No. 819,263. PATENTED MAY 1, 1906.

H. P. BALL.

MACHINE FOR TRANSFERRING PATTERNS.

APPLICATION FILED OCT. 24, 1903.

4 SHEETS—SHEET 1.

FIG. 1.

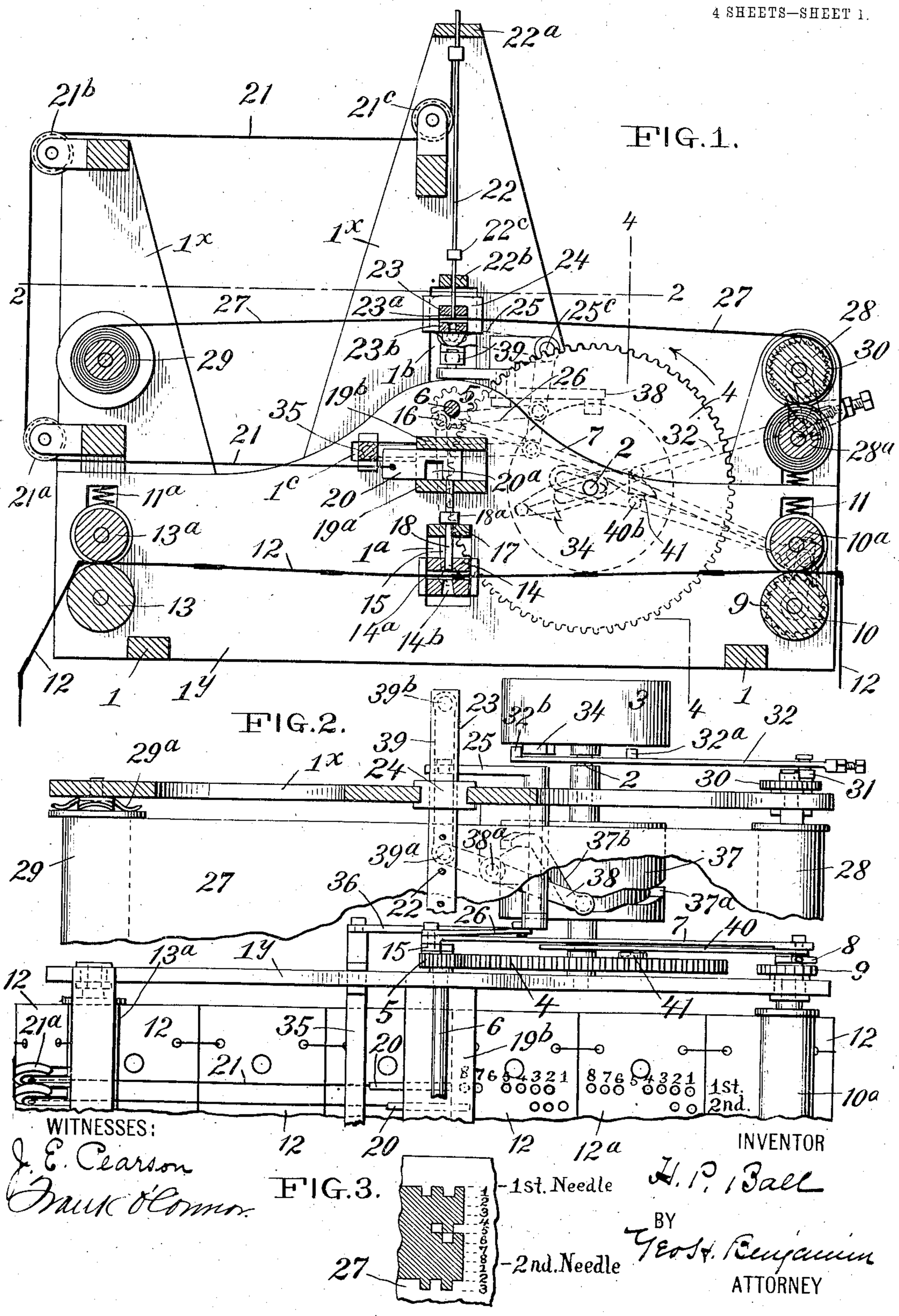

FIG. 2.

FIG. 3.

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4 SHEETS—SHEET 2.

FIG. 4.

