substantially as described.

7. In a machine of the class described provided with punches and selecting mechanism therefor, the combination of a movable selector the position of which determines the punches to be selected, a tracing mechanism, and connections between the tracing mechanism and the selector, whereby the movement of the tracing mechanism is transmitted to and positions the selector for the selection of the punches corresponding to the point of the pattern for which a card is to be punched, substantially as described.

8. In a machine of the class described provided with punches and selecting mechanism therefor, the combination of a selector the position of which determines the punches to be selected, said selector being adapted to be rotated in either direction, a tracing mechanism, and connections between the tracing mechanism and the selector, whereby the movement of the tracing mechanism is transmitted to the selector and rotates the latter to position for the selection of the punches corresponding to the point of the pattern for which a card is to be punched, substantially as described.

9. In a machine of the class described provided with punches and selecting mechanism therefor, the combination of a movable se-

lector the position of which determines the punches to be selected, a tracing mechanism having a universal movement, and connections between the tracing mechanism and the selector, whereby the movement of the tracing mechanism in any direction is transmitted to and positions the selector for the selection of the punches corresponding to the point of the pattern for which a card is to be punched, substantially as described.

10. In a machine of the class described provided with punches and selecting mechanism therefor, the combination of a plurality of movable selectors the position of which determines the punches to be selected, a tracing mechanism having a universal movement, and connections between the tracing mechanism and the selectors, whereby the movement of the tracing mechanism in any direction is transmitted to and positions some or all of the selectors for the selection of the punches corresponding to the point of the pattern for which a card is to be punched, substantially as described.

11. In a machine of the class described provided with series of direction and extent punches and selecting mechanism therefor, the combination of a plurality of movable selectors the position of which determines the punches to be selected, a tracing mechanism, and connections between the tracing mechanism and the selectors, whereby the movement of the tracing mechanism is transmitted to and positions the selectors for the selection of both direction and extent punches, substantially as described.

12. In a machine of the class described provided with series of direction and extent punches and selecting mechanism therefor, the combination of a movable selector for each series of punches, the position of which determines the punches to be selected, a tracing mechanism, and connections between the tracing mechanism and the selectors, whereby the movement of the tracing mechanism is transmitted to and positions the selectors for the selection of both direction and extent punches, substantially as described.

13. In a machine of the class described provided with a plurality of series of direction-punches and a plurality of series of extent-punches and selecting mechanism therefor, the combination of a plurality of movable selectors the position of which determines the punches to be selected, a tracing mechanism, and connections between the tracing mechanism and the selectors, whereby the movement of the tracing mechanism is transmitted to and positions some or all of the selectors for the selection of direction and extent punches from one or more of the series, substantially as described.

14. In a machine of the class described, the combination, with the punches, of a movable selector the position of which determines the punches to be selected, mechanism for operating the selector to select the punches for

which it is positioned, normally-broken operating connections between the operating mechanism and the selector, a tracing mechanism, and connections between the tracing mechanism and the operating connections and selector, whereby the operation of the tracing mechanism simultaneously positions the selector for the selection of the desired punches and adjusts the operating connections for the operation of the selector, substantially as described.

15. In a machine of the class described, the combination, with the punches, of a movable selector the position of which determines the punches to be selected, mechanism for operating the selector to select the punches for which it is positioned, normally-broken connections between the operating mechanism and the selector, a tracing mechanism, connections between the tracing mechanism and the selector for positioning the selector, and yielding connections between the tracing mechanism and the operating connections, whereby the movement of the tracing mechanism adjusts the operating connections for the operation of the selector and the movement of the tracing mechanism and selector is permitted after the operating connections are adjusted, substantially as described.

16. In a machine of the class described, the combination, with the punches, of a plurality of movable selectors the position of which determines the punches to be selected, mechanism for operating the selectors to select the punches for which they are positioned, normally-broken connections between the operating mechanism and the selectors, a tracing mechanism, and connections between the tracing mechanism and the selectors and operating connections, whereby the movement of the tracing mechanism simultaneously positions one or more of the selectors for the selection of the desired punches and adjusts the operating connections for the operation of the selector or selectors thus positioned, substantially as described.

