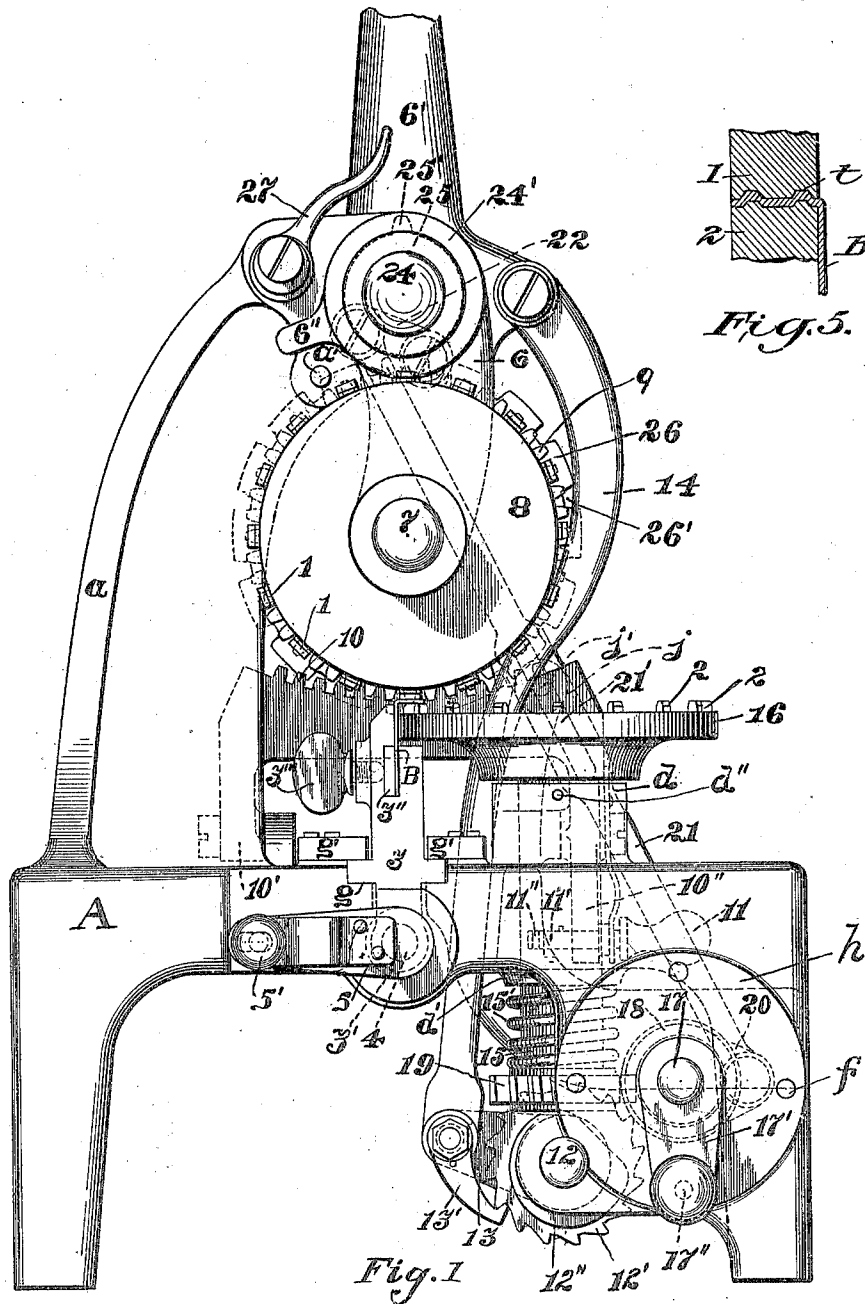


F. H. RICHARDS.
MACHINE FOR MAKING TYPES AND TYPE BARS.
APPLICATION FILED AUG. 7, 1902.

957,904.

Patented May 17, 1910.

48 SHEETS—SHEET 1.



Witnesses.
C. A. Jarvis.
G. E. Thompson

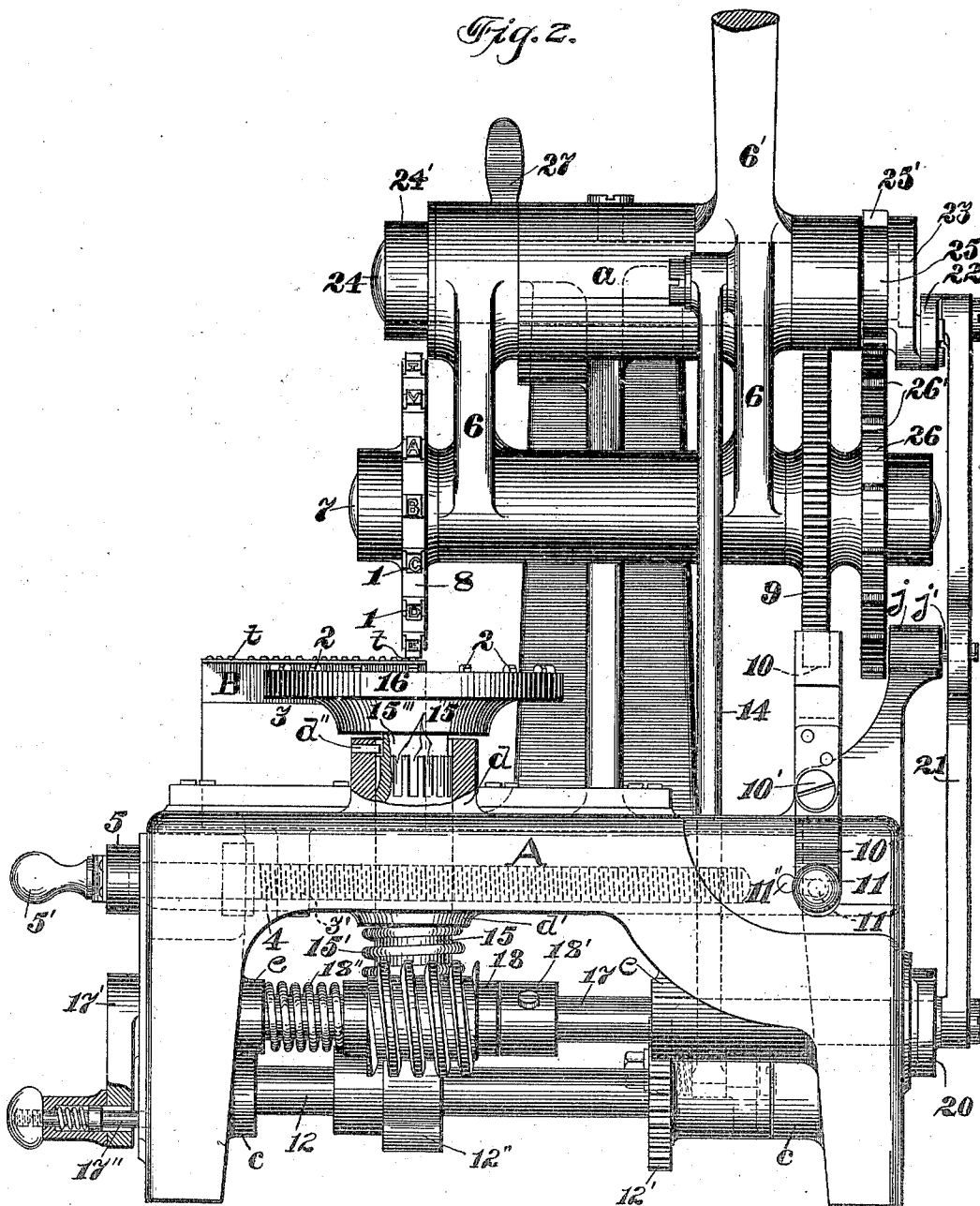
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4 SHEETS—SHEET 2.



