Dec. 19, 1922.

1,438,951.

B. S. ELROD.

MAKING PRINTERS' LEADS, SLUGS, AND RULES.

ORIGINAL FILED MAY 14, 1917.

3 SHEETS—SHEET 1.

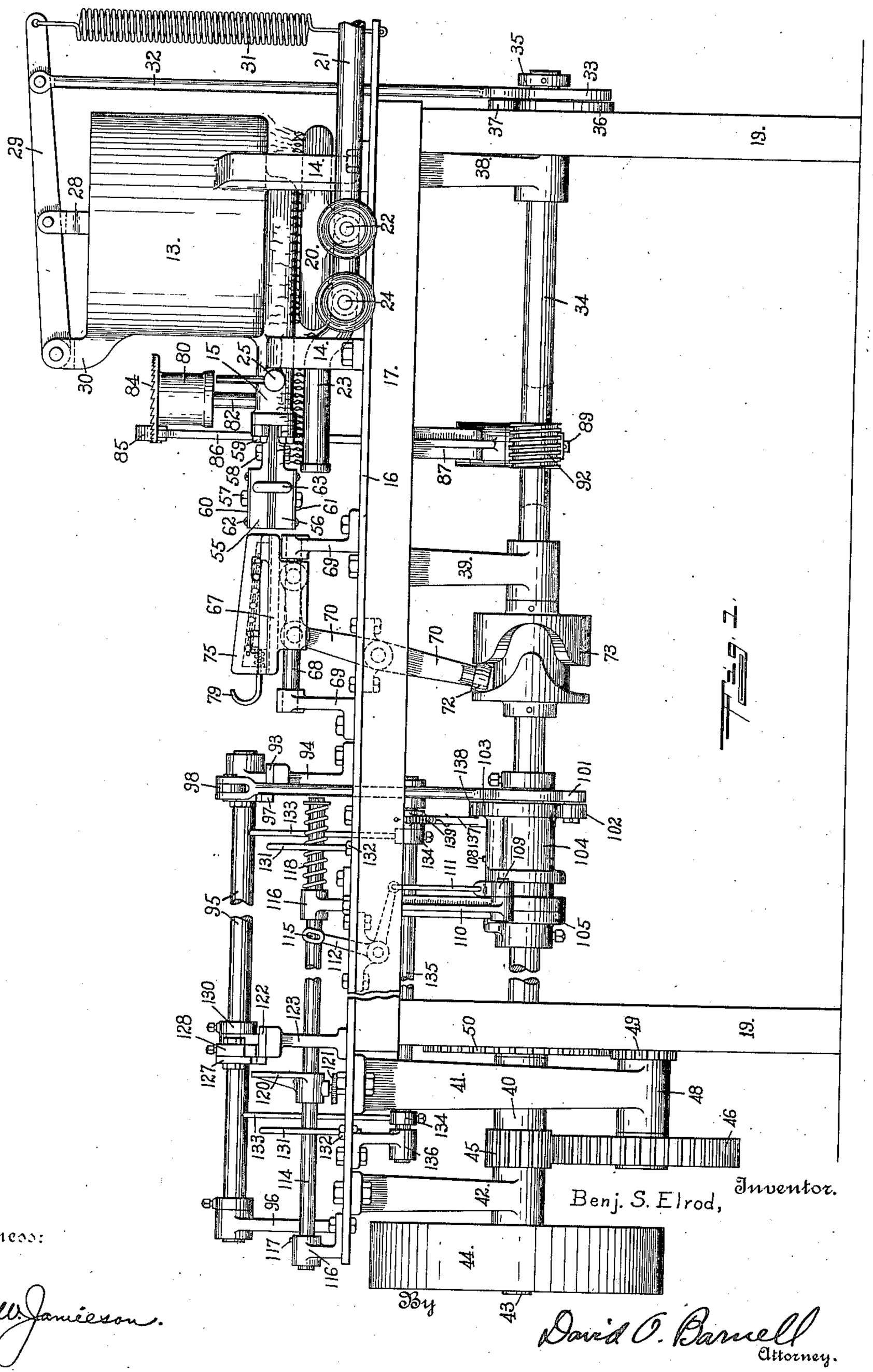

Fig. 1.

Witness:

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Inventor.

Benj. S. Elrod,

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3 SHEETS—SHEET 2.