17. In a machine of the class described, the combination, with the punches, of a series of selecting-rods corresponding to the punches, connections between said selecting-rods and punches, whereby the punches to be operated are determined by the operation of the selecting-rods, a selector for operating the selecting-rods, a tracing mechanism, and connections whereby the relative positions of the selector and selecting-rods are varied by the movement of the tracing mechanism for the operation of the selecting-rods which select the punches corresponding to the point of the pattern for which a card is to be punched, substantially as described.

18. In a machine of the class described, the combination, with the punches, of a circular series of selecting-rods corresponding to the punches, connections between said selecting-rods and punches, whereby the punches to be operated are determined by the operation of

the selecting-rods, a selector for operating said selecting-rods, a tracing mechanism, and connections whereby the relative positions of the selector and selecting-rods are varied by the movement of the tracing mechanism for the operation of the selecting-rods selecting the punches corresponding to the point of the pattern for which a card is to be punched, substantially as described.

19. In a machine of the class described, the combination, with the punches, of a series of selecting-rods corresponding to the punches, connections between said selecting-rods and punches, whereby the punches to be operated are determined by the operation of the selecting-rods, a selector for operating the selecting-rods for which it is positioned, a tracing mechanism, and connections between the tracing mechanism and the selector, whereby the movement of the tracing mechanism is transmitted to and positions the selector for the operation of the selecting-rods which select the punches corresponding to the point of the pattern for which a card is to be punched, substantially as described.

20. In a machine of the class described, the combination, with series of direction and extent punches, of corresponding series of selecting-rods, connections between said selecting-rods and punches, whereby the punches to be selected are determined by the operation of the selecting-rods, a selector for each series of selecting-rods, a tracing mechanism, and connections between the tracing mechanism and selectors, whereby the movement of the tracing mechanism is transmitted to and positions the selectors for the operation of selecting-rods from each series, substantially as described.

21. In a machine of the class described, the combination, with a plurality of series of direction-punches and a plurality of series of extent-punches, of corresponding series of selecting-rods, connections between said selecting-rods and punches, whereby the punches to be operated are determined by the operation of the selecting-rods, a selector for each series of selecting-rods, a tracing mechanism, and connections between the tracing mechanism and the selectors, whereby the movement of the tracing mechanism is transmitted to some or all of the selectors and positions the latter for the operation of the selecting-rods to select both direction and extent punches from one or more of the series, substantially as described.

22. In a machine of the class described, the combination, with the punches, of stops controlling said punches, a movable selector, connections between the selector and the stops, whereby the position of the selector determines the stops to be operated, a tracing mechanism, and connections between the tracing mechanism and selector, whereby the movement of the tracing mechanism is transmitted to and positions the selector for the operation of the stops which select the punches corre-

sponding to the point of the pattern for which a card is to be punched, substantially as described.

23. In a machine of the class described, the combination, with the punches, of stops by which said punches are locked in position for operation, a movable selector, connections between the selector and the stops, whereby the position of the selector determines the stops to be operated to lock the corresponding punches, a tracing mechanism, and connections between the tracing mechanism and selector, whereby the movement of the tracing mechanism is transmitted to and positions the selector for the operation of the stops corresponding to the point of the pattern for which a card is to be punched, substantially as described.

24. In a machine of the class described, the combination, with the punches and stops controlling said punches, of a series of selecting-rods corresponding to the punches and stops, connections between the selecting-rods and stops, whereby the operation of the selecting-rods determines the stops to be operated, a selector for operating the selecting-rods for which it is positioned, a tracing mechanism, and connections between the tracing mechanism and selector, whereby the movement of the tracing mechanism is transmitted to and positions the selector for the operation of the selecting-rods selecting the punches corresponding to the point of the pattern for which a card is to be punched, substantially as described.