Witnesses,
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J. E. Maynard

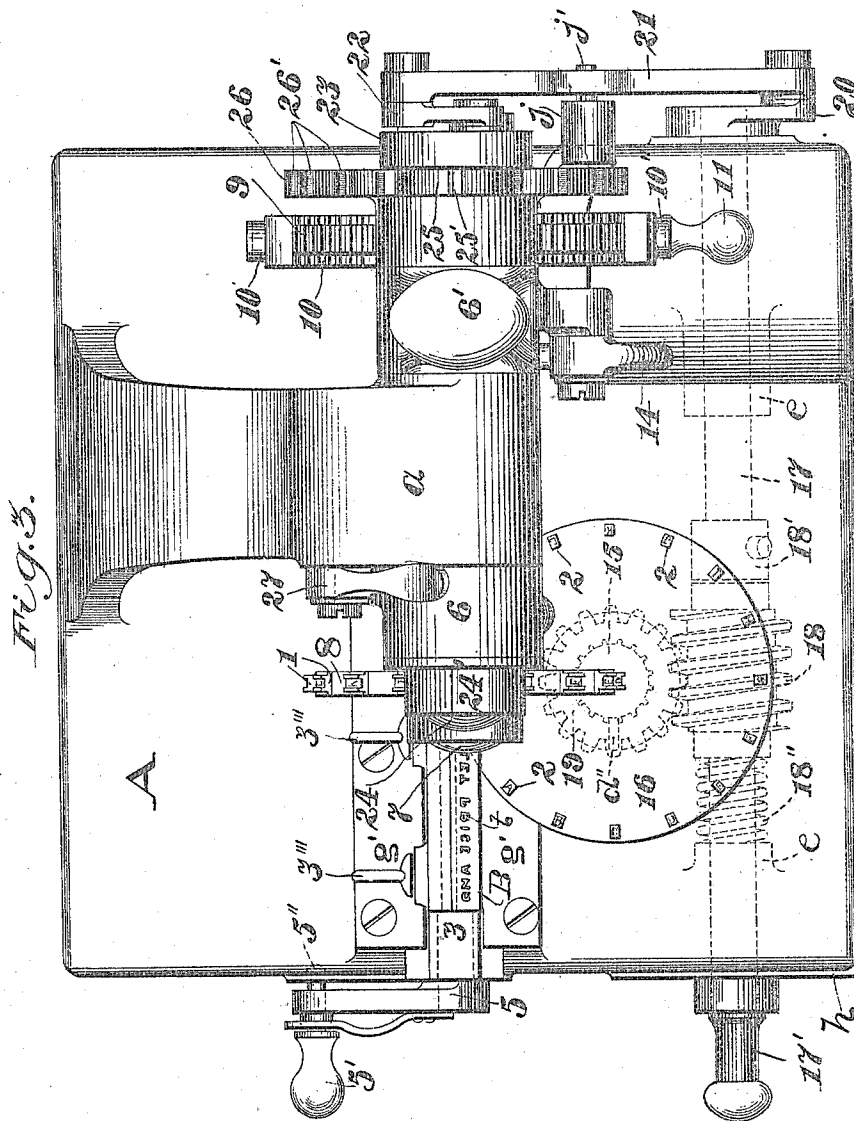
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4 SHEETS—SHEET 3.



Witnesses,
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Inventor
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4 SHEETS—SHEET 4.

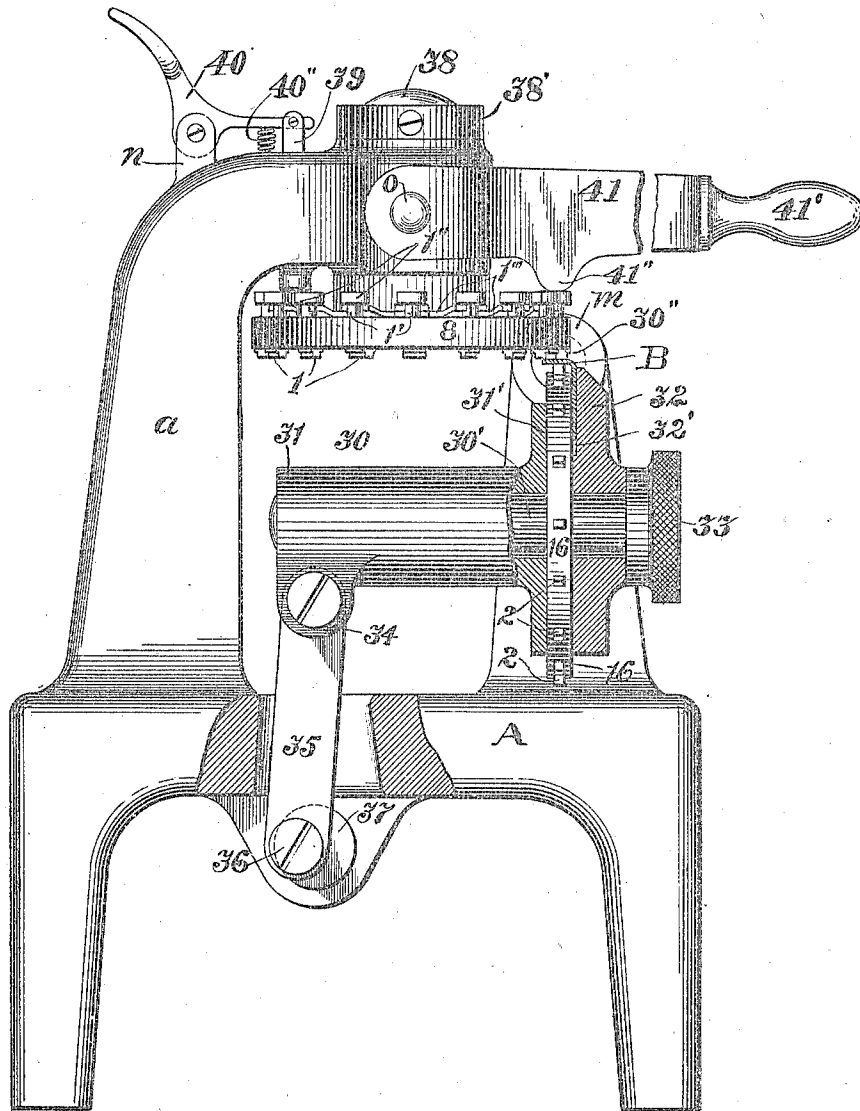


Fig. 4

Witnesses,
C. A. Jarvis.
J. E. Maynard

Inventor,
F. H. Richards.

