(No Model.) 3 Sheets—Sheet 1.

O. MERGENTHALER.

MACHINE FOR PRODUCING PRINTING BARS.

No. 317,828. Patented May 12, 1885.

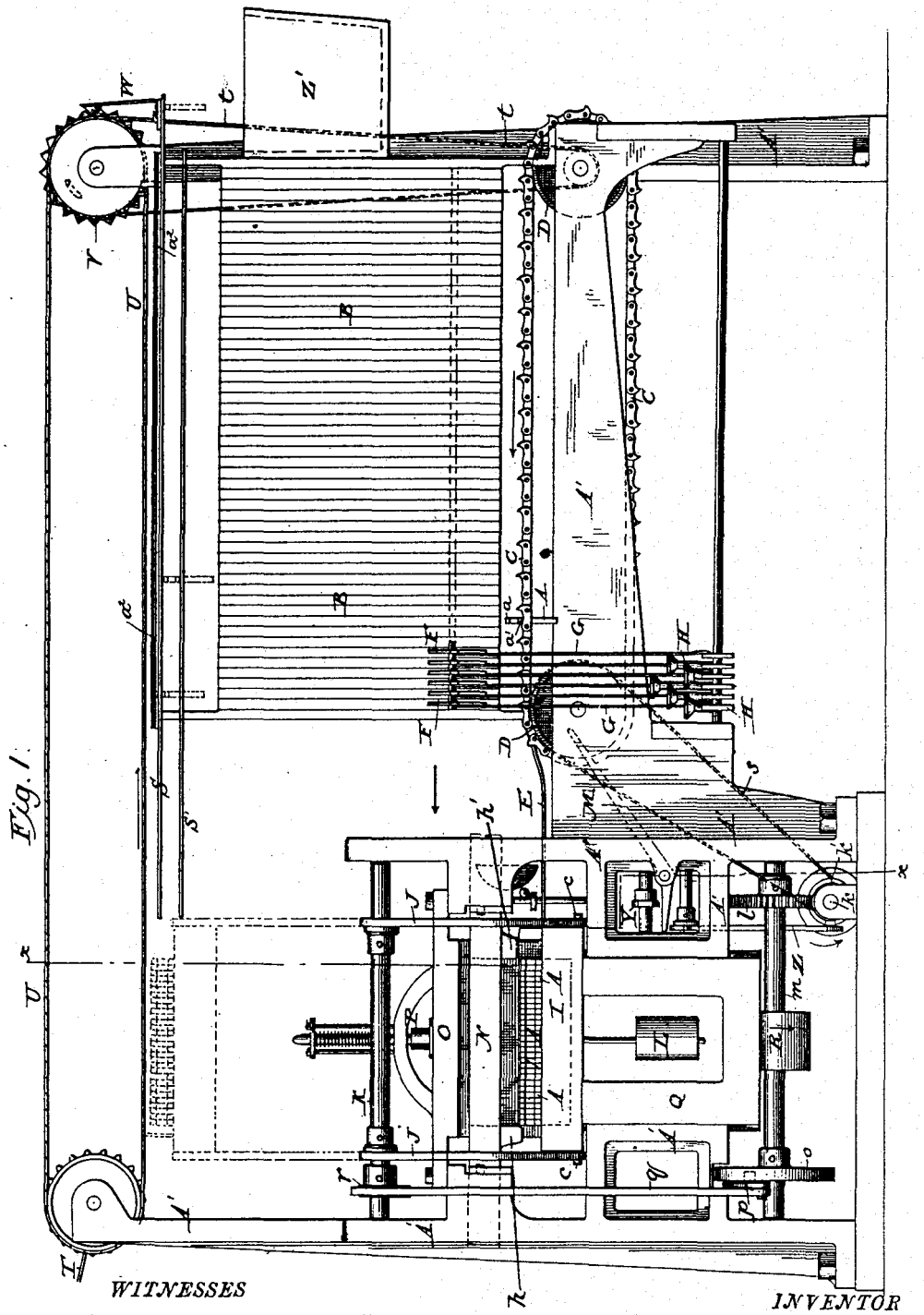

Fig. 1.

