No. 870,926. PATENTED NOV. 12, 1907.

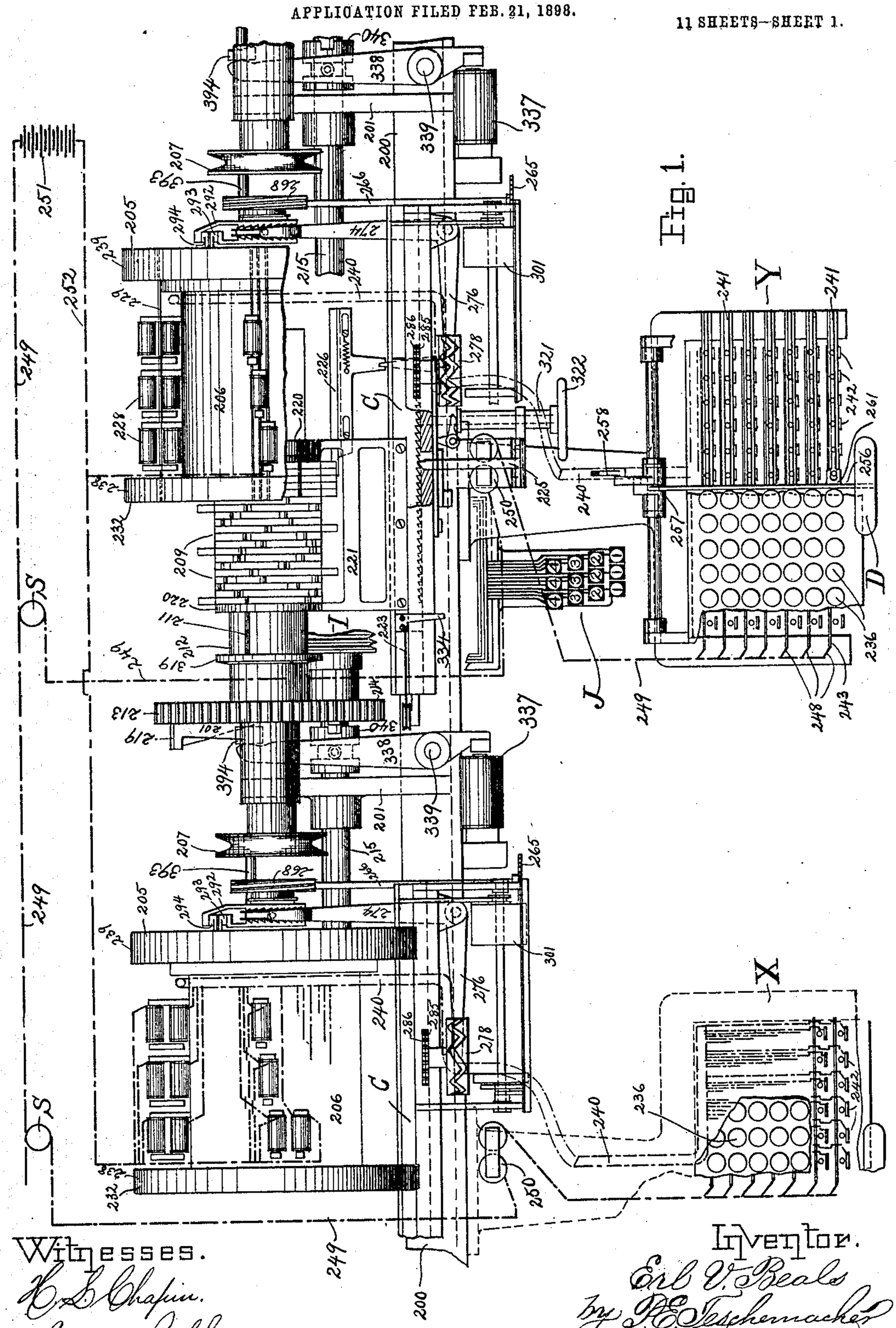
E. V. BEALS.

COMPOSING MECHANISM FOR PRINTING BAR, MATRIX MAKING, AND TYPE SETTING MACHINES.

APPLICATION FILED FEB. 21, 1898.

11 SHEETS—SHEET 1.

Fig. 1.



Witnesses.

H. L. Chapin.

Louise R. Chace

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Earl V. Beals

by P. E. Teschemacher

Atty.

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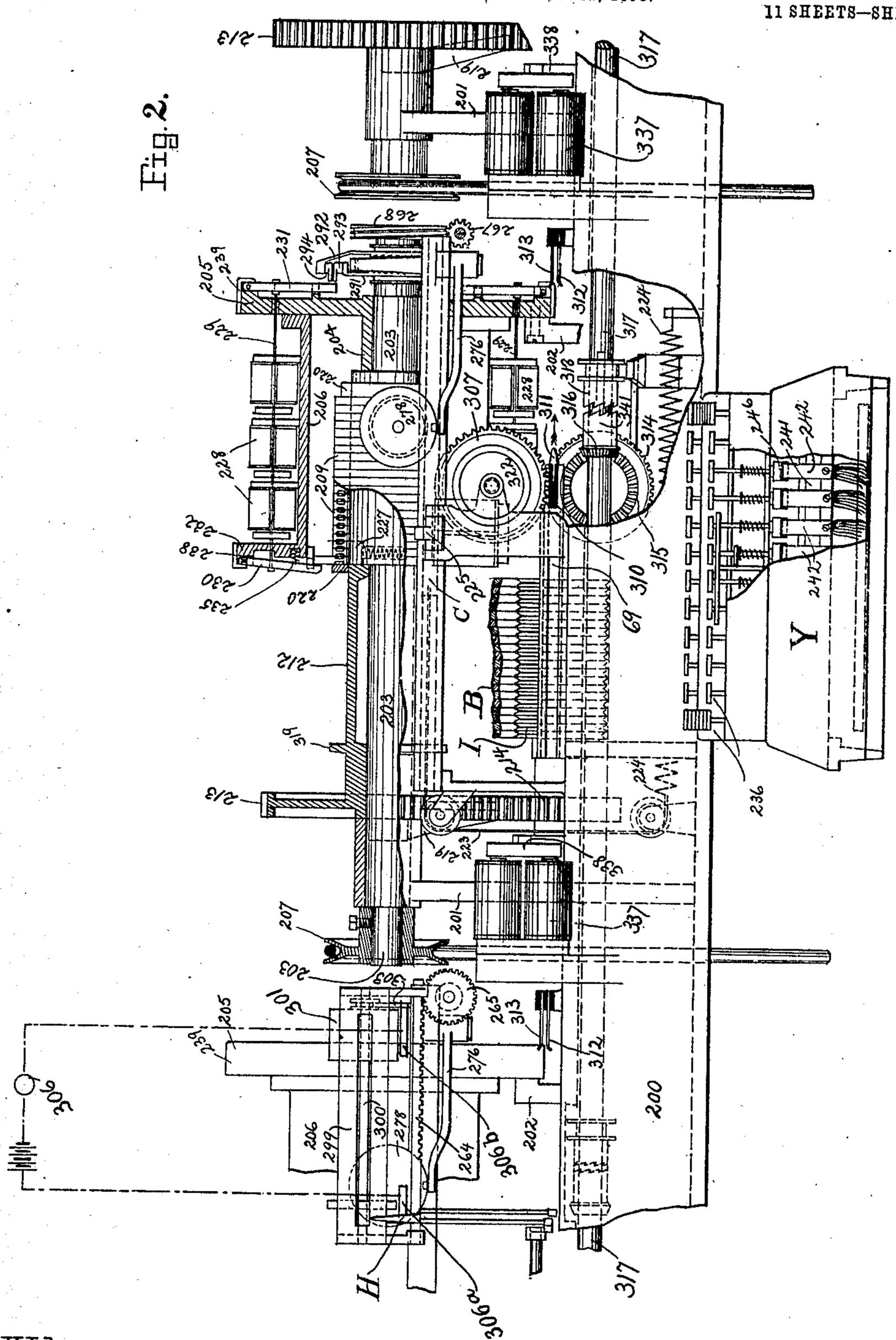
11 SHEETS—SHEET 2.

Fig. 2.



Witnesses.

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11 SHEETS—SHEET 3.

Fig. 8.

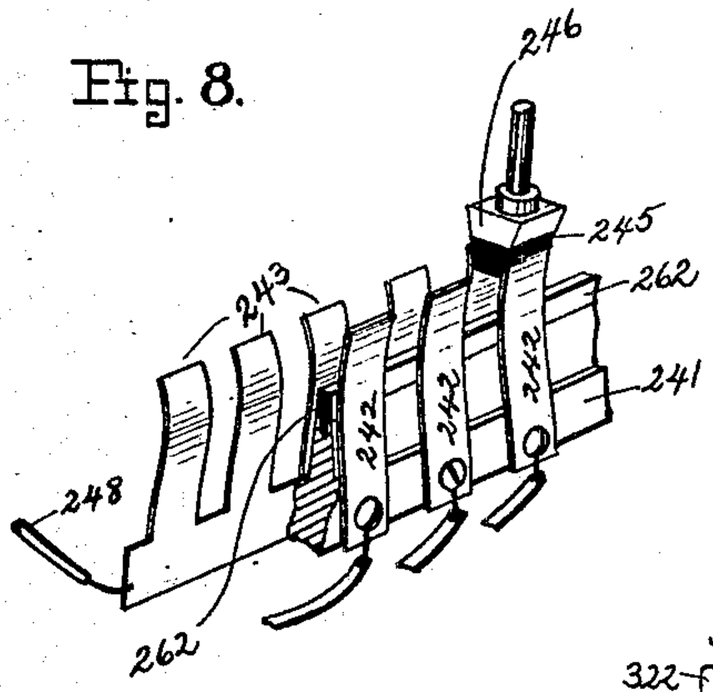

Fig. 3.

Fig. 21.

Fig. 22.

Witnesses.

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11 SHEETS—SHEET 4.

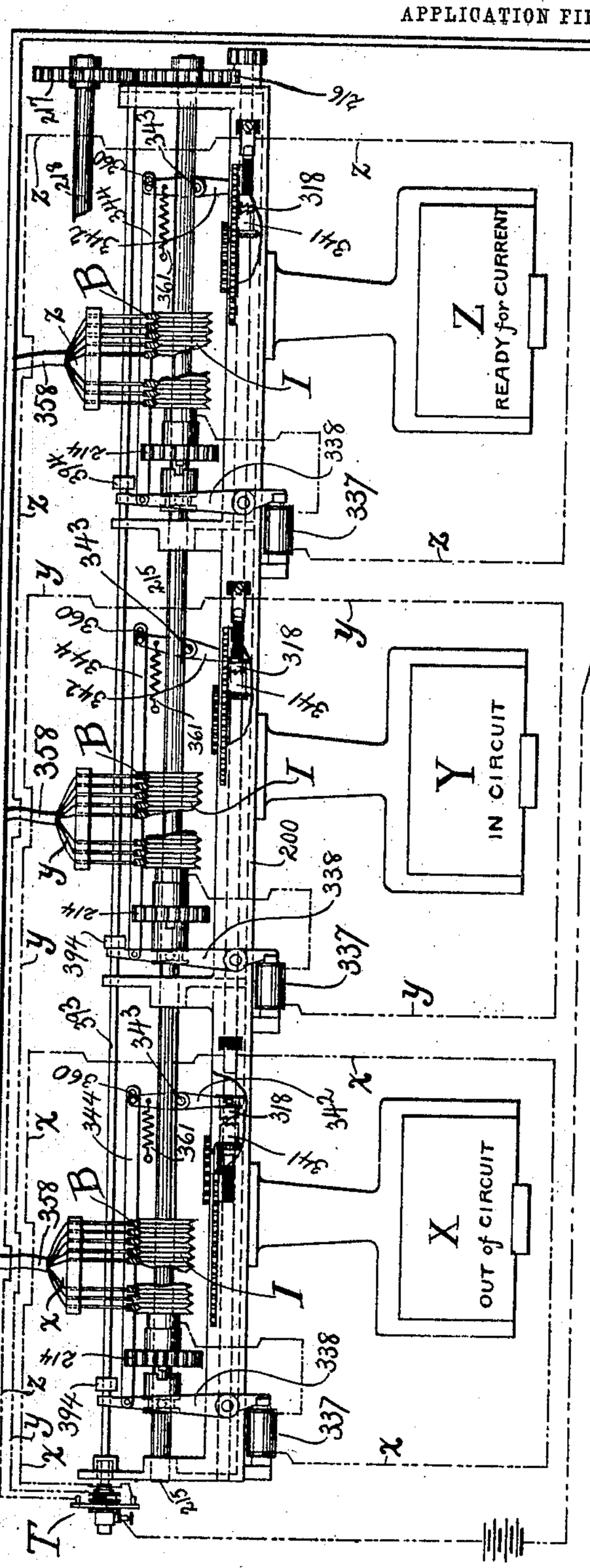

Fig. 4.

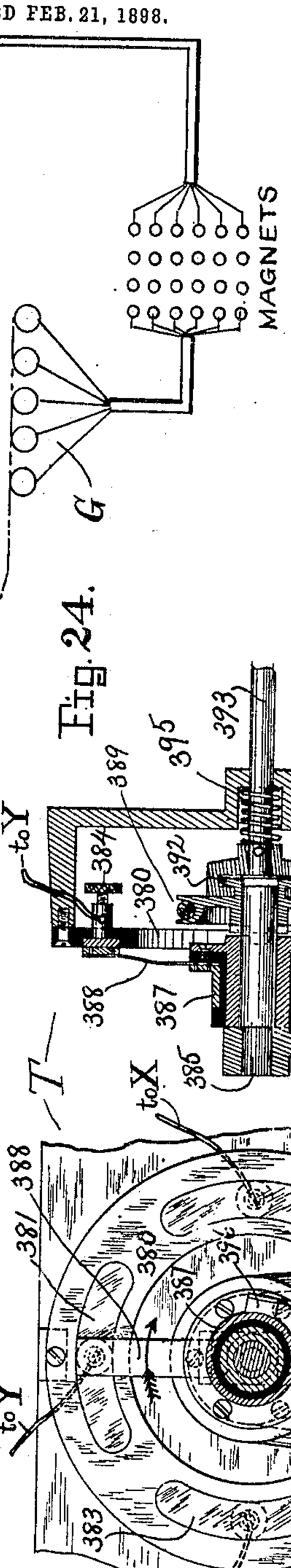

Fig. 24.

Fig. 23.

Witnesses.
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Attys

No. 870,926. PATENTED NOV. 12, 1907.

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COMPOSING MECHANISM FOR PRINTING BAR, MATRIX MAKING, AND TYPE SETTING MACHINES.

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Fig. 5.