UNITED STATES PATENT OFFICE.

FRANCIS H. RICHARDS, OF HARTFORD, CONNECTICUT, ASSIGNOR, BY MESNE ASSIGNMENTS, TO AMERICAN TYPOGRAPHIC CORPORATION, A CORPORATION OF ARIZONA TERRITORY.

MACHINE FOR MAKING TYPES AND TYPE-BARS.

957,904.

Specification of Letters Patent.

Patented May 17, 1910.

Application filed August 7, 1902. Serial No. 118,760.

To all whom it may concern:

Be it known that I, FRANCIS H. RICHARDS, a citizen of the United States, residing at Hartford, in the county of Hartford and State of Connecticut, have invented certain new and useful Improvements in Machines for Making Types and Type-Bars, of which the following is a specification.

This invention relates to mechanism for forming impressions upon sheet material and is particularly adapted for use in the typographic art in the production of type-bars from sheet material.

The machine embodying the present improvements will comprise dies or molds for acting upon one side of the material under treatment and complementary dies or punches for coöperative action upon the other side of the material; carriers will be provided for the molds and ramming punches together with mechanism for bringing the selected die and its associated punch to the working point together with mechanism for imparting working movements to each of said members.

In the drawings accompanying and forming a part of this specification, Figure 1 is an end view of a practicable embodiment of a form of my invention. Fig. 2 is a front elevation thereof. Fig. 3 is a plan view. Fig. 4 is an end elevation of a modification, and Fig. 5 is a cross sectional view of a blank being acted upon by a die and counter-part rammer.

A sliding work-holder 3 is illustrated herein, which is shown provided with clamping means, herein shown as a gib 3'', and thumb-screws 3''', 3''', by which an angle bar B, may be secured in the holder. Gibs g', g', secured to the base A, by screws, serve to retain the holder 3, in a groove g, formed in the base A. A screw-threaded nut 3', fixed on the holder 3, projects downward through a slot in the base A, and engage a feed member herein shown as a screw-threaded shaft 4, which is journaled in suitable bearings secured to the base A, and may be rotated by means of a crank 5, attached to said feed-member. The crank-handle 5', embodies in the present showing a spring-pressed bolt having a conical point 5'', which engages in a recess formed in the base A, and thus prevents the crank 5, from being accidentally moved. The pitch of the thread of the feed-screw 4, will purposely bear a

definite relation to a linear unit of type measurement; as, for instance, to a "point", technically so-called; and the several types formable by the machine, will, in their respective transverse dimension lengthwise of a line of said types respectively equal multiples of said unit.

The term "type", as used herein, is intended to apply to the printing face of an impression device, and to also include in the transverse dimensions thereof due proportions of the spaces between said face and the adjacent faces in a line of types, and of the spaces between said faces and the faces in adjacent lines of so-called "solid matter". Therefore, the elements mentioned may be so definitely proportioned one to the other that by means of the feed-screw 4, a bar B, may be definitely and accurately moved to receive consecutive and properly spaced impressions from the impressing members herein shown as dies 1, 1.

Journaled in a bracket a, which is shown integral with the base A, is shown a rotatable shaft 24, which is utilized as a pivot for a rocking-frame 6. Journaled in said rocking-frame is shown a rotatable shaft 7, on which is mounted a mold-holder, herein termed a die-carrier, rotatable with the shaft 7, and shown as a disk 8, with radiating intaglio or molding dies 1, 1, rigidly mounted on its periphery. A lever 6, is fixed upon, and may be integral with the rocking-frame 6, and by means thereof the die-carrier 8, may be rocked transversely of the typebar-holder 3. A stop-member which has an arm 6'', is fixed upon a hub of the rocking-frame 6, and a fixed stop herein shown as a stud a', and a pivoted adjusting stop 27 are shown attached to the bracket a, and positioned to limit the movement of the stop-member 6'', and thereby to limit the rocking movement of the frame 6, and die-carrier 8. Mounted on the shaft 7, is also shown a spur gear-wheel 9, adapted to mesh with a curved rack or internally toothed gear-segment 10, the ends of which are pivoted, as at 10', 10', to permit the gear-segment 10, to be rocked transversely of the gear-wheel 9; an arm 10'' being shown as fixed upon the gear-segment 10, for the purpose mentioned. A handle 11, is attached to the arm 10'', and embodies a spring-pressed bolt 11', the latter to engage endwise in either of two holes 11'', (one only being shown,) which are

formed in the base A, and severally adapted to receive the bolt end. The pitch of the gear-wheel 9, will preferably be an exact divisor of that of the die-carrier 8, the latter being considered as a toothed wheel on which the dies 1, 1, are supposed to occupy the positions of teeth. Assuming now that a die 1, be brought to the proper impressing position, and the spring-pressed bolt 11', be engaged as shown in the drawing, the gear-wheel 9, will so engage the gear-segment 10, as to first precisionize, if necessary, the operative die, and thereafter to properly locate transversely of the typebar any type-formative movements that may be made by said die. The type-formative pressure that coacts with the working movements of the molding die to form types may be applied in gradations varying at each successive movement of said die; said gradations being properly adapted to cause the mold-cavity of the die to gather, at each of said movements, such a portion of the type-formable material as it may, at the time, be capable of molding into a shape which is particularly adapted to forward the type-forming process. In the mechanism illustrated herein, a cam 12'', is shown as a member which will be operated for the purpose mentioned.

A rotatable shaft 12, is shown journaled in bearings *c, c*, on the base A. A ratchet-wheel 12', mounted upon and adapted to rotate the shaft 12, is engaged by a spring-pressed pawl 13', which is pivoted on an arm 13, which will rock on the shaft 12. A link 14, is also shown pivoted to the arm 13, and to the rocking-frame 6. The cam 12'', is mounted upon and rotates with the shaft 12. A vertical rotatable shaft 15, is shown, journaled in a bearing *d*, upon the base A. Mounted upon one end of the shaft 15, is shown a member herein termed a punch-carrier 16, in the form of a disk which projects into the angle of a bar B, in the workholder 3, and the other end of said shaft abuts against the periphery of the cam 12''. Mounted on and axially of the punch-carrier 16, are shown rammers or counter-punches 2, 2, which may be equal in number to the dies 1, 1, and be severally correlated to and adapted to coact with the mold-cavities of the respective dies to form types or other characters. For some purposes however, as, for instance, where the dies have similar mold-cavities, a single ramming-punch may be used with a plurality of dies. Assuming now that a correlative ramming-punch has been suitably positioned (as hereinafter related,) to coact with an operative molding die in forming a type *t*, on the particular bar B, which may be in position in the typebar-holder, and that the lever 6', be operated for the purpose before-mentioned; then, at each downward movement of the