WITNESSES

Sidney P. Hollingsworth

Wm. H. Shipley

INVENTOR

Ottmar Mergenthaler

By P. T. Dodge

Attorney

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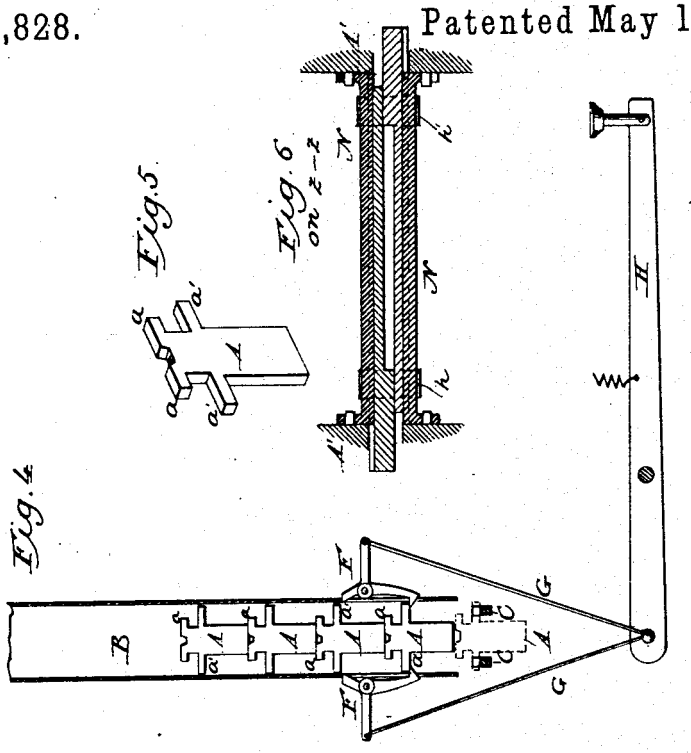

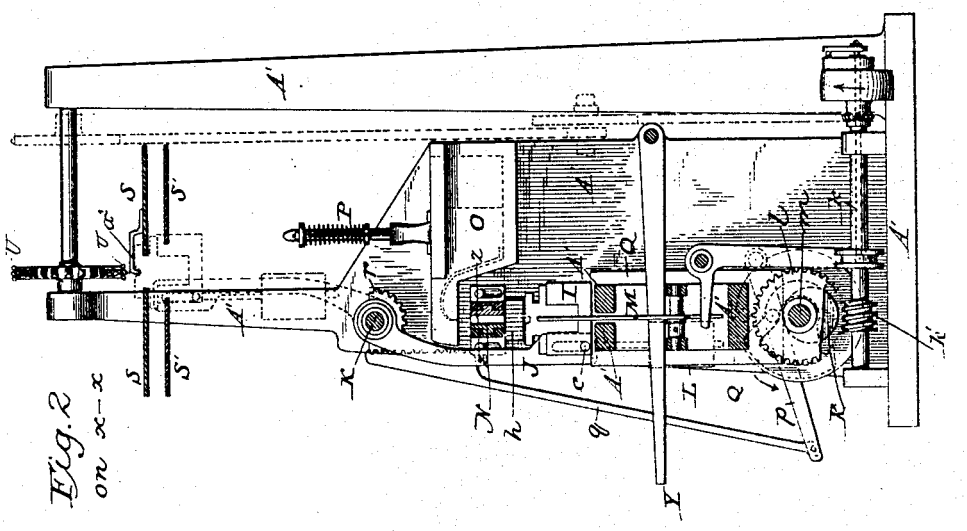

WITNESSES

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Wm. H. Shipley

INVENTOR

Ottmar Mergenthaler

By Philip T. Dodge.

