(No Model.) 5 Sheets—Sheet 1.

G. A. GOODSON & A. S. CAPEHART.

MATRIX MAKING MACHINE.

No. 479,772. Patented July 26, 1892.

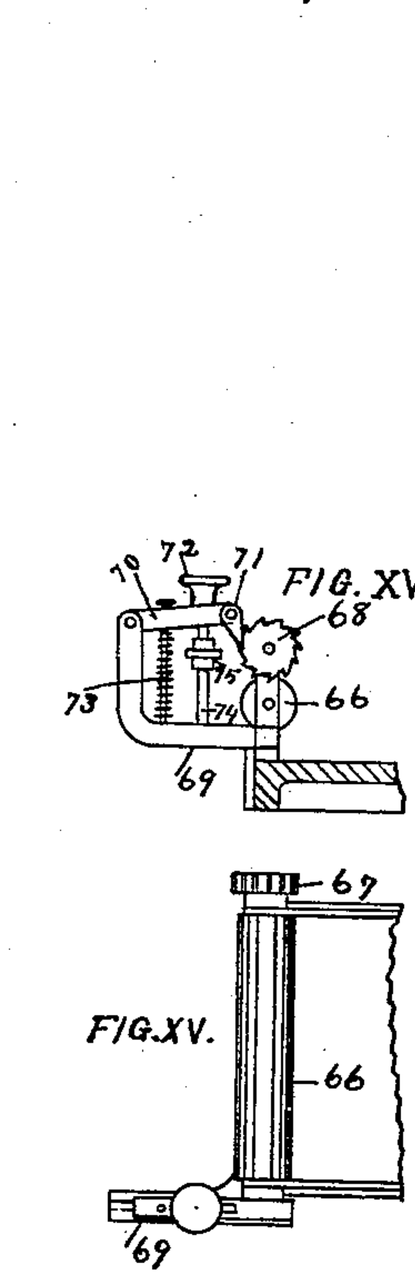

FIG. XVI.

FIG. XV.

FIG. I.

Witnesses
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5 Sheets—Sheet 2.

G. A. GOODSON & A. S. CAPEHART.

MATRIX MAKING MACHINE.

No. 479,772. Patented July 26, 1892.

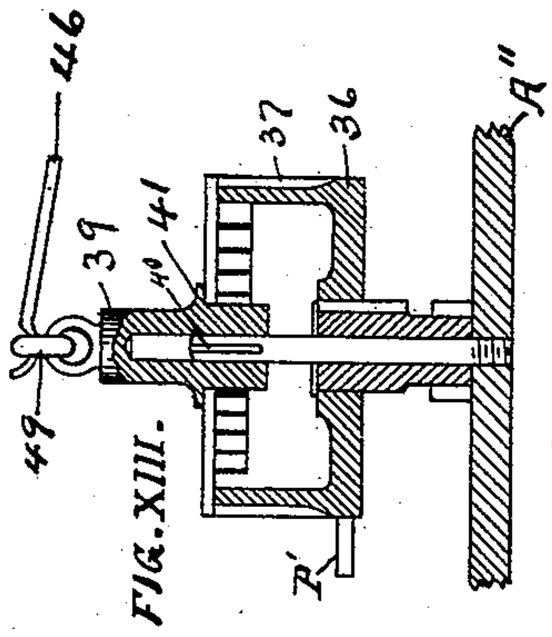

FIG. XIII.

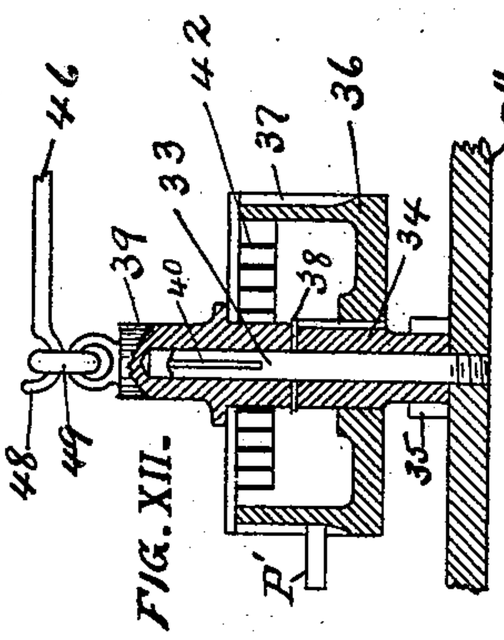

FIG. XII.

FIG. II.

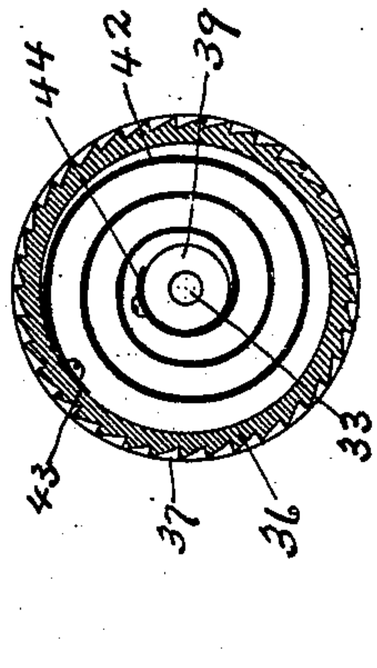

FIG. XIV.

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MATRIX MAKING MACHINE.

No. 479,772. Patented July 26, 1892.

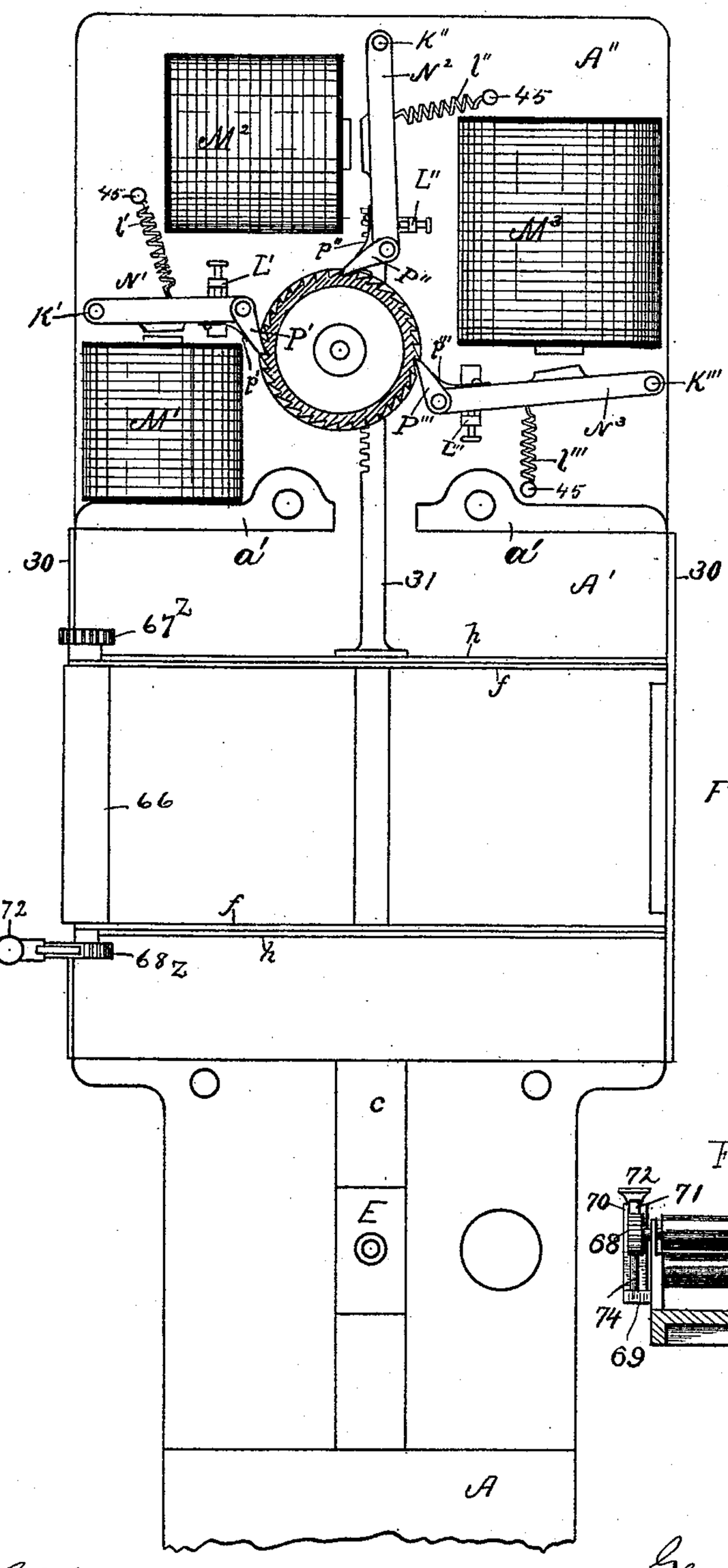
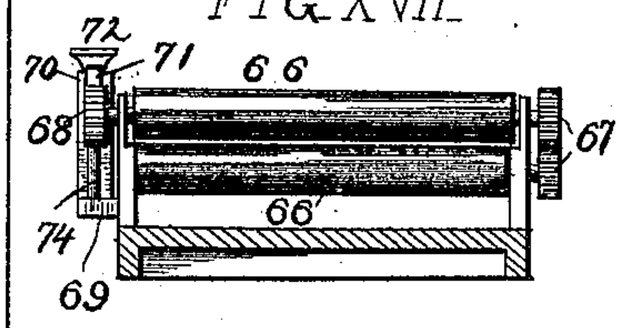