lever 6', the pawl 13', will engage a tooth of the ratchet-wheel 12', and at each returning or upward movement of the lever 6', the pawl 13', will partly rotate the shaft 12, and cam 12''. The periphery of the cam 12'', being suitably formed for the purpose, the several partial rotations of the latter will cause it to move the shaft 15, punch-carrier 16, and ramming-punch 2, toward the operative die 1, and by means of the operative punch 2, to ram the interposed material of the bar B, into the particular type-forming member or die 2, which may then be operating on the bar B. This driving process will be accomplished intermittently, and at each step thereof each working movement of the die may cause the latter to gather in its mold-cavity such a portion of the type-formable material as it may, during the particular movements, be capable of molding, as before-mentioned. The cam 12'', as shown, is of such a form that when it has been rotated until its longest radius has passed the axis of the shaft 15, it will permit the latter with the parts mounted thereon to be suddenly returned to their first positions; said return being effected in this instance by means of a helical spring 15', shown herein as encircling the shaft 15, and engaging at one end a member which is secured to said shaft, and at the other end a boss *d'*, which forms a part of the bearing *d*. The operating die will now be withdrawn from the formed type; the gear-segment 10, be unmeshed from the gear-wheel 9, and the die-carrier 8, be rotated to bring another die 2, into position to form a type.

Journaled in bearings *e, e*, is shown a shaft 17, which may be rotated by means of a crank 17', the handle of which embodies a spring-pressed indexing bolt 17'', which engages in any of a number of holes *f, f*, formed in a graduated index circle concentrically of the shaft 17, on a disk *h*, which is carried by the base A. Slidably splined on the shaft 17, is shown a worm-threaded sleeve 18, which is urged toward a stop-collar 18', by a helical spring 18'', which encircles the shaft and impinges against the sleeve 18, and against a boss which forms part of a bearing *e*. The worm-threaded sleeve 18, engages a worm-wheel 19, which is fixed upon and rotates the shaft 15.

In the boss *d'*, is shown a guide-pin *d''*, which may engage in recesses 15'', 15'', which are formed in the shaft 15, and are equal in number to the ramming-punches 2, 2, on the punch-carrier 16. The shaft 15, may be reduced in diameter as at 15''', near the hub of the punch-carrier 16, sufficiently to let it rotate freely when the reduced portion 15''', is on a plane with the guide-pin *d''*. Assuming now that a punch 2, be brought to a ramming position relative to the bar B, by rotating the punch-carrier 16,

and that the latter, with the shaft 15, be moved toward the die-carrier 8; then, the guide-pin d'' , will enter a recess 15'', and guide the shaft 15, in an axial direction, thereby directing the operative punch 2, toward the normal operative positions thereof.

By my present invention, provision is made for permitting the worm-threaded sleeve 18, to move axially of the shaft 17, in order to accommodate itself to any movement thereof which may be caused by the axial movement of the worm-wheel 19. In the organization shown herein, the spring 18'', will yield sufficiently to allow an axial movement of the threaded sleeve 18, when the latter is urged in said direction by an axial movement of the spiral teeth of the worm-wheel 19, engaging with the worm-thread on said sleeve. In the mechanism shown herein, a clockwise rotation of the crank 17', will cause the sleeve 18, to be urged toward and against the collar 18', by the action of the parts mentioned. Should the crank 17', be rotated in the opposite direction, the spring 18'', will retain the parts mentioned in contact with each other. When the sleeve 18, abuts against the collar 18', rotation of the former will cause the rotation of the shaft 15, and of the members mounted thereon.

Provision is made by my present invention, for insuring the synchronous rotation of the die-carrier 8, and the punch-carrier 16. In the organization shown herein, there is mounted on the shaft 17, a crank 20, which is pivoted to one end of a connecting-rod 21, which is slotted lengthwise as at 21', where it is engaged by and rocked on a fulcrum-pivot j' , fixed in a bracket j , carried by the base A. At its other end the connecting-rod 21, is pivotally connected to a link 22, which is also pivotally connected with a crank 23, which is mounted on an end of the shaft 24, on which are secured collars 24', 25, to prevent end play of said shaft. A tooth 25', projects radially from the collar 25, and engages with notches 26', 26', which are shown as formed in a disk 26, and equal in number to the dies 1, 1. The disk 26, is mounted on the shaft 7. The bolt 17'' being disengaged from the index disk h , (see more particularly Fig. 1,) the crank 17', may be operated as before-mentioned to rotate the shaft 17, and, with the latter, the crank 20, by means of which the connecting-rod 21, will be so operated as to cause the link 22, to rotate the crank 23, and the shaft 24. At each rotation of the latter, the tooth 25', of the collar 25, will engage in a notch 26', of the disk 26, and thus partially rotate the latter. The correlation of the members which are operated by the crank 17', will be such that each rotation of the latter will effect an equal angular movement of the punch-carrier 16, and the die-carrier

8, and by means thereof all of the dies 1, 1, and punches 2, 2, will be correlatively presented at their respective type-forming positions, and the engagement of the indexing-bolt 17'', in a particular hole f , in the index-disk h , will denote and insure the type-forming positioning of the indicated molding-die and of the correlative ramming-punch.

In the organization thus far described is embodied mechanism for rocking a molding-die or dies by a cycloidal movement to form a type upon a typebar; but my present invention is not limited to such mechanism nor to a rocking movement of any particular part of the type-forming elements. The die may be operated as before-mentioned, or the punch may, by a suitable motion communicated thereto, force the type-formable material into the cavity of the die and the interstices thereof; and in Fig. 4 of the drawing, I have illustrated mechanism for forming types or other characters according to my present invention by rocking a bar of suitable material against a type-forming die; the bar herein shown being also reinforced or backed at the opposite side of the die-contacting point. The molding-dies and rammers are shown of the general form shown in the remaining figures of the drawing, and mounted, as before-mentioned, in rotating carriers. The bar shown in this figure is also similar in form to one described elsewhere herein; and relatively the same reference marks are used throughout the drawings, for said bar and for the dies and punches and die and punch-carrier. A simple form of a mechanical organization is shown in Fig. 4, however, in order to avoid needless complication in illustrating the operation of my present invention in the form thereof which is now being more particularly described.