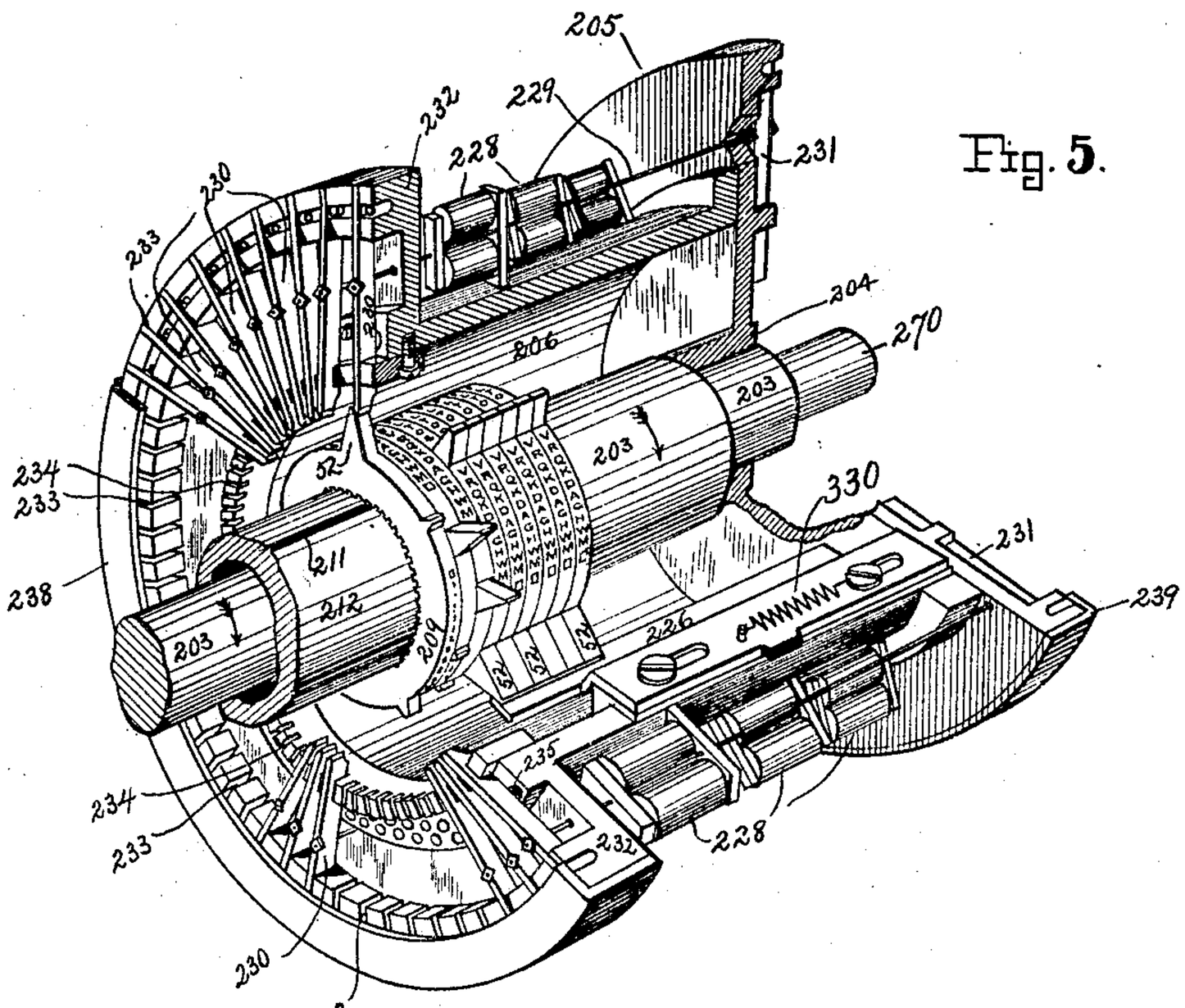

Fig. 7.

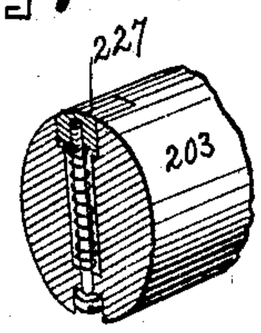

Fig. 6.

Witnesses.
H. L. Chapin
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by P. E. Teschemacher
Atty

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11 SHEETS—SHEET 6.

Fig. 10.

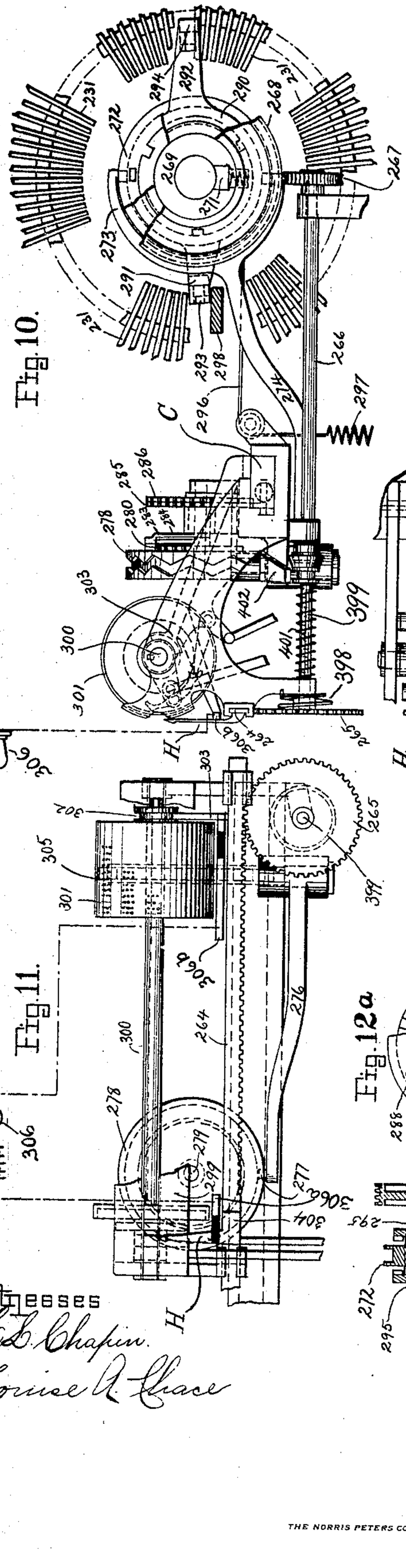

Fig. 13

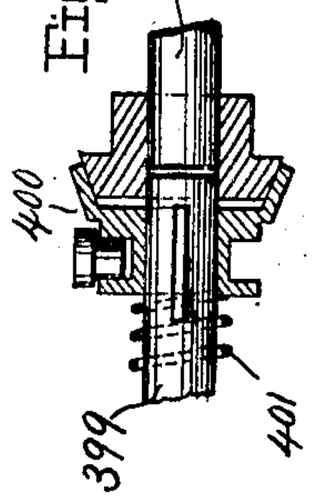

Fig. 9.

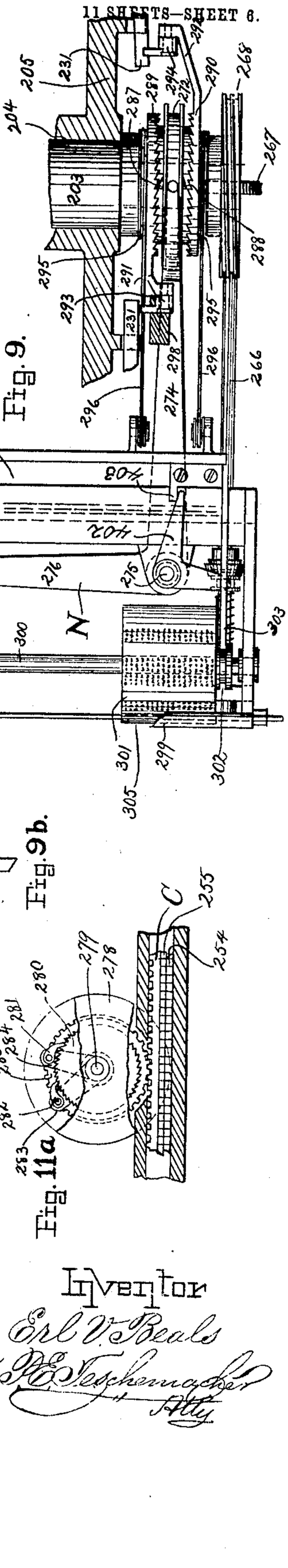

Fig. 11.

Fig. 9a

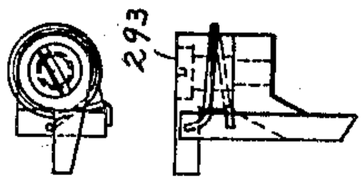

Fig. 9b.

Fig. 12a

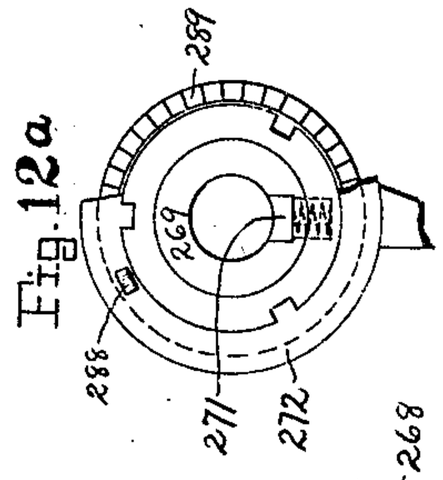

Fig. 12

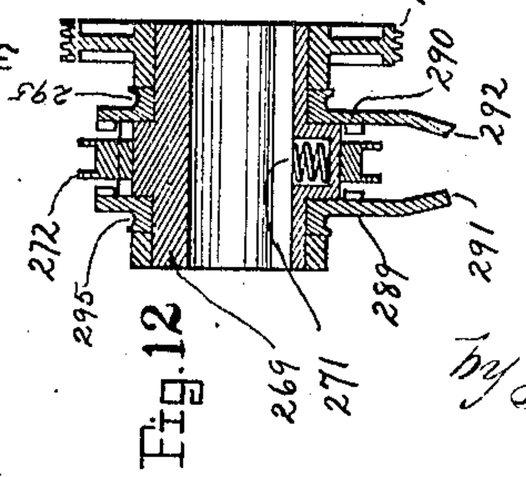

Fig. 11a

Witnesses

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11 SHEETS—SHEET 7.

Fig. 14.

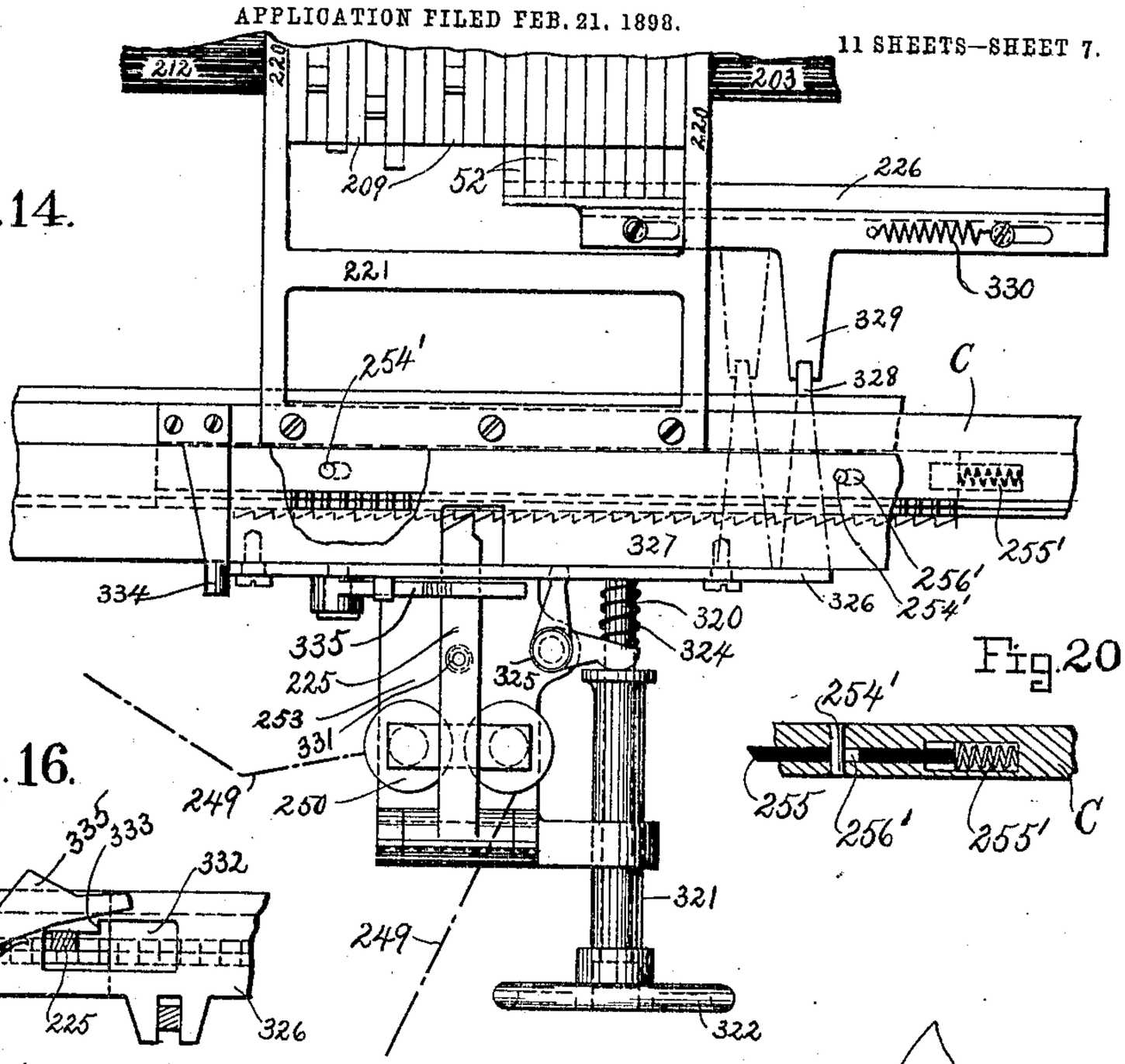


Fig. 20

Fig. 16.

Fig. 17.

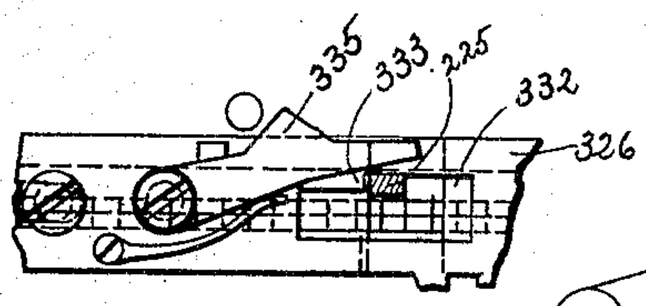


Fig. 15.