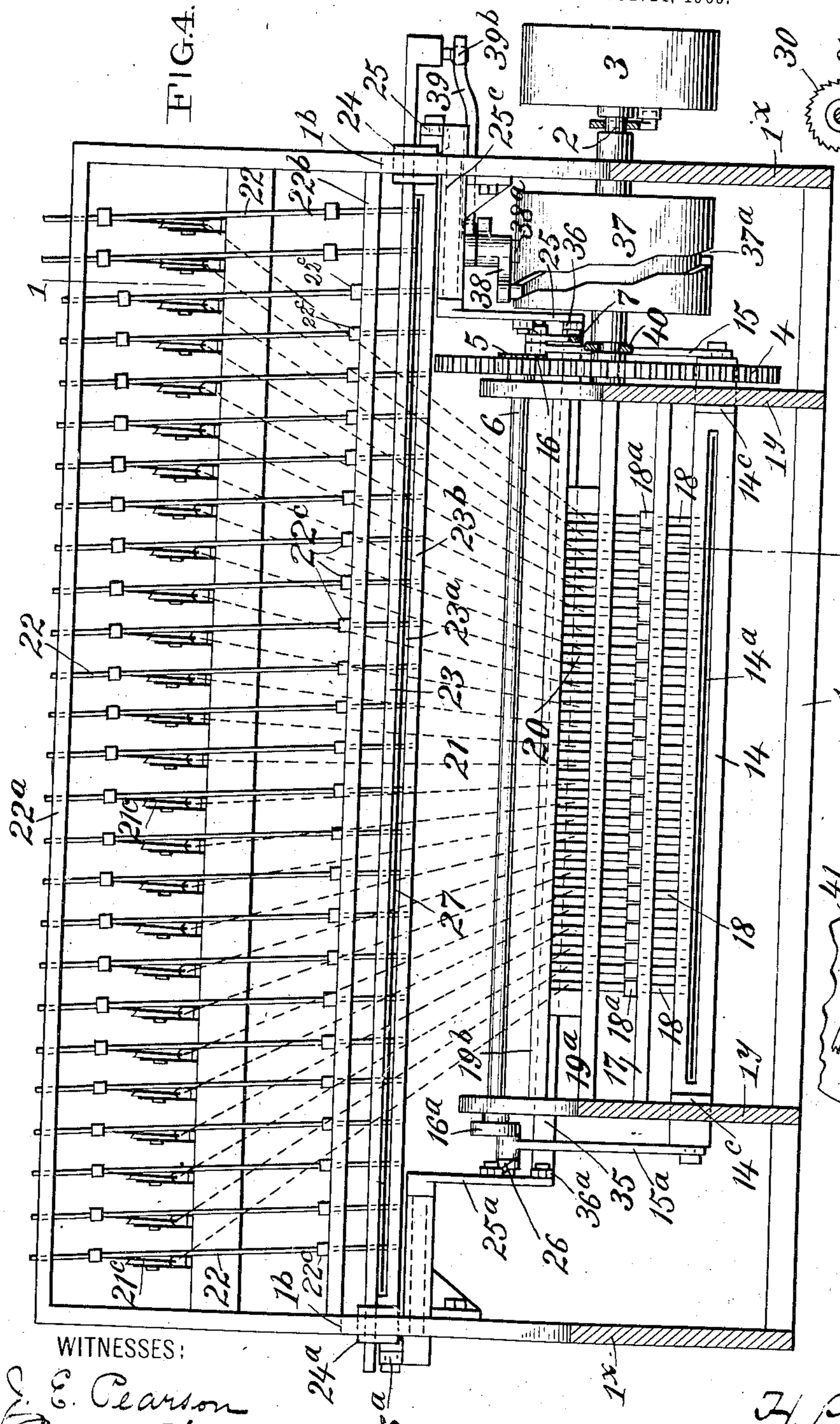


FIG. 6.

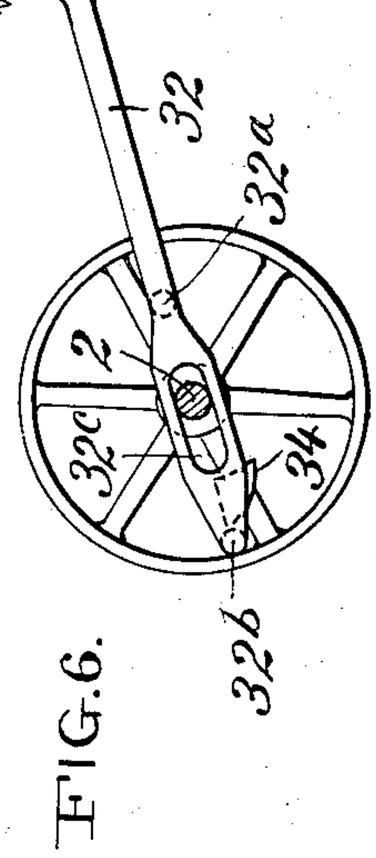
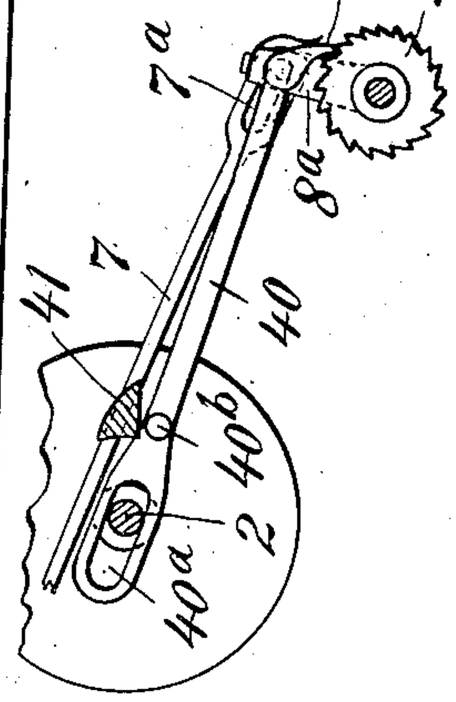


FIG. 5.



WITNESSES:

E. E. Pearson

Frank O'Connor

INVENTOR

H. P. Ball

BY

Geo. H. Benjamin

ATTORNEY

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4 SHEETS—SHEET 3.