As shown in Fig. 4, rammers or punches 2, 2, are mounted radially on the punch-carrier 16, which is rotatably mounted on a horizontal pivot 30', which is fixed in a rocker herein generally designated as 30, which comprises a tubular portion 31, and a disciform part 31', between which and a clamp 32, the punch-carrier 16, and angle-typebar B, may be clamped by means of a member shown herein as a knurled nut 33, which will engage with a screw-thread formed on the stud or pivot 30'. The clamp 32, is rabbeted as at 32', to adapt it to hold the angle-bar B, in the proper position for a type to be formed thereon. The rocker 30, is shown as pivoted at 30'', to a bracket m , carried by the base A, the axis of said pivot being in line with the type-formative elements when the latter are operatively positioned. A lug 34, which may be integral with the tubular member 31, of the rocker 30, is pivotally connected to a link 35, and the latter is also similarly connected to a

crank 36, mounted on a rotatable shaft 37. In this instance the die-carrier 8, is shown mounted on a vertical shaft 38, rotatable in a bearing formed in the bracket *a*, and have a stop-collar 38', secured thereon to prevent end-play thereof. The molding-dies 1, 1, are shown in Fig. 4, severally mounted upon die-bodies 1', 1', each of which is reciprocable parallelly of the axis of the die-carrier 8, and is provided with a head 1'', with which a returning-spring 1''', engages. An indexing bolt 39, is shown, reciprocable in the bracket *a*, and adapted to enter index holes, (not shown herein,) formed in and transversely of the die-carrier 8, and which will be equal in number to the dies 1, 1. A hand-lever 40 is shown fulcrumed between lugs *n*, *n*, which latter may be integral with the bracket *a*. The lever 40, as shown, has two arms, one of which engages the indexing bolt 39, and the other is formed as a hand-piece. A retractive spring 40'', attached at one end to an arm of the lever 40, and at the other end to the bracket *a*, serves to retain the indexing bolt 39, in any index hole in which it may be engaged. An impressing lever 41, is shown oscillatably mounted at *o*, on the bracket *a*, and having a handle 41', and a contact part 41'', the latter being adapted to impinge upon the head 1'', of any die-body 1', which may be positioned to operate a die 1, upon the bar B.

In use, the mechanism illustrated in Fig. 9 may be operated as follows:—The nut 33, being unscrewed and the clamp 32, being opened sufficiently, a bar B, will be inserted in the latter in position to have a type formed thereon by the type-forming elements; a rammer or punch 2, being meantime properly positioned for the purpose, by operating the punch-carrier 16. The clamp 32, will then be closed upon the bar B, and punch-carrier 16, by screwing up the nut 33. The indexing bolt 39, being then withdrawn from the index hole in which it may at the time be engaged, the die-carrier 8, will be rotated to properly position the particular die 1, which will be adapted to form the required type, and the die-carrier will then be locked against rotation by means of the bolt 39. The shaft 37, will now be rotated by a suitable driver, (not shown herein,) and by means of the crank 36, and link 35, cause a working motion of the rocker 30, on the pivot 30''. If the impressing lever 41, be now depressed, it will force the operative die 1, against the bar B, which, being backed by the operative counter-punch 2, will assume at the part thereof operated upon, a form in relief which will be the counterpart of the cavity in the operative molding die 1. The series of operations thus described may be repeated to form a series of types or other characters, on the bar B.

Having described my invention, I claim—

1. The combination of a series of molds; a series of rammers severally correlating the respective molds; mechanism for imparting to a member of one series a plurality of movements at various angles to a correlate member of the other series; and means for imparting to a member of one series a movement advancing toward a correlate member of the other series.

2. The combination of a series of molds; a series of rammers severally correlating the respective molds; mechanism for imparting to a member of one series a working movement; and means for imparting to a member of one series a plurality of movements advancing toward a correlate member of the other series.

3. The combination of a series of molds; a series of rammers severally correlating the respective molds; mechanism for imparting to a member of one series a plurality of movements at various angles to a correlate member of the other series; and means for imparting to a member of one series a plurality of movements advancing toward a correlate member of the other series.

4. The combination of a plurality of molds; a mold-carrier; a plurality of rammers; a rammer carrier; means for imparting to one of said carriers a plurality of movements at various angles to the other carrier; and means for causing a rammer and a mold to co-act impressively.

5. The combination of a mold; a rammer; mechanism for imparting to one of said members a working movement; and means operable by said mechanism for imparting to one of said members an advancing movement.

6. The combination of a mold; a rammer; mechanism for imparting to one of said members a plurality of movements at various angles to the other member; and means operable by said mechanism for imparting to one of said members an advancing movement.

7. The combination of a mold; a rammer; mechanism for imparting to one of said members a working movement; and means operable by said mechanism for imparting to one of said members a plurality of advancing movements.

8. The combination of a mold; a rammer; mechanism for imparting to one of said members a plurality of movements at various angles to the other member; and means operable by said mechanism for imparting to one of said members a plurality of advancing movements.

9. The combination of a series of molds; a series of rammers severally correlating the respective molds; mechanism for imparting to a member of one series a working movement; and means operable by said mechanism for imparting to a member of one

series a movement advancing toward a correlate member of the other series.

10. The combination of a series of molds; a series of rammers severally correlating the respective molds; mechanism for imparting to a member of one series a plurality of movements at various angles to a correlate member of the other series; and means operable by said mechanism for imparting to a member of one series a movement advancing toward a correlate member of the other series.

11. The combination of a series of molds; a series of rammers severally correlating the respective molds; mechanism for imparting to a member of one series a working movement; and means operable by said mechanism for imparting to a member of one series a plurality of movements advancing toward a correlate member of the other series.

12. The combination of a series of molds; a series of rammers severally correlating the respective molds; mechanism for imparting to a member of one series a plurality of movements at various angles to a correlate member of the other series; and means operable by said mechanism for imparting to a member of one series a plurality of movements advancing toward a correlate member of the other series.

13. The combination of a plurality of molds; a mold-carrier; a rammer; mechanism for imparting to the mold-carrier a working movement; and means operable by said mechanism for imparting to the rammer an advancing movement.

14. The combination of a plurality of molds; a mold-carrier; a rammer; mechanism for imparting to the mold-carrier a plurality of movements at various angles to the rammer; and means operable by said mechanism for imparting to the rammer an advancing movement.

15. The combination of a plurality of molds; a mold-carrier; a rammer; mechanism for imparting to the mold-carrier a working movement; and means operable by said mechanism for imparting to the rammer a plurality of advancing movements.

16. The combination of a plurality of molds; a mold-carrier; a rammer; mechanism for imparting to the mold-carrier a plurality of movements at various angles to the rammer; and means operable by said mechanism for imparting to the rammer a plurality of advancing movements.

17. The combination of a mold; a mold-carrier; a rammer; a rammer-carrier; mechanism for imparting to one of said carriers a working movement; and means operable by said mechanism for imparting to one of said carriers an advancing movement.

18. The combination of a mold; a mold-carrier; a rammer; a rammer-carrier; mechanism for imparting to one of said carriers

a plurality of movements at various angles to the other carrier; and means operable by said mechanism for imparting to one of said carriers an advancing movement.

19. The combination of a mold; a mold-carrier; a rammer; a rammer-carrier; mechanism for imparting to one of said carriers a working movement; and means operable by said mechanism for imparting to one of said carriers a plurality of advancing movements.