FIG. III.

FIG. XVII.



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MATRIX MAKING MACHINE.

No. 479,772. Patented July 26, 1892.

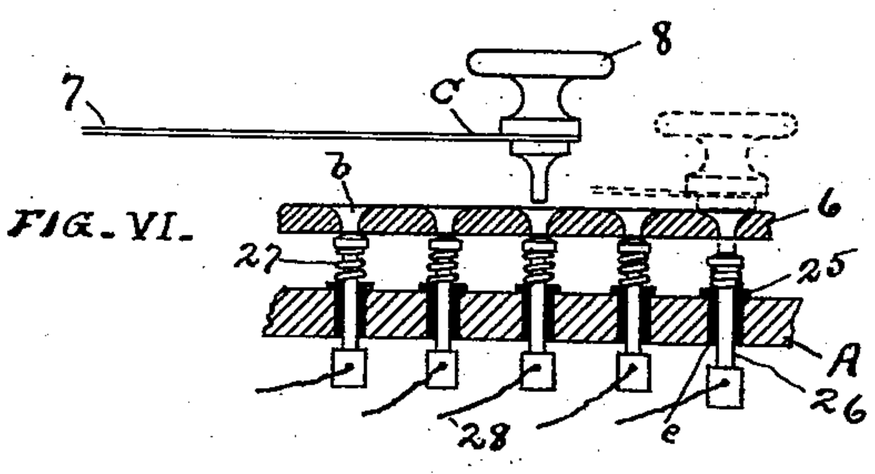


FIG. VI.

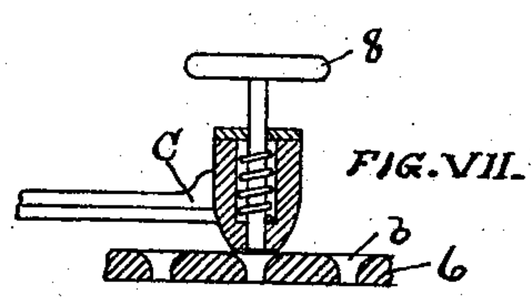
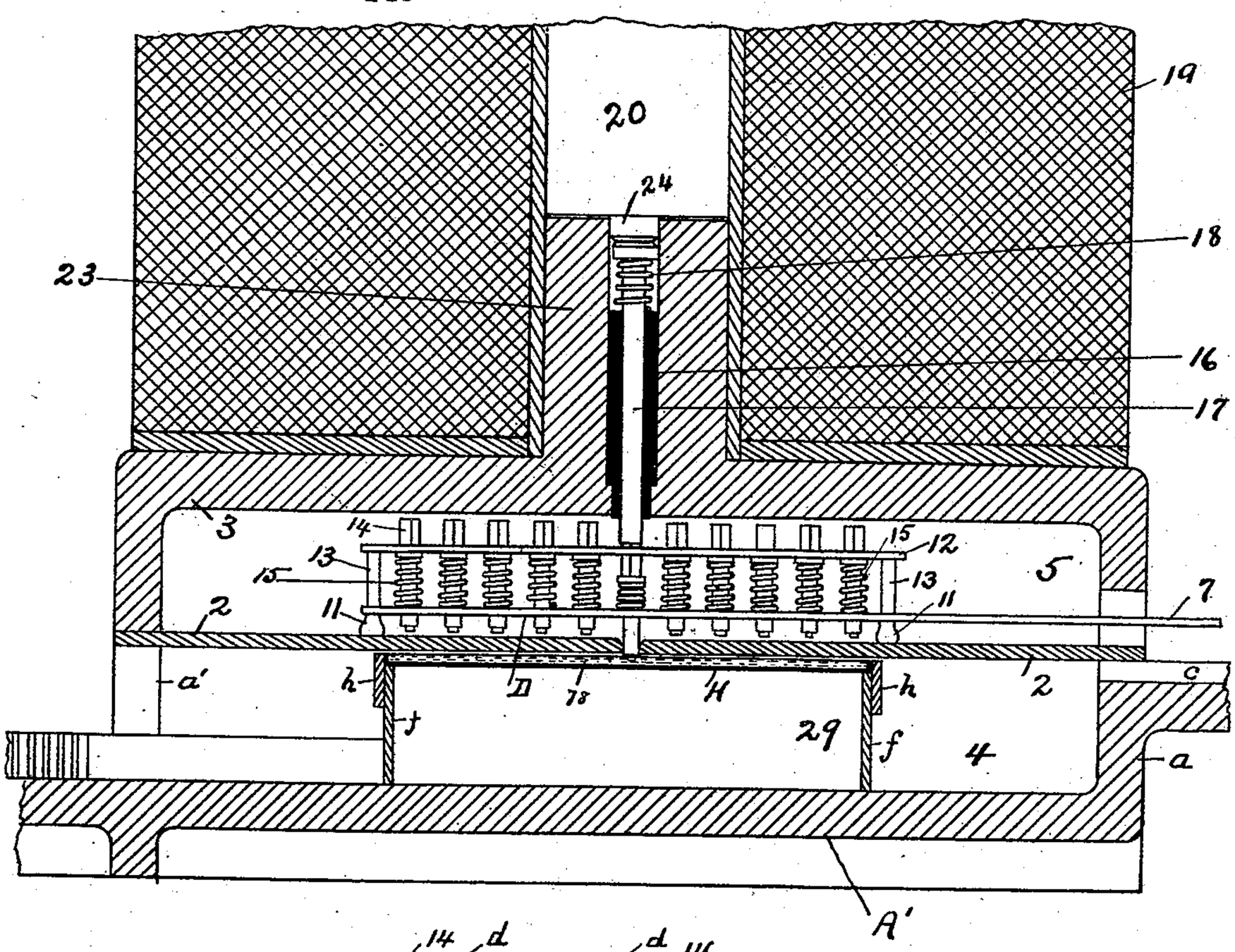


FIG. VII.

FIG. IV.



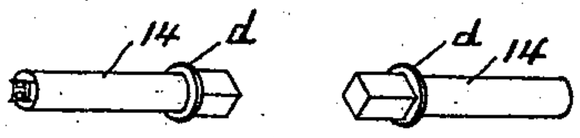


FIG. V.

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(No Model.) 5 Sheets—Sheet 5.

G. A. GOODSON & A. S. CAPEHART.

MATRIX MAKING MACHINE.

No. 479,772. Patented July 26, 1892.

FIG. IX.