25. In a machine of the class described, the combination, with the punches and stops by which said punches are locked in position for operation, of a series of selecting-rods corresponding to the punches and stops, connections between the selecting-rods and the stops, whereby the operation of the selecting-rods determines the stops to be operated to lock the corresponding punches, a tracing mechanism, a selector for operating the selecting-rods for which it is positioned, and connections between the tracing mechanism and selector, whereby the movement of the tracing mechanism is transmitted to and positions the selector for the operation of the selecting-rods controlling the stops corresponding to the point of the pattern for which a card is to be punched, substantially as described.

26. The combination, with the punches, of stop-rods carrying stops by which said punches are locked in position for operation, a griff for operating said stops to lock the selected punches, a series of needles for moving said stop-rods into position to be actuated by said griff, a series of selecting-rods connected to and actuating said needles, a selector for operating the selecting-rods for which it is positioned, a tracing mechanism, and connections between the tracing mechanism and the selector, whereby the movement of the tracing mechanism is transmitted to and positions the selector for the operation of the se-

lecting-rods controlling the stops corresponding to the point of the pattern for which a card is to be punched, substantially as described.

27. In a machine of the class described provided with punches and selecting mechanism therefor, the combination of a shaft K, adapted to be rotated in either direction, a selector the position of which determines the punches to be selected, connections between the selector and shaft, whereby the selector is positioned by the rotation of the shaft, a tracing mechanism, and connections between the tracing mechanism and the shaft, whereby the movement of the tracing mechanism rotates the shaft and positions the selector for the selection of the punches corresponding to the point of a pattern for which a card is to be punched, substantially as described.

28. In a machine of the class described provided with punches and selecting mechanism therefor, the combination of a shaft K, adapted to be rotated in either direction, a selector the position of which determines the punches to be selected, connections between the selector and shaft, whereby the selector is positioned by the rotation of the shaft, a tracing mechanism, and connections between the tracing mechanism and the shaft, whereby the movement of the tracing mechanism rotates the shaft and positions the selector for the selection of the punches corresponding to the point of the pattern for which a card is to be punched, and means for operating said selector to select the punches for which it is positioned, substantially as described.

29. In a machine of the class described provided with punches and selecting mechanism therefor, the combination of a shaft K, adapted to be rotated in either direction, a selector carried by said shaft, the position of which determines the punches to be selected, a tracing mechanism, and connections between the tracing mechanism and the shaft, whereby the movement of the tracing mechanism rotates the shaft and positions the selector for the selection of the punches corresponding to the point of the pattern for which a card is to be punched, substantially as described.

30. In a machine of the class described provided with series of direction and extent punches and selecting mechanism therefor, the combination of a shaft K, adapted to be rotated in either direction, selectors carried by said shaft, the position of which determines the punches to be selected, a tracing mechanism, and connections between the tracing mechanism and the shaft, whereby the movement of the tracing mechanism rotates the shaft and positions the selectors for the selection of both direction and extent punches corresponding to the point of the pattern for which a card is to be punched, substantially as described.

31. In a machine of the class described provided with punches and selecting mechanism therefor, the combination of a plurality of

shafts K, adapted to be rotated in either direction, selectors carried by said shafts, the position of which determines the punches to be selected, a tracing mechanism, and connections between the tracing mechanism and the shafts, whereby the movement of the tracing mechanism rotates one or more of the shafts and positions the selectors for the selection of the punches corresponding to the point of the pattern for which a card is to be punched, substantially as described.

32. In a machine of the class described provided with a plurality of series of direction-punches and a plurality of series of extent-punches and selecting mechanism therefor, the combination of a plurality of shafts K, adapted to be rotated in either direction, selectors carried by said shafts, the position of which determines the punches to be selected, a tracing mechanism, and connections between the tracing mechanism and the shafts, whereby the movement of the tracing mechanism rotates one or more of the shafts and positions the selectors for the selection of both direction and extent punches from one or more of the series, substantially as described.