Attorney

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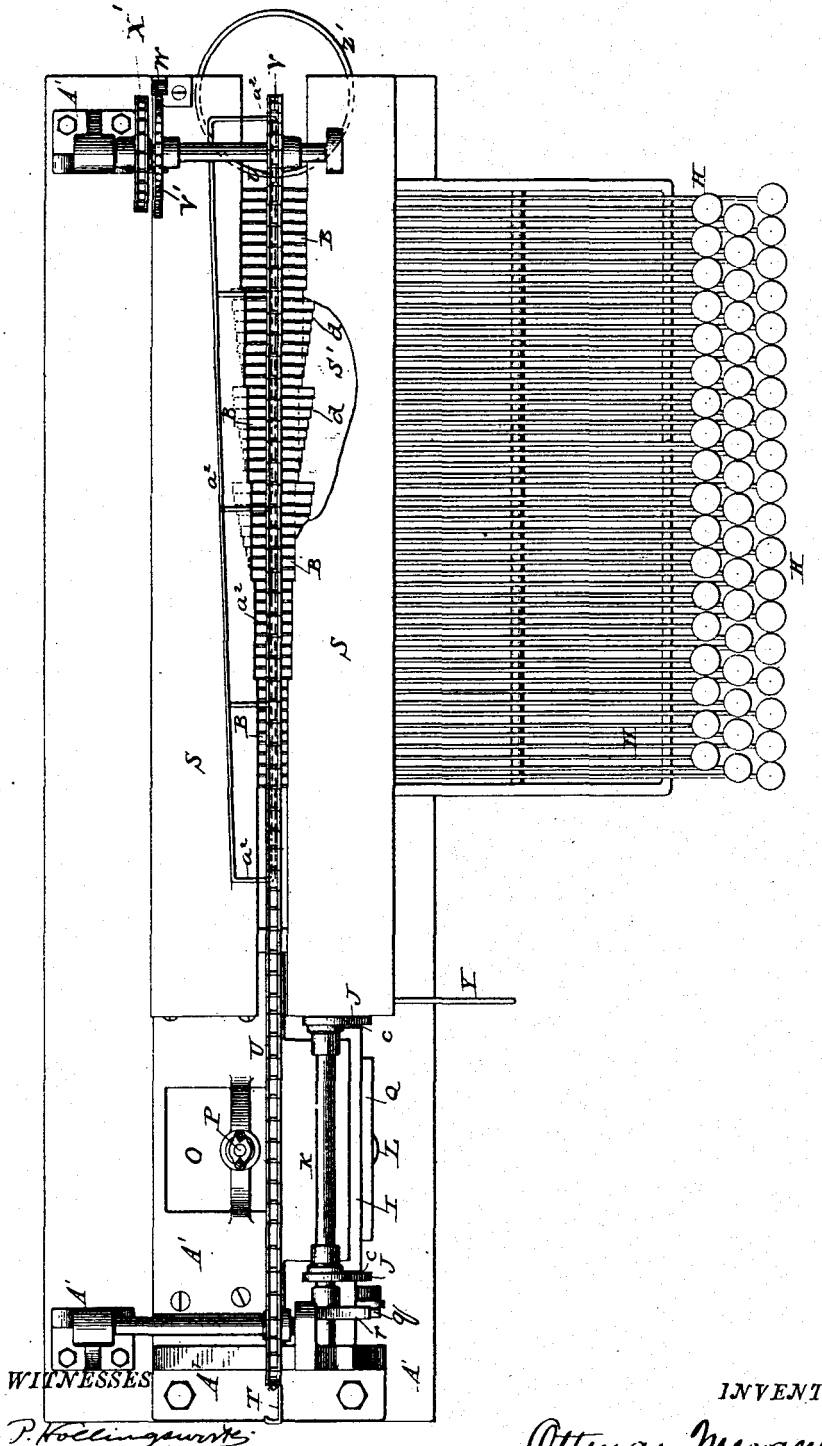

Fig. 3.