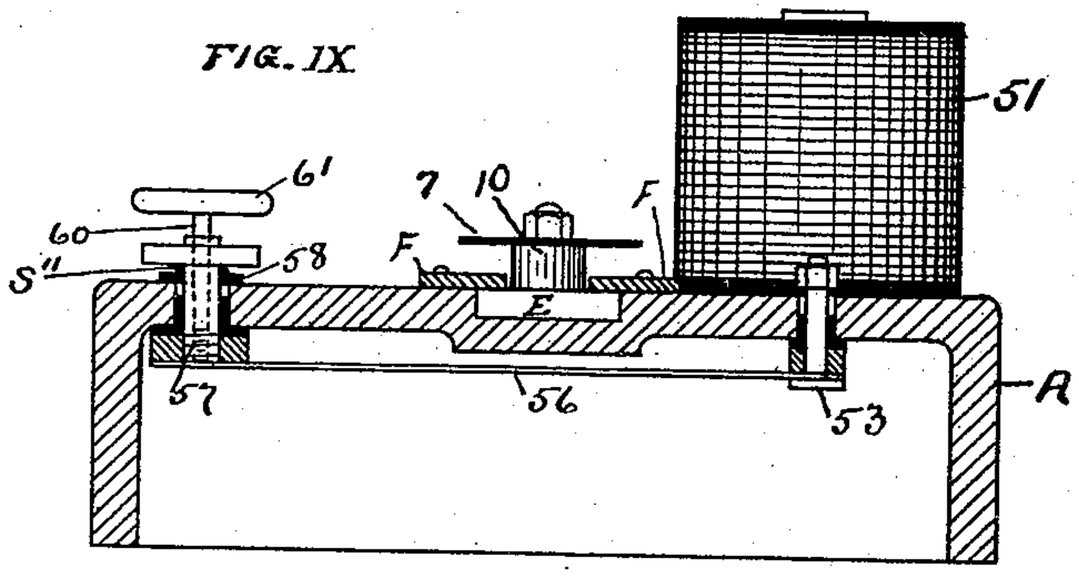


FIG. X.

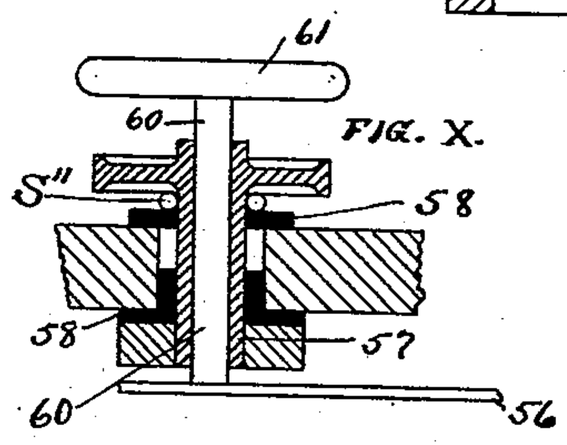


FIG. XI.

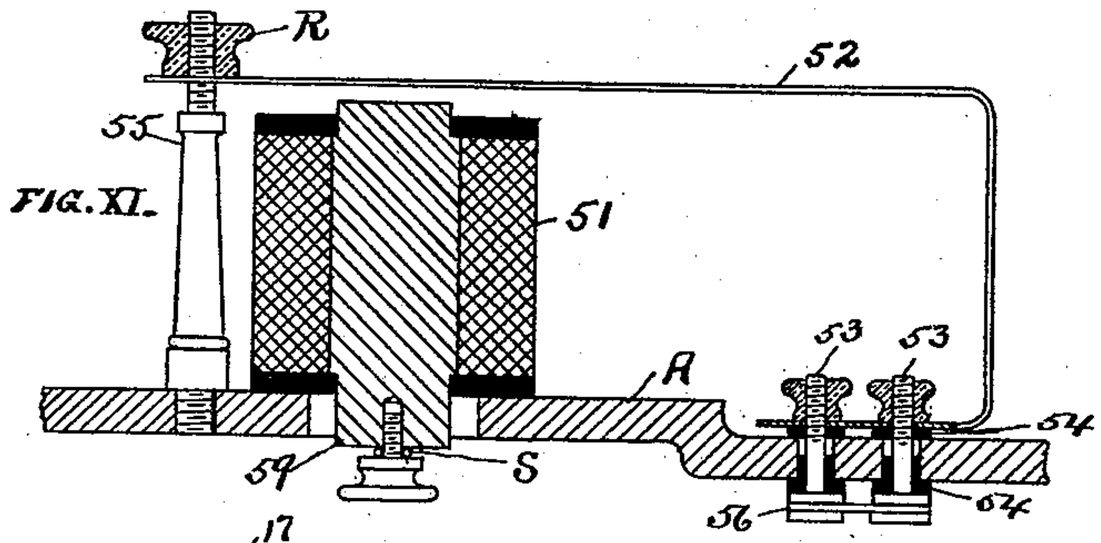
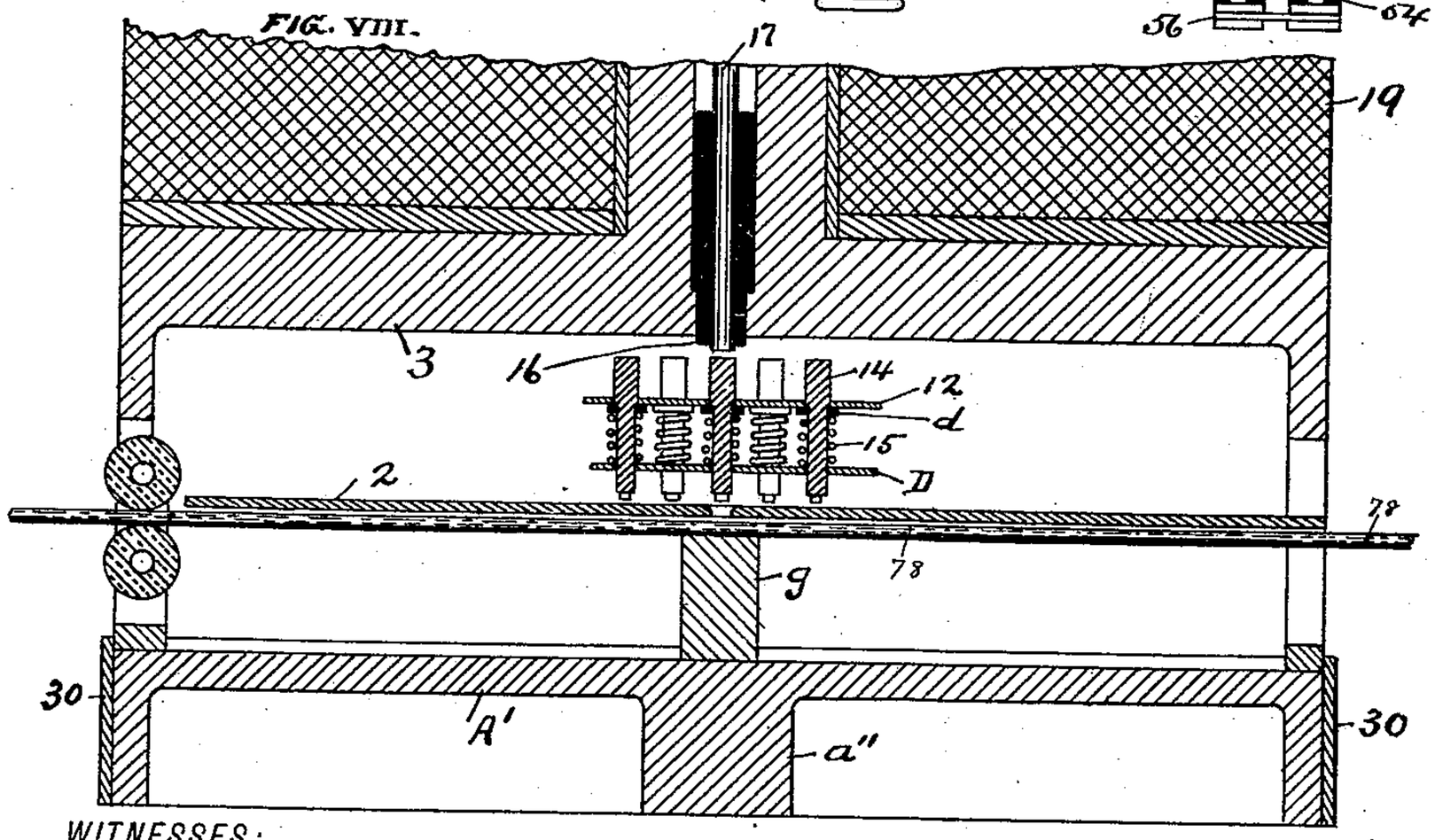


FIG. VIII.