33. In a machine of the class described, the combination, with the punches, of a shaft K, adapted to be rotated in either direction, a series of selecting-rods corresponding to the punches and arranged about said shaft, connections between said selecting-rods and punches, whereby the punches to be operated are determined by the operation of the selecting-rods, a selector carried by said shaft for operating the selecting-rods for which it is positioned, a tracing mechanism, and connections between the tracing mechanism and the shaft, whereby the movement of the tracing mechanism rotates the shaft and positions the selector for the operation of the selecting-rods which select the punches corresponding to the point of the pattern for which a card is to be punched, substantially as described.

34. In a machine of the class described, the combination, with the punches, of a plurality of shafts K, adapted to be rotated in either direction, series of selecting-rods corresponding to the punches and arranged about said shafts, connections between said selecting-rods and punches, whereby the punches to be operated are determined by the operation of the selecting-rods, selectors carried by said shaft for operating the selecting-rods for which they are positioned, a tracing mechanism, and connections between the tracing mechanism and the shafts, whereby the movement of the tracing mechanism rotates one or more of the shafts and positions the selectors for the selection of the punches corresponding to the point of the pattern for which a card is to be punched, substantially as described.

35. In a machine of the class described, the combination, with a plurality of series of direction and extent punches, of a shaft K for each series of direction-punches and a plu-

rality of series of extent-punches, corresponding series of selecting-rods arranged about each of said shafts, connections between said selecting-rods and punches, whereby the punches to be operated are determined by the operation of the selecting-rods, selectors carried by said shaft, a tracing mechanism, and connections between the tracing mechanism and the shafts, whereby the movement of the tracing mechanism rotates one or more of the shafts to position the selectors for the selection of both direction and extent punches from one or more of the series, substantially as described.

36. In a machine of the class described provided with punches and selecting mechanism therefor, the combination of a shaft adapted to be rotated in either direction, a series of selecting-rods arranged about said shaft and forming a part of the selecting mechanism, an arm carried by said shaft and provided with a movable selector, a lever pivoted in said arm and engaging the selector, and means for actuating the shaft and lever, substantially as described.

37. In a machine of the class described provided with punches and selecting mechanism therefor, the combination of a shaft adapted to be rotated in either direction, a series of selecting-rods arranged about said shaft and forming a part of the selecting mechanism, an arm carried by said shaft and provided with a movable selector, a sleeve mounted to slide on said shaft, a lever pivoted in the arm and engaging the selector and sleeve at its opposite ends, and means for actuating the shaft and sleeve, substantially as described.

38. In a machine of the class described, the combination of a shaft adapted to be rotated in either direction, an arm having a yielding connection with said shaft, a selector carried by the arm, a series of selecting-rods arranged about the shaft, and stops for limiting the movement of the arm with the shaft, whereby the selector may be stopped in position to actuate the rods desired, the shaft being left free to rotate, substantially as described.

39. In a machine of the class described, the combination of a shaft, a plurality of series of selecting-rods arranged about the shaft, arms carried by said shaft and provided with selectors movable in their respective arms, one of said arms having a yielding connection to the shaft, and stops for limiting the movement of the yieldingly-connected arm, whereby the selectors are positioned by the rotation of the shaft for the operation of the desired selecting-rods, substantially as described.

40. In a machine of the class described, the combination of a shaft adapted to rotate in either direction, a series of selecting-rods arranged about said shaft, a selector carried by an arm on said shaft, said selector being provided with two operating-arms and having an oscillatory movement on its support to bring one or the other arm into position to operate

said rods according to the direction of rotation of the shaft and selector, and yielding connections between the selector and a fixed part of the machine, whereby as the shaft is
 5 rotated in either direction against the tension of the yielding connections the selector is oscillated into and held in position with one of its operating-arms in position to operate the selecting-rods, substantially as described.