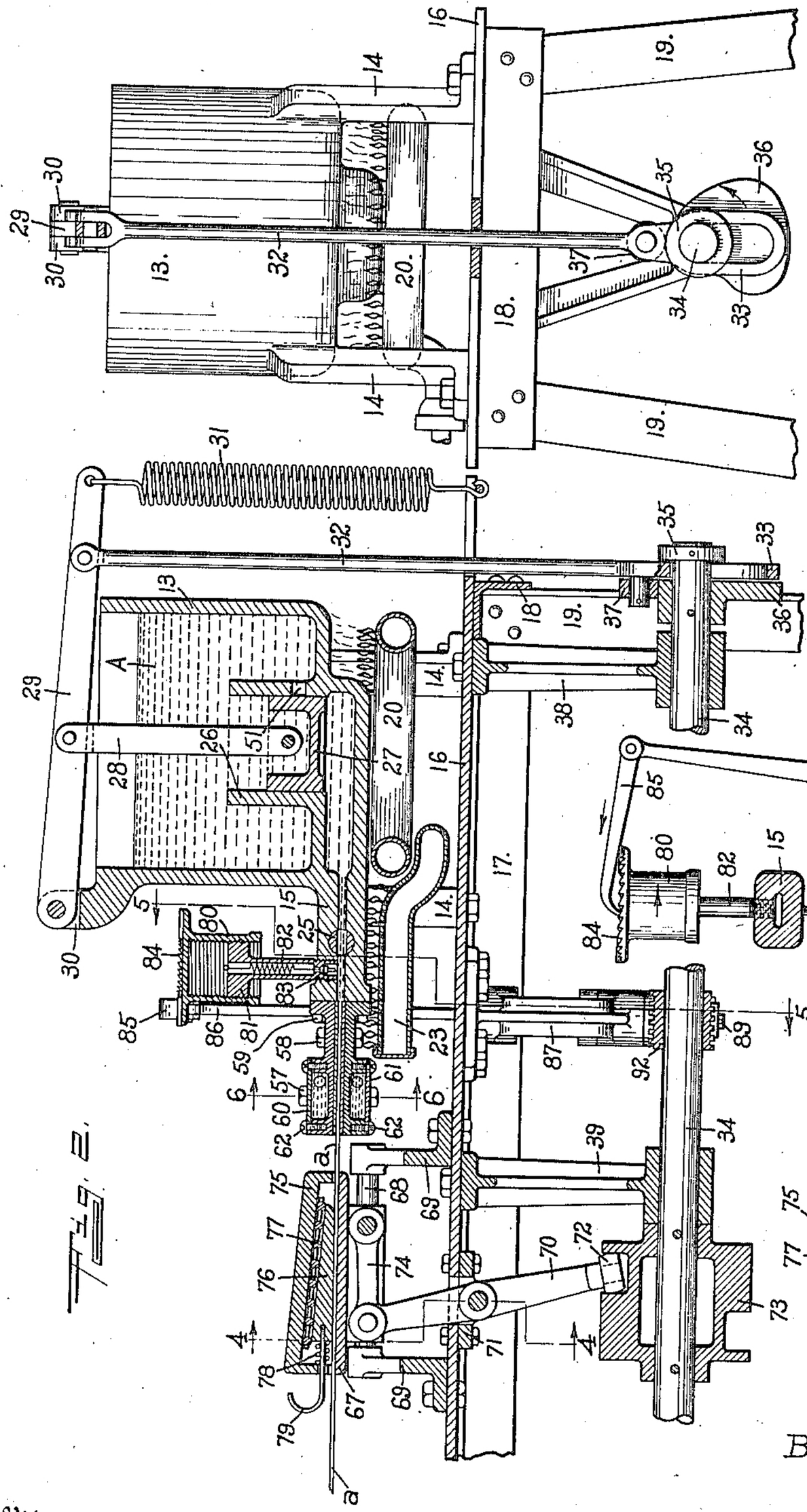

FIG. 2.

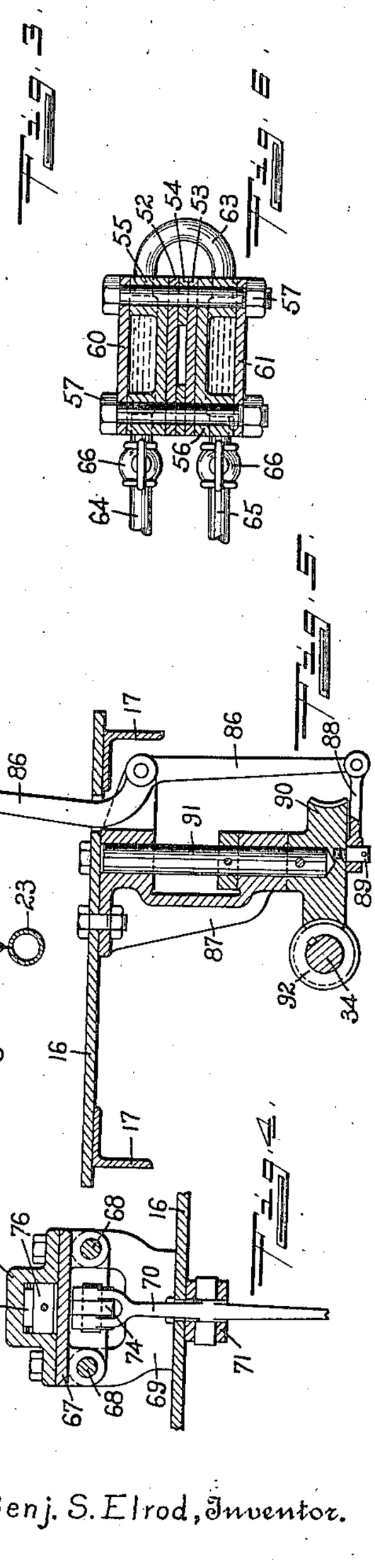

FIG. 3.

FIG. 5.

FIG. 7.

FIG. 4.

Witness:

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3 SHEETS—SHEET 3.

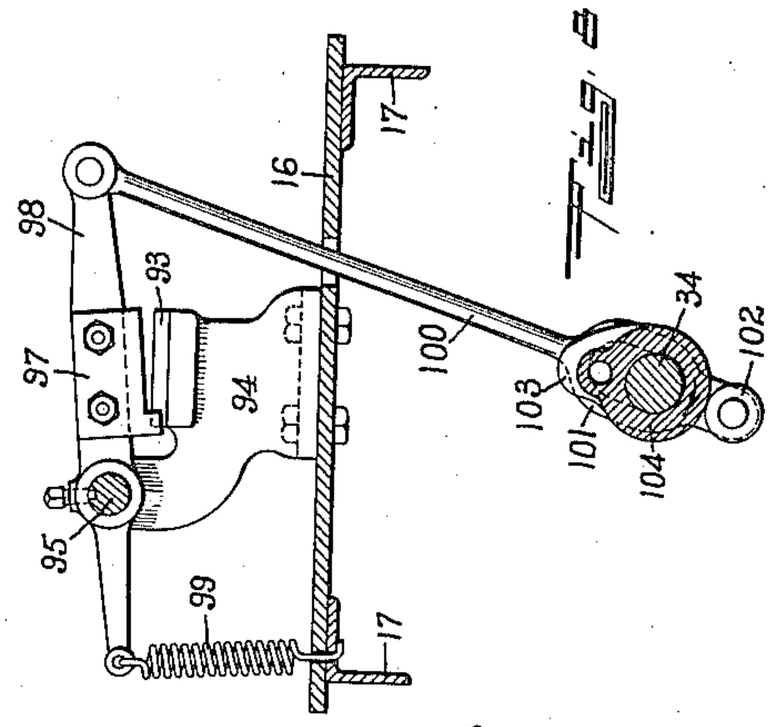

Fig. 8.

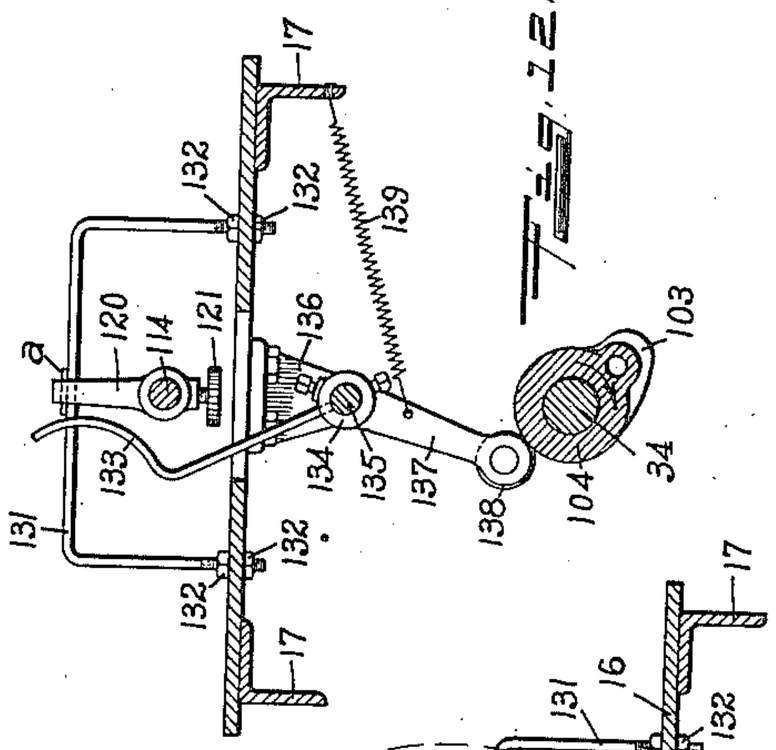

Fig. 12.