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UNITED STATES PATENT OFFICE.

GEORGE A. GOODSON AND ALEXANDER S. CAPEHART, OF MINNEAPOLIS, MINNESOTA, ASSIGNORS, BY MESNE ASSIGNMENTS, TO THOMAS S. BASSFORD, OF NEW YORK, N. Y., RECEIVER OF THE MINNEAPOLIS ELECTRO-MATRIX COMPANY.

MATRIX-MAKING MACHINE.

SPECIFICATION forming part of Letters Patent No. 479,772, dated July 26, 1892.

Application filed May 31, 1887. Serial No. 239,735. (No model.)

To all whom it may concern:

Be it known that we, GEORGE A. GOODSON, a citizen of Canada, and ALEXANDER S. CAPEHART, a citizen of the United States, residents of the city of Minneapolis, in the county of Hennepin, State of Minnesota, have invented a new and useful Matrix-Making Machine, of which the following is a specification, reference being had to the accompanying drawings.

In the art of printing as now generally practiced newspapers and similar work requiring many duplicates are printed from stereotype-plates, which are cast from a matrix obtained from a form of hand-set movable type.

The object of our invention is to provide an improved mechanism by means of which the matrix may be made from the copy by the successive impression in the matrix material of dies corresponding to the required characters, instead of setting up type and then forming the matrix from the bed or forms of type.

The mechanism which constitutes our invention comprises among its more noticeable features the following: first, character-selecting devices for bringing any one of a large series of character-dies to a common center, classified into groups according to the space required by each; second, a suitable movable bed or carriage for the matrix material for supporting the same under the common center; third, independent feeding devices for feeding the matrix material, bed, or carriage the unit or the number of units of space required by the different characters; fourth, connections between each group of character-selecting devices and the proper feeding devices for that group, so that the act of selecting a given character will bring into action the necessary devices to effect the due feed of the matrix material for that character; fifth, mechanism for instantaneously depressing the die at the common center; and, sixth, construc tions, whereby the feeding devices and the die-depressing device are controlled by electricity.

In the drawings, Figure I is a plan view of our entire machine with the hammer and its actuating-magnet removed. Fig. II is a longitudinal vertical section on the line X X′ X″ X‴ of Fig. I. Fig. III is a plan view of the bed-plate except a part of the front portion of the same and the feeding mechanism. Fig. IV is an enlarged view of the central part of the machine on the same line as Fig. II. Fig. V is a detail showing the type-carrying rods. Fig. VI is a vertical longitudinal section of a part of the index-plate or keyboard, and Fig. VII is a modification of the same. Fig. VIII is a vertical cross-section through the center of the machine at right angles to Fig. IV. Fig. IX is a vertical cross-section on the line Y Y′ of Fig. I. Fig. X is a detail of the same in vertical section on an enlarged scale. Fig. XI is a longitudinal vertical section of the hammer-circuit-closing magnet and its spring-armature in position on the bed-plate. Figs. XII and XIII are vertical central sections of a part of the mechanism for feeding the matrix lengthwise of the machine. Fig. XIV is a horizontal section of Fig. XII or XIII or plan view of the spring-case with the cap-plate removed. Fig. XV is a plan view of the rollers, detached, for feeding the matrix crosswise of the machine; and Fig. XVI is a side elevation of the forward end of the same in position on the matrix-carriage. Fig. XVII is a view showing the mechanism for feeding the matrix material to form new lines in front elevation.

The main frame is composed of a metallic bed-plate 1, suitably shaped to support the working mechanism. All the parts of this bed-plate are cast in one piece; but the forward part A is in a different and higher plane than the central and rear portions A′ and A″, the two horizontal parts of the plate being connected by the vertical plate or offset *a*, which projects slightly above the level of the front plate A′. The central and rear portions A′ and A″ are separated by the vertical cross plate or rib *a*′, which projects above the bed-plate to the level of the plate *a*. This cross-rib *a*′ is cut away at its central part, as shown in Fig. III, for a purpose hereinafter named. The bed-plate is provided with suitable feet or supports, which in the drawings are shown as formed by projecting downward

the end and side plates and one or more solid cross-ribs. Directly under the center of the part A′ is cast integral with the bed-plate the heavy longitudinal rib or base-block *a″*. Rigidly secured to the vertical parts *a* and *a′* is a hardened and smoothly-ground bearing-plate 2, provided with a countersunk or tapering hole B exactly in its center, which point may be called the "common center" or "printing-point." This hole tapers from above downward, and is of a size on the under side of the bearing-plate corresponding exactly to the size of a die, and serves as a guide for the same. On this bearing-plate 2 rests an inverted-box-shaped cap-plate 3, having the central parts of all its four sides cut away. The plates 2 and 3 and the bed-plate 1 are tightly bolted together, forming between them the free spaces 4 and 5.

To the front part A of the bed-plate 1 is rigidly attached an index-plate or keyboard 6, which for purposes of insulation is made of vulcanized rubber. In this index-plate are apertures or holes *b*, each of the characters which it is desired to use being represented on the index-plate by an aperture or hole, and each aperture may be designated by having the character represented thereby marked on the plate near it; but whether this is done or not the plate may for convenience in the description and claims be denominated a "character-board." The apertures in the index-plate are preferably arranged in a series of concentric hexagons. These apertures are adapted to receive the key or point of the lever 7, and may be termed "key-seats."

7 is a combined key-lever and type-aligning plate. Its front or lever end C is provided with a key 8, for fitting into the perforations of the index-plate, and its other extremity is enlarged into a disk D, and is provided with a series of type-rod seats or square holes 9, which correspond in number and inversely in location with the apertures or key-seats in the index-plate. About midway of its length this aligning-plate is pivotally secured by a pivot-pin and nut 10 to a small cross-head E, which is held in a longitudinal slot *c* in the forward part of the bed-plate by suitable guides F.

The type-rod seats or holes 9 correspond inversely in location to the apertures or key-seats in the index-plate, and they are made necessarily to do so by making the latter the gage for cutting the former—that is to say, let the punch or drill be at a fixed point a definite distance from the center of the index-plate, and let the plate 7 be pivoted in a slot in the press-plate. Then insert the key 8 successively in the apertures or key-seats of the index-plate and punch out the corresponding type-seats. Thereafter any given type-seat or the type-rod held therein must come to the common center when the key 8 is in the corresponding perforation of the index-plate.

The type-seat disk D is provided with pendent studs or feet 11, which rest upon and traverse the bearing-plate 2. If so desired, these feet may be provided with swiveled casters or ball-rollers (not shown) to minimize friction.

12 is a top type-seat plate, which is an exact duplicate of the disk D, with coincident type-rod holes, and the two plates are held together at a fixed distance apart by the shouldered studs or bolts 13, to the opposite ends of which the plates are riveted.

14 are short type-carrying rods, each of which has a type on its lower end and is provided with a hardened head at its other extremity. Each type-rod is also provided with an annular flange or shoulder *d*. These type-rods are placed in position, each in its respective type-seat, with their type ends protruding below the disk D and their square or top ends projecting above the plate 12, and are sustained in that position by the coiled springs 15, encircling the rods and pressing against the disk D and the annular flanges *d*. These two plates, with their type-rods, make up what we call the "type-carriage." In virtue of its pivotal connection to the cross-head in the slot of the bed-plate the aligning-plate 7 has a movement laterally and longitudinally in the horizontal plane, and its lever end C is a flat spring with sufficient movement in the vertical plane to retract the key from the index-plate.