10 41. In a machine of the class described, the combination of a movable selector the position of which determines the punches to be selected, a tracer and pattern-carrier, one of which is movable relatively to the other, an
 15 operating mechanism, and connections between the operating mechanism and the movable member of the tracing mechanism and the selector, both sets of connections being provided with adjustable lost-motion devices
 20 whereby the tracing mechanism and selector are moved simultaneously and the backlash is taken up on a reverse movement, substantially as described.

42. In a machine of the class described, the
 25 combination, with a movable selector the position of which determines the punches to be selected, of a tracer, a cylindrical pattern-carrier mounted to rotate in either direction to bring under the tracer successively the points
 30 of the pattern for which the cards are to be punched, and connections between the carrier and the selector, whereby the movement of the pattern-carrier is transmitted to and positions the selector for the selection of the
 35 punches corresponding to the point of the pattern for which the card is to be punched, substantially as described.

43. In a machine of the class described, the combination of a carriage, a cylindrical pattern-carrier mounted on said carriage to rotate in either direction at right angles to the line of movement of the carriage, and means for imparting rotary movement to the cylinder and sliding movement to the carriage in
 45 either direction, substantially as described.

44. In a machine of the class described, the combination, with the punching and punch-selecting mechanism, of a pattern-carrier and tracer the relative positions of which are
 50 varied in accordance with the movements of the selecting mechanism to determine the punches to be operated, means for setting the punching mechanism in operation for punching the card after the punches are selected, and a marker movable to and from the pattern and connected to and operated by said means, whereby the marker is moved against the pattern and marks the point for which each card is punched, substantially as
 60 described.

45. In a machine of the class described provided with punches and selecting mechanism therefor, the combination of a series of needles forming a part of said selecting mechanism,
 65 means for moving from their normal positions the needles corresponding to the punches to be selected, a repeater-drum for moving all

the needles except those corresponding to the punches to be selected, and means for operating the selecting mechanism to select either
 70 the punches corresponding to the needles moved out of their normal positions or to select the punches corresponding to the needles not moved out of their normal positions, substantially as described.

75 46. In a machine of the class described, the combination, with the punches, of stop-rods normally out of position to render the punches operative, needles engaging said rods, means for moving the needles and stop-rods corresponding to the punches to be operated, a repeater-drum for moving the needles and stop-rods corresponding to the punches not to be operated, mechanism for operating the stop-rods, and means for adjusting said operating
 85 mechanism to actuate the stop-rods either when in their normal positions or only when moved out of their normal positions, substantially as described.

47. In a machine of the class described, the
 90 combination, with the punches and stop-rods, of a griff for actuating said stop-rods and means for adjusting the relative positions of the stop-rods and griff, so that the griff shall actuate the stop-rods when in their normal
 95 positions or only when moved out of their normal positions, substantially as described.

48. In a machine of the class described, the combination, with the punches and stop-rods, of a griff for actuating said stop-rods and means for adjusting the griff into position to actuate the stop-rods when in their normal positions or to actuate the stop-rods only when moved out of their normal positions, substantially as described.
 105

49. The combination, with the reciprocating carriage B and the pattern-carrier C, mounted on said carriage and moving at right angles thereto, of the handles F G and connections between the handles and carriage and carrier, substantially as described.
 110

50. The combination, with the reciprocating carriage B and the pattern-carrier C, mounted on said carriage and moving at right angles thereto, of the handles F G and connections for operating said carriage and carrier, adjustable lost-motion devices forming a part of each of said connections, substantially as described.
 115

51. The combination, with the movable pattern-carrier C and the shaft K, adapted to rotate in either direction, of the handles F G and connections between the handles and the carrier and shaft, adjustable lost-motion devices forming a part of each of said connections, substantially as described.
 125

52. The combination of the shaft 93, swinging rod 103, connections for operating the rod from the shaft, lever 112, connected to said rod, slotted cross-bar 106, and means for operating the cross-bar to engage the rod and actuate the lever when the rod is swung in either direction from its central position, substantially as described.
 130

53. The combination of the shafts 93, swinging rods 103, connections for operating the rods from the shafts, levers 112, connected to said rods, slotted cross-bar 106, and means for
 5 operating the cross-bar to engage the rod or rods and actuate one or both of the levers when one or both of the rods are swung in either direction from a central position, substantially as described.