20. The combination of a mold; a mold-carrier; a rammer; a rammer-carrier; mechanism for imparting to one of said carriers a plurality of movements at various angles to the other carrier; and means operable by said mechanism for imparting to one of said carriers a plurality of advancing movements.

21. The combination with operative mechanism, of a plurality of molds; a plurality of rammers severally correlating and co-operative with the respective molds when aligned therewith and when at various angles thereto; and means for vibrating the working mold and its rammer.

22. The combination with operative mechanism, of a plurality of molds; a plurality of rammers severally correlating and co-operative with the respective molds when at various angles thereto; and means for vibrating the working mold and its rammer.

23. The combination of a series of molds; a series of rammers severally correlating the respective molds; means for synchronously positioning the correlated molds and rammers; mechanism for imparting to a member of one series a working movement; and means for imparting to a member of one series a movement advancing toward a correlate member of the other series.

24. The combination of a series of molds; a series of rammers severally correlating the respective molds; means for synchronously positioning the correlated molds and rammers; mechanism for imparting to a member of one series a plurality of movements at various angles to a correlate member of the other series; and means for imparting to a member of one series a movement advancing toward a correlate member of the other series.

25. The combination of a series of molds; a series of rammers severally correlating the respective molds; means for synchronously positioning the correlated molds and rammers; mechanism for imparting to a member of one series a working movement; and means for imparting to a member of one series a plurality of movements advancing toward a correlate member of the other series.

26. The combination of a series of molds; a series of rammers severally correlating the

respective molds; means for synchronously positioning the correlated molds and rammers; mechanism for imparting to a member of one series a plurality of movements at various angles to a correlate member of the other series; and means for imparting to a member of one series a plurality of movements advancing toward a correlate member of the other series.

27. The combination of a mold; a rotatable mold-carrier; a plurality of rammers; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; means for imparting to one of said carriers a vibratory working movement; and means for causing a rammer and the mold to co-act impressively.

28. The combination of a mold; a rotatable mold-carrier; a plurality of rammers, a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; means for imparting to one of said carriers a plurality of vibratory working movements at various angles to the other carrier; and means for causing the mold and a rammer to co-act impressively.

29. The combination of a plurality of molds; a rotatable mold-carrier; a plurality of rammers; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; means for imparting to one of said carriers a vibratory working movement; and means for causing a rammer and the mold to co-act impressively.

30. The combination of a plurality of molds; a rotatable mold-carrier; a plurality of rammers; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; means for imparting to one of said carriers a plurality of vibratory working movements at various angles to the other carriers; and means for causing a rammer and a mold to co-act impressively.

31. The combination of a mold; a rotatable mold-carrier; a rammer; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; means for imparting to one of said carriers a vibratory working movement; and means for causing the rammer and the mold to co-act impressively.

32. The combination of a mold; a rotatable mold-carrier; a rammer; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; means for imparting to one of said carriers a plurality of movements at various angles to the other carrier; and means for causing the mold and the rammer to co-act impressively.

33. The combination of a plurality of molds; a rotatable mold-carrier; a rammer; a rotatable rammer-carrier; means for syn-

chronously effecting the angular positioning of the carriers; means for imparting to one of said carriers a working movement; and means for causing a mold and the rammer to co-act impressively.

34. The combination of a plurality of molds; a rotatable mold-carrier; a rammer; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; means for imparting to one of said carriers a plurality of movements at various angles to the other carrier; and means for causing a mold and the rammer to co-act impressively.

35. The combination of a mold; a rotatable mold-carrier; a rammer; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; and means for imparting to one of said carriers an oscillating movement.

36. The combination of a mold; a rotatable mold-carrier; a rammer; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; and means for imparting to one of said carriers a plurality of movements at various angles to the other carrier.

37. The combination of a mold; a rotatable mold-carrier; a rammer; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; and means for imparting to one of said carriers a plurality of advancing movements.

38. The combination of a mold; a rotatable mold-carrier; a rammer; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; means for imparting to one of said carriers a working movement; and means for imparting to one of said carriers an advancing movement.

39. The combination of a mold; a rotatable mold-carrier; a rammer; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; means for imparting to one of said carriers a plurality of movements at various angles to the other carrier; and means for imparting to one of said carriers an advancing movement.

40. The combination of a mold; a rotatable mold-carrier; a rammer; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; means for imparting to one of said carriers a working movement; and means for imparting to one of said carriers a plurality of advancing movements.

41. The combination of a mold; a rotatable mold-carrier; a rammer; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; means for imparting to one of said carriers a plurality of movements at various

angles to the other carrier; and means for imparting to one of said carriers a plurality of advancing movements.

42. The combination of a series of molds; a series of rammers severally correlating the respective molds; means for synchronously positioning the correlated molds and rammers; mechanism for imparting to a member of one series a working movement; and means operatable by said mechanism for imparting to a member of one series a movement advancing toward a correlate member of the other series.

43. The combination of a series of molds; a series of rammers severally correlating the respective molds; means for synchronously positioning the correlated molds and rammers; mechanism for imparting to a member of one series a plurality of movements at various angles to a correlate member of the other series; and means operatable by said mechanism for imparting to a member of one series a movement advancing toward a correlate member of the other series.

44. The combination of a series of molds; a series of rammers severally correlating the respective molds; means for synchronously positioning the correlated molds and rammers; and mechanism for imparting to a member of one series a plurality of movements advancing toward a correlate member of the other series.

45. The combination of a series of molds; a series of rammers severally correlating the respective molds; means for synchronously positioning the correlated molds and rammers; mechanism for imparting to a member of one series a plurality of movements at various angles to a correlate member of the other series; and means operatable by said mechanism for imparting to a member of one series a plurality of movements advancing toward a correlate member of the other series.

46. The combination of a mold; a rotatable mold-carrier; a rammer; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; mechanism for imparting to one of said carriers a working movement; and means operatable by said mechanism for imparting to one of said carriers an advancing movement.

47. The combination of a mold; a rotatable mold-carrier; a rammer; a rotatable rammer-carrier; means for synchronously effecting the angular positioning of the carriers; mechanism for imparting to one of said carriers a plurality of movements at various angles to the other carrier; and means operatable by said mechanism for imparting to one of said members an advancing movement.

48. The combination of a mold; a rotatable mold-carrier; a rammer; a rotatable

rammer-carrier; means for synchronously effecting the angular positioning of the carriers; mechanism for imparting to one of said carriers a working movement; and means operatable by said mechanism for imparting to one of said carriers a plurality of advancing movements.

49. The combination of a mold; a rotatable mold-carrier; means for synchronously effecting the angular positioning of the carriers; a rammer; a rotatable rammer-carrier; mechanism for imparting to one of said carriers a plurality of movements at various angles to the other carrier; and means operatable by said mechanism for imparting to one of said carriers a plurality of advancing movements.