With the mechanism now described it is evident that any given type-rod may be brought to the common center. It is equally evident that if a stroke can be given to the type-rod while at the center an impression can be made on any suitable matrix material properly held on a resisting-bed. We do this by electromotive force and mechanism, as follows: The cap-plate 3 is provided with a central hole directly over the common center B. Into this fits a sleeve 16, which is made of brass to prevent permanent magnetism. In the sleeve is a hardened metallic pin 17, which is sustained in position with its head above the top of the sleeve by the spring 18. On the plate 3 we place a large helix electro-magnet 19, having the armature 20, which we make to serve as a hammer. The hammer is threaded on its upper extremity and provided with a hand-nut 21. A spring 22 encircles the hammer resting upon the top of the magnet and bearing against the under surface of the hand-nut and serves to retract the hammer after the stroke. In the hollow axis of the magnet, at the bottom of the same, is fixed a core 23 for the purpose of increasing the power and limiting the downward stroke of the hammer and the pin. This core is rigidly secured to the magnet bed-plate 3 and has its axis bored out to fit over the brass sleeve 16 and its inclosed pin 17. These parts fit snugly together. The hammer is provided with a downwardly-projecting head 24, which just fits into the hollow axis of the core 23. As the hammer nears the end of its stroke it moves very rapidly. Sufficient outlet will not be afforded for the escape of all the air between the body

of the hammer and the core 23, and an air-cushion will thus be afforded, preventing jarring contact of the two surfaces. By making and breaking a circuit to this magnet 19 strokes may be made at will with the armature-hammers 20. That part of the bed-plate 1 lying directly under the index-plate C is provided with corresponding coincident holes *e*. In these holes are placed vulcanized rubber sleeves or bushings 25, and in the bushings are placed the short platinum-headed rods 26, which are held in position with their heads flush against the lower face of the index-plate by the encircling springs 27. The lower ends of these rods are connected with branch wires 28, which form part of a circuit, as hereinafter described. In the space 4 directly under the bearing-plate 2 and resting on the bed-plate is placed a matrix-carriage 29, consisting of front, rear, and side vertical plates *f*, the heavy central rib *g*, and top plate H, and the guides *h*, attached to the front and rear plates and projecting above the level of the matrix bed-plate or resistance-plate H. This matrix-carriage is of the same width as the bed-plate A′ and is held from lateral displacement by the vertical projecting flanges 30, which are rigidly attached to the bed-plate. The central rib *g* is solid and rests directly over the bed-block *a*″. To the front plate of the carriage is rigidly secured the rack-bar 31, which is provided with the teeth 32 on its inner vertical face for engaging with a driving-pinion. This rack-bar is supported by the bed-plate and extends toward the rear of the same. At a suitable point in the bed-plate is fixed a vertical post 33, and on this post is placed a loose sleeve 34, provided with the pinion or gear-teeth on its periphery at 35. This pinion 35 engages with the rack 31. On the sleeve 34 is placed a cylinder-shaped spring-case 36, which is provided with teeth, constituting a rack 37, on the upper two-thirds of its periphery. This spring-case is fastened to and turns with the sleeve 34, and may be adjusted vertically thereon for a limited distance. A pin 38 through the post 33 prevents any vertical movement of the sleeve and pinion and limits the vertical adjustment of the spring-case. Over the top part of the post 33 fits a cap-sleeve 39, passing through a hole in the cap-plate of the spring-case. This cap-sleeve has a free vertical movement on the post, but is prevented from turning thereon by a vertical feather 40. This cap-sleeve rests on the cap-plate of the spring-case by the annular flange 41, and is secured to the same in any suitable way, so that the cap-plate may be free to turn on the sleeve, but so that when the sleeve is raised or lowered the cap-plate and entire spring-case will be raised or lowered with it. As shown, it is held by the spring in the case.

In the case 36 is a coiled flat spring 42, which at one end 43 is attached to the vertical wall of the case and at the other end 44 is attached to the sleeve 39. It is evident that this spring will be wound up by turning the case from left to right and that the spring will turn the case and pinion in the opposite direction when set free.

On the rear part of the bed-plate, in convenient suitable positions with respect to the spring case and rack, we place a series of magnets M′, M², and M³, and to a series of vertical posts K′, K″, and K‴ we pivot a corresponding series of armatures N′, N², and N³, the free ends of which are supported in their proper horizontal plane by a series of brackets L′ L″ L‴, suitably supported on the bed-plate. To the outer end of the armatures are pivotally attached a series of spring-pawls P′ P″ P‴, held in proper position for engaging with the ratchet on the spring-case 37 by the small flat springs *p′ p″ p‴*. After the circuit has been opened the armatures are retracted by springs *l′ l″ l‴*, attached to studs 45 on the bed-plate. These magnets M′, M², and M³ have armatures which move through different distances which are multiples of a common unit of space and move the pawls through corresponding distances. For example, M³ moves the pawl P‴ three times as far as M′ moves pawl P′. As many of these magnets are used as may be required to correspond to the space-classes into which the type characters may be grouped. A lever 46 is fulcrumed to a post 47, fixed on the outer left-hand corner of the hammer bed-plate 3. One end of this lever is provided with a hook 48, which engages a loop or link 49 in the end of the cap-sleeve 39, and the other end is provided with a finger disk or handle 50. By pressing down on the disk 50 the spring-case may be raised from the position shown in Fig. XII to that shown in Fig. XIII and the ratchet on the periphery of the case will be thrown out of gear with the pawls and the case and pinion will be rapidly turned in the opposite direction by the spring 42. During this movement of unwinding or retraction of the carriage the pawls rest against the smooth part of the periphery of the spring-case. The smooth part is of a larger diameter and connects with the ratchet part by an inclined or cam surface, thus preventing the pawls from catching under the ends of the teeth when the case is lowered.

On the front part A of the bed-plate 1, intermediate the hammer-magnet and the index-plate, we place a circuit-closing magnet 51 and a spring-armature 52, which is bolted to the bed-plate by the bolts 53 and insulated from the same by rubber bushing 54. The free end of this armature extends beyond the magnet 51 in the direction of the hammer-magnet and is adjustable on a post 55, made of hard rubber or other insulating material and provided with a screw-threaded top and a thumb-nut R for varying the distance through which the armature may be made to move. A wire S connects the insulated core 59 of this magnet 51 with the hammer-magnet 19. To the under side of the bed-plate is

attached by the bolts 53 a flat metal spring 56, having metallic contact through the bolts 53 with the armature 52 and extending at right angles to the armature to the left side of the bed-plate. At this point it comes in contact when closed with the metallic sleeve 57, which is inclosed within rubber bushings 58 and extends up through the bed-plate and is connected to a wire S″, leading to a source of electricity. A vulcanized-rubber key 60 rests loosely in the sleeve 57 and is provided with the hand-disk 61, within easy reach of the operator's left hand. The wire S′ is connected at one end to the hammer-magnet 19 and at the other to a dynamo, (not shown,) and the circuit is completed through wire S′, core 59, armature 52, metallic bolts 53, spring 56, sleeve 57, and return-wire S″. By pressing the key 60 this hammer-circuit may be broken at will.

As hereinbefore stated, the type characters or type-rods are classified into groups according to the amount of space required by each, measured by a common unit, as the one, two, and three unit classes, &c., and from their respective corresponding metallic rods 26 branch wires 28 connect to the corresponding main wire for any given class. The wire marked 63^a is such a main wire for the class of characters requiring one unit of space, and may be called the "one-unit wire." It leads from its respective branchlets 28 to and through the one-unit magnet M′, and by its extension 63^b connects with a source of electricity (not shown) 64^a and 64^b, and 65^a and 65^b are the corresponding two and three unit wires, running from their respective branchlets through the magnets M^2 and M^3 to the same source of electricity. From this common source of electricity, which may be either a dynamo or a battery, (not shown,) the common outleading wire 62 extends to and through the magnet 51 and is soldered to the bed-plate A. From the bed-plate the current passes through the pivot-pin 10 to the key-lever C and completes the circuit through the key 8.

It will be noted that the feed-magnet circuits and the hammer-circuit are entirely independent and that the latter is closed by a magnet 51, placed on the former. For the hammer-magnet we use a quantity-current, employing a large wire to avoid any possible chance of shock to the operator, preferably employing a dynamo as the source. For the feed-magnets we use an intensity-current, employing a small wire, and either a dynamo or a battery may be used as the source. By the proper independent connections the same dynamo may be made to supply the proper currents to both circuits.

At all points where circuits are made and broken platinum surfaces are used. A pawl 76 is attached to a post 77, fixed to the bed-plate A″, and engages the teeth on the spring-case 36 and is disengaged therefrom by the vertical movement of the case, the same as the pawls P′, P″, and P‴. This pawl serves to prevent any slipping backward of the case and to make the successive throws of any given pawl of exactly the same length.