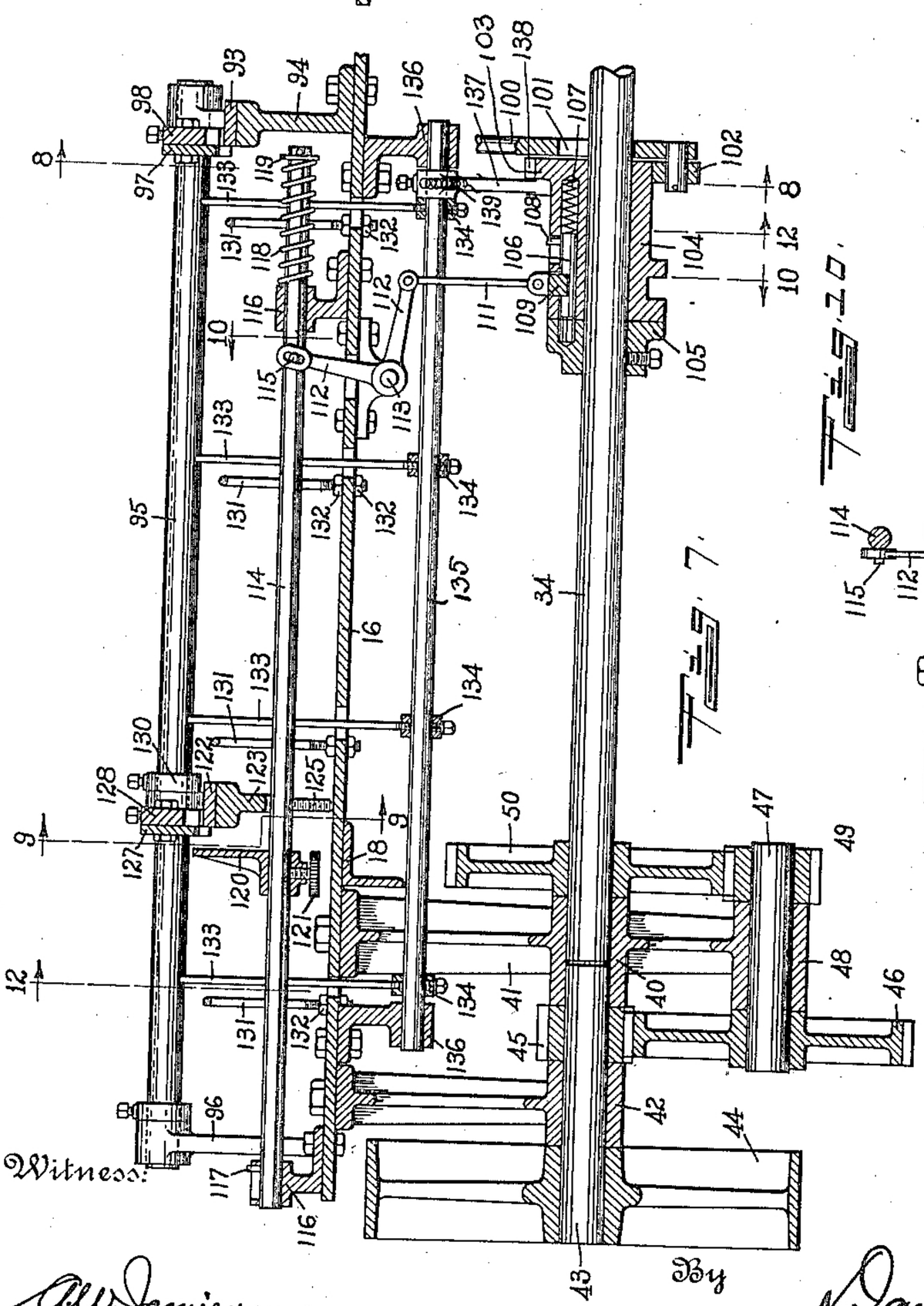

Fig. 7.

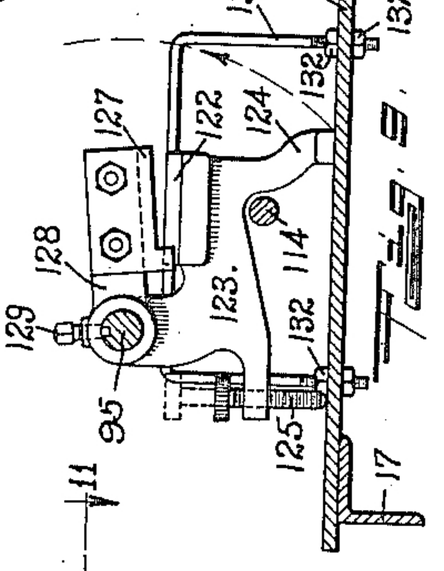

Fig. 9.

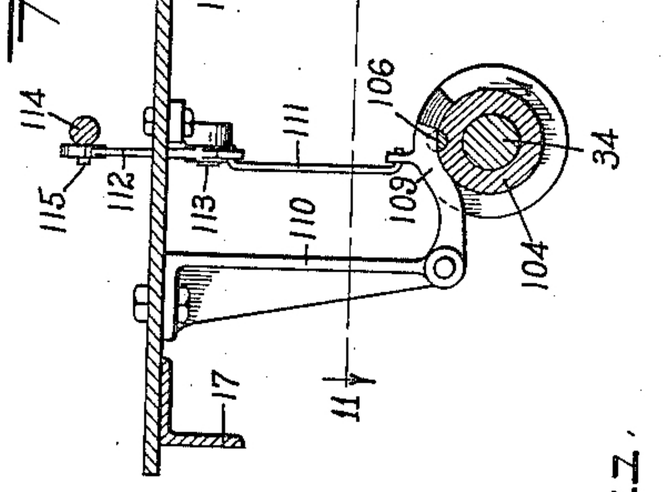

Fig. 10.

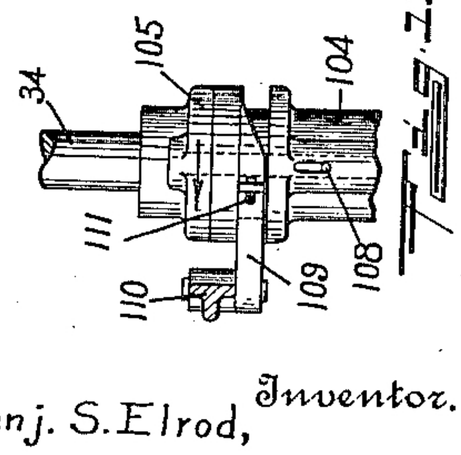

Fig. 11.

Witness:

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Attorney.

Patented Dec. 19, 1922. 1,438,951

UNITED STATES PATENT OFFICE.