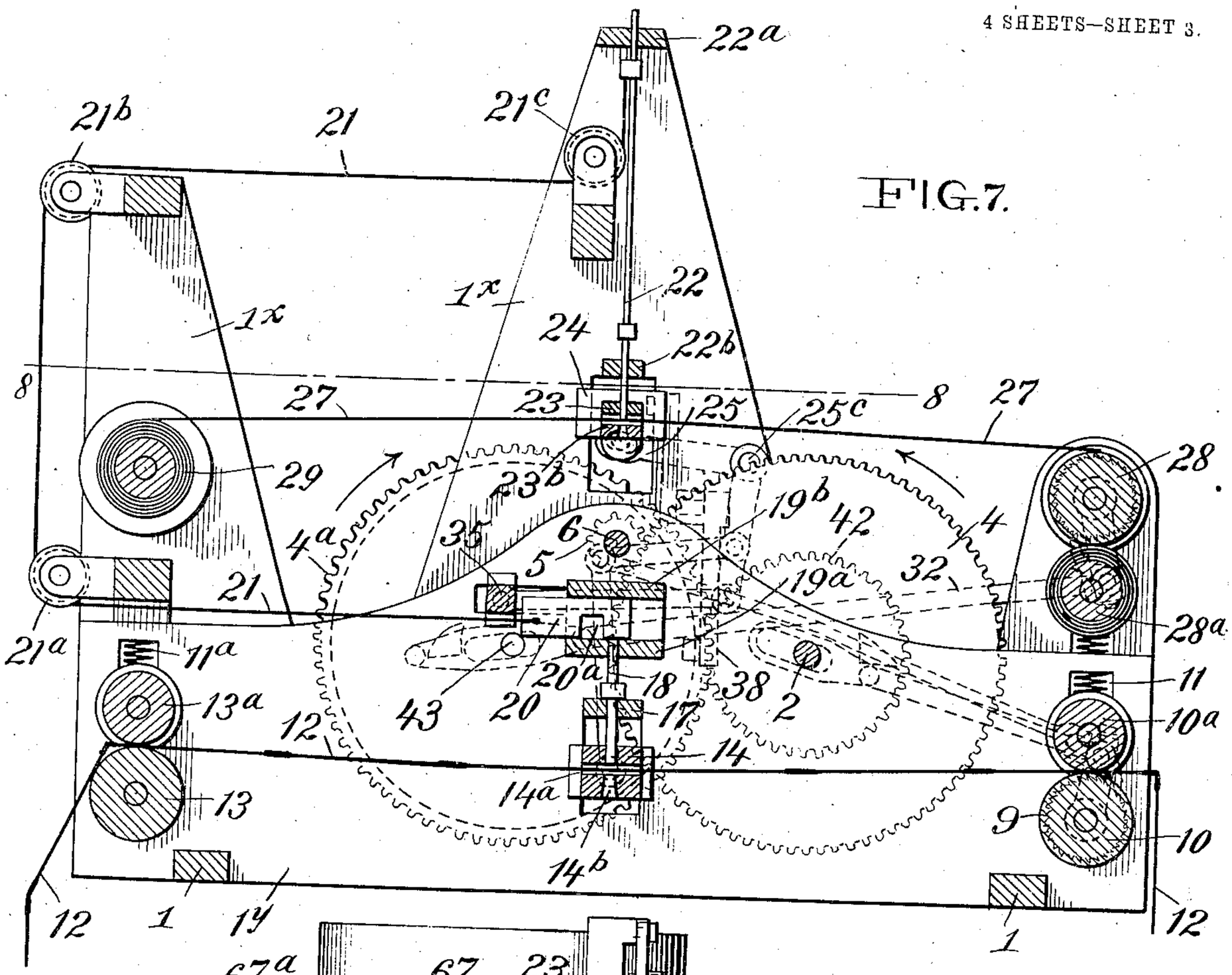

FIG. 7.

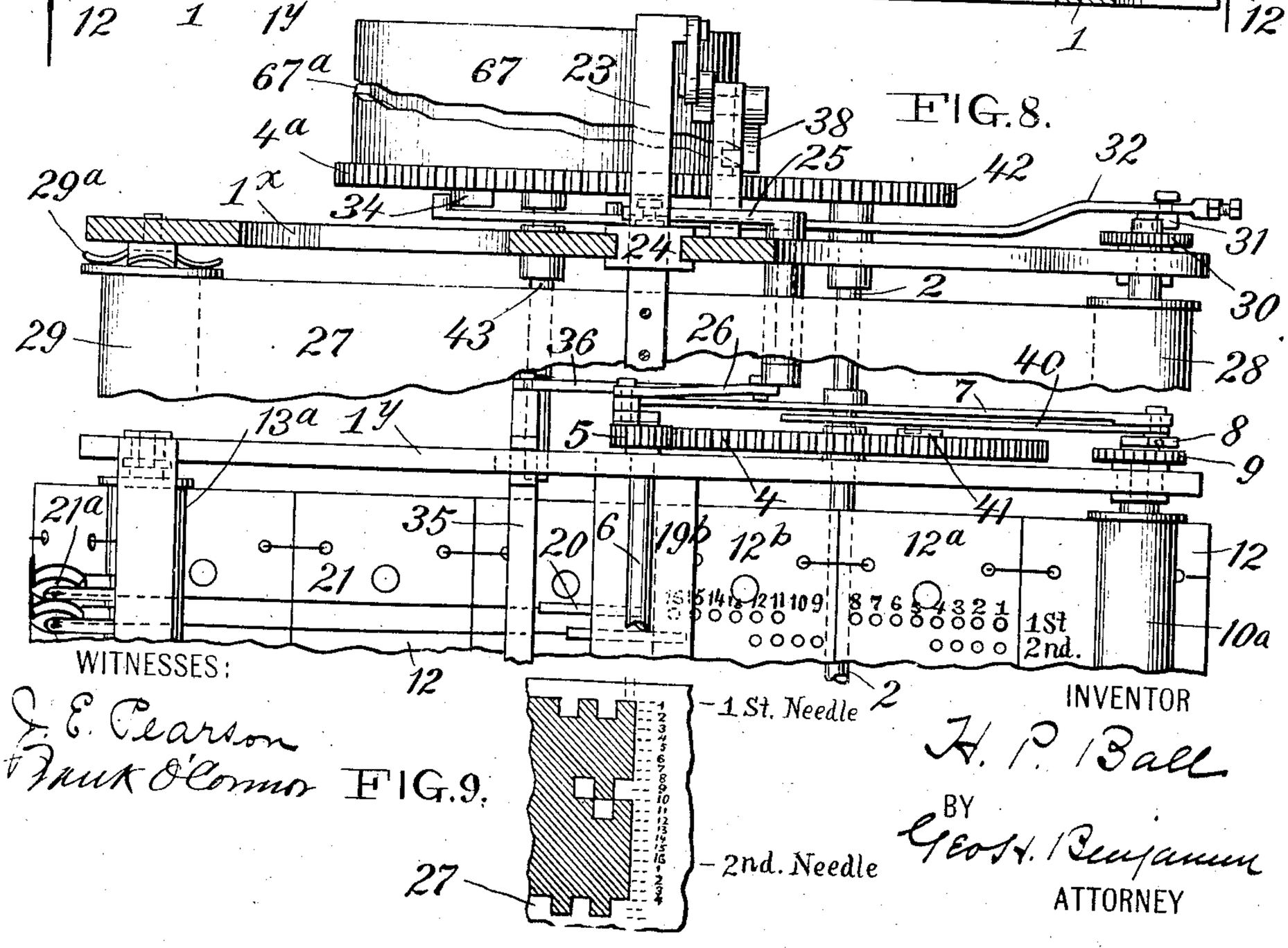

FIG. 8.

FIG. 9.

WITNESSES:

J. E. Pearson

Frank O'Connor

INVENTOR

H. P. Ball

BY

Geo. H. Benjamin

ATTORNEY

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4 SHEETS—SHEET 4.

FIG. 10.