WITNESSES

Sidney P. Hollingsworth

Wm. H. Shipley

INVENTOR

Ottmar Mergenthaler

By Philip T. Dodge.

Attorney

UNITED STATES PATENT OFFICE.

OTTMAR MERGENTHALER, OF BALTIMORE, MD., ASSIGNOR TO THE NATIONAL TYPOGRAPHIC COMPANY, OF WASHINGTON, D. C.

MACHINE FOR PRODUCING PRINTING-BARS.

SPECIFICATION forming part of Letters Patent No. 317,828, dated May 12, 1885.

Application filed October 21, 1884. (No model.)

To all whom it may concern:

Be it known that I, OTTMAR MERGENTHALER, of Baltimore, in the State of Maryland, have invented certain Improvements in Machines for Producing Printing-Bars, &c., of which the following is a specification.

My invention relates to a machine in which a series of loose independent matrices or dies each containing one or more characters, and a series of blank dies for spacing purposes, are combined with finger-keys and intermediate connecting and driving mechanism in such manner that when power is applied to the machine and the preferred finger-keys actuated the matrices will be assembled or composed in line. A mold of suitable form is arranged to be operated in connection with the assembled dies and with means for supplying molten metal or its equivalent, whereby a printing-bar may be formed in the mold against the assembled matrices, so as to bear on its edge in relief the characters represented by said matrices. A mechanism is also provided to effect the distribution of the matrices after the completion of the cast to the respective holders or magazines from which they were originally delivered. The machine contains a series of holders or feed-tubes each adapted to receive a series of matrices bearing the same character, and each provided with a detent or escapement connected with an appropriate finger-key, the operation of which will permit the delivery of a single matrix at a time. It further contains parallel chains traveling continuously beneath the feed-tubes to receive the matrices, each of which is provided at its upper end with laterally-projecting shoulders which rest on top of the chains so as to support the matrices between them that they may be carried forward thereby. At one end of the conveying-chains a grooved track or guide receives the successive matrices therefrom, supporting them side by side. A lever provided for the purpose serves to transfer the matrices, when a considerable number have been accumulated to form a line of the width of the required page or column, to a movable support or anvil. This anvil is combined with mechanism by which it is elevated bodily, so as to present the matrices between clamping devices and against the mouth of a mold, which is in turn forced thereby against the mouth of a melting-pot, from which metal is delivered into the mold, forming therein a type-bar bearing on its edge, properly spaced or justified, the letters or characters to print a single line. The anvil which supports the matrices during the casting operation is sustained in swinging arms, which act immediately after the casting operation to carry the anvil with the matrices therein to an elevated position, so as to present the matrices opposite the end of horizontal grooved plates. An endless belt provided with a projecting finger acts against the series of matrices and forces them from the anvil between the divergent edges of suspending plates or rails, which I denominate the "distributing" plates. The distribution or assortment of the matrices and the delivery of each matrix to its proper tube or receptacle is secured by forming the different matrices with sustaining-shoulders of different widths, all matrices bearing the same character being of the same width. As the matrices are advanced between the divergent plates suspended therefrom by their shoulders, they will be released and permitted to descend at different points, according to the width of the shoulders.

Referring to the accompanying drawings, Figure 1 represents a front elevation of my improved machine, certain portions being broken away, as hereinafter explained, to expose other parts to view. Fig. 2 is a vertical cross-section on the line *x x* of Fig. 1, the lever for moving the matrices being shown in its forward position. Fig. 3 is a top plan view of the machine with a portion of one of the distributing-rails broken away. Fig. 4 is a vertical section of one of the matrix tubes or magazines with the escapement and the key mechanism connected therewith. Fig. 5 is a perspective view of one of the matrices. Fig. 6 is a horizontal cross-section showing the construction and arrangement of the separable mold.