BENJAMIN S. ELROD, OF OMAHA, NEBRASKA, ASSIGNOR, BY MESNE ASSIGNMENTS, TO OMAHA TRUST COMPANY, A CORPORATION OF NEBRASKA, TRUSTEE.

MAKING PRINTERS' LEADS, SLUGS, AND RULES.

Application filed May 14, 1917, Serial No. 168,546. Renewed April 20, 1922. Serial No. 555,694.

To all whom it may concern:

Be it known that I, BENJAMIN S. ELROD, a citizen of the United States, and a resident of Omaha, in the county of Douglas and State of Nebraska, have invented certain new and useful Improvements in Making Printers' Leads, Slugs, and Rules, of which the following is a specification.

My invention relates broadly to the arts of die-expressing and drawing of metals, and more particularly to the forming of continuous bars of metal from a molten body thereof.

Type-bar and type casting machines are now employed very extensively in the printing trades, and where such machines are in use the type for any particular form or composition is used but once, and is then recast into new type or type-bars. This is done not only because of the advantage of having new type-faces for each job, but because the machine-made type-bars and type can be produced more cheaply than the type can be distributed and reset. It has been customary, however, before remelting the metal from a form, to separate therefrom the leads, slugs and rules employed therein, because the same could not heretofore be produced by means at the disposal of average printing establishments and at a cost comparable to that of reproducing the type itself. With the foregoing facts in view, it is the primary object of my invention to provide means for producing printers' leads, slugs and rules in such quantities and at such low costs that it may be practicable to entirely avoid sorting or distribution of printing forms, and to discard a used form as a whole, merely utilizing the metal therein for new type, or leads and slugs.

The embodiment of my invention herein disclosed is an organized machine of comparatively simple and inexpensive construction, capable of producing rapidly and automatically, after being properly started and adjusted, printers' leads, slugs and rules of any desired thickness and length, using lead, type-metal or similar soft-metal alloys capable of fusion at moderate temperatures and having a fair degree of tensile strength when cold. My machine is especially characterized by its adaptation to form a continuous metal bar by drawing the same from the bottom or from below the surface of a molten body of the metal, the metal being drawn through the shaped channel of a suitable die and cooled while passing through said channel, so that the metal enters one end of the channel as a fluid and emerges from the other end thereof as a solid bar, the movement of the bar being effected by pulling upon the portion thereof protruding from the die, and the molten metal being subjected merely to a sufficient pressure to cause it to follow through the die-channel, as distinguished from a pressure great enough to directly expel or extrude the metal through the die-channel.

Subordinate objects of my invention relate to details of the metal-melting, pressure producing, bar drawing, cooling, measuring, cutting off and ejecting means, and will be fully set forth hereinafter.

In the accompanying drawings Fig. 1 is a side view of a machine embodying my invention, parts being broken away, Fig. 2 is a vertical longitudinal section of a portion of the same, Fig. 3 is a partial front end view thereof, Figs. 4, 5 and 6 are detail transverse vertical sections on the respective lines 4—4, 5—5 and 6—6 of Fig. 2, Fig. 7 is a longitudinal vertical section through the measuring, cutting and ejecting devices, Figs. 8, 9 and 10 are detail transverse vertical sections on the respective lines 8—8, 9—9 and 10—10 of Fig. 7, Fig. 11 is a detail horizontal section on the line 11—11 of Fig. 10, and Fig. 12 is a transverse vertical section on the offset planes of the line 12—12 of Fig. 7, showing details of the ejecting mechanism.

In the illustrated structure there is provided a melting-pot 13 of cylindrical form, the same having legs 14 extending downwardly and a spout 15 extending rearwardly from the lower portion thereof, both the legs and spout being integral with the body of the pot. The legs 14 have foot-portions which rest upon and are secured to a horizontal table or frame-plate 16, the body of the pot being thereby supported above the front end of the table. The table 16 forms the top of a bench-like frame having angle-bar side-pieces 17, end-pieces 18 and legs 19. Beneath the melting-pot there is a circular gas-burner 20 to which gas is supplied from a pipe 21 through a controlling valve 22. The pipe 21 also supplies an auxiliary

burner 23, extending beneath the spout 15 and controlled by a valve 24. The passage through the spout 15 is controlled by a shut-off cock 25, and said passage communicates with the lower end of a pump-cylinder 26 formed integrally with the body of the pot, as shown in Fig. 2. A piston or plunger 27 fits slidably in the cylinder 26 and is actuated by means of a connecting-rod 28 extending upwardly therefrom to a lever 29 which is fulcrumed on a lug 30 formed integrally with the pot 13 at one side thereof. The lever 29 is pulled downward by means of a spring 31 which is connected with the end thereof and extends down to a projecting portion of the table 16. A rod 32 is pivotally connected with the lever 29 near the end thereof, said rod extending down through a slot in the front end-portion of the table 16, and having at its lower end a head 33 which slotted longitudinally and fits slidably over a shaft 34, between an end-collar 35 and a cam 36 secured to the shaft. At one side of the head 33 there is a horizontally extending pin carrying a roller 37 which rests normally upon the peripheral edge of the cam 36 so that by rotation of the shaft 34 the cam may raise the rod 32 and push the lever 29 upwardly in opposition to the pull of the spring 31.

From the collar 35 the shaft 34 extends horizontally rearward through bearings therefor formed in the lower portions of brackets or hangers 38 and 39 which are secured to the lower side of the table 16, and the rear end of the shaft extends partly through a bearing 40 formed in a hanger 41 secured to the table near the rear end thereof. An end hanger carries a bearing 42 which is alined with the bearing 40, and in said bearings is journaled the drive-shaft 43, the same being axially alined with the shaft 34. On the rear end-portion of the drive-shaft 43 is secured a pulley 44 which may be connected by belt with a suitable source of power. Between the bearings 40 and 42 a pinion 45 is secured on the drive-shaft and said pinion meshes with a gear 46 carried on a shaft 47 which is journaled in a bearing 48 at the lower end of the hanger 41. On the front end of the shaft 47 is a pinion 49 which meshes with a gear 50 carried on the shaft 34 adjoining the bearing 40.

When the machine is in use the pot 13 is kept filled with metal A which is maintained in a molten and fluid condition by heat from the burners 20 and 23. When the pump-lever 29 is raised by the lifting of the cam-rod 32, as described, the lower end of the plunger 27 passes above an opening 51 in the side of the cylinder 26, and metal from the main body of the pot flows through said opening into the lower part of the cylinder. After lifting of the pump-lever by the cam-rod, continued rotation of the cam frees the lever, which is moved downwardly merely by the pull of the spring 31. After the lower end of the plunger 27 passes below the opening 51 the metal in the cylinder is subjected to a pressure which is proportional to the tension of the spring, and unless the metal is allowed to escape from the cylinder the plunger will not make a full downward stroke, but will stop when the pressure in the cylinder balances the pull of the spring.