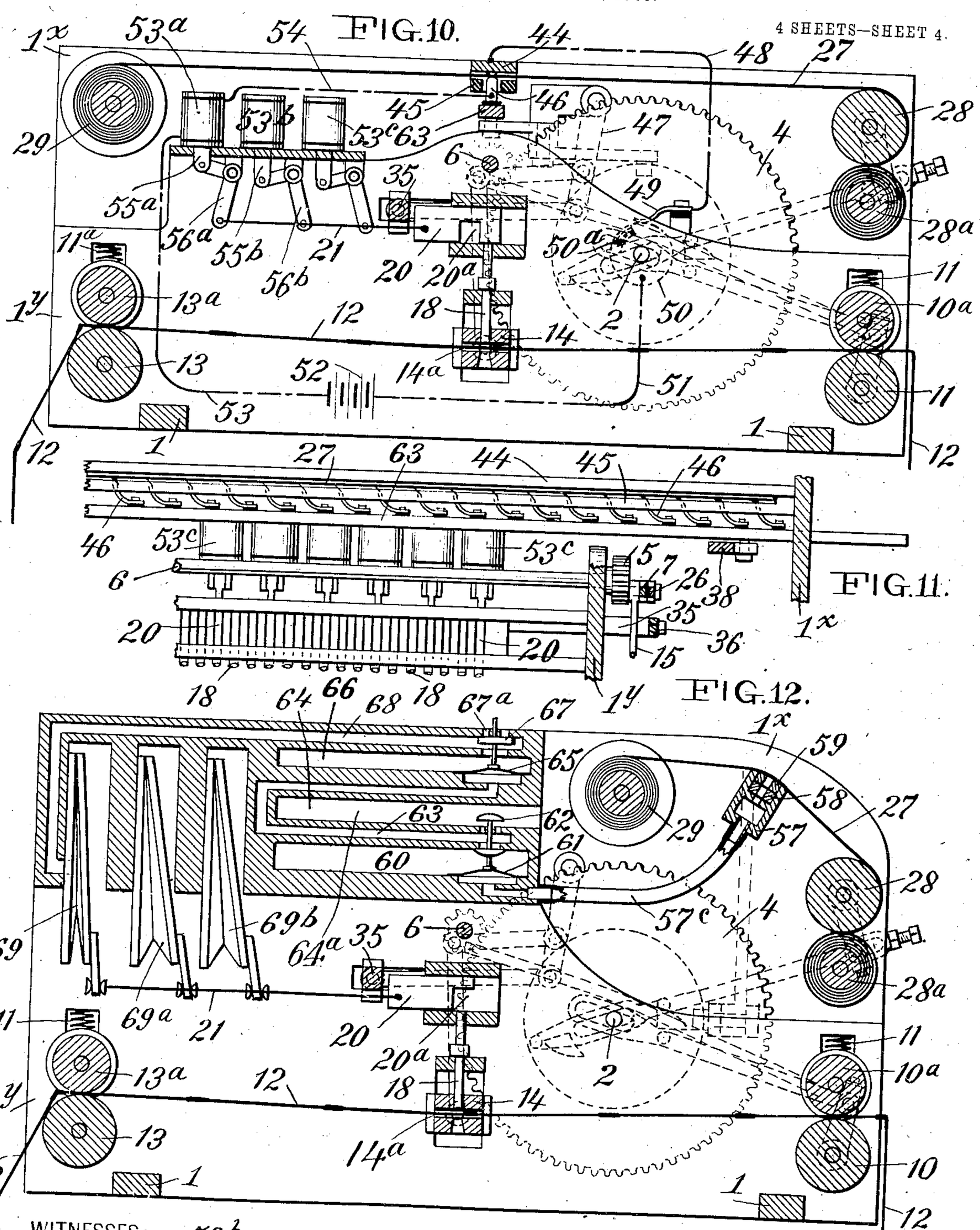


FIG. 11.

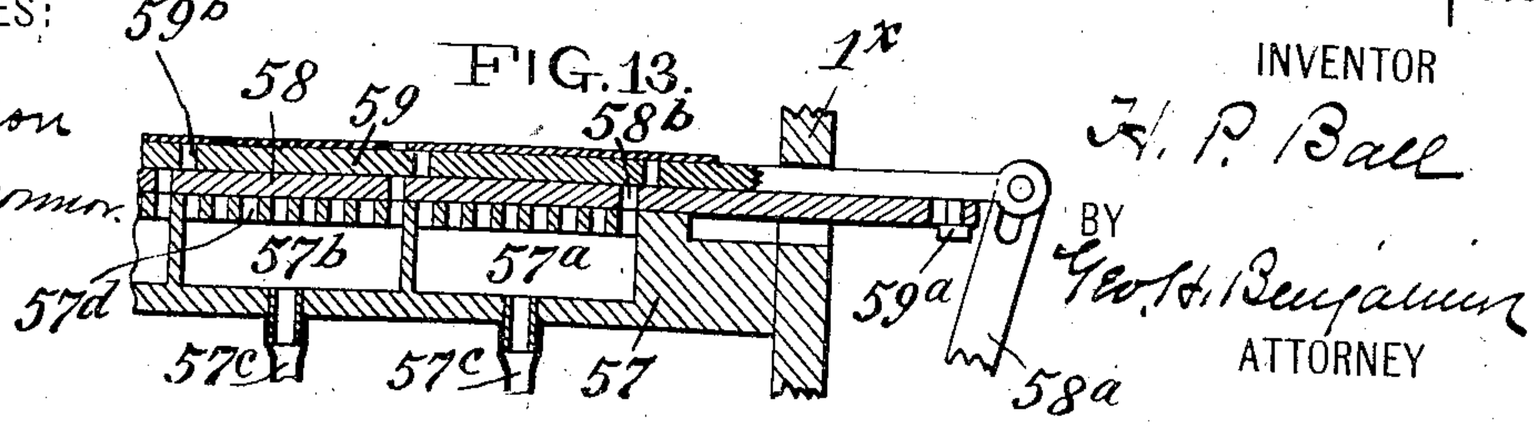
FIG. 12.

WITNESSES:

E. E. Pearson

Mark Clemmer.

FIG. 13.



INVENTOR

H. P. Ball

BY

Geo. H. Benjamin

ATTORNEY

UNITED STATES PATENT OFFICE.

HENRY PRICE BALL, OF SCHENECTADY, NEW YORK, ASSIGNOR OF ONE-HALF TO SAMUEL INSULL, OF CHICAGO, ILLINOIS.