The mechanism so far described will bring the type to the common center, feed the matrix material along the line, and make the stroke. The lateral movement to effect the spacing between the lines is secured by the mechanism shown in Figs. III, XV, and XVI. A pair of rollers 66 are supported on the left side of the matrix-carriage 29, one directly over the other, so that the top of the lower roller shall be on the same level as the matrix-bed plate H. The rear ends of these rollers are provided with intermeshing gear-wheels 67, and the upper roller is provided with a ratchet-wheel 68 on its forward end. A bracket 69 projects outward from the side plate of the matrix-carriage, and to the vertical arm of the same is pivoted a pawl-lever 70, which carries on its inner extremity a spring-pawl 71 for engagement with the ratchet-wheel 68. To the top of the pawl-lever is attached a finger disk or key 72 within easy reach of the operator. A resistance-spring 73 is fastened to the horizontal arm of the bracket and presses upward against the pawl-lever, serving to hold the pawl out of engagement with the ratchet-wheel. Under the free end of the pawl-lever is placed an adjustable stop, consisting of a vertical post 74, attached to the horizontal arm of the bracket, screw-threaded on its upper extremity and provided with the screw-threaded hand-nut 75. By adjusting this hand-nut the throw of the pawl may be made longer or shorter and the spacing between the lines be varied at will. To insure accuracy, a graduated scale may be attached or marked on the post. As shown, these rollers are moved by hand.

In the modification shown in Fig. VII the rods 26 are dispensed with and the key 8 is itself made vertically movable within a rubber bushing and is retracted by an encircling spring. The matrix material is shown and marked 78 in Figs. II, IV, and VIII.

The operation of our machine is clear from the foregoing description. With the key 8 the operator spells out the words on the index-plate. The resultant movement of the alignment-plate brings the corresponding type-rods to the common center directly under the hammer and over the matrix material. The electrical connections through the key-point and feed-magnets move the matrix material the requisite units of space along the line. Simultaneously therewith the hammer-circuit is closed by the magnet 51, and an instant later (sufficient but almost inappreciable) the stroke is given by the hammer and the impression is made. In case increased space is wanted, as between words or at the end of the line or for paragraphs, or if for any reason it may be desirable to avoid the stroke of the hammer, the operator presses down on the disk 61 and opens the hammer-

circuit. In moving the matrix-carriage along the line the armatures have wound up the spring 42 within its case about the non-revoluble sleeve 39. When the end of the line has been reached, the operator presses on the disk 50, disengaging the ratchet-teeth on the spring-case from the pawls, and the spring unwinds, retracting the carriage to its starting-point. Simultaneously therewith the operator presses on the disk 72, feeding the matrix material laterally the requisite space, and all is in readiness to start a new line. It will be noted that the stroke of the hammer is made to follow and not precede or coincide with any movement of the matrix material or the type-rod by making the armature of the hammer-closing circuit move through a larger space than the longest distance moved through by any feed-magnet armature, and the necessary proximate coincidence or simultaneity of movement is secured by closing the hammer-circuit through a magnet placed on the feed-circuit.

The common initiative, all the movements being started from the index-key, and the absolute precision with which all the parts are made, necessarily, to perform their respective functions at the right instant of time are very material features of our machine. There is no chance for the parts to fail in their functions through wear and tear and resultant lost motion.

For the matrix-body we use whatever material will best serve the purpose. Card-board gives excellent results, and we have also found that good results can be obtained from thin sections of wood cut across the fiber or grain.

Justification is effected by the proper preparation of the copy. As hereinbefore stated, the type characters and the feed movement all correspond to certain multiples of a common space-unit. The copy is measured and prepared by the same scale—that is to say, a common space-unit is adopted for measuring the copy, the type-dies, the feed movements, and the printed line. Columns are adopted for the printed page, which are in width exact multiples of said space-unit. The unit is made sufficiently small to measure the smallest type character, and every other character used is a multiple of that. By the eye counting the characters and spaces between words or by proper machinery the copy is measured and the point which will bring the matter to the end of a line is noted thereon. If that point does not fall at the end of a syllable, the division-point is thrown back the necessary number of letters, and the corresponding necessary number of unit-spaces to be thrown in are noted above the word and may be distributed by the proper notation between the words along the line. In this way all the operator has to do is to glance at the last word of his line and he sees whether or not it will come out flush with the end of the line, and if not he throws in between the intervening words the requisite number of spaces. Justification is thus absolutely assured. The copy can be prepared in this way with great rapidity by the eye alone.

It will be understood that modifications in the electric connections and the electric controlling devices for said electric connections, as well as in many of the minor features of our mechanism, may be made without departing from the spirit of our invention.

What we claim, and desire to secure by Letters Patent of the United States, is as follows:

1. In a matrix-making machine, the combination, with a movable matrix-material carriage, of character-selecting devices classified into groups according to the space required by the characters to which they correspond, independent and complete automatic feed mechanisms less in number than the characters and each adapted to effect a movement of said carriage a determinate distance in the same direction, and connections between the character-selecting devices and said feed mechanisms, whereby the appropriate feed mechanism for each group will be brought into operation by the manipulation of any of the character-selecting devices of said group, substantially as described.

2. The combination, with the movable matrix-material carriage, of a character-board representing a series of characters, said characters being classified on the board into groups according to the space required by each character, independent and complete automatic feeding devices for the matrix-material carriage less in number than the characters represented on said board, said feeding devices being adapted to move the matrix-material carriage a determinate distance in the same direction, and a different connection between each group of the character-board and the feeding devices, substantially as described.

3. In a matrix-making machine, the combination, with a movable matrix-material carriage, of character-selecting devices classified into groups according to the space required for each character, independent and complete electrically-controlled feed mechanisms less in number than the character-selecting devices and each adapted to move the matrix-material carriage a determinate distance in the same direction, and different electrical connections between each group of the selecting devices and the feed mechanisms, substantially as described.

4. The combination, with a movable matrix-material carriage, of a character-board representing a series of characters, said characters being classified on said board into groups according to the space required for each character, independent and complete feeding devices comprising two or more electric motors, each adapted to move the matrix-material carriage a determinate distance in the same direction, and different electric connections between each group of the character-board and the feeding devices, said electric connec-

tions being provided with circuit-controlling devices, substantially as described.

5. The combination, with the movable matrix-material carriage, of a character-board representing a series of characters, said characters being classified on said board into groups according to the space required for each, as many independent and complete automatic feeding devices as there are groups of characters, each feeding device adapted to move said carriage a different distance in the same direction, and a suitable connection from each group of characters to the corresponding feeding device, substantially as described.

6. The combination, with a movable matrix-material carriage, of two or more electrically-controlled independent and complete feeding devices, each adapted to effect the movement of said carriage a determinate distance in the same direction, and electric connections for said feeding devices, said electric connections being provided with circuit-controllers, substantially as described,

7. The combination, with a movable matrix-material carriage, of electrically-controlled independent and complete feeding devices, each feeding device being adapted to move said carriage a different distance in the same direction, and a different circuit for each feeding device, each of said circuits being provided with circuit-controlling devices, substantially as described.

8. In a matrix-making machine, the combination, with a movable matrix-material carriage, of character-selecting devices classified into groups according to the space required for each character, electrically-controlled independent and complete feed mechanisms, each adapted to move the matrix-material carriage a different distance in the same direction, and electric circuits including said feeding devices, said circuits being controlled by said character-selecting devices, substantially as described.

9. The combination, with a movable matrix-material carriage, of feeding devices comprising two or more electric motors, each motor being adapted to move said carriage a different distance in the same direction, a different electric connection for each motor, and a character-board representing a series of characters, said characters being classified on said board into groups or classes according to the space required for each character, each of said connections being provided with circuit-controlling devices, one part of said circuit-controlling devices in each of said circuits being connected with one of the groups of the character-board, substantially as described.

10. The combination, with a matrix-material carriage, of electric feeding devices for moving said carriage, a bar provided at one end with a series of type-dies and at the other with a single hand-key having a contact-point, an index-plate provided with key-seats corresponding to said type-dies and having contact-points adjacent thereto, and electrical connections between said contact-points and said feeding devices, substantially as described.

11. The combination, with a matrix-material carriage, of electric feeding devices for the same and electric connections for said feeding devices, a die-carriage, an electric hammer for depressing the dies, an electric circuit for said hammer, and an electric circuit-controlling device for the hammer-circuit, located in the electric connections for said feeding devices, said electric connections for the feeding devices being provided with circuit-controlling devices, substantially as described.