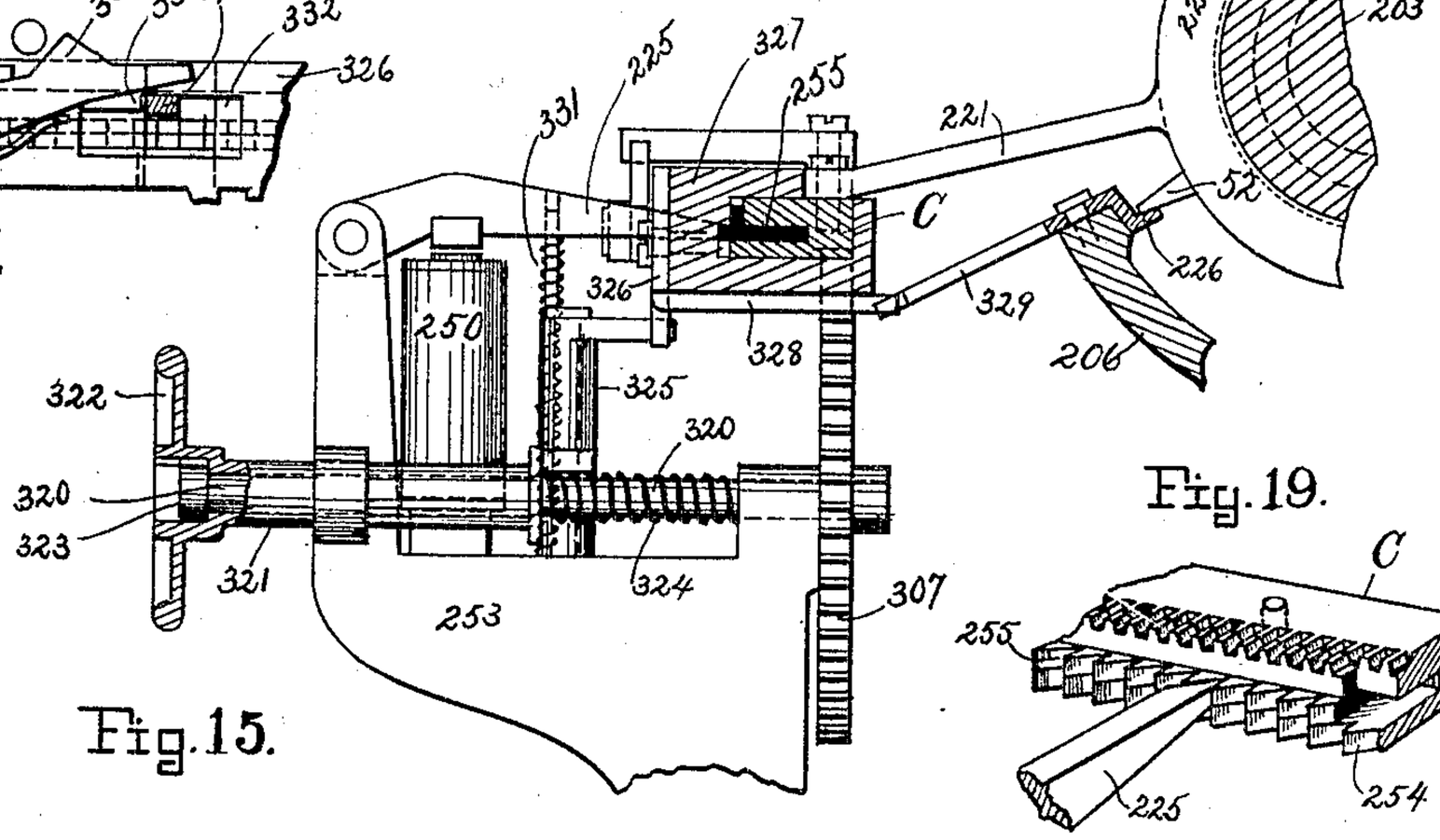
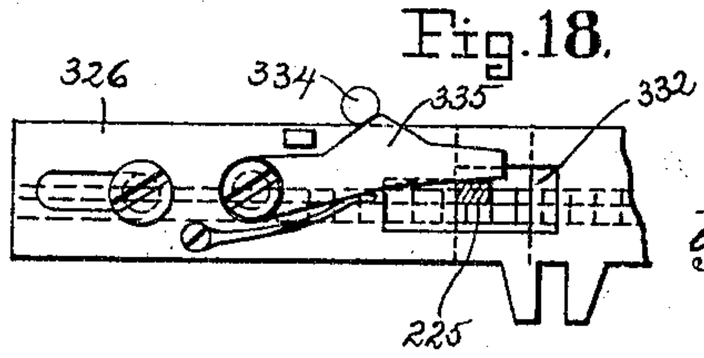


Fig. 19.

Fig. 18.



Witnesses.

H. L. Chapin.

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11 SHEETS—SHEET 8.

Fig. 25.

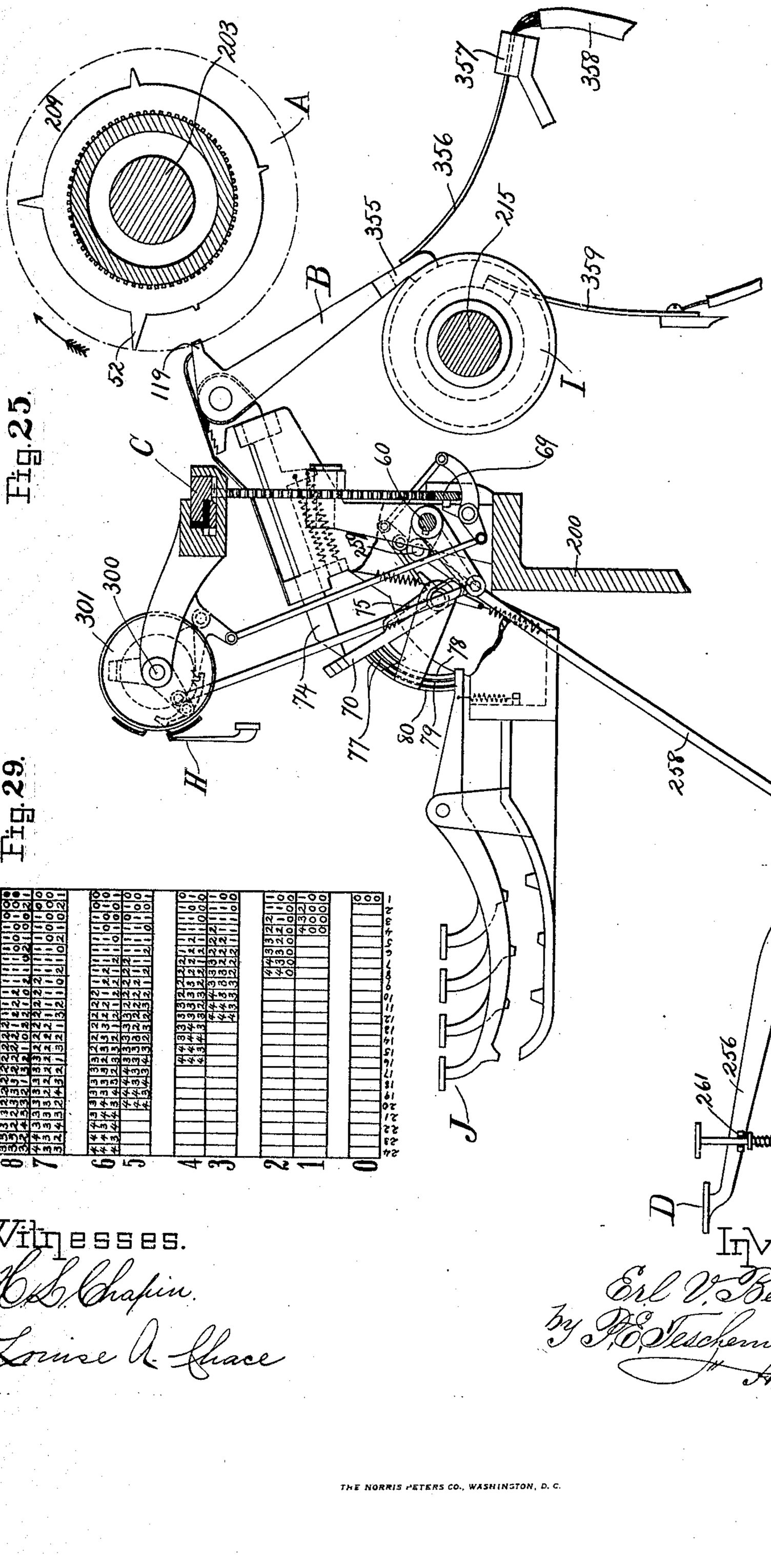

Fig. 29.

Witnesses.

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No. 870,926. PATENTED NOV. 12, 1907.

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COMPOSING MECHANISM FOR PRINTING BAR, MATRIX MAKING, AND TYPE SETTING MACHINES.

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11 SHEETS—SHEET 9.

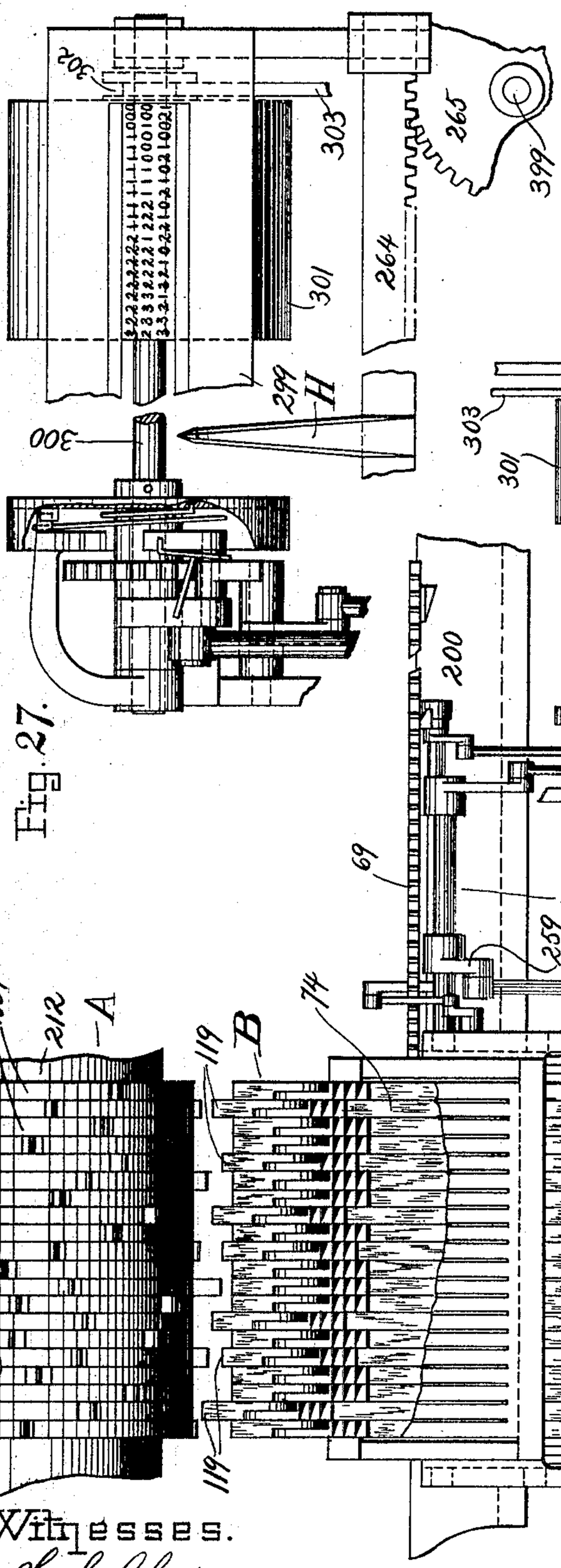

Fig. 27.

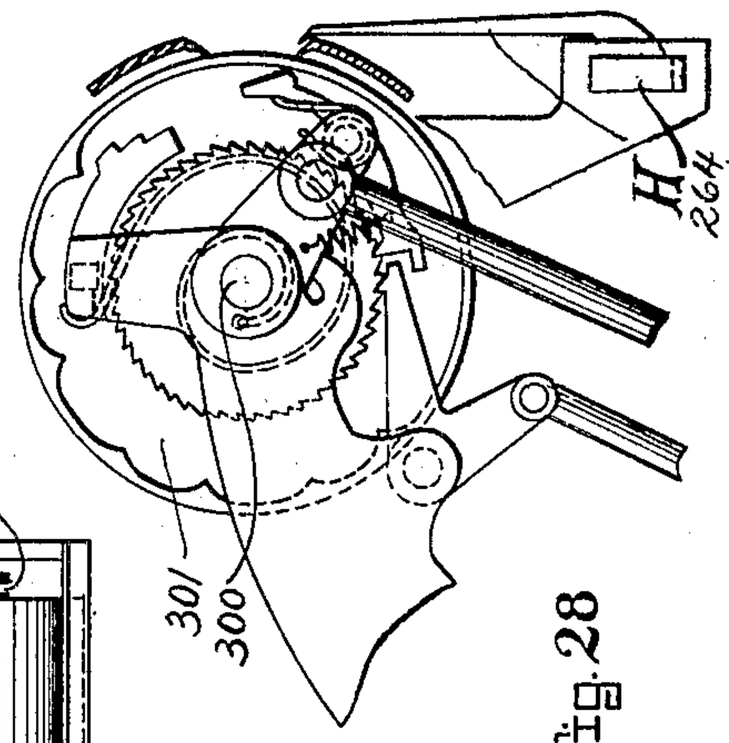

Fig. 28

Fig. 26.

Witnesses.

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No. 870,926. PATENTED NOV. 12, 1907.

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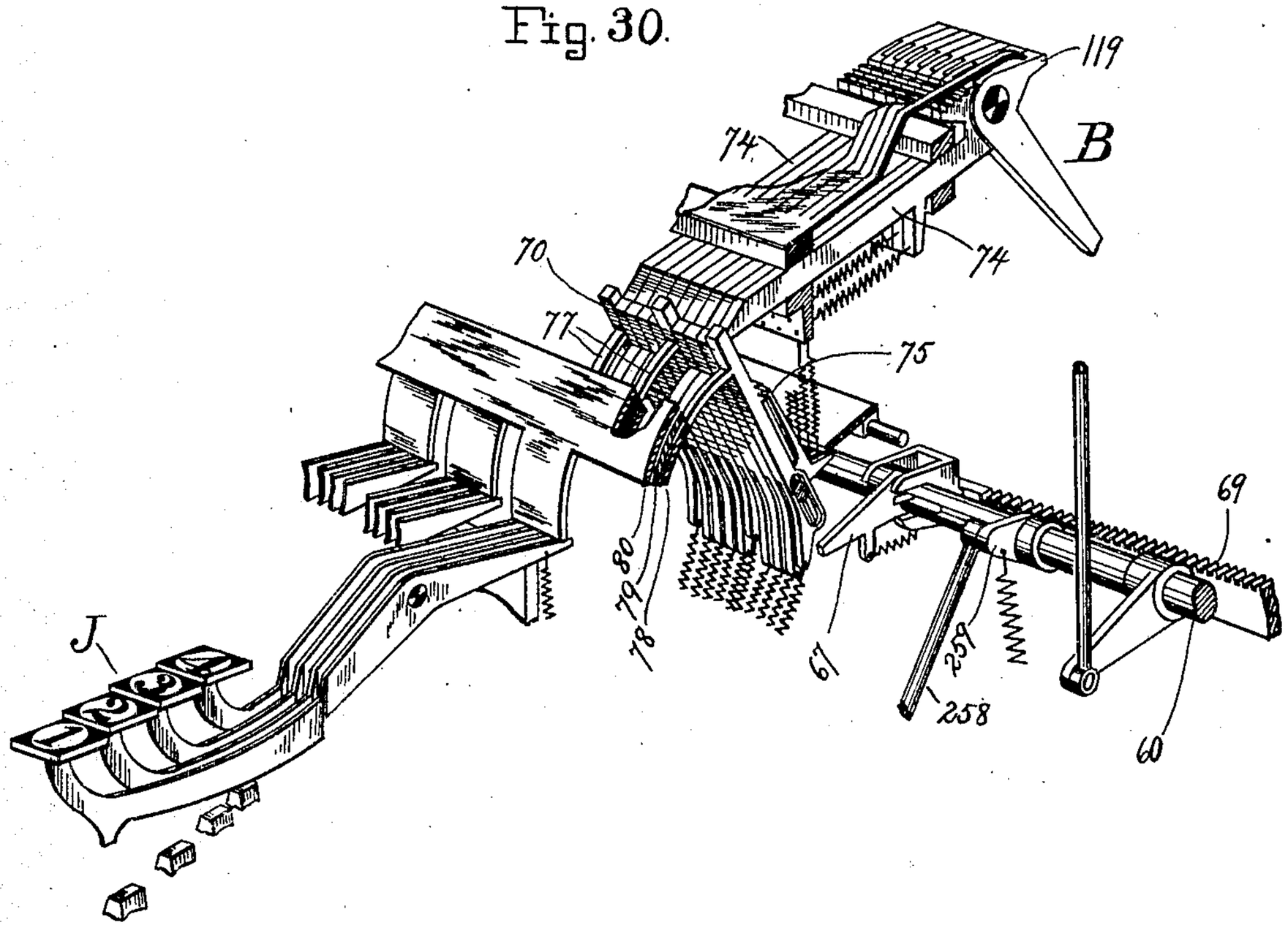
11 SHEETS—SHEET 10.