MACHINE FOR TRANSFERRING PATTERNS.

No. 819,263. Specification of Letters Patent. Patented May 1, 1906.

Application filed October 24, 1903. Serial No. 178,383.

To all whom it may concern:

Be it known that I, HENRY PRICE BALL, a citizen of the United States, residing at Schenectady, county of Schenectady, State of New York, have invented certain new and useful Improvements in Machines for Transferring Patterns, of which the following is a specification.

My invention relates in general to pattern-transferring machines; and more specifically it consists of mechanism for automatically transferring a master-pattern embodying any particular design to a connected series of cards such as are used in the Jacquard loom.

Heretofore it has been customary to employ various machines, known as "piano" mechanisms, consisting of keys struck by a skilled operator, who reads the pattern as he would read a sheet of music and by means of the piano mechanism stamps it out in a series of cards. My invention does away with the services of such skilled operator and automatically and rapidly transfers the pattern to the cards or any other web of continuous material fed through the machine.

The preferred form of mechanism for carrying out my invention is illustrated in the accompanying drawings, and I have shown three modifications thereof designed to operate mechanically, electrically, and pneumatically.

In the drawings, Figure 1 is a vertical longitudinal section of the machine working mechanically, the section being taken on the broken line 1 1 of Fig. 4. Fig. 2 is a detail plan view on line 2 2 of Fig. 1 with parts broken away. Fig. 3 is a detail showing a portion of the master-pattern. Fig. 4 is a vertical cross-section taken on the broken line 4 4 of Fig. 1. Fig. 5 is a detail of the card-feeding mechanism. Fig. 6 is a detail of the pattern-feeding mechanism. Fig. 7 is a view similar to Fig. 1 of a slightly-modified machine designed to produce a series of cards which may be used in a loom working with a greater number of hooks, thereby producing a pattern in the woven material of greater smoothness of outline. Fig. 8 is a view similar to Fig. 2 of this modified mechanism, taken on line 8 8 of Fig. 7. Fig. 9 is a detail of the master-pattern, indicating the greater number of hooks used for the same area of pattern. Fig. 10 is a vertical longitudinal section of a modified machine working by means of electricity and electromagnets. Fig. 11 is a detail cross-section of the electrical portion of said mechanism. Fig. 12 is a longitudinal vertical section of a modification designed to operate pneumatically, and Fig. 13 is a detail cross-section of a portion of the pneumatic mechanism.

Throughout the drawings like reference-figures indicate like parts.

The machine is composed of the main frame 1, having the outer side pieces 1^x 1^x and the inner side pieces 1^y 1^y. 2 is the power-shaft, which is driven by means of the pulley 3 and has the gear-wheel 4 keyed thereon. This gear 4 meshes with a pinion 5, fast upon a crank-shaft 6, which is journaled in the side pieces 1^y 1^y of the frame. Motion is transmitted from the crank-shaft 6 through a rod 7 to operate the feed mechanism for the series of connected cards 12. This feed mechanism consists of the pawl 8, mounted on the pawl-lever 8^a, to which is secured the slotted end 7^a of the rod 7. The pawl-lever 8^a turns loosely on the shaft of the ratchet-wheel 9, to which is rigidly fastened the feed-roller 10. The idler-roller 10^a cooperates with the feed-roller, and the two are held in contact by a spring 11 or equivalent yielding mechanism. The connected series of cards 12 are supported between these feed-rollers and the guide-rollers 13 13^a, which are similarly held in contact by the spring 11^a.

14 is a reciprocating die, through an opening 14^a of which the series of cards 12 are passed, said die having a slotted or perforated lower portion, as shown at 14^b, and a slot or series of perforations in its upper portion, which register therewith, as best shown in Fig. 1. The die 14, extending transversely of the machine between the side pieces 1^y 1^y, is movable vertically in slots 1^a, formed therein, and is provided with guide-cleats 14^c 14^c, bearing against the inner faces of the side pieces. The die is supported at each end by the links 15 15^a, the lower ends of which are pivoted to the die, while their upper ends are pivoted to the crank-pins on the crank-disks 16 16^a of the crank-shaft 6.

Above the die is the punch-rack 17, which is perforated to hold loosely the series of punches 18 18, &c., which pass through said perforations and are prevented from falling by the collars 18^a 18^a, formed on them. These punches extend down through the vertical

perforations or slots in the die 14 and reach below the horizontal slot 14^a when the die is lifted, but do not reach said horizontal slot when the die is lowered. Over this bank of punching mechanism is located a punch-controlling device consisting of a frame formed of bars 19^a 19^b, which extend above and parallel with the punch-rack and are secured to the side pieces 1^y 1^y. Openings are formed in the bar 19^a to receive the upper ends of the punches, and located between the bars there are a series of punch-stops in the form of sliding blocks 20, which are set on edge one in line with each punch of the series. The blocks 20 are notched, as indicated at 20^a, and in certain positions of adjustment straddle the openings in bar 19^a to permit free movement of the punches. A cord or other flexible connection 21 extends from each of these punch-stops round a system of pulleys 21^a, 21^b, and 21^c and has its other end connected to one of a corresponding set of vertical movable fingers 22 22, &c. These fingers have their upper ends guided in perforations in the fixed guide-bar 22^a and their lower ends guided in a slot in the fixed guide-bar 22^b. Both of these guide-bars are rigidly held between the side pieces 1^x 1^x of the main frame. The lower ends of the fingers 22 are consequently free to move transversely of the machine, except as they are guided and controlled by the perforated transversely-sliding finger-guide 23. This sliding finger-guide 23 rests on a transversely-slotted bar 23^b, a space 23^a being left between the two to form a horizontal slot for the passage of the master-pattern 27. The bar 23^b is fastened at each end in guide-blocks 24 24^a, which slide up and down in the openings 1^b 1^b, formed in the frame side pieces 1^x 1^x. The sliding finger-guide 23 is accordingly mounted in these blocks 24 24^a and slides endwise through them. The pattern-guide thus formed is supported on horizontally-extending arms of the bell-cranks 25 25^a, which are pivoted in the main frame at 25^c 25^c, and the downwardly-extending arms of these bell-cranks are connected by the links 26 26^a to the crank-pins on the crank-disks 16 16^a before described, and the pattern-guide is accordingly raised and lowered by the rotation of the crank-shaft through the agency of the above-described mechanism.