In proceeding to construct my apparatus I first provide a series of matrices, A, representing each character, from three to a dozen or more, according to the capacity of the machine, those matrices which represent the same character being duplicates of each other in every respect. The matrices which bear

the different characters are made of different thicknesses corresponding to the width of the respective characters, in order that a uniformity of spacing may be maintained, as hereinafter more fully explained. Each matrix is provided, as represented in Fig. 5, with two pairs of supporting-shoulders, *a* and *a'*, located at opposite edges. The matrices which bear the different characters are made with shoulders of different widths for the purpose of permitting the mechanical distribution or separation, as will hereinafter more fully appear.

Any suitable number of the matrices, of various widths or thicknesses, may be constructed with plain or blank surfaces, or, in other words, may have the characters omitted therefrom, whereby they are adapted to serve as quads or spacing devices to produce in the cast suitable spaces between the words or characters. With the exception of the blank surfaces these quads may be in all respects identical with the character-matrices, and are operated in like manner.

The series of matrices constructed as above are inserted and operated in the machine proper, which will now be described.

A' A' represent the main frame, which may be of any form adapted to sustain the parts hereinafter described.

B B represent a series of upright tubes or reservoirs, in which the matrices are arranged end to end, each tube being adapted to receive matrices representing the same character.

C C represent two horizontal parallel chains traveling about supporting-rolls D, immediately beneath the feed-tubes B, in such position that whenever a matrix is released and permitted to descend from the lower end of a tube, its shoulders are engaged upon the upper edges of the two chains between which the matrix will remain suspended, so as to be carried forward therewith. The chains are driven continuously and at a moderately high speed, so that the matrices which may be delivered from the respective tubes will be carried forward automatically one after another and delivered from the inner end of the chains, where they are received upon and supported by two rails, E, provided for the purpose. The chains are constructed with upwardly-projecting teeth, which serve to prevent the matrices from turning and twisting thereon.

For the purpose of controlling the discharge of the matrices one at a time from the device I provide each tube on opposite sides with two dogs or escapements, F, each pivoted midway of its length, and provided at its lower end with a hook to engage beneath the shoulder of the bottom matrix, and also having at the upper end an arm to engage beneath the shoulder of the next matrix in the series. These dogs I connect by rods G or otherwise to finger-keys H, as represented in Fig. 4, so that when a key is depressed it will actuate the corresponding dogs F in such manner as to release the bottom matrix and permit it to descend upon the carrying-chains, while at the same time the next succeeding matrix is prevented from descending. When the finger-key rises, the dogs resume their original position, disengaging their upper ends from the second matrix and permitting it to descend until it bears upon their lower ends in the position vacated by the preceding matrix.

It will be understood that the finger-keys correspond in practice with the feed-tubes, each key representing a particular character, so that by the manipulation of the proper keys the matrices may be delivered to the chains in the order in which their respective characters are to be printed, the chains in turn delivering and assembling them in like order on the supporting-rails E.

At the end of the rails E there is a grooved anvil or block, I, designed to receive and support matrices representing all the characters which will occur in one line of a printed page or column. This anvil is sustained by horizontal pivots *c* at its ends seated in vertical slots in the extremities of two arms, J, which are attached to a horizontal rock-shaft, K. The lower side of the anvil is provided with a weight, L, by means of which it is maintained in an upright position and prevented from overturning. After a sufficient number of matrices have been delivered upon the rails E to form a line, as before alluded to, they are transferred to the anvil by means of a vibrating lever, M, provided for the purpose, this lever acting behind the last matrix and urging the series forward toward the anvil. The manner in which this lever is operated will be hereinafter explained.

In the top of the machine, immediately above the anvil, I mount a separable mold, N, the interior opening of which corresponds in length, height, and thickness with the printing-bar to be produced. This mold, which may be identical in construction with that represented in my application for Letters Patent filed on the 30th day of August, 1884, No. 144,851, is arranged to slide vertically to a limited extent. Above this mold I mount a melting-pot, O, having a mouth or delivery-duct adapted to discharge into the upper side of the mold, and containing a pump, P, such as is commonly used in type-casting machines for effecting the forcible delivery of the metal into the mold.