The molten metal from the pot 13, flowing into the passage or channel through the spout 15, passes from the rear end of the latter into a die which determines the form of the bar to be produced. The die, as shown in detail in Figs. 2 and 6, comprises upper and lower liner-plates 52 and 53, side liner-plates 54 disposed between the longitudinal edges of the upper and lower liners to form a rectangular longitudinal channel between them, upper and lower body-blocks 55 and 56 between which the liner-plates are held, and bolts 57 and 58 which extend vertically through the longitudinal edge-portions of the preceding parts to clamp them together. The body-blocks have flanges at their front ends through which screws 59 are passed to removably secure the die to the end of the spout, and near the rear end the body-blocks have formed therein water-chambers of which the outer sides are closed by plates 60 and 61 secured respectively to the upper and lower sides of the blocks by screws 62. The upper and lower water-chambers are connected to each other at one side of the die by a U-shaped pipe 63, and at the opposite side there are supply and discharge pipes 64 and 65, controlled by valves 66 (shown in Fig. 6). Water from any suitable source is circulated through the water-chambers from the pipe 64 to the pipe 65, to cool the rear end-portion of the die. The auxiliary burner 23 extends beneath the front end of the die so as to heat the same, but terminates in front of the chambered cooling-portion thereof.

Near the rear end of the die there is arranged a reciprocating clutch device for grasping and intermittently drawing the formed bar from the die. The main body 67 of the clutch device is slidably mounted on a pair of horizontal parallel rods 68 of which the ends are held in standards 69 secured to the table 16. A lever 70 extends through a slot in the table and is fulcrumed on a block 71 beneath the same, the lower end of the lever carrying a roller 72 which fits in the groove of a cam 73 secured on the shaft 34. Said cam is adapted to cause oscillating movements of the lever during rotation of the shaft, and said movements are communicated to the clutch-body 67 by means of a link 74 connecting the same with the upper end of the lever, as shown. To the upper side of the body 67 there is secured a cover-plate 75, having therein a longitudinal recess

in which a wedge-block 76 is slidably disposed. The upper side of the recess is parallel with the inclined upper side of the wedge-block, and between said parallel surfaces there is disposed a plurality of small transversely extending anti-friction rollers 77 which are retained in spaced relation to each other by a suitable cage. Between the rear end of the recess and the adjacent large end of the wedge-block there is a coil spring 78 which pushes the wedge toward the front end of the recess, said movement causing the same to be pressed downwardly toward the upper face of the body 67. The spring is disposed around a small rod 79 which is screwed into the end of the wedge-block and extends through a slot in the rear end of the cover-plate 75, the protruding portion of the rod being formed into a hook which may be conveniently grasped to pull the block rearwardly and manually release the clutch. The formed bar *a*, emerging from the die, extends horizontally through the channel between the wedge-block and the upper side of the body 67, and is automatically clamped between the same during the rearward movements of the clutch, the wedge being moved by the spring 78 into contact with the upper side of the bar to start the clamping action. At the beginning of the forward stroke of the clutch device, the wedge-block first lags sufficiently to release the bar *a*, and then moves with the other parts to the end of the forward stroke, the spring holding the wedge lightly in contact with the bar so that the same will be again clamped at the beginning of the rearward stroke.

The drawing of the formed bar *a* from the die may be facilitated by introducing a suitable lubricant into the spout 15 so that portions of the lubricant will be carried into the die along with the molten metal from the spout. For so supplying lubricant, there is shown an inverted cup or container 80 which is threaded internally and screwed onto a threaded plunger 81 formed integrally with a tubular stem 82 of which the lower end is screwed into the upper side of the spout 15 between the shut-off cock 25 and the end to which the die is secured. A valve 83 is arranged within the stem 82, said valve closing upwardly and being for the purpose of preventing any of the molten metal flowing up through the stem into the container. The container or cup 80 is screwed down onto the plunger 81 to force the lubricant down through the stem 82, and the cup may be actuated automatically at a rate proportional to the rate of drawing of the formed bar, as follows: A circular flange 84 at the upper end of the cup is provided with ratchet-teeth which are engageable by a pawl 85 carried on the upper end of a lever 86, as shown in Fig. 5. Said lever extends down through the table 16, being fulcrumed on a bearing-hanger 87 secured to the lower side of the table, and the lower end of the lever is connected by means of a rod 88 with a crank-pin 89 carried by and arranged eccentrically to the axis of a worm-gear 90. Said worm-gear is carried on the lower end of a vertical shaft 91 journaled in the bearing-hanger 87, and the gear meshes with a worm 92 on the shaft 34, so as to be driven by said worm during rotation of said shaft. The relatively slow rotation of the worm-gear causes oscillating movements of the lever 86, actuating the pawl 85 to intermittently turn the cup 80 and screw the same down over the plunger 81. The length of the pawl is such that it may follow the cup downward without getting out of operative relation to the ratchet-teeth thereon, and when removing the cup to refill the same with lubricant the pawl may be merely swung upwardly out of the way, being swung back to engagement with the ratchet when the refilled cup is replaced upon the plunger.

As the formed bar *a* emerges from the rear end of the reciprocating clutch-device, it first passes over the ledger-bar 93 of a cutting device or shear which is carried on a standard 94 secured to the table 16. In the upper part of said standard there is a bearing for the front end of the cutter-shaft 95, the other end of said shaft being carried by a bearing-standard 96 disposed near the rear end of the table. A shear-blade 97 is arranged in cooperative relation with the rear edge of the bar 93, being carried on an arm 98 which is secured to the shaft 95. A portion of said arm 98 is extended beyond the shaft and has a spring 99 connected to the end thereof and to the table, as shown in Fig. 8. Said spring holds the arm and shear-blade 97 in the raised position shown, except when the arm is pulled downwardly by the cam-rod 100 connected with the end thereof. The cam-rod extends down through an opening in the table and has a slotted lower end-portion 101 fitting slidably over the shaft 34. A roller 102 is mounted on a pin at one side of said end-portion 101, said roller being positioned for engagement by a cam 103 formed integrally with a clutch-sleeve 104. The shaft 34 fits revolubly within the bore of the clutch-sleeve, and on the shaft adjoining the end of said sleeve there is secured a collar 105 having in the end-face thereof an opening for receiving the end of a pin 106 by which the collar and sleeve may be operatively connected. Said pin 106 fits slidably in an opening extending longitudinally of the sleeve 104, and is pressed yieldingly toward the collar by a spring 107 disposed at the end of the pin within the opening. Longitudinal movement of the clutch-pin 106 is limited, and rotation thereof within the opening prevented, by a pin 108