28 is a feed-roller for the master-pattern 27. This feed-roller is journaled in the main frame in the side pieces 1^x 1^x, and coöperating therewith there is a spring-pressed take-up roll 28^a, which latter is driven from the feed-roller in any well-known manner to take up the pattern as the same is unrolled from the magazine-roller 29 and fed through the machine. A spring friction device 29^a or equivalent means may be employed to produce a slight resistance to the revolution of the magazine-roller 29, and so keep the master-pattern 27 taut during its passage through the machine. The feed-roller 28 is driven by pawl-and-ratchet mechanism comprising the ratchet-wheel 30, the pawl, and pawl-lever 31 coöperating therewith, as clearly shown in Fig. 6, and the link 32, having an adjustable slotted connection 33 with said pawl-lever. The link 32 has lugs 32^a 32^b and is provided with a slot 32^c, through which the power-shaft 2 extends.

34 is a cam on the pulley 3, (see Fig. 2,) cooperating with the lugs 32^a and 32^b on the link to reciprocate the same.

35 is a stop-returning bar mounted and guided in the horizontal slots 1^c 1^c, formed in the side frames 1^y 1^y and controlled by the links 36 36^a, which are pivoted to the outer ends of the bar 35 and have their other ends pivoted to the downwardly-extending arms of the bell-cranks 25 25^a.

37 is a cam-drum keyed to the power-shaft 2, having a cam-slot formed in its circumference composed of a series of steps 37^a, inclined in one direction, and a quick-return portion 37^b, inclined in the other direction. This cam-slot operates one end of a cam-lever 38, having a pivot 38^a, with a vertical axis on the main frame. The other arm of this cam-lever is connected by the universal joint 39^a to one end of the link 39, the other end of which is connected by the universal joint 39^b to the outer end of the sliding-finger guide-bar 23.

40 is a link connecting the card-feed mechanism (see Fig. 5) with a cam 41 on the gear 4, the said link being provided with a slotted end 40^a, through which the power-shaft 2 passes, and the lug 40^b, with which the cam 41 coöperates. This cam will serve to give the card-feed mechanism an extra movement periodically for the purpose of carrying the punching mechanism safely across the connecting-line between adjoining cards. The two feed mechanisms connected to pawl-lever 8^a operate independently each of the other by reason of the fact that while the link 40 is pivoted to the pawl-lever its other end is slotted at 40^a and moves idly on the shaft 2 as the pawl-lever 8^a is moved by the link 7, and similarly link 7 is connected to pawl-lever 8^a by pin-and-slot connection 7^a, which allows a considerable amount of lost motion during the rotation of the crank-disk 16. The two mechanisms are so timed that cam 41 acts when link 7 is well over to the right, (see Fig. 5,) so that slot 7^a permits the extra movement to the right of the pawl-lever 8^a given to link 40 by cam 41.

In the modified mechanism shown in Fig. 7 the power-shaft 2, driven by a belt-pulley (not shown) or in any other suitable manner, has mounted upon it a gear-wheel 42, which meshes with a gear 4^a, mounted on a stud-shaft 43, which also carries a cam-drum 67. As shown, the diameters of the gears 42 and 4^a

have the ratio of one to two, and consequently the cam-drum 67 makes but half a revolution for each revolution of the power-shaft. Accordingly the cam-drum 67 is made of twice the diameter of the cam-drum 37 and has double the number of steps 67ª formed in the cam-slot. The other connections of the machine are the same as those before described, except that preferably the pattern-feed connection 33 is so adjusted as to give the master-pattern only half as much travel at each step of the feed as before. This modification of the speed can also be produced by modifying the pitch of the cam 34, which operates the pattern-feed.

In the electrically-operated modification shown in Figs. 10 and 11 the pattern-guide consists of the bar 44, of conducting material, and the non-conducting slotted bar 45 below the same, the two being rigidly fixed in the side frames and leaving a space or horizontal slot between them, through which the pattern 27 passes as before. In place of the transversely-sliding finger-guide bar 23 of the other constructions there is a transversely-sliding bar 63, which carries a series of spring-fingers 46 46, of conducting material, each of which is connected, through wires 53 and 54, with a source of current-supply 52. This bar 63 is moved by the cam-lever 38 as before, except that no universal-joint mechanism is necessary between the two, the bar 63 having no vertical movement. The bell-cranks 25 25ª are no longer necessary, the place of each one being supplied by a swinging lever 47, which corresponds to the downwardly-extending arm of the bell-crank. A wire 48 extends from the conducting-bar 44 to the commutator-finger 49, which coöperates with the rotating commutator 50, having a non-conducting segment 50ª. A wire 51 extends from the commutator-shaft to one pole of the battery 52 or other source of electrical current, and connected in circuit by wires 53 54 between the other pole of the battery and each of the fingers 46 there is an electromagnet 53ª 53ᵇ 53ᶜ, &c. Each of the magnets 53ª, &c., has an armature or movable core 55ª 55ᵇ, &c., and each of these armatures is connected to one end of a bell-crank 56ª 56ᵇ, &c., the other end of which is connected by a cord 21 to the punch-controlling mechanism as before.

In the pneumatically-operated mechanism shown in Figs. 12 and 13 the pattern-guide is replaced by a hollow transverse beam or tracker-bar 57, over which the master-pattern is drawn. This hollow beam has air-chambers 57ª 57ᵇ formed therein, which correspond in number to the movable fingers of the mechanical device or the contact-fingers of the electrical device. Each chamber 57ª 57ᵇ, &c., has a series of suction-holes 57ᵈ communicating therewith corresponding in number to the different steps of travel of the movable fingers of the other forms of the mechanism. Over these suction-openings is a transversely-sliding perforated bar 58, which has an opening 58ᵇ for each chamber 57ª, &c., and on which is superimposed a loosely-connected duplicate bar 59, having openings 59ᵇ, the two being connected together by the pin-and-slot connection 59ª (see Fig. 13) and the two being connected to the lever 58ª, which is given motion corresponding to the cam-lever 38 by means of cam mechanism. (Not shown.) A series of tubes 57ᶜ are connected to the various air-chambers in the hollow beam 57, and these connect with the ordinary pneumatic-valve system, which, as indicated in Fig. 12, comprises the low-pressure suction-chamber 60, a series of piston-valves 61, controlling the communication between each tube 57ᶜ and said chamber 60, valves 62, operated thereby to open communication between the air-passage 64ª and the space 64, which communicate with the open air, the piston-valve 65, connecting the air-passage 64ª with the high-pressure suction-chamber 66, the valve 67, operated thereby to alternately connect the air-passage 68 with the high-pressure suction-chamber 66 or with the air-inlet 67ª, and the collapsing bellows 69, communicating with the air-passage 68. A series of said bellows 69ª 69ᵇ are shown banked one behind the other, as are the magnets in the electrical construction for the purpose of saving space, and the vibrating member of each pair of said bellows is connected by cords 21 21 with the punch-controlling mechanism as before.