The details of the mold and the mechanism for operating the pump are not claimed as a part of the present invention, as they will be made the subject of a separate application. The mold may in the present machine be opened and closed by hand and the pump operated in like manner; or they may be combined with operating devices identical with those in my application No. 144,851.

The anvil above referred to is acted upon by a vertical frame, Q, the lower end of which is sustained by an eccentric, R, the rotation of which has the effect of elevating the anvil and lifting the assembled matrices against the

under side of the mold, which is in turn forced upward by the matrices firmly against the mouth of the melting-pot until the completion of the casting operation, after which the parts are lowered to their original positions.

In order to confine the matrices together during the casting operation I provide clamping devices therefor.

In the drawings, *h h'* represent the clamps attached to the two parts of the mold to act against opposite ends of the line of dies.

After the completion of the casting operation a rotation of the shaft K causes the arms J to swing upward, as indicated by dotted lines, whereby the anvil containing the matrices is lifted and carried forward to the position indicated by dotted lines in Fig. 2, in order that the matrices may be delivered from the anvil to the distributing rails or plates S S'. The upper rails, S S, are arranged horizontally, their inner edges being shouldered or offset so as to present an intermediate space or slot varying in width at different points, as plainly represented in Fig. 3. There may be any suitable number of sections, varying in width. In the drawings I have represented six divisions for the purposes of illustration. After the anvil has been lifted to its upper position, so as to present the matrices opposite the rails S, a finger, T, attached to a horizontal endless chain, U, acts against the last matrix in the series and forces them forward out of the anvil into the space between the distributing-plates, the upper shoulders, *a*, of the matrices engaging over the edges of the plates, so that the matrices remain suspended between them, after which the anvil descends to its original position in order to receive the matrices which have in the meantime been assembled to produce the characters for the next succeeding line. The movement of the finger T forces the series of matrices forward between the plates. It will be remembered that the shoulders of matrices bearing different characters were made of different widths horizontally, in consequence of which it follows that those matrices having narrow shoulders will descend through the narrowest section of the space between the rails, while those having the next narrowest will descend through the second section, and so on successively. If the machine contained but a small number of characters, it would be possible to devote a separate section of the distributing-rails to each matrix, but inasmuch as the machine will ordinarily contain eighty or more distinct forms of matrix, it is manifestly impossible to give a sufficient variation in the passage between the distributing-plates without rendering the matrices excessively large. To overcome this difficulty I provide the second pair of distributing-rails, S', to engage with the second or lower shoulders in the matrices. I divide the series of matrices, for example, into six groups, the upper shoulders of which correspond in width with the respective portions of the passage between the upper rails, S. Consequently all matrices belonging to one group—for instance, the first twelve characters—will descend through the first section of the upper rails, while the next group will pass through the second section, and so on. In order to subdivide these groups and present each matrix to its proper tube, I divide the passage between the lower rails into numerous sections varying in width, as shown at *d*, Fig. 3, each section representing a single character. The lower necks or shoulders of the matrices are made of corresponding width.

In the action of the machine a matrix suspended by its upper shoulder on the upper rails, S, will pass forward until its proper section is reached, when it will drop through with its companions to the lower rails, S', whereon it will hang suspended by the lower shoulders. Continuing its forward movement it will remain suspended until it reaches a section directly above the mouth of its feed-tube, when it will pass through into the tube. In order to prevent lateral movement of the matrices, which would result in a disengagement of one shoulder before the other, I propose to employ a guide of any suitable character. A simple devise for this purpose is a longitudinal rail or bar, a^2, arranged above the distributing-plates in position to enter the notches in the upper ends of the matrices, as represented in the drawings. It will thus be seen that the divergent plates or rails in connection with the matrices having shoulders of different widths and the means for moving the matrices endwise over the rails, constitute jointly an automatic distributing mechanism by means of which each matrix is delivered to its appropriate feed-tube.