extending therefrom through a slot in the side of the sleeve 104. Said sleeve has a rectangular peripheral groove near the end adjoining the collar 105, and the pin 106 intersects a part of said groove, the pin having in the outer side thereof a rectangular notch adapted to coincide with the groove when the pin is withdrawn from engagement with the collar 105. A trip-lever 109 is pivoted on a hanger 110 depending from the table, and said trip-lever has a portion adapted to fit within the groove of the clutch-sleeve, as shown in Fig. 10, one side of the lever being beveled to a point at the end, as shown in Fig. 11. A rod 111 connects the trip-lever with one arm of a bell-crank 112 which is pivoted on a pin 113 beneath the table, the other arm of the bell-crank extending up through an opening in the table and alongside the trip-rod 114. A pin 115 extends laterally from the trip-rod through a slot in said arm of the bell-crank to operatively connect said rod and crank. The trip-rod is slidable longitudinally in supports 116, its movement being limited and rotation prevented by a pin 117 extending therefrom through a slot in the rear support. The trip-rod is held yieldingly in the normal position shown in Fig. 7, by means of a spring 118 disposed around the same between the front support and a collar 119 secured on the rod near its front end. A trip-finger 120 is mounted slidably upon the rod and secured in adjusted relations thereto by means of a thumb-screw 121. The trip-finger is adapted to extend into the path of the formed bar so as to be engaged by the end thereof and pushed rearwardly, thereby moving the trip-rod to raise the lower arm of the bell-crank 112 and lift the end of the trip-lever 109 out of the groove in the clutch-sleeve. When the trip-lever is out of the groove the clutch-pin 106 may be moved by the spring 107 into engagement with the face of the collar 105, and as rotation of the shaft 34 brings the opening of said collar into alinement with the clutch-pin the latter passes into the opening to connect the collar and sleeve so that the latter will be driven with the shaft. If the trip-lever be dropped back into the groove, at the next approach of the clutch-pin to the pointed end of the lever the latter will enter the notch in the pin, causing the pin to be forced back into the sleeve until the notch coincides with the groove in the sleeve, the end of the pin being thereby withdrawn from engagement with the collar, so that driving of the clutch-sleeve will cease until the trip-lever is again raised sufficiently to release the clutch-pin. Besides the bar-cutting device formed by the parts 93—97, there is a second cutting or shearing device which is operatively connected with the shaft 95 and is adjustable longitudinally thereof. The second shear or cutter has a ledger-bar 122 which is secured to a member 123 having a head-portion fitting pivotally and slidably upon the shaft 95, an integral foot-portion 124 being adapted to rest upon the surface of the table 16, and a second foot-portion being formed by the end of a screw 125 as shown in Fig. 9. A shear-blade 127, adapted for cooperation with the ledger-bar 122. is carried by an arm 128 which is secured adjustably upon the cutter-shaft 95 by a set-screw 129 of which the end extends into a longitudinal groove in the shaft. The head of the member 123 is confined between the arm 128 and a collar 130 which is secured to the shaft by a set-screw as shown in Fig. 7. For supporting the formed bar *a* between the two cutting devices, there are provided a plurality of transverse supporting-rods 131 having horizontal portions disposed at the level of the ledger-bars 93 and 122, and vertical terminally-threaded portions extending through the table 16 and secured thereto by nuts 132 screwed on said threaded portions, as shown. Adjacent to each of the rods 131 there is a transversely movable rod or ejector-finger 133 which extends through a slot in the table and at its lower end connects with a collar 134 secured on a rocking-shaft 135 which is pivotally mounted in suitable bearings 136 beneath the table. Near the front end of the rocking-shaft 135 an arm 137 is secured thereto and extends into proximity to the cam 103 on the clutch-sleeve 104. Said arm 137 carries a roller 138 adapted for engagement by said cam 103 during rotation thereof, a spring 139 being connected with the arm, as shown in Fig. 12, for pulling the roller toward the cam.

From the foregoing description of the machine structure, the operation thereof as a whole may be clearly understood. During the operation of the machine the shaft 34 is driven continuously through the gearing connecting the same with the primary drive-shaft 43. Metal is supplied to the pot 13 as required to keep the same filled, and the gas-burners 20 and 23 are so regulated as to keep the metal in a molten and free-flowing condition within the pot, the spout, and the adjacent front end-portion of the die. The burner 23, in particular, is so adjusted that the heat therefrom will keep the portion of the die above the same heated to or above the melting-point of the metal passing through the die-channel. A convenient test for the die-temperature is afforded by placing on the upper surface of the body-block 55, in front of the water-chambered rear portion thereof, small pieces of the same metal contained in the pot, and observing that said metal melts and remains molten. The channel or passage through the die is preferably of uniform size throughout the length thereof, and different dies may be

used for producing the various desired sizes of leads, slugs and rules, or the size of the die-channel may be varied by using different liners between the body-blocks. For use with ordinary type-metals it has been found that common cast-iron, or cast-iron hardened by chilling, is a suitable and satisfactory material for forming the liners or the walls of the die-channel, there appearing to be no tendency for the type-metal to adhere to said material or to wear the same sufficiently to require replacement of the parts except after long-continued use. When changing or replacing the die, the spout shut-off cock 25 may be closed, and after the die is in place and its temperature suitably controlled the cock may be re-opened to permit the metal to flow through the spout to the die-channel. For starting the drawing operation, a previously-formed bar or piece of the material is inserted through the reciprocating clutch-device and into the die-channel from the orifice or rear end thereof, the starting-bar being extended into the die-channel to a point therein at which the metal is molten. Then, upon opening the shut-off cock 25 the metal from the spout joins the metal at the end of the starting-bar, becoming substantially continuous therewith, so that the drawing operation may proceed upon commencing movement of the clutch-device. The actuating mechanism is so timed that the rearward stroke of the bar-drawing clutch or clamping device is made during the downward stroke of the pump-plunger 27, the pull upon the formed bar commencing after the plunger has moved down past the feed-opening 51 into the cylinder 26, so that during the movement of the bar through the die-channel the pressure upon the molten metal in the spout is sufficient to cause the same to follow through the die-channel and prevent the bar being pulled apart at that point where the metal becomes pasty or semi-solid in changing from the molten to the solid form.

The clutch mechanism for actuating the cutting devices is so arranged that the latter will be operated to sever the formed bar only during the intervals between the rearward movements of the drawing mechanism, or when the bar is stationary. When it is satisfactory to have the severed portions of the bar in lengths which are multiples of the length of bar drawn from the die at each stroke of the drawing mechanism, the rear cutting device formed by the parts 122—127 may be omitted or disconnected, and the lengths of the severed bar-portions gaged approximately by setting the trip-finger 120 at a suitable position upon the trip-rod. In this case, as the formed bar passes back over the support-rods 131, the end thereof engages the finger 120 and causes the trip-lever 109 to be lifted, releasing the clutch-pin 106 at an instant near the conclusion of a rearward stroke of the bar-drawing mechanism. Then as the clutch-pin passes into the opening therefor in the collar 105, the sleeve 104 and cam 103 begin to rotate with the shaft 34, the cam first actuating the front cutter to sever the bar at the rear edge of the ledger-bar 93, and then actuating the rocking-shaft 135 by which the ejector-fingers 133 are moved laterally to push the severed portion of the bar aside. As the slug or severed part of the formed bar is ejected, the trip-finger is released, and the trip-lever is permitted to drop back into the clutch-stopping position thereof within the groove of the sleeve 104, so that movement of the sleeve and cam is stopped after the same having made one complete revolution. The cutting mechanism then remains quiescent until again set in operation by the engagement of another portion of the formed bar with the trip-finger.