Fig. 30.



Witnesses.

H. L. Chapin.

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No. 870,926. PATENTED NOV. 12, 1907.

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11 SHEETS—SHEET 11.

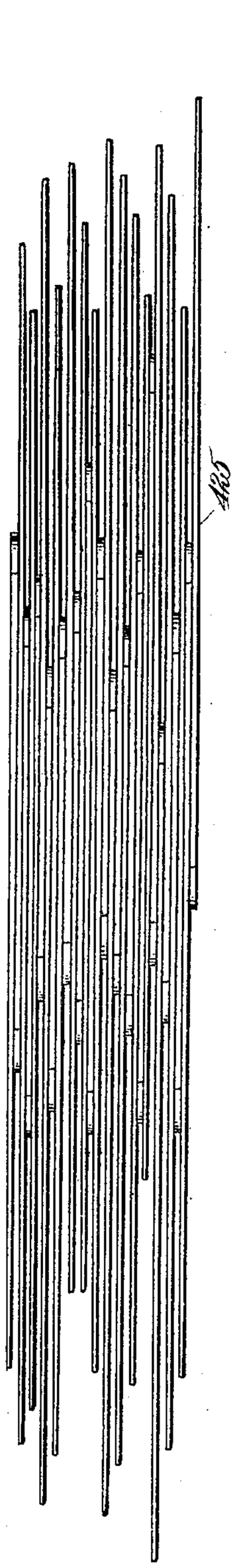

FIG. 31.

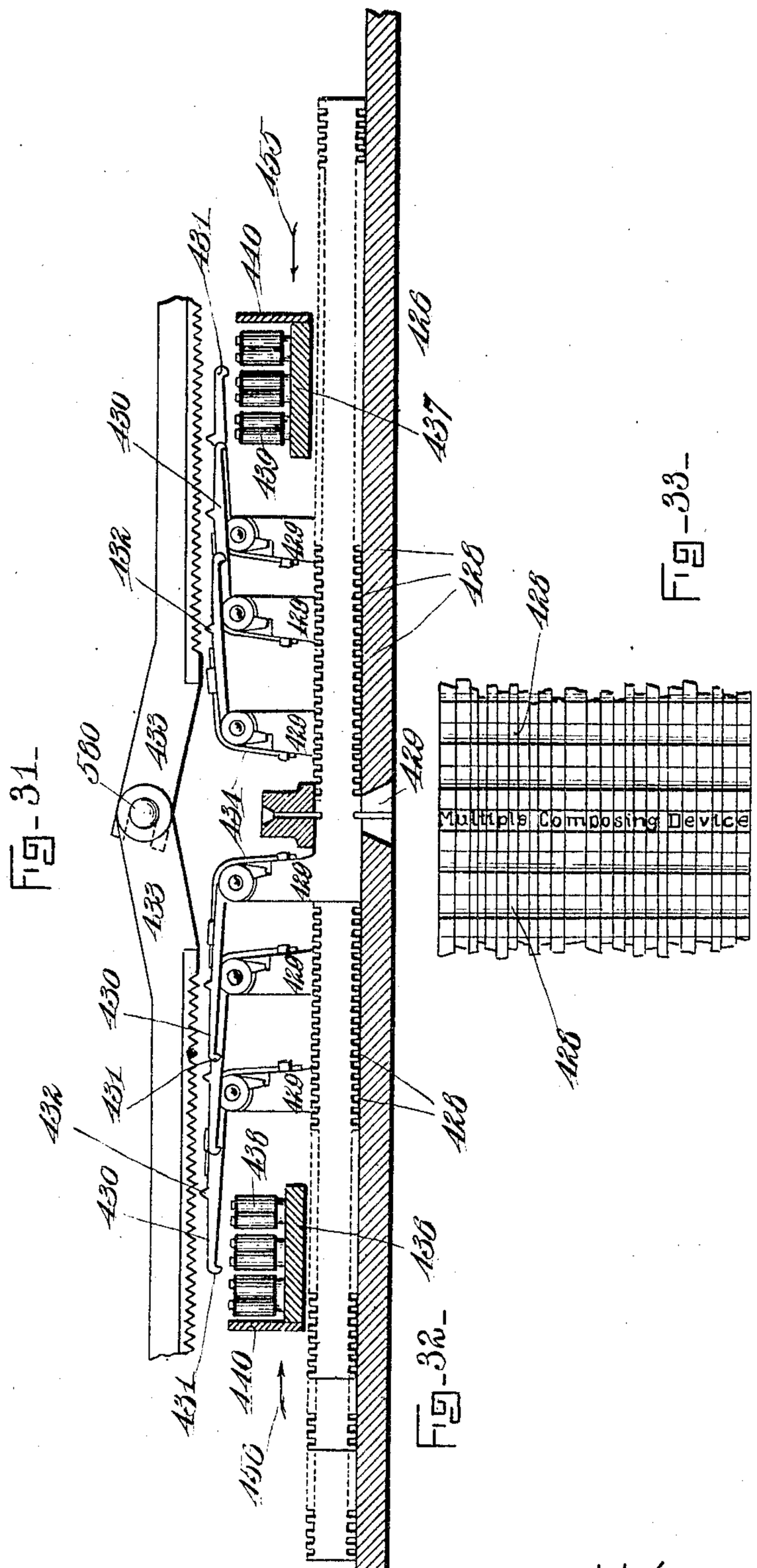

FIG. 32.

FIG. 33.

WITNESSES—

Wm. H. Varnum.

L. L. Basford.

INVENTOR—

Earl V. Beals

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Atty.

UNITED STATES PATENT OFFICE.

ERL V. BEALS, OF BOSTON, MASSACHUSETTS.

COMPOSING MECHANISM FOR PRINTING-BAR, MATRIX-MAKING, AND TYPE-SETTING MACHINES.

No. 870,926. Specification of Letters Patent. Patented Nov. 12, 1907.

Application filed February 21, 1898. Serial No. 671,170.

To all whom it may concern:

Be it known that I, ERL V. BEALS, a citizen of the United States, residing at Boston, in the county of Suffolk and State of Massachusetts, have invented certain Improvements in Composing Mechanism for Printing-Bar, Matrix-Making, and Type-Setting Machines, of which the following is a specification.

This invention is intended to facilitate and increase the product of printing-bar-producing, matrix-making and type-setting machines whose operations are entirely automatic except as to the manipulation of the fingerboard. Heretofore in machines of these classes the automatic part of each machine or that which directly assembles the characters in a composed line, has been controlled by a single operator working upon a single fingerboard attached thereto, and the speed or product of such automatic part has been limited to the capacity of one operator and restricted to the controlling action of one fingerboard. The automatic part of such machine is of necessity complicated and costly and therefore it is desirable that its operation be maintained as continuously as possible as well as at the greatest speed consistent with the strength and function of its parts.

In some machines of the present day, the automatic part referred to is made to perform part of its work while the operator is preparing a new line but even in these machines the speed of the automatic part is kept down to the limits of the fingerboard or else the continuous operation of the automatic part, if its full speed is maintained, is broken and rendered intermittent. Now the present invention is intended to take full advantage of this loss of operation in the automatic part by introducing a multiple fingerboard mechanism to take the place of the single fingerboard and thereby permitting more than one operator to work upon a single automatic assembling machine at one time. This multiple fingerboard mechanism is to coöperate directly with the "escapement mechanism" which exists in various forms of construction in all machines, whether type-setting, matrix-making or printing-bar-producing, the purpose of said escapement mechanism being to release in proper order the various characters to be assembled in line from their retained positions in magazines or from the other means by which they may be individually or collectively held.

It is obvious to all who are conversant with the art that the operation of a fingerboard, under the best practicable manipulation, is much slower than that which the "escapement mechanism" is capable of being worked to assemble in line the matrices or types as the case may be; *i. e.*, the interval of time devoted to touching of each key is much longer than that which is required by the corresponding resulting action in a properly constructed "escapement mechanism", and the present invention is intended to take advantage of this fact by automatically working the "escapement mechanism", with which it directly coöperates, at such a rate of speed as no single operator could possibly work it, the sequence of the escapements being so close that all the characters and spaces in a line seem to be assembled by one stroke or operation.

My multiple fingerboard mechanism consists in a series of independent fingerboards all coöperatively connected together, and each operating, in any sequence of turns, the one escapement mechanism, there being an operator for each fingerboard. The number of fingerboards depends upon the capacity of or speed at which can be operated the automatic part of the machine. In the drawings the coöperation of three fingerboards is shown and with such connections as will enable them to work in conjunction with an automatic machine of special construction invented by me and which forms no part of the present invention, said automatic machine being designed to both assemble and return all the characters and spaces of a line practically simultaneously instead of consecutively in the order in which they occur in a line.

In order that the detailed description herein given may be better understood, I will here give a general explanation of the principle parts and their function.

The whole multiple fingerboard mechanism is divided into as many distinct sets or parts as there are fingerboards used, and each set is the exact duplicate of each of the other sets. Each set has mounted on a fast-revolving arbor a series of thin revolving rings each having a lug or projection extending out radially beyond its periphery. The finger keys, acting through suitable mechanism upon each ring of this series consecutively, in the order in which said rings are mounted, stop it so that its lug will stand in a certain definite radial position which depends upon the particular key struck. As the rings are stopped or set they are slipped sidewise off the revolving arbor on a stationary arbor which holds them in their set positions, said slide movement being effected by the whole series of rings being slipped along, after each key is struck, a distance just equal to the thickness of one of the rings so that, when all the keys for a single line have been operated, all the rings, as a "sectional cylinder", have been slid on the stationary arbor and the lugs of said rings project in all manner of radial positions. The one lug on each ring can be stopped in as many different radial positions as there are different characters in printing, so that each lug may become the agent for producing in any line any character the operator may desire to insert, the actual assembling of the character in line being effected by revolving the whole series of set rings, as a cylinder, coöperatively with the action of the character "escapement mechanism" of any automatic ma-

chine so that the lugs or projections on said rings may properly effect the releasing of the characters—the lug on the first ring effecting the escapement of the first character, the lug on the second ring the second character, etc. For example, if the characters of the word "multiple" are to be produced in line, the operator will strike the "m" key and the revolving of the first ring will be stopped with its lug in the "m" radial position; next the "u" key will be struck and the revolving of the second ring will be stopped with its lug in the "u" radial position; and so on until the revolving of the 3rd, 4th, 5th, 6th, 7th and 8th rings has been stopped with their respective lugs in the "l" "t" "i" "p" "l" "e" radial positions. At the conclusion of the line the operator pushes a delivery lever, and the sectional cylinder, made up of the series of set rings, revolves one or more times according to the particular automatic machine with which it is connected, and the rings are then immediately and automatically returned to the revolving arbor, ready to be set again for the next line, and the automatic machine produces the printing-bar, matrix or line of type in the usual manner and delivers it properly into as many different galleys as there are operators at work.

It should be understood that each operator works independently of his neighbors on different matter and with such intervals of action and inaction as he may choose; in fact just as though he were the only one at work on a single keyboard machine; also that each operator is connected directly with the automatic part of the machine only from one to three seconds at a time, and simple means are provided by which are prevented any possible interferences such as would occur if two or more operators should happen to complete their lines at exactly the same time.

My invention also consists in other devices and combinations of less importance to the understanding thereof, and these will be described more fully and pointed out in the claims.

As one example of a machine to which my present invention may be applied, I will refer to Letters Patent of the United States, No. 490,263, granted to me January 24, 1893, for a matrix-making machine. In the machine shown and described in the said patent, the assembling of matrices is electrically controlled by a perforated strip or roll of paper which passed beneath a series of electric needles connected by wires with the assembling mechanism. My present invention relates to a mechanism which is intended to supplant the electric needles, reeling device and perforated roll above referred to, and is designed to coöperate with the mechanism for assembling the matrices in substantially the same manner as was accomplished by said perforated roll.

In the accompanying drawings:—Figure 1 is a plan of my improved composing mechanism for printing-bar, matrix-making and type setting machines. Fig. 2 is a front elevation of the same. Fig. 3 is an end elevation of the same. Fig. 4 is a plan view of the multiple fingerboards, illustrating the manner in which they coöperate. Fig. 5 is an enlarged perspective view showing the manner of arranging the lug-bearing rings which are designed to actuate the mechanism for assembling matrices or types, certain portions being broken away to show the interior construction. Fig. 6 is an enlarged perspective view of a portion of the mechanism shown in Fig. 5, together with the operating gears, portions of the justifying mechanism and circuit-breakers used in connection therewith. Fig. 7 is a detail to be referred to. Fig. 8 is a detail in perspective showing a portion of the stem of one of the composing keys and illustrating the manner of closing and breaking the electric circuits which control the setting of the lug-bearing rings. Figs. 9, 10, 11, 11^a, 9^a, 9^b, 12, 12^a and 13 show the registering device in plan, and side and end elevation, together with details of the same. Figs. 14, 15, 16, 17, 18, 19, and 20 are details of the escapement mechanism and parts immediately connected therewith, showing a portion of the sectional ring cylinder and its connections with the escapement-bar. Figs. 21 and 22 are two detail views illustrating the manner of locking the sleeve upon which the lug-bearing rings are threaded. Figs. 23 and 24 are details of the mechanism for automatically preventing the interference of the operation of one fingerboard with another. Figs. 25, 26, 27, 28, 29 & 30 are details of the justifying mechanism which coöperates with the composing mechanism. Fig. 31 is a plan of a series of matrix strips in a machine for producing printing-bars with which the composing mechanism forming the subject of this application is designed to coöperate. Fig. 32 is a side elevation of said matrix strips, their operating magnets mounted upon carriages, the hooked armatures pivoted to the matrix strips, and the grooved plates for locking said matrix strips. Fig. 33 is a detail of the under side of the matrix strips on the line 33—33 of Fig. 31.