12. The combination, with a matrix-material carriage, of two or more electric motors in different circuits adapted each to move said carriage a different distance, a die-carriage, an electric hammer for depressing said dies, an electric circuit for said hammer, and an electric-circuit-controlling device for the hammer-circuit, located in each of said motor-circuits, said motor-circuits being provided with a circuit-controlling device or devices, substantially as described.

13. The combination, with a matrix-material carriage, of electric feeding devices for the same and electric connections for said feeding devices, a die-carraige and electric hammer for depressing the dies, an electric circuit for said hammer, a hand circuit-breaker in said hammer-circuit, and an electric-circuit-controlling device for said hammer-circuit, located in the electric connections for the said feeding devices, the electric connections for the feeding devices being provided with a circuit-controller, whereby the said hammer may be operated from the feeding circuits or the feeding devices be worked independently of said hammer, as desired, substantially as described.

14. The combination, with a matrix-material carriage, of two or more electric motors adapted each to move said carriage a different distance in the same direction, a lever provided with a die-carriage at one end and a hand-key at the other, said hand-key having a contact-point, an index-plate provided with key-seats corresponding to the dies of said die-carriage and having contact-points adjacent thereto, electric circuits through each of said contact-points, an electric die-depressing device, and an electric-circuit controller for said electric die-depressing device located in the feeding-circuit, substantially as described.

15. The combination, with a matrix-material carriage, of a character-board representing a series of characters, said characters being classified on said board into groups according to the space required for each character, feeding devices comprising two or more electric motors each adapted to move said carriage a certain distance in the same direction, an electric die-depressing device, different electric connections from each group of

characters to the corresponding feeding device, an electric connection for said die-depressing device, the said connections for the feeding devices being provided with circuit-controllers, and a circuit-controller for the connections of the die-depressing device, substantially as described.

16. The combination, with a matrix-material carriage, of a die-carriage seat, a bar capable of movement in all directions in a plane parallel with the plane of the carriage-seat, provided with type-dies at one end classified according to the space required for each, and with a hand-key at the other having a contact-point, an index-plate having key-seats and contacts corresponding to said type-dies, feeding devices consisting of two or more electric motors each adapted to move said carriage a certain distance in the same direction, an electric die-depressing device, different electric connections from each group of contacts to the corresponding feeding device or devices, an electric circuit through said connections, hand-key, and contacts, an electric circuit through said die-depressing device, and an electric-circuit controller for said depressing device located in the connections of the electric feeding devices, substantially as described.

17. In combination, the electro-magnet 19, provided with a hollow axis, the armature 20, serving as a hammer, provided with a retracting-spring 22, the die-depressing pin 17, the cap-plate 3, the brass bushing 16, an electric circuit through said magnet, and means, substantially as described, for opening and closing said circuit, as and for the purposes set forth.

18. In combination, magnet 19, provided with a hollow axis, closely-fitting armature-hammer 20, provided with the head 24, the sleeve 23, the bushing 16, and the pin 17, resting in said bushing and provided with a head closely fitting the interior of said sleeve, whereby an air-cushion is provided preventing jarring contact between said hammer and said sleeve.

19. In a matrix-making machine, the combination, with a matrix-material carriage, of a rack attached thereto, a pinion engaging said rack, a ratchet-wheel connected with the pinion, a series of actuating-pawls engaging said ratchet, each having a different range of movement of fixed extent, the movement of each greater pawl being a multiple of the movement of the pawl moving the least distance, and an independent electro-magnet for actuating each pawl, substantially as described.

20. The combination, with a matrix-material carriage and a rack attached thereto, of a pinion engaging said rack and its shaft, a ratchet-cylinder having a smooth surface adjacent to the ratchet-teeth, keyed on the pinion-shaft rotating therewith, and movable longitudinally thereon, and an actuating-pawl engaging said ratchet, substantially as described.

21. In feeding devices for matrix-making machines, a ratchet-cylinder keyed to and movable lengthwise of its supporting-shaft and revolving therewith, having a smooth surface adjacent to its ratchet-teeth, the said smooth portion and the broader faces of the teeth being connected by inclines, and an actuating-pawl engaging said ratchet when at one extreme of movement, substantially as described.

22. In feeding devices for matrix-making machines, a cylinder keyed to and movable lengthwise of its supporting-shaft and having on its periphery a series of ratchet-teeth the outer tips of which extend to the periphery of the cylinder, the larger faces of said ratchet-teeth being connected with the smooth portion of the cylinder by inclines, and an actuating-pawl engaging said ratchet-teeth when in one extreme of movement, substantially as described.

23. The combination, with a matrix-material carriage provided with a rack, of a pinion engaging said rack, having a hub extending on one side of the same, a cap-sleeve mounted on the axis of the pinion, movable lengthwise of the same, a cylinder having ratchet-teeth and a smooth peripheral portion adjacent to its ratchet-teeth keyed to said extending hub and said sleeve, and an actuating-pawl engaging said ratchet, substantially as described.

24. The combination, with a matrix-material carriage provided with a rack, of a pinion engaging said rack, having a hub extended on one side of the same, a cap-sleeve keyed to the axis of the pinion and movable lengthwise of the same, a cylinder having a smooth peripheral portion adjacent to its ratchet-teeth keyed to said extended hub and mounted on said sleeve, an actuating-pawl engaging said ratchet-teeth, and a band-spring attached at one end to said cap-sleeve and at the other to the interior of the cylinder, substantially as described.

25. In a matrix-making machine, the combination, with type-dies, an impression device, and an oscillating and sliding lever adapted to present said dies successively to the impression device, of a carriage for a matrix-body thereunder, and suitable electrical devices for moving said carriage and actuating the impression device upon the closing of a circuit by the operation of said lever.

26. In a matrix-making machine, a die-carrier adapted to present the dies in sequence to an impression device, a matrix-carriage thereunder, a rack connected thereto, a pinion engaging the rack, a ratchet-wheel and pawls arranged to turn the pinion, armatures actuating the pawls and having different degrees of movement, and electro-magnets therefor, substantially as set forth.

27. In combination, in a matrix-machine

having means for presenting type-dies in succession to an impressing device, a matrix-carriage provided with side pieces having guides for the edges of a matrix-strip, and a central bridge constituting an anvil, feed-rolls, and ratchet and pawl devices for turning them to slide the strip in its guides to separate lines of impressions, and means for advancing the carriage to space the impressions in the lines, substantially as set forth.

28. In a matrix-machine, the combination of a die-carrier provided with a series of type-dies movable in guides in said carrier, a matrix-carriage movable laterally, a lever controlling the movement of the die-carrier for locating the type-dies opposite the impression-point, a feed mechanism for advancing the matrix-carriage, an impressing device for engaging each type-die when brought to the impression-point, a character-index co-operating with the controlling-lever for locating the type-dies, electro-magnetic devices operating the impressing device and the feed mechanism of the matrix-carriage, circuit connections, and circuit-controlling devices operated by the lever which adjusts the position of the type-dies, substantially as set forth, whereby as the dies are successively brought into position at the impression-point the matrix-carriage is advanced and the impressing device operated to project the type-dies into the matrix-strip.

29. In a matrix-machine, an impressing device, type-dies mounted to reciprocate in guides in a movable die-carrier, a plate provided with a centering-aperture opposite the impressing device, a matrix-carriage movable laterally of the central aperture, variably-feeding devices for actuating said matrix-carriage, and a lever controlling the motions of the die-carrier and determining the position of the type-dies relatively to the impressing device and centering-aperture, electro-magnetic devices controlling the feed mechanism and circuits, and circuit connections controlled by the lever which locates the die-carrier, substantially as set forth.

30. In a matrix-machine, an impressing device, a laterally-movable die-carrier provided with type-dies, a plate provided with a centering-aperture, a matrix-carriage movable laterally of and below the said plate and providing guides for a matrix-strip, and a feeding device movable with said matrix-carriage and engaging the matrix-strip borne thereby, substantially as set forth.