When it is desired that the slugs or severed portions of the formed bar be of exact lengths, the second or rear cutting device is employed, the same being adjusted longitudinally of the cutter-shaft 95 to a position such that the cutting edge of the ledger-bar 122 is spaced from the corresponding edge of the bar 93 the required length to which the pieces are to be cut. Such adjustment is effected by loosening the collar 130 and the set-screw 129 of the arm 128, then moving said arm 128, the member 123 and collar 130 to the desired positions, and finally securing the arm and collar to the shaft by tightening down the set-screws therefor. To permit the member 123 being moved past the supporting-rods 131, the screw 125 may be backed up to such a position as shown by dotted lines in Fig. 9, the member 123 then swung about the shaft 95 in the direction indicated by the arrow in said figure to a position clearing the rods, then moved past the rods, and finally swung down to the normal position and the screw 125 moved down to engage the table. Obviously when both cutting devices are in use, the bar-portions are cut simultaneously at both ends and are exactly the length of the space between the cutters. At each operation a short piece of the formed bar between the trip-finger 120 and the rear cutter, will be wasted, but such pieces of the material may be returned to the melting-pot and again used. As it might be necessary to place the rear cutter at positions interfering with the rods 131 or the ejector-fingers 133 at the normal positions thereof, the latter are arranged for slight longitudinal adjustments by slotting the table, the ejector-finger collars 134 being adjustable longitudinally of the rocking-shaft 135, and the vertical end-portions of the rods 131 being movable longitudinally of the table in slots therefor (not shown).

It will be apparent that the described and illustrated mechanism provides a comparatively simple and effective means for automatically producing printers' leads, slugs and rules, inexpensively and in large quantities, the mechanism being operable in ordinary printing establishments for the special purpose first herein set forth. It may be noted that extensive tests have shown the bar-producing means to be capable of successful operation without special attention, even the regulation of the temperature of the die merely requiring that a flow of water be maintained through the water-chambers of the die to cool the rear end-portion thereof, while the front end-portion is maintained at a temperature such as is readily shown by the described test therefor. The bars produced by the mechanism are solid, smooth-surfaced, of uniform thickness, and free from porous or spongy portions such as are produced by casting or slug-forming machines in which molten metal is forced into an air-filled mold-cavity, necessitating the displacement of air as the metal enters the space in which it is cooled and formed. Various modifications may be made in the structural details of the mechanism, it being understood that the particular mechanism herein disclosed is merely illustrative of the invention more comprehensively set forth in the appended claims.

Now, having described my invention, what I claim and desire to secure by Letters Patent is:

1. The method of making continuous bars of soft metal, consisting in melting the metal, flowing portions thereof from below the surface of the molten mass into a channel of substantially the sectional form of the desired bar, cooling the metal to solid form during its passage through said channel, pulling the solid metal from the end of the channel, and simultaneously subjecting the molten metal at the entrance of the channel to sufficient pressure to cause same to follow the solid portion through such channel but insufficient alone to extrude such metal.

2. The method of making continuous bars of soft metal, consisting in melting the metal, flowing portions thereof from below the surface of the molten mass into a channel of substantially the sectional form of the desired bar, cooling the metal to solid form during its passage through said channel, intermittently pulling the solid metal from the end of the channel, and simultaneously subjecting the molten metal at the entrance of the channel to sufficient pressure to cause same to follow the solid portion through such channel but insufficient alone to extrude such metal.

3. The method of making continuous bars of soft metal, consisting in melting the metal, flowing portions thereof from below the surface of the molten mass into a channel of substantially the sectional form of the desired bar, introducing a lubricant into the channel with the metal, cooling the metal to solid form during its passage through said channel, pulling the solid metal from the end of the channel, and simultaneously subjecting the molten metal at the entrance of the channel to sufficient pressure to cause same to follow the solid portion through such channel.

4. Means for forming continuous soft-metal bars, comprising a die having a substantially uniform rectilinear channel through it, means for cooling the same at one end, means for pulling a formed bar from the channel at the cooled end, and means for supplying molten metal to the other end of the channel under pressure sufficient to cause same to follow through as the bar is drawn therefrom but insufficient alone to extrude such metal.

5. Means for forming printers' leads, slugs and the like, comprising a die having a longitudinal channel of substantially uniform cross-section, means for cooling the same at one end of the channel, means for supplying molten metal under controlled pressure to the other end of the channel, such pressure being insufficient alone to extrude such metal, and means for drawing from the channel the solid bar formed from the metal as it approaches the cooled end of the channel.

6. In a machine of the class described, a melting pot, a die connected at one end with said pot to receive molten metal therefrom, means for cooling said die whereby such metal is caused to solidify as it passes therethrough, means for intermittently pulling the sodidified bar from the outer end of said die, aand means for applying pressure to the molten metal.

7. In a machine of the class described, a melting pot, a die connected at one end with said pot to receive molten metal therefrom, means for cooling said die whereby such metal is caused to solidify as it passes therethrough, means for intermittently pulling the solidified bar from the outer end of said die, and means for applying pressure to the molten metal, such pressure being insufficient alone to extrude the solidified metal from said die.

8. In a machine of the class described, a melting pot, a die connected at one end with said pot to receive molten metal therefrom, means for cooling said die whereby such metal is caused to solidify as it passes therethrough, means for intermittently pulling the sodidified bar from the outer end of said die, and means for intermittently applying pressure to the molten metal.

9. In a machine of the class described, a melting pot, a die connected at one end with

said pot to receive molten metal therefrom, means for cooling said die whereby such metal is caused to solidify as it passes therethrough, means for intermittently pulling the solidified bar from the outer end of said die, and means for intermittently applying pressure to the molten metal, such pressure being insufficient alone to extrude the solidified metal from said die.

10. In a machine of the class described, a melting pot, a die connected at one end with said pot to receive molten metal therefrom, means for cooling said die whereby such metal is caused to solidify as it passes therethrough, means for intermittently pulling the solidfied bar from the outer end of said die, and means for applying pressure to the molten metal, said pressure-applying means including a chamber interposed between said pot and die, a piston reciprocable in said chamber, means normally actuating said piston to force metal from said chamber, and means adapted intermittently to retract said piston, said chamber being adapted to receive metal from said pot upon such retraction of said piston.

11. In a machine of the class described, a melting pot, a die connected at one end with said pot to receive molten metal therefrom, means for cooling said die whereby such metal is caused to solidify as it passes therethrough, means for intermittently pulling the solidified bar from the outer end of said die, and means for applying pressure to the molten metal, said pressure-applying means including a chamber interposed between said pot and die, a piston reciprocable in said chamber, means normally actuating said piston to force metal from said chamber, and means adapted intermittently to retract said piston, said chamber being adapted to receive metal from said pot upon such retraction of said piston and said retracting means operating while said pulling means are idle.