In the description, since all the fingerboard sets are alike, I will describe first one complete and then their joint arrangement.

In the drawings 200 represents the base of the machine from which rise two arms 201, 202.

203 is a horizontal shaft, one end of which is journaled in the arm 201, its opposite end being supported in a bearing 204 formed at the center of one head 205 of a magnet-supporting casing or shell 206. At one end of the shaft 203 is a pulley 207 over which passes a small belt by which it is rotated at a high speed. Over an enlarged portion of the shaft 203 are arranged to slide laterally and rotate freely thereon, a series of thin rings 209, as shown in Figs. 5 and 6, each provided with a long lug 52 and also with other shorter lugs of various lengths for justifying purposes, as will be hereinafter described. Each ring is provided on its inner periphery with teeth which, as said ring is moved laterally along the shaft 203, engage longitudinal ribs 211 on a sleeve 212 supported on the shaft 203, as shown in Figs. 1 and 2, said sleeve carrying a gear 213 with which meshes a smaller gear 214 secured to a long shaft 215 extending lengthwise of the mechanism and connected by suitable gears 216, 217 with a shaft 218 receiving motion from the main machine in such manner that it will intermittently revolve in one direction and then in the opposite direction. The right hand end of the sleeve 212 fits closely against a shoulder on the shaft 203 formed by the enlarged portion of the same, the diameter of said sleeve being the same as that of the said enlarged portion. The sleeve 212 is held in a fixed position as shown in Figs. 21 and 22, by a spring locking-device 219 fastened to the projection 201 and acting,

by entering a notch 222, to lock the gear 213 to which the sleeve is fastened as shown in Figs. 1 and 2. The entire series of rings 209 is embraced by two collars 220 forming part of a yoke 221 secured to an escapement bar C as shown in Figs. 1, 14 and 15. To the left hand end of this bar is secured a cord 223 passing over guide pulleys and having its other end fastened to a long coiled spring, 224, which serves to draw the said escapement bar to the left as permitted by a vibrating magnet-actuated pawl 225. All of the rings 209 being upon the enlarged portion of the revolving shaft 203, as shown in Fig. 2, they would revolve with said shaft if not prevented by a sliding stop-bar 226 with which the long lugs 52 are brought into contact, as shown in Fig. 5. This sliding stop-bar 226, when in its normal position as shown, permits the revolving of three of the rings 209 with said shaft, such revolution being insured by a spring-pressed block 227 inserted within the shaft 203, as shown in Figs. 2 and 7, and designed to produce a frictional contact with the interior periphery of said rings, as clearly shown in Fig. 2.

The composing magnets.—The shell or casing 206 encircles the enlarged portion of the shaft 203 and the rings upon the same, and, arranged around the outside of this casing, are as many magnets 228 as there are different characters used in printing. These magnets are arranged in rows, one behind the other, so that their centers will be in different radial positions. Secured to the armature of each magnet is a rod 229, the left hand end of which passes through a flange 232 forming the left-hand end of casing 206 and is connected with one of a series of pivoted stop arms 230, the other end of said rod passing through the head 205 and being connected with one of a series of similar arms 231 pivoted at its outer end in said head. The arms 230 are arranged radially around the flange 232, being supported in grooves 233, 234 in rims formed on the outer face of said flange and the arms 231 are arranged radially around the head 205 in a manner similar to the arms 230 and designed for a purpose to be hereafter described. The inner ends of the arms 230 are normally held by springs 235 out of the plane of travel of the first of the three rings 209 which revolve with the shaft 203, and when the inner end of any one of the arms 230 is drawn inward to the bottom of its groove 234, by the action of its particular magnet 228, to the armature of which its rod 229 is attached, it is placed in the path of travel of the first of the three revolving rings only to intercept the long lug 52, thereby arresting the rotation of this ring with the said lug 52 in a radial position determined by the radial position of the stop arm 230 which was drawn in to intercept it, the frictional contact of the spring-pressed block 227, in the revolving shaft 203, keeping said lug 52 in contact with said stop-arm, as shown in Fig. 5. Each of these magnets 228 is electrically connected with only one of the composing keys 236 of one of the three fingerboards X, Y, Z, the keys thereof controlling the radial positions in which the long-lugs of the several rings are stopped, since there are as many magnets as keys and radial arms as there are magnets.

Threading the composed rings.—As a composing key is released after having been depressed to stop a ring as desired, the whole series of rings 209 is moved to the left by the action of the spring 224, on the escapement bar C attached to the yoke 221, a distance limited by said escapement bar in a manner to be hereinafter described, which lateral movement of the rings causes the ring last set or stopped to be forced off from the enlarged portion of the shaft 203 onto the stationary sleeve 212, the teeth of said rings engaging the ribs 211 of said sleeve as it is threaded thereupon, and so on with each of the other rings in succession until they are all threaded onto the stationary sleeve 212 except as will hereinafter be explained. The body of the casing or shell 206 together with its flange 232, instead of being a complete circle, is provided with an opening 237, as shown in Fig. 3, to permit of the passage of the yoke 221 which slides the rings on the revolving shaft 203, and the flange 232, is provided at its periphery with an annular cap 238 which projects over the pivoted ends of the arms 230 to hold them in the grooves 233 in which they are pivoted. The pivoted arms 231, which are arranged radially around the head 205, similarly to the arms 230 on the flange 232, are likewise held in place by an annular flange 239 similar to the flange 238, said arms being designed to control the registering device to be hereinafter described.

The key board.—Leading from a battery 251 Fig. 1 is a wire 252 which is electrically connected alike with all of the magnets 228, and leading from said magnets is a series of insulated wires preferably laid together and forming a cable 240, there being in this cable one insulated wire from each magnet. This cable leads to the fingerboard Y its wires being spread out and communicating one with each composing key in the manner shown in Fig. 3 which will now be described. A series of bars 241, composed of non-conducting material, extend in parallel rows under the series of rows of composing keys of the key board. Each bar has secured to it on one side a series of separate spring contact-strips 242, insulated from each other by said bar and each having one of the wires of the cable 240 attached thereto. To the opposite side of each bar 241 is secured a second series of spring strips 243 all connected together at their lower ends, forming a single piece to which is attached a single wire 248, the wires from the several pieces converging to and being connected with a single wire 249 which leads to the magnet 250 which operates the vibrating escapement pawl 225 before referred to, the current thence passing by the wire 249 to a suitable device S, of known electrical resistance, from which it returns to the battery 251 by the continuation of the wire 249. Between the upper ends of the strips 242, and 243 is a tapered block secured to the lower end of a composing key-stem, said block being composed of a lower section 245 of non-conducting material and an upper section 246 formed of a conducting material whereby, when the key is held in its normal raised position by its spring 247, the non-conducting section 245 only will be between the upper ends of the strips 242, and 243, thus interrupting or breaking the circuit at that point. On the depression of a key the conducting section 246 will be interposed between the ends of the two strips, thus completing the circuit to energize the particular magnet 228 connected therewith.

262 is a soft rubber buffer for cushioning the downward stroke of the key.

The escapement magnet 250 is mounted on a supporting bracket 253, Fig. 3, its armature having secured

to it the escapement pawl 225 which is pivoted to the upper end of a projection on the said bracket. The vibrating end of this pawl is adapted to engage alternately two rows of ratchet teeth, 254, and 255, slidingly coupled together, Figs. 19 and 20, whereby the escapement bar C is given a step by step movement by the spring 224 in a well known manner as shown particularly in Figs. 19 and 20, a spring 255′ being interposed between the slides 254 and 255, which spring serves to push forward the slide 255 as far as the pin 254′ in the slide 254 will permit, a slot 256′ being provided in the slide 255 for the play of said pin 254′.

256 is the space key lever pivoted at 257 and having connected therewith a rod 258, Fig. 1, the upper end of which is pivoted to an arm 259 on a rock-shaft 60 which actuates the justifying mechanism to be hereafter referred to. The space key lever is provided near its outer end with a forked projection 261 which embraces the stem of a space composing key which is designed to produce a space instead of a character, said key making and breaking, in the same manner as described for the composing keys, a circuit controlling a particular stop arm 230 which is designed to stop any ring 209 of the series with its longest lug in such a radial position as will produce, along with the printing characters, the thinnest spaces which it is intended to place between the words of a composed line.

The registering device.—To enable the operator to know, at diverse times during the composition of a line, what portion of a line remains to be filled, I provide a registering device to point it out on a scale or indicator. This device is provided with a pointer H, Figs. 10 and 11, which is attached to a rack-bar 264 operated by a gear 265 on a shaft 399 which is coupled by a friction clutch 400, Fig. 13, to a shaft 266, to the opposite end of which is secured a worm gear 267 meshing with a worm 268 on a sleeve 269 which is fitted over the reduced end 270, Fig. 5, of the rapidly revolving shaft 203. Motion is transmitted to this sleeve from the shaft 203 through an adjustable spring friction device 271, Figs. 12 and 12ª. Upon this sleeve is splined a grooved ring 272 which is embraced by the forks 273 of one arm 274 of a bell crank lever N fulcrumed at 275, the other arm 276 of said lever N having a pin 277 which enters the serpentine groove of a cam wheel 278, whereby said bell crank lever N is vibrated so as to slide the grooved ring 272 backward and forward on the sleeve 269 upon which it is splined. The cam wheel 278 is loosely mounted on a shaft 279, said wheel carrying a ratchet wheel 280 which is engaged by the pawls 281 and 282 secured to arms 283 and 284, said arms being connected respectively with two gears 285 and 286, which communicate reciprocating motion to them. These gears mesh with teeth, Fig. 19, on the upper sides of the two ratchet-toothed escapement bars 254 and 255, and each gear is alternately rotated a small fraction of a whole revolution at each complete action of a composing key, since said bars are slidingly coupled so that one will move ahead of the other on the down stroke of the key to be followed by the other on the up stroke of the same, and thus, through the connections described, intermittent motion is imparted to said cam wheel 278 to produce the required lateral vibration of the grooved ring 272. This grooved ring is provided on opposite sides with two teeth 287 and 288 which engage, respectively, ratchet teeth on the inner faces of two rings 289 and 290 loosely mounted on the sleeve 269, said rings having two arms 291 and 292 which are provided at their ends with spring pressed pivoted tips 293 and 294 adapted to yield in one direction only, said tips swinging on their pivots in planes at right angles to their arms as shown in Figs. 9ª and 9ᵇ. Each of the rings 289 and 290 is provided with a grooved hub 295, around which passes a cord 296 connected with a spring 297 which tends to rotate the ring to which it is attached until the tip of its arm is brought into contact with some one of the series of radially pivoted stop arms 231 which has been thrown out by the action of one of the magnets 228, as previously described, the tip of the arm 292 being shown in contact with one of said stop-arms 231 in Fig. 9, the other arm 291 being shown in contact with a fixed stop 298 projecting from the frame against which stop, both arms are brought into contact alternately as will now be described. The friction device 271, on the shaft 203 acting upon the sleeve 269 upon which is splined the grooved ring 272, tends to rotate said ring 272 in a direction opposite to that in which the arm 292 was revolved by the spring and cord to bring it into contact with the stop-arm 231, and thus when the grooved ring 272 is so vibrated that its tooth 288 engages a notch of the ratchet ring 290 and its tooth 287 is withdrawn from engagement with the toothed ring 289, the ring 272 is free to be moved by the frictional device described, carrying with it the ring 290 until its arm 292 strikes against the fixed stop 298 in the frame. The fractional revolution of the grooved ring 272 and the sleeve 269 and worm 268 connected therewith is measured by the distance that the arm 292 has traveled from the particular stop arm 231 (which corresponds to a certain thickness of letter) to the fixed stop 298, this distance being varied each time a different composing key is struck to throw out a stop-arm 231 into a different radial position; consequently this varied movement of the worm 268, through the means described, is transmitted to the registering pointer H.

When the grooved ring 272 was vibrated, as described, the tooth 287 was disengaged from the ratchet toothed ring 289 and the latter, with its arm 291, was by its spring and cord rotated to bring the tip 293 of the said arm into contact with such one of the stop arms 231 as was thrown out by the depression of the particular composing key struck to effect the last vibration of the grooved ring; the arm 291 being thus stopped in the radial position determined by the radial position of the pivoted stop arm 231. Said ring 272 is then vibrated in the opposite direction, by the secondary motion of the cam 278, coincidently with the upward movement of the composing key, bringing the tooth 287 back into engagement with one of the notches of the ratchet ring 289 without entirely disengaging the tooth 288 from the ratchet ring 290. On the downward stroke of the next composing key struck, the primary movement of the cam wheel 278 vibrates the grooved ring 272 (which as just described was left normally in an intermediate position between the toothed rings 289 and 290) to its extreme inward lateral throw, thereby entirely disengaging its tooth 288 from the notches of the ratchet ring 290; thus permitting the ring 272 with the worm 268 to revolve with the shaft 203 until the arm

291 of the ratchet ring 289, which it carries with it, comes into contact with the fixed stop 298 in the same manner as the other arm 292, after which the grooved ring 272 again returns to its intermediate normal position; but before this return of the grooved ring the arm 292 has been thrown over by its spring and cord to contact with and be stopped by another pivoted stop-arm 231 which has been thrown out by the depression of the composing key which had produced the extreme inward movement of the grooved ring 272 as just described. Thus it will be understood that the arms 291 and 292 act alternately in the manner described to impart varying rotary motion to the worm 268, one arm acting through the mechanism described to register the variable thickness of one character and the other arm the next character, as struck by the composing keys, and so on; the different degree of rotation of the worm 268 imparting, through its connections described, a correspondingly varying amount of the movement to the registering pointer H to point out on a scale or other indicator 299 what portion of the line being composed remains to be filled. For the purpose of returning the registering pointer H to its starting point, I provide a spring 398 Fig. 10, one end of which is secured to the frame and the other end to the gear 265 which drives the rack 264 to which the pointer H is attached. When the pointer H travels forward, the spring 398 is wound up and serves to return the pointer to its starting point as soon as the shaft 399 is released which is effected by the uncoupling of the clutch 400 against the resistance of a push spring 401 which is accomplished by a bell crank lever 402, one arm of which is struck by a lug 403 on the escapement bar C after the line has been composed. The registering device just described does not register the total thickness of each character composed but only the excess in thickness of each character over the thickness of the thinnest character, no provision being here made, in the mechanism thus far described, to record the thickness of the thinnest character, the record of which is kept by a coöperating device, which will now be described.