In order to prevent the adhesion of the adjacent matrices and to insure their separation in order that the distribution may be effected, I propose to impart a vibratory motion to them in any appropriate manner. Figs. 1 and 3 represent a simple device for this purpose.

The shaft of the roll V, which carries one end of the feed-chain U, is provided with the fixed pulley V'. This pulley is notched or toothed in its edge and is united by means of a slot and pin with the driving-wheel X', mounted loosely on the shaft. A spring-pawl, W, having a V-shaped end, engages in the notched edge of the wheel. The driving-wheel X', is turned positively and continuously by a chain, as shown, or other suitable means. When its pin reaches the forward end of the slot in wheel V', the latter is turned ahead with a positive action, but the instant that the next tooth of wheel V' passes the point of the pawl the latter acts on the rear side of the tooth and causes the wheel V' to turn ahead of the driving-wheel X', thereby giving the chain U a sudden impetus. The pawl seats itself between the teeth and holds the wheel W and the chain at rest until the pin of the driving-wheel reaches the front of the slot as before. Thus it will be seen the chain U is given an intermitting movement, and its arm T caused to

advance the matrices with a rapping or striking action.

Referring to the details of the driving mechanism, *k* represents a driving-shaft provided with a driving-pulley and with a worm, *k'*, engaging the wheel *l*, mounted on the shaft *m*, which carries the anvil-lifting eccentric R. This shaft *m* also carries a wheel, *o*, having in its side a cam-groove engaging a stud or roller on a lever, *p*, which is pivoted to the frame and connected at one end to a rack-bar, *q*, the upper end of which engages a pinion, *r*, on the shaft K to cause the lifting of the anvil and matrices to the distributing mechanism. A chain, *s*, transmits motion from a pulley on the shaft of roller D, which carries one end of chain C. A pulley on the shaft of the other roll D is connected by a chain or belt, *t*, to the pulley X of the distributer-chain. A hand-lever, Y, pivoted to the frame, acts on the finger M to cause the advance of the matrices to the anvil. The finger M near the completion of its movement actuates an elbow-lever, *z*, which actuates an ordinary clutch for connecting the worm *k'* with the shaft. This permits all the parts except the chains to remain normally at rest, and causes the other operative parts to be automatically set in action the instant that the matrices are seated in the anvil. Each matrix may contain a single character or two or more characters which are to be printed together. For those characters which are rarely used I propose to use matrices to be inserted by hand. These will have necks of such size that they will all pass over the ends of the distributing-rails into a common receptacle, *z'*, provided to receive them.

In place of the dies or matrices with intaglio characters, I propose to use dies with raised or cameo characters when matrices with intaglio impressions are to be formed.

While I have described and represented herein those details of construction which I consider best adapted for practical purposes, it is to be understood that the form and arrangement of the parts may be modified in many respects which will be suggested by the judgment and experience of the skilled mechanic, without changing the general mode of action or departing from the limits of my invention.

I believe myself to be the first to combine with independent disconnected matrices each bearing a single character, finger-keys, intermediate mechanism for placing the designated matrices in line, and a casting mechanism which co-operates with the line of assembled matrices in such manner as to take a single cast from the entire line; and it is to be distinctly understood that my invention covers such combination in any form the equivalent of that herein detailed.

I do not claim herein any device or combination of devices shown or claimed in my applications for patent filed July 9, 1884, No. 137,225, and August 30, 1884, No. 141,851, or either of them.

Having thus described my invention, what I claim is—

1. In a machine for producing printing-bars, the combination of a series of independent matrices each representing a single character or two or more characters to appear together, holders or magazines for said matrices, a series of finger-keys representing the respective characters, intermediate mechanism, substantially as described, to assemble the matrices in line, and a casting mechanism, substantially as described, to co-operate with the assembled matrices.

2. In a machine for producing printing-bars, the combination of independent disconnected matrices each having a single character or two characters to appear together, magazines or holders to contain the assorted matrices, the finger-keys representing the various characters or letters borne by the matrices, mechanism, substantially as described, connecting the keys with the matrix-holders, an assembling mechanism, substantially as described, a casting mechanism, substantially as described, to co-operate with the line of assembled matrices, and mechanism, substantially as described, for distributing the matrices.