The mode of operation of my invention is as follows: Rotation being given to the power-shaft 2, the crank-shaft 6 is rotated at a higher rate of speed, and the die 14 and the pattern-guide are given vertical reciprocatory motions, while the pattern-feed mechanism and the card-feed mechanism are also set in operation. In the drawings the proportion of the gear 4 to the pinion 5 is as eight to one. Consequently the cards are fed forward eight steps and the die and pattern-guide are lifted eight times for every step forward which the pattern makes. In the same way the cam-drum 37 has eight feed-steps, so that the sliding finger-guide 23 and the lower ends of the fingers carried thereby are moved eight corresponding steps from right to left transversely across the face of the pattern before the quick-return portion 37ᵇ of the cam returns them to the right-hand position. The master-pattern for either the mechanical or pneumatic device is painted or otherwise superimposed upon a web of material having regular rows of perforations, such as a strip of perforated paper or a strip of wire-cloth. The number of perforations, counting transversely across the web of material, is equal to the number of fingers 22 multiplied by the number "8," and the

parts of the mechanism are so designed that the first finger will register *seriatim* with each of the first eight spaces, the second finger with each of the second eight spaces, and so on as the machine is operated. As the cards are fed forward eight steps for each one step of the master-pattern, it is evident that each punch which corresponds to a yielding finger will tend to punch a series of eight holes extending across each card if said punch is thrown into operation at each reciprocation of the die. Looking at the fragment of the pattern shown in Fig. 3, the various positions of the first finger during the progress of one card through the machine, during which time no feed of the pattern takes place, are represented by the numbers one to eight consecutively. The perforations in the web of the pattern being filled up by the superimposed design at points which would come in contact with the lower end of the first finger in the first four positions, it is evident that during these reciprocations of the pattern-guide the said finger 1 will meet with an obstruction when the pattern is lifted up in contact with its lower end, and said finger will accordingly be lifted in each case. This lifting action of the finger, as indicated in Fig. 4, will produce a pull on the cord 21 and draw the punch-stop 20, corresponding to the first punch, into the position shown in Fig. 1, moving the notch 20^a out of line with the top of the punch and placing the full portion of the stop in line therewith. Accordingly on the upward motion of the die 14, which takes place after said punch-stop has been moved into position, the first punch will strike the stop and remain stationary and a hole will be punched in the card. On the downward motion of the pattern-guide the first finger will come to rest by reason of its collar 22^c striking the slotted bar 22^b, and this finger, as well as all the other fingers, will be held up by this bar while the pattern is carried down free of their ends, and they are left free to be swung one step to the left by reason of the cam-lever 38 moving over one of the steps 37^a of the cam-drum 37, when the operation will be repeated. This operation controlled by the first finger being repeated four times consecutively, the four holes shown in the first row in card 12^a will be produced. When the finger comes into the position indicated by the numeral 5 in Fig. 3 and the pattern is lifted, the lower end of the finger will meet with no resistance and will go through the perforation in the pattern. Consequently there will be no pull on the cord 21 and the punch-stop 20 will remain in its normal position, with the notch 20^a registering with the upper end of the first punch. Accordingly the said punch will be lifted by the card 12^a when the die is lifted, and no hole will be punched in said card. In the remaining three positions, the pattern-space being filled, the finger will be lifted, the punch locked, and three holes punched, all as shown in Fig. 2. This operation is being carried out by each of the other punches in a manner controlled by its corresponding finger in accordance with the condition of the pattern underneath it, and the result is as many series of perforations across the card 12^a as there are fingers 22, as indicated in Fig. 2. After the eight operations have been performed as above described the quick-return section 37^b of the cam 37 swings the fingers over to the right again, and during its return the cam 34 on the pulley 3 has operated the pattern-feeding mechanism to feed the pattern forward one step, the cam 41 on the gear 4 has given the card-feeding mechanism an extra jump to bring the next card into position in the punch mechanism, and the parts are all in position for a repetition of the operation on the next card. It is understood, of course, that after each downward stroke of the die, whereby all the punches are dropped down into their lowermost position, the return-bar 35 is moved to the right to replace all the punch-stops in their former position.

In the modification shown in Figs. 7 and 8 the feed of the master-pattern is cut down one-half, and while the yielding fingers 22 are swung through the same transverse arc, so that each finger covers the same section of the pattern as before, this swinging action is divided up into sixteen steps instead of eight, and the web on which the pattern is placed must accordingly have twice the number of perforations to the same width as well as twice the number of perforations for the same length. In this case the line of perforations made by any one punch during one complete vibration of the fingers will accordingly extend across two cards 12^a and 12^b unless cards of twice the width are substituted or the card-feed is cut down one-half.

In the electrical mechanism the operation is substantially as before described, except that in this case the web on which the master-pattern is produced should be of some non-conducting material and the pattern formed thereon by some fluid or other material which will change those portions of the web to which it is applied into a conducting material. Accordingly there will be a current passing through those circuits whose fingers 46 rest on the portions of the pattern which are electrically conductive at each operation of the machine, and these circuits will energize their respective magnets and pull the punch-stops into operative position, accordingly punching holes in the card, while those fingers which bear on non-conducting portions of the pattern will break their corresponding circuits, their magnets will not be energized, and the corresponding punch-stops will remain in the position into which they have been thrown by the return-bar, so that the punches will

lift idly and not produce perforations in the card. While the sliding finger-carrying bar 63 is being moved back from one extremity of motion to the other during the passage from one card to another the commutator-finger 49 rests upon the non-conducting segment 50ª of the commutator 50, and no current passes through any of the magnets, and consequently all of the punch-stops are out of position and none of the punches operate.