10 54. The combination, with the shaft K, adapted to rotate in either direction and carrying one or more selectors, of a shaft 93 for actuating said shaft, swinging rod 103, yielding connections between the shaft 93 and rod, slotted
 15 cross-bar 106, means for operating the cross-bar to engage the rod when the latter is swung in either direction, and the lever 112, carrying the rod and connected to operate the selector or selectors, substantially as de-
 20 scribed.

55. The combination, with the selecting-rods 61, of the shaft K, friction-disk 51, arm 53, having friction-piece 52, stops 63, selector 59, and means for actuating said selector, sub-
 25 stantially as described.

56. The combination, with the selecting-rods 61, of the shaft K, friction-disk 51, arm 53, having friction-piece 52, stops 63, selector 59, lever 55 for operating said selector, sleeve
 30 57, loose on the shaft and engaging the lever 55, and means for moving said sleeve, substantially as described.

57. The combination of shaft K, selecting-rods 61 84, selectors 59 69, carried by said
 35 shaft into position to operate selecting rods, levers 55 71 for operating said selectors, sleeve 57, loose on the shaft and engaging the levers 55 71, and a lever 112 for operating said sleeve, substantially as described.

40 58. The combination of shaft K, arm 64, carried by the shaft, forked selector 69, pivoted on said arm, arm 76, loose on said shaft and engaging a fixed friction-disk 81, a lever connection between the selector and the arm
 45 76, and a lost-motion connection between the arms 64 and 76, substantially as described.

59. The combination of shaft K, arm 64, carried by said shaft, forked selector 69, pivoted on said arm, fixed friction-disk 81, a
 50 friction-piece moving with the shaft and engaging the friction-disk, and a lever connection between the selector and the friction-piece, substantially as described.

60. The combination, with the movable
 55 frame L, carrying the selecting-rods and pro-

vided with holes 87, registering with the rods, of the selector 69, carrying a beveled pin 73, adapted to enter one of the holes as the selector is actuated, whereby the frame is positioned for the operation of the selecting-rods 60
 by the selector, substantially as described.

61. The combination, with the needles 126, of wires 86, selecting-rods 84, and a selector for actuating any of said rods for which it is positioned, substantially as described. 65

62. The combination, with the needles 126, of wires 86, selecting-rods 84, selector 69, and means for positioning and actuating said selector to operate selected needles, substantially as described. 70

63. The combination, with the needles 126, of the frame 137, engaging said needles, and mechanism whereby said frame is moved to allow the needles to be operated and to positively return the operated needles to their
 75 normal position, substantially as described.

64. The combination, with the needles 126, of a selector, as 59 or 69, connections between the selector and needles, and means for positioning and actuating said selector to operate
 80 selected needles, substantially as described.

65. The combination, with the needles 126, of the frame 137, engaging said needles, arm 138, carrying said frame and rigidly connected to shaft 195, and arm 196 and cam 139 for
 85 rocking said shaft, substantially as described.

66. The combination, with the needles 126, provided with loops, of the frame 137, having cross-wires 135 extending through said loops, and mechanism whereby said frame is moved
 90 to allow the needles to be operated and to positively return the operated needles to their normal position, substantially as described.

67. The combination, with stop-rods 129, carrying pins 136, of griff 132, engaging said
 95 stop-rods on its movement in one direction, and returning-bars 140, carried by said griff and engaging pins 136 to return the stop-rods to their normal position on the return movement of the griff, substantially as de- 100
 scribed.

In testimony whereof we have hereunto set our hands in the presence of two subscribing witnesses.

JOS. IRISH.
 SAMUEL J. BRIDEN.

Witnesses:

STEPHEN OSBORNE,
 W. B. BOSTWICK.