3. The combination of the series of free disconnected matrices, the magazines or holders therefor, the series of finger-keys representing the respective characters, mechanism, substantially as described, between the keys and matrix-holders to effect the discharge of the matrices, mechanism, substantially as described, to assemble the designated matrices in line, the movable anvil to receive and sustain the aligned matrices, the clamps to confine the matrices in the anvil, the mold opposite the anvil, and the melting-pot and forcing mechanism to deliver the metal to the mold, said parts being adapted for conjoint operation, substantially as set forth.

4. In combination with the feed-tubes, their escapements and the finger-keys connected therewith to effect the delivery of the matrices, the carrier traveling past the tubes to receive the matrices and assemble them side by side in the order of their delivery.

5. The matrices provided with sustaining-shoulders, in combination with the endless carrying or assembling chains.

6. In combination with the series of free independent matrices, the carrying-chains provided with shoulders or teeth to engage opposite sides of the matrices.

7. The feed-tubes and their escapements, connected with finger-keys, in combination with the matrices, the carrying-chains, and the receiving-rails whereon the matrices are assembled.

8. The combination, substantially as hereinbefore described and shown, of the feed-tubes or magazines, their escapements, and the finger-keys, with the disconnected matrices, the matrix conveying or assembling mechanism, the rails whereon the matrices are

delivered, the anvil to receive the matrices from the rails, the transferring device M, the mold, the melting-pot and its delivery-pump, and the mechanism to force the anvil toward the mold.

9. In combination with the anvil to sustain the matrices, the casting devices to co-operate with the matrices in the anvil, the distributing mechanism, and mechanism, substantially as described, to move the anvil and matrices from the casting to the distributing mechanism.

10. In a machine for producing printing-bars, and in combination with a series of free disconnected matrices, a casting mechanism, the distributing mechanism, and an anvil or matrix support which advances alternately to the casting and to the distributing mechanism.

11. In combination with the pivoted anvil or matrix carrier, the vertically-swinging sustaining-arms.

12. In combination with the melting-pot and its delivery-pump, the movable mold, the anvil, the matrices therein, the frame to sustain the anvil, and the eccentric to raise the frame.

13. In combination with the feed-tube, the series of independent matrices, an escapement or detent, substantially such as shown, and the finger-key connected therewith.

14. In combination with the independent matrices, those of the same character of equal width but those of different characters of different widths, the distributing rails or plates arranged to present a passage of increasing width toward the delivery end, and mechanism, substantially as described, to advance the matrices through said passage, whereby an automatic distribution or assortment of the matrices is secured.

15. In combination with the series of independent matrices, each provided with two pairs of shoulders graduated in width, as described and shown, two distributing-supports with expanding passages to operate in connection with the respective shoulders, whereby the matrices are first divided into groups each containing several characters, and these groups finally divided to assort the characters.

16. The series of independent matrices provided with sustaining-shoulders, as described, those which represent like characters being of equal width and those of different characters of different widths.

17. The matrices each having two pairs of sustaining-shoulders, as described.

18. In a composing mechanism, the combination of a series of tubes or holders each containing matrices of a given letter, escapement mechanism to discharge the type one at a time, and a carrier traveling in one direction beneath the entire series of tubes, whereby the discharged characters are assembled in the order of delivery and without reference to the relative order or position of the tubes.

19. In combination with the distributing rails or plates, the endless belt provided with an arm, T, the notched pulley to carry said belt, the driving-pulley loosely connected therewith, and the spring-arm acting on the notched pulley, whereby the arm is caused to advance the matrices with a jarring action.

In testimony whereof I hereunto set my hand this 11th day of October, 1884, in the presence of two attesting witnesses.

OTTMAR MERGENTHALER.

Witnesses:
MURRAY HANSON,
RICHARD R. BERGER.