In the pneumatic modification the master-pattern is again formed on a perforated web, and, continuous suction being kept up on both the high and low suction-chambers, the admission of air through any perforation in the pattern to the perforated slide-bars 58 and 59 and through them to the air-chambers and suction-pipes will permit the valves to lift and produce a suction on the corresponding bellows, which will throw the punch-stop out of operation. With this construction the arrangement of the punch-stop is reversed, so that normally all the punches operate, and it is only when air is admitted to a particular tube and the corresponding bellows operated that a punch-stop is pulled out of position and the punch accordingly disabled. This reversal is necessary, because the stop mechanism is positively operated by a perforation in the pattern, whereas in the mechanical form the punch-stop is positively operated by the unperforated portions of the pattern. By reversing the mechanism, as above described and as shown in Fig. 12, it is possible to use the same master-pattern either on the mechanical or on the pneumatic device.

During the return swing of the yielding fingers it is evident that all admission of air to the suction-pipes must be shut off, as otherwise all the punch-stops would be moved and the mechanism deranged. This is accomplished by the loose-motion connection between the two bars 58 and 59, which is so designed that when the bars are pulled to the right (see Fig. 13) the corresponding openings through them do not register and the air-passages are closed; but when they are pushed to the left during the operating portion of the machine cycle the corresponding openings register and coöperate with the suction-holes in the suction-bar in the manner hereinbefore described.

The advantages of my invention comprise its perfect automatic action, which renders it possible to dispense with skilled operators and substitute therefor the services of one man to oversee and adjust a large number of machines and the consequent great economy resulting therefrom.

It is evident, of course, that various changes could be made in the details of construction illustrated without departing from the spirit and scope of my invention. Other forms of punching mechanism and other arrangements of yielding fingers might be substituted for those shown, and the connecting mechanisms between these and other parts might be modified in numerous ways which will occur to the skilled mechanic. The construction of the punch-controlling mechanism might be varied and also that of the various feed mechanisms. The character of the connecting-gearing and the various adjustments of parts might be altered; but all such modifications would still be within the boundaries of my invention so long as the essential principle of operation above described and illustrated is preserved.

Having therefore described my invention, what I claim as new, and desire to protect by Letters Patent, is—

1. An automatic pattern-transferring machine comprising a moving pattern, a moving series of cards, a series of fingers adapted to coöperate with said moving pattern, means for moving the fingers transversely relative to the pattern, a series of perforating devices adapted to coöperate with the cards, and means controlled by the fingers for controlling the movement of the punches.

2. An automatic pattern-transferring machine comprising a moving pattern, a moving series of cards, means for imparting motion to said cards, a series of fingers adapted to coöperate with said moving pattern, means for moving the pattern vertically relative to the fingers, means for moving the fingers transversely relative to the pattern, a series of punches adapted to perforate the cards, means for moving the cards vertically relative to the punches, and means controlled by the fingers for controlling the movement of the punches.

3. An automatic pattern-transferring machine comprising a moving perforated pattern, a moving series of cards to be perforated, means for imparting to said pattern and cards rates of forward movement different from each other, a series of reciprocatory fingers adapted to coöperate with the perforations in the moving pattern, means for moving the fingers across the pattern, a series of punches adapted to perforate the cards, and means controlled by the fingers for throwing the punches into and out of action.

4. An automatic pattern-transferring machine comprising a moving strip of material having successive series of transversely-arranged perforations therein, a series of transversly-arranged fingers adapted to coact with such perforations, means for reciprocating said fingers transversely across the moving strip of material, means for vertically reciprocating the moving strip of material relative to the fingers, a moving series of cards, a series of punches arranged transversely over the cards, means for imparting a forward movement to the cards greater than that imparted

to the moving strip of material and means controlled by the movement of the fingers for controlling the punches.

5. An automatic pattern-transferring machine comprising a perforated pattern, means for imparting forward movement to said pattern, a series of fingers adapted to coact with the perforations in said pattern, a series of moving cards, means for imparting forward movement to said cards at a rate which is a multiple of that imparted to the perforated pattern, a series of punches arranged in relation to said cards, means for reciprocating the fingers across the moving pattern and mechanism controlled by the fingers and, in turn, controlling the punches.

6. In an automatic pattern-transferring machine, the combination of mechanism for feeding a continuous web of blank material through the machine, a bank of punching mechanisms through which the blank web is fed, controlling devices for throwing each punch into or out of operation independently of the others, mechanism for feeding a perforated master-pattern through the machine at a speed proportional to that of the web, a series of yielding fingers arranged in operative relation to the perforated pattern, means for causing said pattern and fingers to alternately approach toward and recede from each other, and a connection from each finger to a punch-controlling device, together with means for giving the fingers an intermittent motion across the face of the master-pattern.

7. In an automatic card-punching machine, the combination of mechanism for feeding a series of connected cards step by step through the machine, a bank of punching mechanisms through which the cards are fed, controlling devices for throwing each punch into or out of operation independently of all the others, mechanism for feeding a perforated master-record step by step through the machine, the pattern being fed one step for every predetermined series of steps the cards are fed, a series of yielding fingers arranged in operative relation to the perforated pattern, means for causing said pattern and fingers to alternately approach toward and recede from each other, a connection from each finger to a punch-controlling device, and means for giving the fingers a step-by-step motion across the face of the pattern synchronously with the step-by-step motion of the cards.

8. In a mechanism for giving a step-by-step feed-motion to a connected series of cards, the combination of the feed-rollers, pawl-and-ratchet mechanism, a crank-shaft and connecting-rod to said pawl, a quick-action cam geared to the crank-shaft by speed-reducing gearing, and a connecting-rod from said cam to said pawl.

9. The combination of step-by-step feed mechanism for a web-pattern, a series of fingers movable across the face of said pattern at right angles to its line of travel, a rotating cam geared to the feed mechanism so as to make one rotation for each step thereof, the face of said cam having a series of steps in one direction, and a single return step in the other direction, mechanism for moving the fingers across the face of the pattern, and connections between said mechanism and said cam.

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

HENRY PRICE BALL.

Witnesses:
J. E. PEARSON,
FRANK O'CONNOR.