The co-operating drum of combinations.—On a shaft 300 having its bearings in suitable supports shown in Figs. 9, 10 and 11 is mounted to slide longitudinally thereon a cylinder 301, on the end of which is a grooved collar 302 which is embraced by a forked arm 303 which is secured to the escapement rack bar C which rack bar is traveling in the direction of the arrow Fig. 9 during the composing of a line, carrying with it the cylinder 301 an equal distance for each letter struck no matter what its character may be. The pointer H is attached to the rack-bar 264 as before stated, which bar moves in guideways in the supporting arms of the shaft 300, said pointer being thus permitted to travel in a path parallel to that of the cylinder 301 but in the opposite direction so that they travel toward each other. At the beginning of a line the pointer starts from a position 304 shown in Figs. 9 and 11, and the cylinder 301 starts from a position 305, and as each composing key is struck the escapement-bar C of course moves and carries with it the cylinder 301 a certain fixed distance at the same time the pointer H travels toward it, in varying distances according to the character composed; the cylinder moving a definite distance and the pointer a varying distance. Lengthwise of the cylinder 301, and beginning at the outer edge, are formed twenty-four divisional lines each division representing a unit of measure, the lateral extent of which exists a certain number of times or fractions thereof in each character to be assembled. The distance from the outer or zero edge of the cylinder 301 to the starting point 304 of the pointer H is a fixed number of these units of measure, for instance one hundred and eighteen, which represents the predetermined length of a composed line. Now as the cylinder and pointer approach each other, it will be understood that when the pointer reaches the zero edge of the cylinder 301 the line is full, since the movement of the cylinder 301 recorded a definite part of the thickness of each character to be assembled and the movement of the pointer recorded all that varying part of each character in excess of what was recorded by the cylinder, and any time before the pointer reaches said edge, after having passed the first edge, it will indicate on the divisional lines of said cylinder the unfilled portion of the line in units of measure not exceeding twenty-four in number. A suitable alarm or signal device 306 is provided which will give notice to the operator when the pointer has reached the first edge of the cylinder. I preferably use a colored incandescent lamp which is lighted by closing a circuit when the two contact points 306^a, 306^b, Fig. 2, one secured to the pointer H and the other to the arm 303 which slides the cylinder 301 on its shaft, come together.

As one example showing how the indicator operates to point out the units of measurement of the characters of a particular line, I will assume the line to contain the words "Multiple Composing Attachment." Upon depressing the "M" key, Fig. 11, the cylinder 301 moves to the left two units, and the pointer H moves to the right four units, as previously described, bringing the cylinder and pointer six units nearer together, which number of units represents the amount of lateral space that the letter "M" occupies in the line. Upon depressing the "u" key for the second letter in the line, the cylinder 301 again moves to the left, as before, a distance of two units, and the pointer H moves to the right a distance of two units only instead of four units, as before, by means of the mechanism already described, thus bringing the pointer and cylinder four units nearer together, which represents the amount of space that the letter "u" occupies in the line. Upon depressing the key for the letter "l" the cylinder 301 moves to the left two units, as before, but the pointer H does not move at all to the right since the movement of the cylinder alone brought the pointer and the cylinder two units nearer together, which was sufficient to represent the amount of space that the letter "l" occupies in a line. When the "t" key is depressed the pointer and cylinder will come nearer together three units, the "i" will bring them nearer together two units, the "p" four, the "l" two, the "e" three, the space between the words "Multiple" and "Composing" two, the "C" four, the "o" four, the "m" six, the "o" four, the "s" three, the "i" two, the "n" four, the "g" four, the space two, the "A" four, the "t" three, the "t" three, the "a" four, the "c" three, the "h" four, the "m" six, the "e" three, the "n" four, the "t" three, and the period two. It will be found that after the proper keys have been depressed for all the letters in said line, the cylinder 301 and

pointer H will have been moved toward each other a total distance of 104 units, which represents the total space occupied by the characters in the line "Multiple Composing Attachment". When during the manipulation of the keys, the key for the letter "c" in the word "Attachment" was depressed, the pointer H and the cylinder 301 had arrived within 24 units of each other, and, therefore, during the rest of the line the pointer H indicated on the chart encircling the cylinder 301, the number of units in the line remaining unfilled as well as pointing out thereon one of a series of combinations which are for the purpose of justifying the line, and constitute no portion of this invention.

The delivery of the set rings.—After the operator has reached the end of a line, as indicated by the registering pointer just described, all of the lug-bearing rings, including such at the right hand end of the series as it may not have been found necessary to use in said line, are carried over to the left until they are stopped by the shoulder 319 on the sleeve 212 where they will be in the proper position so that their lugs will contact with the proper circuit-breakers, when the cylinder is revolved as will be described. This is effected by the spring 224 acting on the yoke attached to the escapement-bar C which is released by raising the magnet pawl 225 entirely clear of the teeth of said bar, which releasing is effected by the operator in the following manner. Over the shaft 320 of the gear 307, (which shaft is supported in suitable bearings in the frame) is fitted a long splined sleeve 321 provided at its outer end with a hand-wheel 322 and having a longitudinal movement on said shaft and prevented from slipping off the same by a head 323 thereon. This sleeve is adapted to be pushed in by the operator against the resistance of a spring 324 to act on the lower arm of a sleeve 325 mounted on a vertical stud and having an upper arm which engages a horizontal slide 326 supported in suitable guides on a slideway 327 of the escapement-bar. The slide 326 is provided with a projecting arm 328 which engages a notch in the end of an arm 329 projecting from the sliding stop-bar 226 the inner edge of which, as before stated, acts as a common stop for all the lug bearing rings except three before said rings are set by the composing key. In the slide 326 is formed a rectangular slot or opening 332, Figs. 16 and 17, through which extends the vibrating end of the magnet pawl 225, such opening being enlarged at its right hand end, forming a shoulder 333. The magnet pawl 225 normally lies within the narrower portion of the slot, as shown in Fig. 16, which serves to keep it in engagement with the escapement-bar, but when the slide 326 is moved to the left, by the means described, the wider portion of slot 332 is brought over the magnet pawl which is then forced entirely out of engagement with the escapement-bar by its spring 331, and thus the escapement is free to be drawn by the coiled spring 224 to the end of its traverse in that direction. When the rings are automatically returned to the right for the beginning of a new line, as will be described, a projection 334, on the escapement-bar C contacts with an angular projection on a spring-pressed pivoted arm 335 which acts on the vibrating end of the magnet pawl 225 to force it down into engagement with the teeth of the escapement-bar C after which the slide 326 is free to be moved to the right by the spring 330, bringing the parts again into the position shown in Fig. 16, and keeping the magnet pawl from springing out of engagement with the escapement-bars.

The correcting of errors.—In order to enable the operator to discover any errors and make corrections thereof during the composing of a line, I provide the periphery of each of the lug-bearing rings with all the different characters used in printing, and as the rings are set, such of these characters as are to appear in the composed line, are brought side by side in a common line to be read transversely of the rings. Now if the operator discovers a wrong letter on one of the rings, as shown in this line, he releases the escapement-bar C from the magnet pawl 225 by pressing in the hand-wheel 322 as already described, retaining his hand on said wheel, by the turning of which he rotates the splined shaft 320 and, through its connections with the escapement-bar C brings back the entire series of rings in the yoke 221 (which as before stated is connected with the escapement-bar) until the particular misset ring is again brought into the intercepting plane of the stop-arms 230 where the said ring is reset to bring its lug in the proper radial position in the regular manner as has been described, after which the operator proceeds to complete the composition of the line.

The justifying mechanism.—The line having been composed, it now remains to justify the same which is accomplished by a justifying mechanism Figs. 6 and 30. This mechanism forms the subject of a separate application for patent to be filed by me and will therefore be only sufficiently described herein to illustrate the manner in which it coöperates with the composing mechanism. At the beginning of the composed line a traveling splined arm 67 stands under the first one of a series of pivoted sliding plunger-bars 70, and after the first character key is struck, said arm is moved along a rock-shaft 60, Fig. 30, by an escapement rack-bar 69 geared to and receiving an intermittent movement from the main escapement-bar C, so that said arm will be brought successively under plunger bars until the end of a word is reached, when the space key D is struck which rocks the shaft 60 and causes the particular plunger-bar which happens to be over said splined arm 67 to be raised, in which raised position it is retained by one of a series of pawls 75 entering a particular one of the three notches on said plunger bar depending upon the height to which it was raised. The arm 67 then continues to travel lengthwise of the shaft 60 until the end of the second word is reached, when the space key is again struck for the second space in a line and a second plunger-bar is raised in the same manner as the first one and so on until the composition of a line is completed. The plunger-bars are raised three different heights determined by a check mechanism shown in Figs. 27 & 28 as fully described in my aforesaid separate application for patent, the same order in the raising of the plunger-bars being observed in every line; and coöperating with this check mechanism is a combination chart Fig. 29 and also fully described in my said separate application. This chart is mounted on a cylinder 301 coöperating with the registering device which has been herein previously described. At the conclusion of the composition of a line the registering pointer H indicates on this chart a cer-

tain combination of three figures and the operator depresses such of a series of justifying keys J, Figs. 3, 25 & 26 as bear numbers corresponding to the figures of said combination. These keys act upon swinging pusher-bars 78, 79 and 80 which in turn act upon the arms 77 projecting from the plunger-bars 70, swinging the same forward on their pivots and projecting or thrusting outwardly certain ones of a series of slides 74 which have pivoted at their outer end the circuit-breaking levers B. The slides 74 are thrust forward the same or different distances which are determined by the particular justifying keys that are depressed, the particular ones which are thrust out depending on the particular plunger-bars which are raised by the space key D. All the plunger-bars which are raised to a certain height cause their corresponding slides to be thrust out an equal distance. The series of slides 74 is located, as shown in Fig. 6, in front of and close to the sectional lug-bearing ring-cylinder A in such manner that the tips 119 of the circuit breaking levers B, pivoted to said slides, may be struck by the lugs of said rings as they are revolved, and thus cause to be assembled the proper spaces to justify the line as will be explained in the description of the manner in which the tripping of the circuit-breakers B produces the assembling of characters.

The revolving of the series of set rings.—The revolving of the rings is effected in the following manner: When the operator pushes in the hand-wheel 322 to deliver the rings to a fixed position as described, the tapered block 311 carried by the justifying rack-bar 69 is then advanced in the direction of the arrow, Fig. 2, to the end of its traverse and closes an electric circuit by contacting with the two spring strips 312 and 313. In this circuit is interposed a magnet 337, the armature of which is attached to the short arm of a lever 338 pivoted at 339 and operating a clutch 340 splined on the shaft 215 which has an intermitting reciprocating movement as before described, thereby connecting said shaft with the gear 214, the hub of which constitutes the other member of the clutch 340; and thus, when the circuit is closed, the magnet 337 is energized and, through the connections described, the motion of said shaft 215 is communicated to said gear 214 and thence to the cylinder A through the gear 213 and its integral sleeve 212 upon which the rings are threaded, the sectional cylinder A then making one complete revolution at which time the motion of the shaft 215 is arrested.

The breaking of the electric circuits.—The manner in which the revolving of the rings effects the breaking of the electric circuits is as follows: I is a metallic rotatable cylinder secured to the shaft 215 and insulated therefrom and is interposed in an electric circuit. The ends of the circuit-breakers B are normally in contact with said cylinder I, said levers B being provided at their ends with sectional pieces 355 insulated from the body of the lever, and engaging with these pieces 355 are a series of spring circuit-conducting wires 356 which are insulated from each other and are supported in a suitable support 357 connected with the frame. The conducting wires 356 converge as shown in Fig. 6 and are arranged to form a cable 358 to be hereafter referred to. 359 is an electric brush bearing against the reduced end of the metallic cylinder I and serving to connect said cylinder with a source of electricity, and thus it will be understood that as the levers B are raised out of contact with the periphery of the cylinder I the circuits are broken. As has been stated the present invention is shown and described as adapted to coöperate with a printing-bar producing machine of my own invention and also with a matrix-making machine such as is shown and described in U. S. Letters Patent, No. 490,263, granted to me January 24, 1893, and herein previously referred to, in which all the characters of a line are practically assembled in one operation, and to this end it is necessary to interrupt at varying intervals of time a series of electric circuits, and this is effected by revolving in the direction of the arrow the sectional lug-bearing ring-cylinder A. The lugs in the sectional cylinder are arranged in definite and varying positions by the composing keys and will strike the tips 119 of the circuit-breaking levers B simultaneously or consecutively and break the circuits accordingly.

For the assembling of the characters, only the longest lugs 52 are designed to strike the tips 119, and the slides 74, which control the positions of these tips, remain in their backward position. The different radial positions in which these lugs are set, with respect to a fixed point by the composing keys, causes them to travel in their path of revolution a lesser or greater distance before contacting with said tips 119 and consequently the sooner or later will the circuits be broken, resulting in the selections of different characters.

For the assembling of spaces any of the lugs of various lengths are designed to strike the tips 119 and for this purpose the justifying mechanism thrusts out the slides 74 varying distances toward the cylinder A, so that they will be acted upon by the shorter lugs it being understood that the thrusting out of the slides is doné after the line has been composed so that the distances they are thrust out and the corresponding thicknesses of spaces may be determined by the residue or unfilled portion of the line, which residue is to be seen only at the conclusion of the composition thereof. It should be remembered that such of the lug-bearing rings of the series as are intended to produce spaces in the composed line are set from the keyboard in the same manner as are the rings which are to produce characters in the line, and that said spacer rings coact to produce the assembled line in the same manner as the character rings, except that their operation is modified by the intervention of the justifying mechanism and it will be seen that the set positions of the spacer rings do not necessarily determine the thicknesses of the spaces finally assembled in the line; but, in accordance with the manner in which the positions of the slide, coacting with the shorter lugs break the circuits before the longest lugs 52 in their set position can break said circuits, the particular thicknesses of these spaces assembled depending on which one of the shorter lugs are permitted to contact with the tips 119. I have shown and described a justifying device coöperating with the above described composing mechanism, but it should be understood that this justifying device may be dispensed with and the justification of the line effected automatically by devices forming a part of the printing-bar producing, matrix-making or type-setting machine to which my composing mechanism may be attached, in which case the rings 209 would be provided with the long lugs 52 only

Restoring the rings for a new line.—Meshing with the

teeth on the escapement-bar C is the gear 307 secured to a shaft 320 supported in suitable bearings in the frame and engaging a secondary escapement-bar 69 (which serves to operate a part of the justifying mechanism) whereby, as the escapement-bar C is moved to the left during the composing of a line, the secondary escapement-bar 69 is moved an equal distance in the direction of the arrow Fig. 2. To the right hand end of the escapement-bar is secured a block of insulating material 310 to which is affixed a metallic tapered-piece 311 designed at the conclusion of each line to enter between two spring strips 312, 313 insulated from each other and included in an electric circuit, the entrance of said tapered piece 311 being adapted to close the electric circuit at this point to energize the magnet 337. The gear 307 meshes with the gear 314 revolving on a stud projecting from the frame, said gear 314 having secured to its side face a beveled gear 315 which meshes with another beveled gear 316 provided with a hub forming one member 341 of a clutch, said gear being loosely mounted between fixed collars on a shaft 317 extending lengthwise of the mechanism. 318 is the other member of the clutch which is splined on said shaft 317 which is intermittently rotated in opposite directions by suitable connections with the automatic machine to which the composing mechanism is attached. This member 318 of the clutch is operated by a lever 342 pivoted at 343 the inner end of which is connected by a pin and slot with one end of a connecting rod 344, the opposite end of which is pivoted to the lever 338 which operates the clutch 340 by which the ring cylinder is set in motion. When the magnet is energized, as described, and the lever 338 is vibrated on its pivot 339, this clutch member 318 is caused to engage the other member 341 through the lever 342 and the rod 344 connected with said lever 338, at which time the shaft 317 is at rest. The shaft 317 is revolved through suitable connections with the main machine previously referred to, only after the sectional ring cylinder A has completed its one revolution, and when said shaft is revolved, the clutch being engaged as described, the main escapement-bar C, with which the yoke 221 is connected, is returned, through the connections described, to the position that it occupies at the beginning of a line, causing the entire series of lug-bearing rings 209 to be slid back onto the enlarged portion of the shaft 203. At the commencement of the backward movement of the rings 209, the backward movement of the rack-bar 69 causes the tapered piece 311 to be withdrawn from contact with the strips 312, 313, interrupting the electric circuit and demagnetizing the magnet 337; when the lever 338 is drawn back by mechanism to be hereinafter described disengaging the clutch 340 from the gear 214, the corresponding movement of the connecting rod 344 which is pivoted to the arm 338, by reason of its slot connection 360 at its opposite end, fails to disengage the two members 318 and 341 of the clutch, thereby permitting the shaft 317 (which still continues to revolve) to effect the complete return movement of the escapement-bar C after the electric circuit has been broken as described. The teeth of the two members 318 and 341 of the clutch are undercut to prevent them from being separated by a spring 361 connected with the lever 342 until the shaft 317 completes its forward revolutions and commences its backward rotation, when the clutch members are disengaged and the parts are in position for beginning the composition of a new line.