12. In a machine of the class described, a melting pot, a die connected at one end with said pot to receive molten metal therefrom, means for cooling said die whereby such metal is caused to sodidify as it passes therethrough, means for intermittently pulling the solidified bar from the outer end of said die, and means for applying pressure to the molten metal, said pressure-applying means including a chamber located in said pot and having an opening in its side, a piston reciprocable in said chamber adapted when retracted to uncover such opening whereby said chamber may receive metal from said pot, means normally actuating said piston to force metal from said chamber, and means adapted intermittently to retract said piston.

13. In a machine of the class described, a melting pot, a die connected at one end with said pot to receive molten metal therefrom, means for cooling said die whereby such metal is caused to solidify as it passes therethrough, means for intermittently pulling the solidified bar from the outer end of said die, and means for applying pressure to the molten metal, said pressure-applying means including a chamber located in said pot and having an opening in its side, a piston reciprocable in said chamber adapted when retracted to uncover such opening whereby said chamber may receive metal from said pot, means normally actuating said piston to force metal from said chamber, and means adapted intermittently to retract said piston, said retracting means operating while said pulling means are idle.

14. In a machine of the class described, a melting pot, a die having a channel connected at one end of said pot to receive molten metal therefrom, means for cooling said die, whereby such metal is caused to solidify as it passes therethrough, adjustable means for intermittently pulling the solidified bar from the outer end of said die not to exceed a predetermined distance.

15. In a machine of the class described, a melting pot, a die connected at one end with said pot to receive molten metal therefrom, means for cooling said die whereby such metal is caused to solidify as it passes therethrough, means for intermittently pulling the solidified bar from the outer end of said die, and means for applying pressure to the molten metal, said pressure-applying means including a chamber interposed between said pot and die, a piston reciprocable in said chamber, adjustable pressure means normally actuating said piston to force metal from said chamber, and means adapted intermittently to retract said piston, said chamber being adapted to receive metal from said pot upon retraction of said piston.

16. In a machine of the class described, a melting pot, haying a horizontally disposed discharge-spout opening from the lower portion thereof, a die connected with said spout and having a channel communicating with the passage therethrough, means for cooling said die, whereby molten metal received in such channel from said spout is caused to solidify as it passes through such channel, a reciprocating clamping device located beyond the outer end of said die and movable substantially in line with the channel therein, a rotatable shaft parallel with the direction of movement of said clamping device, and means for applying pressure to the molten metal in said pot, said means including a chamber located in said pot and having an opening in its side, a piston reciprocable in said chamber adapted when retracted to uncover such opening, whereby said chamber may receive metal from said pot, a spring normally forcing said piston downwardly, and cams on said shaft respectively connect-

ed to raise said piston against said spring and to reciprocate said clamping device.

17. In a machine of the class described, a melting pot having a horizontally disposed discharge-spout opening from the lower portion thereof, a die connected with said spout and having a channel communicating with the passage therethrough, means for cooling said die, whereby molten metal received in such channel from said spout is caused to solidify as it passes through such channel, a reciprocating clamping device located beyond the outer end of said die and movable substantially in line with the channel therein, a rotatable shaft parallel with the direction of movement of said clamping device, and means for applying pressure to the molten metal in said pot, said means including a chamber located in said pot and having an opening in its side, a piston reciprocable in said chamber adapted when retracted to uncover such opening, whereby said chamber may receive metal from said pot, a spring normally forcing said piston downwardly, and cams on said shaft respectively connected to raise said piston against said spring and to reciprocate said clamping device, said cams being so timed that said spring is left free to force said piston downwarly before the gripping device engages the solidified metal to pull same from the die and continues in action during the whole of such pulling movement.

18. In a machine of the class described, a melting pot having a discharge-spout opening from the lower portion thereof, a die connected with said spout and having a channel communicating with the passage through the spout, means for cooling the die at the terminal portion of said channel, means for heating the pot and spout and adjacent end-portion of the die, movable bar-drawing means positioned near the orifice of the die-channel, and means for forcing molten metal under intermittent pressure from the lower portion of the pot through the spout and into the die-channel to the cooled portion thereof.

19. The combination in a machine of the class described, of a die having a channel through it of substantially the sectional form of the article to be formed, means in connection with one end of said die-channel for supplying molten metal thereto, means for heating said end of the die to keep the metal therein melted, means for cooling a portion of the die to solidify the metal in a part of the channel, means for pulling the solidified metal from the channel as a continuous formed bar, and means for applying pressure to the molten metal sufficiently only to cause the same to follow the solidified metal through the channel but insufficient to extrude the solidified metal from the die-channel.

20. An organized machine for automatically forming a relatively thin continuous bar of soft metal alloy having low heat-expansibility and low tensile strength at temperature near its melting point, comprising a die having a channel of substantially the sectional form of the desired bar, means for supplying molten metal at one end of said channel, means for heating the die to maintain the metal in a molten condition in a part of the channel, means for cooling a part of the die to solidify the metal near the discharge orifice of the channel, reciprocating clamping means for pulling the bar of solidified metal from the orifice of the channel without deformation of the bar, and means for intermittently applying pressure to the molten metal in the channel, the movement of the clamping means away from the die being timed to occur during the application of pressure to the molten metal, whereby partially cooled portions of the metal are caused to follow through the channel without separation from the adjoining fully solidified portions.

21. An organized machine for automatically forming printers' leads, slugs and rules, comprising a die having a channel through it, of substantially the sectional form of the article to be formed, means for supplying molten metal under intermittent pressure to one end of the die-channel, means for cooling the die to solidify the metal in a part of the die-channel, means for pulling solidified sections of the metal from the die-channel as portions of a continuous formed bar, and means for gaging the length of and cutting off pieces from the formed bar as the same emerges from the pulling means.

22. In a slug and rule forming machine, a die having a formed channel extending longitudinally thereof, means for supplying molten metal to one end of the channel, reciprocating bar-clamping means for pulling a formed bar from the other end of the channel, means for cooling the metal near the latter end of the channel, means for introducing a lubricant into the channel, and means for applying pressure to the molten metal simultaneously with movement of the clamping means away from the die.

23. In an organized machine for forming thin continuous bars from soft metal alloys, means having therein a longitudinal channel of substantially the sectional form of the desired bar, means for supplying to one end of said channel molten metal under intermittent pressure, means for introducing a lubricant into the channel, means for cooling the molten metal to solidify the same in a part of the channel, and means for pulling the formed bar from the channel, the pulling means being actuated intermittently and adapted to move the bar from the channel simultaneously with increases of pressure of

the molten metal at the feed end of the channel.

24. In an organized machine for forming continuous soft metal bars of uniform section, a mold having therein a continuous longitudinal channel of substantially the sectional form of the desired bar, means for applying to one end of said channel molten metal under pressure, means for cooling a part of the mold to solidify the metal in the adjacent part of the channel, means for pulling from the channel the bar formed by cooling of the molten metal, and means for introducing a lubricant into the portion of the channel containing the molten metal.

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