50. In a typebar machine, the combination of a bar-holder; a rotatable and reciprocable carrier; a plurality of punches mounted on the carrier and severally adapted to operate on an inner face of an angle-bar mounted in the bar-holder; a die-carrier; and a die mounted on the die-carrier and adapted to operate on an outer face of an angle-bar mounted in the bar-holder.

51. In a typebar machine, the combination of a bar-holder; a rotatable and reciprocable carrier; a plurality of punches mounted on the carrier and severally adapted to operate on an inner face of an angle-bar mounted in the bar-holder; a die-carrier; and a plurality of dies mounted on the die-carrier and severally adapted to operate on an outer face of an angle-bar mounted in the bar-holder.

52. In a typebar machine, the combination of a bar-holder; a rotatable and reciprocable carrier; a plurality of punches mounted on the carrier and severally adapted to operate on an inner face of an angle-bar mounted in the bar-holder; a die-carrier; and a die mounted on the die-carrier and adapted to operate transversely of the bar-holder on an outer face of an angle-bar mounted in the bar-holder.

53. In a typebar machine, the combination of a bar-holder; a rotatable and reciprocable carrier; a plurality of punches mounted on the carrier and severally adapted to operate on an inner face of angle-bar mounted in the bar-holder; a die-carrier; and a plurality of dies mounted on the die-carrier and severally adapted to operate transversely of the bar-holder and on an outer face of an angle-bar mounted in the bar-holder.

54. In a typebar machine, the combination of a bar-holder; a rotatable and reciprocable carrier; a plurality of punches mounted on the carrier and severally adapted to operate on an inner face of an angle-bar mounted in the bar-holder; a die-carrier; and a die mounted on the die-carrier and adapted to operate transversely of the punch carrier on an outer face of an angle-bar mounted in the bar-holder.

55. In a typebar machine, the combination of a bar-holder; a rotatable and reciprocable carrier; a plurality of punches mounted on the carrier and severally adapted to operate
 5 on an inner face of an angle-bar mounted in the bar-holder; a die-carrier; and a plurality of dies mounted on the die-carrier and severally adapted to operate transversely of the punch-carrier on an outer face of an angle-bar
 10 mounted in the bar-holder.

56. In a typebar machine, the combination of a bar-holder; a carrier; a punch mounted on the carrier and adapted to operate on an inner face of an angle-bar
 15 mounted in the bar-holder; a die-carrier; a die mounted on the die-carrier and adapted to operate on an outer face of an angle-bar mounted in the bar-holder; and means for imparting to one of said carriers a plurality
 20 of working movements.

57. In a typebar machine, the combination of a bar-holder; a carrier; a punch mounted on the carrier and adapted to operate on an inner face of an angle-bar
 25 mounted in the bar-holder; a die-carrier; a die mounted on the die-carrier and adapted to operate on an outer face of an angle-bar mounted in the bar-holder; and means for imparting to one of said carriers a plurality
 30 of movements at various angles to the bar.

58. In a typebar machine, the combination of a bar-holder; a carrier; a punch mounted on the carrier and adapted to operate on an inner face of an angle-bar
 35 mounted in the bar-holder; a die-carrier; a die mounted on the die-carrier and adapted to operate on an outer face of an angle-bar mounted in the bar-holder; and means for imparting to one of said carriers an advancing
 40 movement.

59. In a typebar machine, the combination of a bar-holder; a carrier; a punch mounted on the carrier and adapted to operate on an inner face of an angle-bar
 45 mounted in the bar-holder; a die-carrier; a die mounted on the die-carrier and adapted to operate on an outer face of an angle-bar mounted in the bar-holder; and means for imparting to one of said carriers a plurality
 50 of advancing movements.

60. In a typebar machine, the combination of a bar-holder; a carrier; a punch mounted on the carrier and adapted to operate on an inner face of an angle-bar
 55 mounted in the bar-holder; a die-carrier; a die mounted on the die-carrier and adapted to operate on an outer face of an angle-bar mounted in the bar-holder; means for imparting to one of said carriers a working
 60 movement; and means for imparting to one of said carriers an advancing movement.

61. In a typebar machine, the combination of a bar-holder; a carrier; a punch
 65 mounted on the carrier and adapted to oper-

ate on an inner face of an angle-bar mounted in the bar-holder; a die-carrier; a die mounted on the die-carrier and adapted to operate on an outer face of an angle-bar
 70 mounted in the bar-holder; means for imparting to one of said carriers a working movement; and means for imparting to one of said carriers a plurality of advancing movements.

62. In a typebar machine, the combination of a bar-holder; a carrier; a punch mounted on the carrier and adapted to operate on an inner face of an angle-bar
 75 mounted in the bar-holder; a die-carrier; a die mounted on the die-carrier and adapted to operate on an outer face of an angle-bar mounted in the bar-holder; means for imparting to one of said carriers a plurality
 80 of working movements; and means for imparting to one of said carriers an advancing movement.

63. In a typebar machine, the combination of a bar-holder; a carrier; a punch mounted on the carrier and adapted to operate on an inner face of an angle-bar
 90 mounted in the bar-holder; a die-carrier; a die mounted on the die-carrier and adapted to operate on an outer face of an angle-bar mounted in the bar-holder; means for imparting to one of said carriers a plurality
 95 of working movements; and means for imparting to one of said carriers a plurality of advancing movements.

64. In a typebar machine, the combination of a bar-holder; a carrier; a punch mounted
 100 on the carrier and adapted to operate on an inner face of an angle-bar mounted in the bar-holder; a die-carrier; a die mounted on the die-carrier and adapted to operate on an outer face of an angle-bar mounted in the
 105 bar-holder; means for imparting to one of said carriers a plurality of movements at various angles to the bar; and means for imparting to one of said carriers an advancing movement.

65. In a typebar machine, the combination of a bar-holder; a carrier; a punch mounted on the carrier and adapted to operate on an inner face of an angle-bar
 110 mounted in the bar-holder; a die-carrier; a die mounted on the die-carrier and adapted to operate on an outer face of an angle-bar mounted in the bar-holder; means for imparting to one of said carriers a plurality of movements at various angles to the bar; and means for imparting to one of said carriers a plurality
 115 of advancing movements.

66. In a typebar machine, the combination of a bar-holder; a carrier; a punch mounted on the carrier and adapted to operate on an
 120 inner face of an angle-bar mounted in the bar-holder; a die-carrier; a plurality of dies mounted on the die-carrier and severally adapted to operate on an outer face of an angle-bar mounted in the bar-holder; and
 130

parting to one of said carriers a plurality of advancing movements.

73. In a typebar machine, the combination of a bar-holder; a carrier; a punch mounted on the carrier and adapted to operate on an inner face of an angle-bar mounted in the bar-holder; a die-carrier; a plurality of dies mounted on the die-carrier and severally adapted to operate on an outer face of an angle-bar mounted in the bar-holder; means for imparting to one of said carriers a plurality of working movements; and means for imparting to one of said carriers an advancing movement.