The arrangement of the multiple fingerboards.—Having now described the construction and mode of operation of one of the sets of ring-setting devices, which is controlled by a single fingerboard, it now remains only to describe how a plurality of such sets of ring-setting devices may be arranged in one group to act upon a single matrix or type assembling mechanism without interfering one with another, each fingerboard acting upon its own ring-setting device which acts upon the matrix or type-setting mechanism common to all, in such turn and manner as permitted by an electric circuit-interrupting device T, to be now described.

In the mechanism here shown and described there are three separate sets of ring-setting devices, arranged upon a common frame 200, as shown in Fig. 4, each set being a duplicate of each of the others, but a greater number of sets may be arranged in like manner if desired. The circuit-interrupting device T, shown particularly in Figs. 23 and 24 and at the left hand end of Fig. 4, consists in a disk 380, of non-conducting substance, which is secured to arms projecting from the frame 200, said disk having inlaid, flush with its surface three curved pieces or sections 381, 382 and 383 composed of conducting material having binding posts 384 with respective electric connections with the three fingerboards. On a stud 385, supported in an arm 386 projecting from the frame 200, is mounted a commutator provided with a spring conducting arm 388 which is adapted when rotated as will be described to travel and contact with the face of the disks 380 and the strips of conducting substance 381, 382 and 383. On the stud 385 is also placed a clutch pulley 389 over which passes the driving belt 390 by means of which it is continuously revolved. This pulley 389 is provided on its inner side with a flange 392 which is embraced by a hooked shaped piece 391 secured to the end of a long shipper rod 393 extending full length of the multiple fingerboard mechanism and provided with fixed collars 394 against which the magnet levers 338 act when vibrated by the magnets to move the rod 393 against the resistance of a spring 395, Fig. 24, to disengage the clutch pulley 389 from the commutator to arrest the rotation of the arm 388. 396 is a commutator brush electrically connected with one pole of the battery by a wire 397.

x, y, z, represent the lines through which the current passes from the interrupting device T to the several fingerboard devices X, Y, Z, to successively but irregularly connect them with the assembling mechanism of the automatic machine, the current passing over such one of said lines as is determined by the interrupting device T and in the following manner: First from the battery to the intercepting device T thence through a magnet 337, a metallic cylinder I and the circuit-breakers B to the cable 358 by which it passes through the magnets of the assembling mechanism and thence through a series of suitable resistances G to the battery. The three lines, x, y, z, are connected to the interrupting device T as shown in Figs. 23 and 24, the line x being connected with the inlaid conducting piece 382,

the line *y* with the inlaid piece 381, and the line *z* with the inlaid piece 383. While the several fingerboards are being independently operated by different operators to set the several series of rings in the composing of several different lines, the arm 388 is being continuously revolved by the clutch pulley 389 which remains in engagement with the commutator 387 which carries said arm until one of the operators has completed the composition of a line and has closed the circuit of his particular fingerboard by causing the metallic tapered piece 311 to contact with the spring strips 312 and 313 which is effected by pressing in the hand-wheel 322 as already described.

Fig. 4 shows the parts of the fingerboard mechanisms X, Y, Z, in the following positions: In X the composition of a line is incomplete and its mechanism is consequently cut out of the circuit; in Y the composition of a line is complete and its mechanism is included in the circuit operating the assembling magnets of the main machine; and in Z the composition of the line is complete but the circuit is closed only as far as the interrupting device T, the block 311 being in contact with the strips 312 and 313, and consequently the fingerboard mechanism Z, though ready for the current is nevertheless cut out of the circuit. When the operator at Y completed his composed line and closed his circuit as described up to the conducting piece 381, in the interrupting device T, with which piece his circuit *y* is directly connected, the arm 388 was revolving in the direction of the arrow Fig. 23 and the instant said arm 388 contacted with the inlaid piece 381 the circuit was completed through the commutator brush 396 thus engaging the particular magnets 337 of the mechanism Y and vibrating the lever 338 to draw the rod 393 against the resistance of the spring 395 and thereby withdraw the clutch 389 from engagement with the commutator 387 which carries the arm 388, thus stopping said arm in contact with the inlaid piece 381 and although the operator at the fingerboard Z had completed his composed line and had closed his circuit *z* as far as the inlaid piece 382 in the interrupting device T with which piece his circuit is directly connected, it is impossible for his mechanism to be cut into the circuit until the arm 388 is again revolved to contact with the inlaid conducting piece 382. The arm 388 is again set in motion in the direction of the arrow by the breaking of the circuit *y* by the automatic withdrawal of the tapered block 311 from contact with the spring strips 312 and 313 as previously described which demagnetizes the magnet 337 allowing its armature lever 338 to release the rod 393 which is then actuated by the spring 395 to engage the clutch pulley 389 with the commutator 387 which carries the arm 388, which then commences to rotate until it contacts with the inlaid piece 382 of circuit *z* which the operator as before stated previously completed up to this point. The magnet 337 of fingerboard mechanism Z is then energized which again disconnects the clutch pulley 389 and stops the arm 388 as before. The instant that the magnet 337 of the fingerboard mechanism Z is energized this mechanism is included in the circuit to operate the assembling magnets of the main machine. If the operator at Z had not completed the composition of his line when the arm 388 commenced to revolve said arm would not have been arrested on contacting with the inlaid piece 382 but would have passed over the same and would have been arrested only upon contacting with the first inlaid piece connected with the circuit next completed by any one of the operators who may have first completed his line. In this manner a number of operators can work simultaneously without loss of time and without interfering with each other thereby materially increasing the capacity of a single printing-bar-producing, matrix-making or type setting machine provided with my improved mechanism.

To illustrate the application of the above described composing device to a machine for producing printing-bars, I will refer particularly to Figs. 31, 32 and 33, which show a portion of a line casting machine of my invention. 425 represents a series of horizontally arranged sliding matrix strips which are supported on a table 426 which forms a guideway for the same, and in this table midway between the ends is formed an opening 427 for the reception of the mouthpiece of the casting mechanism. The matrix strips are tapered from end to end and are arranged with their thin ends extending alternately in opposite directions, their thick ends normally lapping each other and sliding longitudinally past each other, each strip moving in a direction opposite to that of the strips next adjacent thereto. Each strip is provided at its lower edge with a series of rectangular indentations 428, the inner surfaces of which are provided with intaglio characters. Each strip has all the characters used in printing arranged in the order of their width. The characters are sunk in the bottoms of the indentations 428 in such manner that they will stand properly side by side in a line transverse of the series of matrix strips, as shown in Fig. 33. The upper edge of each strip is provided with notches arranged directly over the indentations for the purpose of alining the matrix strips. At the thick end of each matrix strip is a projection 429, to the outer end of which is pivoted an arm 430 having at its outer end a hook 431, and on its upper edge a projection 432 which is adapted to engage the transversely grooved surface of one of a pair of hinged plates 433 located thereover, whereby said strip is temporarily held in position. These plates are hinged at their outer ends in any suitable manner and are connected together at 580 by a pin on the one fitting into a slot in the other so as to permit said plates to be raised and lowered at this point. On carriages 436, 437, sliding in any suitable guides are mounted two sets of magnets 438 and 439, said carriages which are located over the matrix strips moving longitudinally and synchronously in opposite directions with respect to each other and being each provided with a transverse bar 440 over which catch the hooks 431 of the pivoted arms 430 when the carriages are at the limit of their inward movements, said arms constituting the armatures of said magnets. These carriages may be reciprocated in any suitable manner, but their entire movement must be synchronous with the rotation of the set series of lug-bearing rings. When the carriages are at the limit of their inward movements the tapered matrix strips are all in their extreme outward positions and as the carriages are moved outwardly away from each other, they carry with them the matrix strips tem-

porarily connected therewith, the strips at the right being moved in the direction of the arrow 455 by the carriage 436, and those on the left in the direction of the arrow 456, by the carriage 437. The carriages are enabled to actuate these strips, as above stated, by reason of the arms 430 engaging the transverse bars 440, the hooked ends of said arms 430 being held down in engagement with said bars by the magnets 438 and 439 acting upon the armature arms 430. It will be understood that the projections 429 of the matrix strips on the right-hand side are located on the left-hand side of the center transverse assembling or casting line, said projections never crossing said line; and that the projections 429 of the matrix strips on the left-hand side are located on the right-hand side of said assembling line. During the movement of the carriages away from each other, the two sets of magnets which have been holding down the hooked armature arms 430, are demagnetized successively or simultaneously by the breaking of the individual circuits in which they are included, said breaking being effected by the lug-bearing rings in a manner heretofore fully described. As each magnet is demagnetized its particular arm 430 is thrown up by a spring 434 disengaging the hook 431 from the bar 440 and at the same time causing the projection 432 of said arm to engage one of the notches of the hinged plate 433 thereover, thus instantly arresting the movement of the particular matrix strip to which said arm is pivoted and simultaneously locking said strip in said arrested position with one of its series of intaglio characters in the transverse casting line. It will thus be seen that the particular character brought into the transverse casting line will depend upon the longitudinal position in which the matrix strip is stopped, and that the stopping of the matrix strip depends upon the set position of the lug-bearing ring which breaks the circuit, as has been fully described. What is true of one martix strip applies to the entire series which are all moved by said carriages, and such ones released and locked in said position or positions, as determined by said series of lug-bearing rings, which series make one complete revolution, as previously described during a single outward movement of said carriages. An example of the relative positions of said strips at the conclusion of an outward movement of said carriages is shown in Fig. 31, the desired characters being assembled in the transverse casting line, as shown in Fig. 33. A cast may then be taken from this alined series of matrices by means of any approved casting mechanism in a manner well known, after which the matrix strips are returned to their normal position by an inward movement of the magnet carriages toward each other. The matrix strips previously assembled are gathered up by the inner edges of the magnet carriages striking against the projections 429 on the thick ends of said matrix strips, the hinged plates 433 having been raised previous to said inward movement of the carriages. The matrix strips are then in a position for the next outward movement of the magnet carriages and the assembling of a new line of matrices.

I believe myself to be the first to apply a plurality of independently operating fingerboards to a single type or matrix assembling device, said fingerboards to be worked by different operators at the same time or only one of them at a time.

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

1. A plurality of composing mechanisms upon which operators may work independently of each other, a reproducing mechanism, and means whereby the said composing mechanisms are adapted to and do control said reproducing mechanism.

2. A plurality of composing mechanisms upon which operators may work independently of each other, each including a key-board and a mechanical line selectively governed thereby, a reproducing mechanism and provisions whereby the said composing mechanisms are adapted to control said mechanism for reproducing the matter represented by said lines.

3. The series of fingerboard composing mechanisms for controlling the assembling of matrices or types, consisting of a plurality of complete fingerboards, and a series of line-composing devices operated thereby, each of said series being adapted to control independently and at one time only a single matrix or type-assembling device.

4. The series of fingerboard composing mechanisms for controlling the assembling of matrices or types, means whereby said series is connected with and enabled to control a single assembling device, and means whereby only one of said composing mechanisms at a time can operate said assembling device.

5. The series of fingerboard composing mechanisms for controlling the assembling of matrices or types, means whereby said series is connected with and enabled to control a single assembling device, and means whereby any one of said composing mechanisms may be independently and temporarily connected with said assembling device.

6. In a mechanism for controlling the assembling of matrices or types a series of fingerboard mechanisms, a series of line-composing devices, intermediate mechanism whereby each line-composing device is independently controlled and operated by its own fingerboard keys, electric circuits whereby all the line-composing devices are operatively connected with a single matrix or type assembling mechanism, and a circuit interrupting device adapted to contact one of said line-composing devices only at a time with said matrix or type-assembling mechanism.

7. The combination with a series of fingerboard mechanisms and the electric circuits whereby they are connected with a single mechanism for assembling matrices or types, of an interrupting device, a series of circuit-breaking devices one for each fingerboard mechanism, said circuit-breaking devices being included in said circuits, magnets controlled by said circuit-breaking devices, and means operated by said magnets for controlling said interrupting device whereby each of said fingerboard mechanisms is independently and separately connected, one only at a time, with the magnets of the matrix or type assembling mechanism.

8. The combination with a multiple series of matrix or type assembling rings, each series being slidingly mounted on a rotatable support, of a series of mechanisms for revolving said multiple series of rings, clutches for setting in action said mechanisms, a series of magnets included in electric circuits for operating said clutches, a series of circuit-breaking devices included in said circuits for controlling said magnets, and an interrupting device electrically connected with said circuits and automatically controlling the revolving of said multiple series in such manner that one only of said series of rings can be revolved at a time to effect the assembling of a line of matrices or types.

9. The combination of a plurality of simultaneously operative key-board devices and a single type or matrix assembling mechanism operated thereby.

10. The combination of a plurality of simultaneously operative key-board devices, a single type or matrix assembling mechanism, and intermediate connecting devices.

11. A series of matrices or types and their proper assembling mechanism in combination with a plurality of simultaneously operative key-board devices.

12. A series of matrices or types and their proper assembling mechanism, a plurality of simultaneously operative key-board devices, and means for causing said key-board devices to sequentially operate said assembling mechanism.

13. A single matrix or type assembling mechanism and a plurality of simultaneously operative key-board devices in combination with means controlled from said key-board devices for sequentially operating said assembling mechanism.

14. The combination with a series of matrix and type-selecting devices adapted to be set in the same or different positions by a key-board mechanism, of a series of circuit-breakers controlled thereby for the assembling of matrices or types.

15. The combination with a series of matrix or type selecting rings provided on their outer peripheries with lugs adapted to be set in the same or different radial positions, of a series of circuit-breakers actuated by said lugs for the assembling of matrices or types.

16. The combination with the series of fingerboard mechanisms adapted to respectively control a single mechanism for assembling matrices or types, of an interrupting device adapted to prevent said fingerboard mechanisms from interfering the one with another in controlling the operation of said matrix or type assembling machine.