31. In a matrix-machine, the combination of a laterally-movable die-carrier provided with movable type-dies, a matrix-carriage, and devices for intermittingly advancing said carriage, a lever or arm moving with the die-carrier and serving to locate the type-dies oppoposite the impression-point, electro-magnets and circuit connections governing the devices for advancing the matrix-carriage, an index-plate, with which the arm on the die-carrier co-operates to locate the type-dies, and circuit-controlling devices in circuit with the said electro-magnets, arranged to be operated by the movement of the arm connected with the die-carrier as said arm is moved to engage with the index-plate to position the type-dies, substantially as set forth.

32. In a matrix-machine, the combination of a series of type-dies movable toward a common impression-point, an anvil toward which the type-dies are reciprocated in making an impression, a matrix-carriage movable laterally of the impression-point and provided with edge guides between which the matrix-strip is received, and a feeding device mounted upon said carriage and engaging the matrix-strip to advance the latter between the guiding-strips, substantially as set forth.

33. In a matrix-machine and in combination with type-dies adapted to be brought to a common impression-point, a carriage for the matrix-strip movable laterally of the impression-point and carrying an anvil and edge guides for the matrix-strip, substantially as set forth.

34. In a matrix-machine, the combination of the following elements: A movable die-carrier provided with a series of type-dies movable toward a common impression-point, an impressing device, a movable matrix-carriage, feeding devices for advancing the matrix-carriage intermittingly, electro-magnets controlling said feeding mechanism, an electro-magnet controlling the application of the impressing device, circuit connections for the said electro-magnets, including circuit-controlling devices, an arm moving in unison with the die-carriage and co-operating with an index-plate, and the circuit-controlling devices for locating the type-dies and setting in action the impressing and feeding mechanism.

35. In a matrix-machine, an impressing device, a matrix-carriage, a die-carriage, an oscillating sliding lever, one arm attached to the die-carrier and the other carrying a circuit-closer, and devices for determining the position of the type-dies, electro-magnets controlling a feeding mechanism for the matrix-carriage, an electro-magnet controlling the impressing device, circuit connections for said electro-magnets, and contacts in said circuits co-operating with the circuit-closer of the oscillating sliding lever, substantially as set forth.

36. In a matrix-machine, the combination of an impressing device reciprocated in guides, a matrix-carriage movable laterally of said impressing device and provided with feeding mechanism for advancing the matrix-strip on said carriage, a series of type-dies movable laterally of the impressing device between the latter and the matrix-carriage, a feeding mechanism connected to the matrix-carriage, and devices for actuating the feed mechanism and locating the position of the type-dies, substantially as set forth.

37. In a matrix-machine, an impressing device, a series of type-dies movable laterally

of the impressing device, a movable carriage, upon which the matrix-strip is supported beneath the type-dies, a feed mechanism for advancing said carriage, electro-magnetically controlled, an electro-magnetic device controlling the impressing device, a lever carrying the type-dies, an index-plate with which said lever co-operates to locate the type-dies, circuit connections, including the electro-magnets of the impressing and feeding devices, and a pin carried by said lever for engaging both the index-plate and a circuit-controlling device, substantially as set forth.

38. In a matrix-making machine, a sliding oscillating lever carrying type-dies adapted to present them in succession at a common point, an impression device operating at such a point, a perforated index-plate, a circuit-closing pin carried by the lever-arm, contact-points coinciding with perforations of the index-plate, a matrix-carriage, a ratchet attached thereto, a pinion, armatures, and connecting devices for rotating the pinion variable distances, electro-magnets, and electro connections between said contact-points and the appropriate magnet, and also between the contact-points and the impression-device mechanism, for the purposes set forth.

39. The combination, with a matrix-carriage of a matrix-making machine, of a rack, a pinion, a ratchet-wheel, a retracting-spring therefor, pawls, armatures, and electro-magnets for turning the ratchet-wheel in one direction, a locking-dog, and a lever for sliding the ratchet-wheel out of engagement with pawls and dog to permit said spring to reverse the movement and retract the rack, substantially as set forth.

40. The combination, with a matrix-carriage of a matrix-making machine, of a rack, a pinion, a post therefor, a ratchet-wheel arranged to turn with and slide on the hub of the pinion, a sliding sleeve on the post, a spring connected thereto and to the ratchet-wheel, pawls, and means for reciprocating them, and a lever for sliding said sleeve and ratchet-wheel to release the pawls and permit said spring to reverse the wheel movement and cause the retraction of said rack, substantially as set forth.

41. In a matrix-machine, an oscillating and reciprocating lever carrying type-dies on one arm and a circuit-closer on the other arm, a character-index, and corresponding contact-points, a matrix-carriage, variable-feed device therefor, an impression device, electric magnets for operating the feed device and the impression device, and suitable electrical connections between said contact-points and said electro-magnets, substantially as set forth.

42. In a matrix-machine, the combination, with a series of movable type-dies and devices for bringing each type to a common impression-point, of an anvil located opposite the said impression-point, a carriage for the matrix-strip, a plurality of feeding devices connected to said carriage, each of said feeding devices producing a different feed movement from the others, electro-magnets controlling the application of said feed mechanism, a separate circuit for each of said electro-magnets, and circuit-controlling devices in each circuit for throwing either one of the feed mechanisms into action, substantially as set forth.

43. In a matrix-machine, the combination, with a series of type-dies movable toward a common impression-point, of a lever movable with the type-dies and co-operating with an index-plate to determine the position of the type-dies relative to the impression-point, an anvil upon which the matrix-strip is impressed by the type-dies, a movable carriage for the matrix-strip, differential-feed mechanism operating upon the carriage to intermittingly advance the latter, a series of electro-magnets operating upon the feed mechanism to determine the degree of feed movement, circuit connections for electro-magnets, and circuit-controlling devices for each electro-magnet, co-operating with the lever moving with the type-dies, substantially as set forth.

44. In a matrix-machine, a die-carrier adapted to locate type-dies successively at the printing-point and carrying, also, a circuit-controlling device, a series of contacts arranged to co-operate with said circuit-controller, a series of electro-magnetic levers having circuit connections with said contacts, a differential-feed mechanism operated thereby, and an impressing device also operated thereby, substantially as set forth.

45. In a variable-feed mechanism for a matrix-machine, a rack and pinion for propelling the matrix-carriage, a ratchet-wheel arranged to turn with and slide on the axis of the pinion, detents, and means for engaging and disengaging them by the axial movement of the ratchet-wheel, substantially as described.

46. In a feed mechanism, a propelling-gear and a ratchet-wheel turning on a common axis, pawls for turning the ratchet-wheel, and means for the ratchet-wheel's axial movement to engage and disengage said pawl, substantially as set forth.

47. In a matrix-machine, a die-carrier adapted to locate type-dies successively at the printing-point and carrying, also, a circuit-controlling device, a series of contacts arranged to co-operate with said circuit-controller, a series of electro-magnetic devices having circuit connections with said contacts, and a differential-feed mechanism operated thereby, substantially as set forth.

48. In a matrix-machine, a die-carriage adapted to locate type-dies in succession at the printing-point and carrying, also, a circuit-controlling device, a series of contacts arranged to co-operate with said circuit-controller, a series of electro-magnetic devices having circuit connections with said contacts and serving to actuate pawls varying distances, and a ratchet-wheel actuated thereby to provide variable-feed movements, substantially as set forth.

49. In a matrix-making machine, the combination, with a die-carrier having different-spaced dies classified into groups according to the space required by each, of corresponding groups of character-selecting devices, a matrix-material carriage, a variable-feed mechanism for the same, and connections from said groups of character-selecting devices to the feed mechanism, whereby the extent of feed is dependent on the group of characters to which the selected die belongs.

50. In a matrix-making machine, the combination, with a die-depressing device, of a die-carrying lever carrying differently-spaced dies, classified into groups according to the space required by each adapted to present the dies in succession to the depressing device, a character-board having its characters classified into groups corresponding to the groups of dies forming with said lever, the means of selecting the characters, a matrix-material carriage, a variable-feed mechanism for the same, and connections between said feed mechanism and the groups of characters, whereby the extent of feed depends upon the group of characters to which the selected die belongs.

51. In a matrix-making machine, the combination, with a die-depressing device, of a carrier for bringing the dies in succession to the die-depressing device, having its dies classified into groups according to the space required for each, a matrix-material carriage, a variable electro-magnetic feed mechanism for the same, electrical contacts corresponding to each group of dies, and connections from the same to the feed mechanism, through which are produced the requisite feed movements for each group of dies.

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