74. In a typebar machine, the combination of a bar-holder; a carrier; a punch mounted on the carrier and adapted to operate on an inner face of an angle-bar mounted in the bar-holder; a die-carrier; a plurality of dies mounted on the die-carrier and severally adapted to operate on an outer face of an angle-bar mounted in the bar-holder; means for imparting to one of said carriers a plurality of working movements; and means for imparting to one of said carriers a plurality of advancing movements.

75. In a typebar machine, the combination of a bar-holder; a carrier; a punch mounted on the carrier and adapted to operate on an inner face of an angle-bar mounted in the bar-holder; a die-carrier; a plurality of dies mounted on the die-carrier and severally adapted to operate on an outer face of an angle-bar mounted in the bar-holder; means for imparting to one of said carriers a plurality of movements at various angles to the bar; and means for imparting to one of said carriers an advancing movement.

76. In a typebar machine, the combination of a bar-holder; a carrier; a punch 105 mounted on the carrier and adapted to operate on an inner face of an angle-bar mounted in the bar-holder; a die-carrier; a plurality of dies mounted on the die-carrier and severally adapted to operate on an outer face of 110 an angle-bar mounted in the bar-holder; means for imparting to one of said carriers a plurality of movements at various angles to the bar; and means for imparting to one of said carriers a plurality of advancing 115 movements.

77. In a typebar machine, the combination of a bar-holder; a carrier; a plurality of punches mounted on the carrier and severally adapted to operate on an inner face of an angle-bar mounted in the bar-holder; a die-carrier; a die mounted on the die-carrier and adapted to operate on an outer face of an angle-bar mounted in the bar-holder; and means for imparting to one of said carriers a vibratory working movement.

78. In a typebar machine, the combination of a bar-holder; a carrier; a plurality of punches mounted on the carrier and severally adapted to operate on an inner face, 130

5 of working movement.

10 of an angle-bar mounted in the bar-holder:

25 erate on an outer face of an angle-bar mounted in the bar-holder; and means for impart-

35 on the die-carrier and severally adapted to

50 imparting to one of said carriers a working movement; and means for imparting to one

60 operate on an outer face of an angle-bar

of an angle-bar mounted in the bar-holder; 70
a die-carrier; a plurality of dies mounted

on the die-carrier and severally adapted to 85
operate on an outer face of an angle-bar

operate on an outer face of an angle-bar mounted in the bar-holder; means for

die-carrier; a plurality of dies mounted on 110
the die-carrier and severally adapted to

formation of the typebar; means for im- 120
parting a vibratory working movement to

carriers for instruments coöperative in the formation of the typebar means for impart

101. In a typebar machine, the combination of a punch-carrier, a die-carrier, means for supporting a blank between these, means for imparting to one of said carriers a vibratory working movement, and means for adjustably regulating said working movement.

102. In a typebar machine, the combination of a punching mechanism carrier, a die-carrier, means for supporting a blank between these, means for imparting to one of said carriers a plurality of working movements, and means for adjustably regulating the working movements.

103. In a typebar machine, the combination of a punching mechanism carrier, a die carrier, means for supporting a blank between these, means for imparting to one of said carriers a plurality of movements at various angles to the bar, and means for adjustably regulating said movements.

104. In a typebar machine, the combination with type forming instrumentalities, of means for operating these and comprising a rotatable crank, an oscillatable and reciprocatable member attached to said crank, a combined fulcrum and guide for the oscillatable and reciprocatable member, a link and a crank rotatable by the said link.

105. The combination of a plurality of rotatable axially shiftable members one of which has an engaging face formed angularly of the axis thereof and engaging for rotation a co-active face of the other member, said members being arranged transversely of each other on different planes; means for preventing the rotation of said members during their axial movements; and a stop abutting one of said rotatable members when the latter is in a normal position for rotation with the other rotatable member; said stop preventing the axial shifting of the abutting rotatable member in one direction.

106. The combination of a plurality of rotatable axially shiftable members at least one of which has an engaging face formed angularly of the axis thereof and engaging for rotation a co-active face of the other member, said members being arranged transversely of each other on different planes; means for preventing the rotation of said members during their axial movements; a stop abutting one of said rotatable members when the latter is in a normal position for rotation with the other rotatable member, said stop preventing the axial shifting of the abutting rotatable member in one direction; and a resilient member urging the abutting member against the stop.

107. The combination of a mold, a counterpart rammer, means for supporting a blank between these, and means for imparting to the said mold a series of rocking movements during the advance of the rammer.

108. The combination of a plurality of molds, a mold carrier, a plurality of rammers, a rammer carrier, means for imparting to one of said carriers a rocking movement relative to the other carrier and means for causing a rammer and a mold from each carrier to act impressively during said rocking movement.

109. The combination with a blank holder, of a series of dies and means for moving these in relation to one side of a blank in said holder, a series of counterpart dies, and means for moving these in relation to the other side of said blank, and means for bringing a die from each said series into cooperative working relation upon said blank by a succession of gradual advances.

110. In a typebar machine, the combination of a series of punches and a series of dies, means for shifting the members of each series through an orbit, means for supporting a blank between said orbits, means for bringing a punch and a die into cooperative relation with a vibratory working movement imparted to one of these, and means for adjustably regulating said working movement.

111. The combination with a blank holder, of a pair of die carriers, means for supporting these for rotation upon transversely disposed axes, dies upon one of the die carriers having their axes arranged parallel with the axis of rotation of the said carrier, dies upon the other of the said carriers having their axes arranged radially of the axis of rotation of the said carrier, means for synchronously rotating the said die carriers for bringing the dies to working position, means for imparting to one of the carriers a working movement relative to a blank in the blank holder, and means controlled by the said carrier in its said working movement for effecting a relative movement of the carriers one toward the other for closing the dies upon the said blank for making an impression thereon.

112. The combination with a blank holder, of a pair of die carriers, means for supporting these for rotation upon non-coincident axes, cooperative dies upon the die carriers, means for synchronously rotating the said die carriers for bringing the dies to working position, means for imparting to one of the carriers a vibratory working movement relative to a blank in the blank holder, and means controlled by the said carrier in its said working movement for effecting a step by step relative movement of the carriers one toward the other for closing the dies upon the said blank for making an impression thereon.

113. The combination with a die carrier and dies thereon, of a punch carrier and punches thereon, means for supporting a

blank between these, means for imparting to one of the carriers a vibratory working movement relative to a blank in the holder, means for advancing the other of said carriers toward the said blank by a step by step movement, and means controlled by the said vibratorily moving carrier in its vibratory movement for actuating said advancing means.

10 114. The combination with a die carrier and dies thereon, of a punch carrier and punches thereon, means for supporting a

blank between these, means for imparting to one of the carriers a vibratory working movement relative to a blank in the holder, 15 means for advancing the other of said carriers toward the said blank, and means controlled by the said vibratorily moving carrier in its movement for actuating said advancing means.

FRANCIS H. RICHARDS.

Witnesses:

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