17. The combination with a plurality of line composing mechanisms and a circuit for electrically connecting the same with a matrix or type assembling mechanism, of means for automatically closing said circuit at the conclusion of the composition of a line.

18. The combination of a series of line-composing mechanism and electric circuits for connecting the same with a single matrix or type assembling mechanism, of a series of circuit closing devices interposed in said circuits, each circuit-closing device closing its circuit at a particular point at the conclusion of the composition of a line.

19. In a composing mechanism the combination with a series of matrix or type assembling rings of a series of circuit breakers operated by said rings to control the assembling of matrices or types and a justifying mechanism co-operating with said rings to effect the justification of a line.

20. A machine of the character described, comprising a plurality of independent composing mechanisms each including a dummy line adapted to be set up according to the will of the operator, a single duplicating mechanism adapted to coact with said dummy lines, and means whereby said dummy lines can be placed in operative relation to said duplicating mechanism only one at a time.

21. A machine of the character described, comprising a single duplicating mechanism, a plurality of composing mechanisms, and intervening mechanism adapted to coact with said composing mechanism for effecting the actuation of the duplicating mechanism.

22. A machine of the character described, comprising a plurality of series of actuators adapted to be set in any predetermined relation, and a duplicating mechanism adapted to co-act with and be controlled by each of said series of actuators.

23. A machine of the character described, comprising an electro-magnetic duplicating mechanism, in combination with a selective line of actuators, and electrical transferring mechanism co-acting with said actuators and said duplicating mechanism.

24. In a multiple fingerboard system for controlling the assembling of matrices or types, a series of fingerboard mechanisms, a multiple series of rings adapted to be set and threaded on arbors in varying positions by mechanisms controlled by finger keys to act on and control a single matrix or type assembling mechanism, and means whereby any one of said series of rings may independently act on and control the said assembling mechanism when the latter is free from the control of the other fingerboard mechanisms of the series.

25. A composing mechanism for controlling the assembling of matrices or types, comprising a multiple fingerboard system whereby a multiple series of matrix or type selecting rings may be independently operated at the same or different times, each by a distinct set of finger-keys, means for connecting the said multiple fingerboard system with a single assembling device, and means whereby any one series of said multiple series of rings may, after being set by the finger-keys, to be temporarily exclusively connected with said single assembling device to control the operation of the same.

26. A machine of the character described comprising a mechanical line composed of a plurality of successively selected actuators arrangeable into alinement in predetermined relation, with one actuator for each character and duplicating mechanism controlled by said actuators.

27. A machine of the character described comprising a composing mechanism including a plurality of keys, and a mechanical line of actuators successively arrangeable into alinement according to the order of selection of said keys with one actuator for each character, and a duplicating mechanism controlled by said line of actuators.

28. A machine of the character described comprising a composing mechanism including a plurality of keys, and a line of actuators each of which is under the domination of all of said keys, and mechanism whereby said actuators may select a series of things according to their own selection and arrangement.

29. A machine of the character described comprising a composing mechanism including a plurality of keys, and a line of rotary actuators movable about a common axis and successively positioned in a line by said keys, and by which things may be subsequently selected according to the order of selection of said actuators, when said line is complete.

30. A machine of the character described comprising a plurality of keys, a series of rotary actuators each of which is adapted to be positioned in order in predetermined relation to a fixed line by any one of said keys.

31. A machine of the character described comprising a plurality of keys, a series of rotary actuators each bearing an operative projection, and one or more selectors in operative relation to each of the keys and adapted to set each actuator in a predetermined position.

32. A machine of the character described comprising key-actuating mechanism having a plurality of keys, and composing mechanism controlling the key-actuating mechanism and including a line of actuators each of which is under the control of all of said keys and electro-magnetic selecting mechanism for positioning said actuators successively in alinement.

33. A machine of the character described comprising a line of actuators normally free to rotate, and selecting mechanism for positioning said actuators in succession; whereby when said actuators are positioned they constitute a dummy line of matter.

34. A machine of the character described comprising a line of rotatable actuators, means for rotating said actuators, and means for stopping said actuators in succession at any predetermined points in their rotation and positioning them against further rotative movement.

35. A machine of the character described comprising a plurality of rotatable axially movable actuators, a fixed member, and mechanism for stopping each actuator at any point in its rotation, and moving it into engagement with said fixed member whereby it is held against further rotation.

36. A machine of the character described comprising a series of parts successively prearrangeable according to the will of the operator into a line, and selecting mechanism including a plurality of keys, and intervening devices by which each of said keys controls the position of each one of said parts in the line.

37. A machine of the character described comprising a plurality of rotary actuators, a cylindrical support, and mechanism for setting said actuators in operative position on said support, said mechanism including a plurality of stops, and a key corresponding to each stop.

38. A machine of the character described comprising a plurality of rotary actuators, each having a projection, and a plurality of stops each adapted to set each actuator in a predetermined position.

39. A machine of the character described comprising a plurality of rotary actuators, each having a projection, and a plurality of slides arranged about the axis of said

actuators, and each adapted to set any one of said actuators.

40. A machine of the character described comprising a mechanical line of actuators normally in an inactive position, a plurality of keys for placing said actuators in active position, means whereby each actuator is under the control of all of said keys and means for resetting said actuators to reactive position.

41. A machine of the character described comprising a mechanical line of actuators there being one actuator for each character represented in the line and electro-magnetic mechanism for successively setting said actuators into a line including a plurality of keys, and a branch circuit for each key.

42. A machine of the character described comprising an electro-magnetic composing mechanism including a keyboard, magnetic selectors and electrical connections between them, an electro-magnetic duplicating mechanism, and electrical connections between said mechanisms.

43. A machine of the character described comprising a mechanical line of successively prearrangeable parts, a series of members, and mechanism whereby said parts cause the actuation of said members in predetermined order, after said parts have all been successively arranged.

44. A machine of the character described comprising a mechanical line of selective elements, with one element for each character or thing represented in the line selector mechanism and an escapement mechanism for locating said elements in the selected positions.

45. In a device for controlling the assembling of matrices or types, a series of matrix or type-selecting rings provided with means for actuating mechanism whereby characters and spaces are assembled to form a composed line.

46. In a mechanism for controlling the assembling of matrices or types a series of matrix or type-selecting rings provided with devices adapted to be set in the same or different radial positions and subsequently secured upon a rotatable sleeve or arbor to act upon mechanism for assembling characters and spaces to form a composed line.

47. A series of matrix or type selecting rings mounted on a rotatable sleeve or arbor and provided with devices set in predetermined radial positions in combination with mechanism actuated thereby for controlling the assembling of matrices or types.

48. A series of matrix or type selecting rings provided with devices adapted to be set in the same or different radial positions, composing keys and intermediate mechanism operated thereby for setting said rings, a justifying mechanism coöperating with said rings, and means actuated by the rings for controlling the assembling of matrices or types.

49. A series of matrix or type selecting rings loosely mounted on a revolving arbor and provided on their peripheries with lugs adapted to be set in the same or different radial positions, a series of movable stop-arms mounted in a suitable support encircling said rings, a series of magnets for actuating said stop-arms to arrest said rings by contact with their longest lugs, means controlled by the composing keys for energizing said magnets, and an escapement mechanism for transferring said rings in their stopped positions onto a stationary but rotatable sleeve or arbor, means for securing said rings on said arbor, and means for revolving said arbor with its set rings to cause the latter to act upon a series of circuit-breakers for controlling the assembling of matrices or types.

50. The combination of a revolving arbor, a series of matrix or type selecting rings mounted thereon, and a friction device carried by said arbor and adapted to contact with one or more of said rings to cause the same to be frictionally revolved by said arbor.

51. In a mechanism for controlling the assembling of matrices or types, a series of type selecting rings loosely mounted on a revolving arbor and provided on their outer peripheries with lugs of different lengths adapted to be set in the same or different radial positions, and on their inner peripheries with notches, in combination with a stationary but rotatable sleeve or arbor provided with longitudinal ribs adapted to enter said notches when said rings are transferred onto said stationary arbor and thereby hold said rings in fixed positions thereon, and an escapement mechanism controlled by the composing keys for effecting the transfer of the rings from one arbor to the other.

52. As a means for indicating to the operator any errors made during the composition of a line, a series of rings each bearing on its periphery all the different characters used in printing in an order common to all of said rings, said series being adapted to be variably arranged by the composing keys so as to present at a common line characters and spaces corresponding to those of the matrices or types to be subsequently assembled in line.

53. A series of matrix or type selecting rings mounted on a suitable support and provided with devices adapted to be set in the same or different radial positions, each ring bearing on its outer periphery all the different characters used in printing, and said rings, when set, presenting at a common transverse line, a fac-simile of the composed line to be finally produced.

54. The matrix or type selecting ring for use in a composing device, said ring being provided with means for actuating mechanism whereby a character or space is assembled in the formation of a line.

55. The matrix or type selecting ring for use in a composing device, said ring being provided with notches in its inner periphery, and on its outer periphery with means for actuating mechanism whereby a character or space is assembled in the formation of a line.

56. The matrix or type selecting ring provided with notches in its inner periphery and bearing on its outer periphery representations of all of the different characters used in printing.

57. In a mechanism for controlling the assembling of matrices or types, a matrix or type selecting ring provided with lugs for actuating mechanism whereby a character or space is assembled in the formation of a line.

58. In a mechanism for controlling the assembling of matrices or types, the combination with the magnets for arresting the rotation of the matrix or type selecting rings, of the stop-arms 231, actuated by said magnets, reciprocating arms 291 and 292, secured to toothed rings loosely mounted on a sleeve 269 frictionally secured to a revolving shaft, said arms 291 and 292 being adapted to be stopped in various radial positions by said arms 231, means for reciprocating the arms 291 and 292 in opposite directions, consisting of springs 297, a grooved ring 272 splined on a sleeve 269 and provided on each side with a tooth adapted to engage the adjacent toothed ring, a cam-wheel and lever for laterally sliding the grooved ring 272, and means for rotating said cam-wheel, a worm 268 secured to the sleeve 269, a shaft 266 provided with a worm-wheel engaging said worm 268 and having at its opposite end a gear, a rack driven by said gear, and a registering pointer carried by said rack, and means for releasing said pointer at the conclusion of the composition of a line.

59. The combination with a series of matrix or type selecting rings temporarily set on a sleeve or arbor, of means for automatically returning said rings from said sleeve or arbor to their primary position after the composed line has been assembled.

60. A device for automatically returning the matrix or type-selecting rings from their temporarily set position on a sleeve or arbor to their primary position, said device consisting in a yoke embracing said rings, a sliding escapement-bar connected therewith, a driving shaft provided with a clutch, intermediate mechanism between said shaft and the escapement-bar for actuating the latter, and means for automatically operating the clutch to effect the movement of the escapement-bar.

61. The combination with the matrix or type selecting rings slidingly mounted on a suitable support, of an escapement mechanism connected with said rings whereby they may be moved laterally on their support, a device to be operated by hand for releasing the escapement mechanism and controlling the sliding of the escapement-bar thereof.

62. In a mechanism for controlling the assembling of matrices or types, the combination of the matrix or type

selecting rings, the escapement mechanism connected therewith, a fingerboard mechanism for operating said escapement mechanism, and the hand-operated device for releasing said escapement mechanism and controlling the movement of the escapement-bar thereof.

63. The combination with a series of matrix or type selecting rings slidingly mounted on a suitable support and provided with lugs 52, of a sliding stop-bar adapted to intercept said lugs and thereby arrest the revolution of said rings to aline the same, and a hand-operated device connected with said stop-bar to actuate the same and simultaneously release the escapement mechanism connected with said rings.

64. The combination with the rotatable sleeve or arbor onto which the matrix or type-selecting rings are threaded, of a locking device for holding said series in a fixed position to receive the rings when set by the composing keys.

65. In an interrupting device for a multiple fingerboard system, a revolving arm, a commutator connected therewith and interposed in an electric circuit, a clutch-pulley operating said commutator, a shipper-rod for operating said clutch-pulley, means for operating said shipper rod, a series of insulated pieces or sections with which said revolving arm successively contacts, and electric circuit-connections between said insulated pieces, the several fingerboard mechanisms, and the commutator.

66. In a composing mechanism the combination with a shaft adapted to be continuously revolved and provided with a friction device, of a series of matrix or type composing rings mounted on said shaft and adapted to be acted upon successively by said friction device to cause them to be rotated, and a series of stop-arms operated by the composing keys for arresting the revolution of said rings in certain predetermined positions.

67. The combination with a composing key-board, of a series of magnets electrically connected with said key-board, a series of matrix or type-selecting rings, stop-arms actuated by said magnets for setting said rings one at a time, and escapement mechanism for transferring said rings in their set positions onto a stationary but rotatable sleeve or arbor, means for releasing said escapement mechanism at the conclusion of the composition of a line, means for securing said rings on said arbor, means for revolving said arbor with its set rings, a series of circuit-breakers operated by said revolving rings for controlling the assembling of matrices or types, and means for automatically returning said rings from said sleeve or arbor to their primary position after the line has been assembled.

68. The combination of a revolving arbor provided with a friction device, a series of matrix or type selecting rings loosely mounted thereon and provided on their inner peripheries with notches and on their outer peripheries with lugs 52, and a sliding stop-bar interposed in the path of revolution of said lugs, whereby said rings are arrested in a position to permit them to be threaded onto a stationary but rotatable sleeve or arbor provided with longitudinal ribs adapted to enter said notches, said stop-bar during the composing of a line being drawn back to permit one or more of said rings to be frictionally revolved by said first-mentioned arbor, and means for successively arresting said revolving rings one at a time with their lugs 52 in the same or different radial positions.

69. The combination with a composing key-board, of a series of magnets electrically connected with said key-board, a series of matrix or type selecting rings, stop-arms actuated by said magnets for setting said rings one at a time, an escapement mechanism for transferring said rings in their set positions onto a stationary but rotatable sleeve or arbor, means for securing said rings on said arbor, means for revolving said arbor with its set rings, and a series of circuit-breakers controlling the assembling of matrices or types, said circuit-breakers being operated by said rings.

70. The combination with reciprocating arms controlling the action of the registering pointer, of stop-arms for arresting said reciprocating arms in various radial positions, said stop-arm being connected with the stop-arm which set the matrix or type selecting rings, and means controlled by a key-board mechanism for actuating said stop-arm.

71. In a registering device, the combination with a stop-arm 231, of the reciprocating arms 291 and 292, provided with spring-pressed tips adapted to yield in one direction only.

72. The combination with a composing key-board, of a series of matrix or type selecting rings, stop-arms actuated by the key-board mechanism for setting said rings one at a time, mechanism for transferring said rings in their set positions onto a stationary but rotatable sleeve or arbor, means for securing said rings on said arbor, means for revolving same on said arbor with its set rings, and means for controlling the assembling of matrices or types operated by said rings.

73. In a key-board mechanism, a series of circuit closing and breaking devices each having its movable portion composed of two sections, one of conducting and the other of non-conducting material, and insulated contact strips interposed in electric circuits connecting said keyboard with mechanism for controlling the assembling of matrices or types.

Witness my hand this 19th day of February A. D. 1898.

ERL V. BEALS.

In presence of—
P. E. TESCHEMACHER,
LOUISE A. CHACE.