Dec. 30, 1930. C. D. KNOWLTON 1,786,496

METHOD OF FORMING MATERIAL

Original Filed April 8, 1921 3 Sheets-Sheet 1

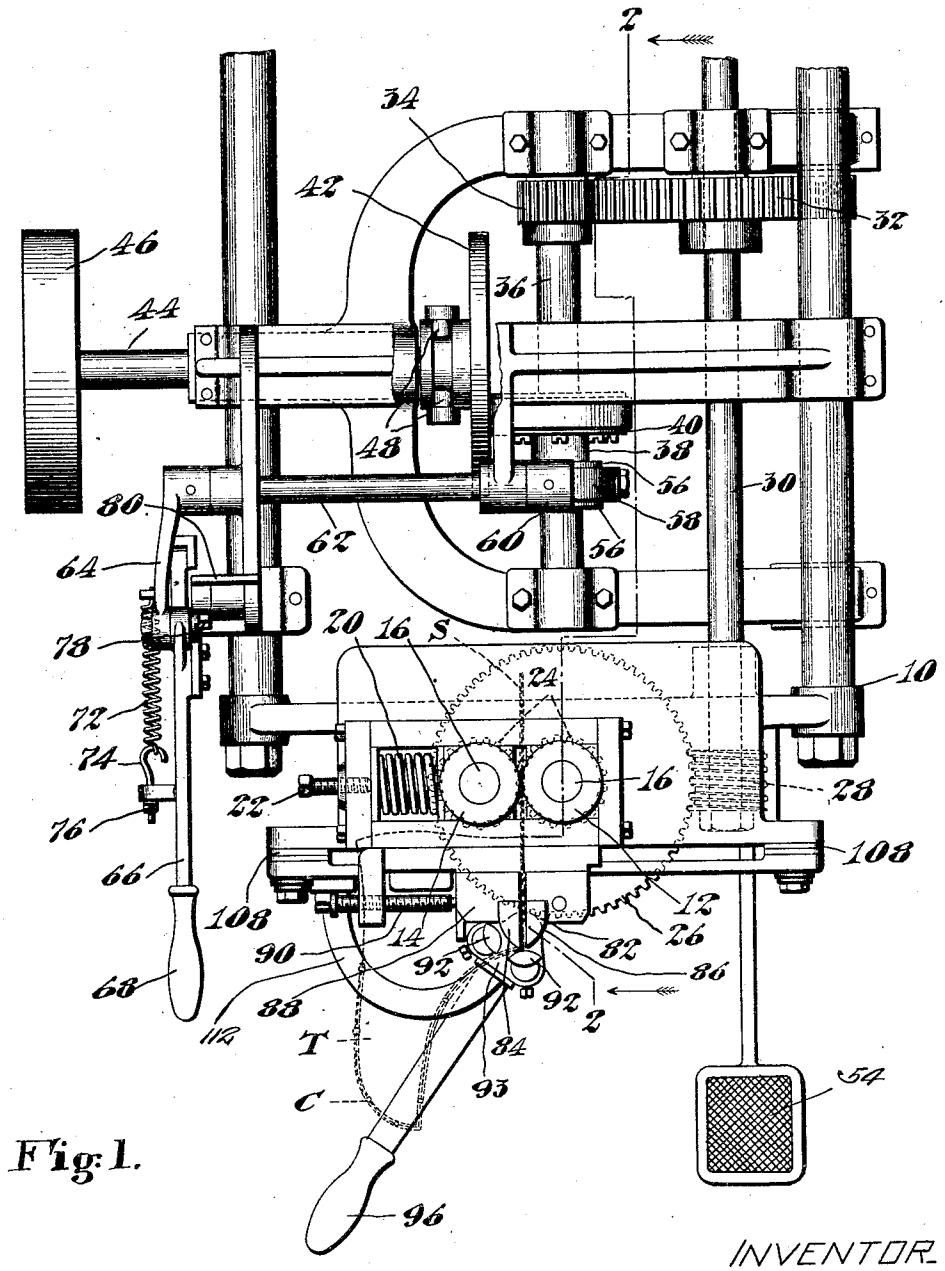


Fig. 1.

INVENTOR.

Cutler D. Knowlton

By his Attorney,

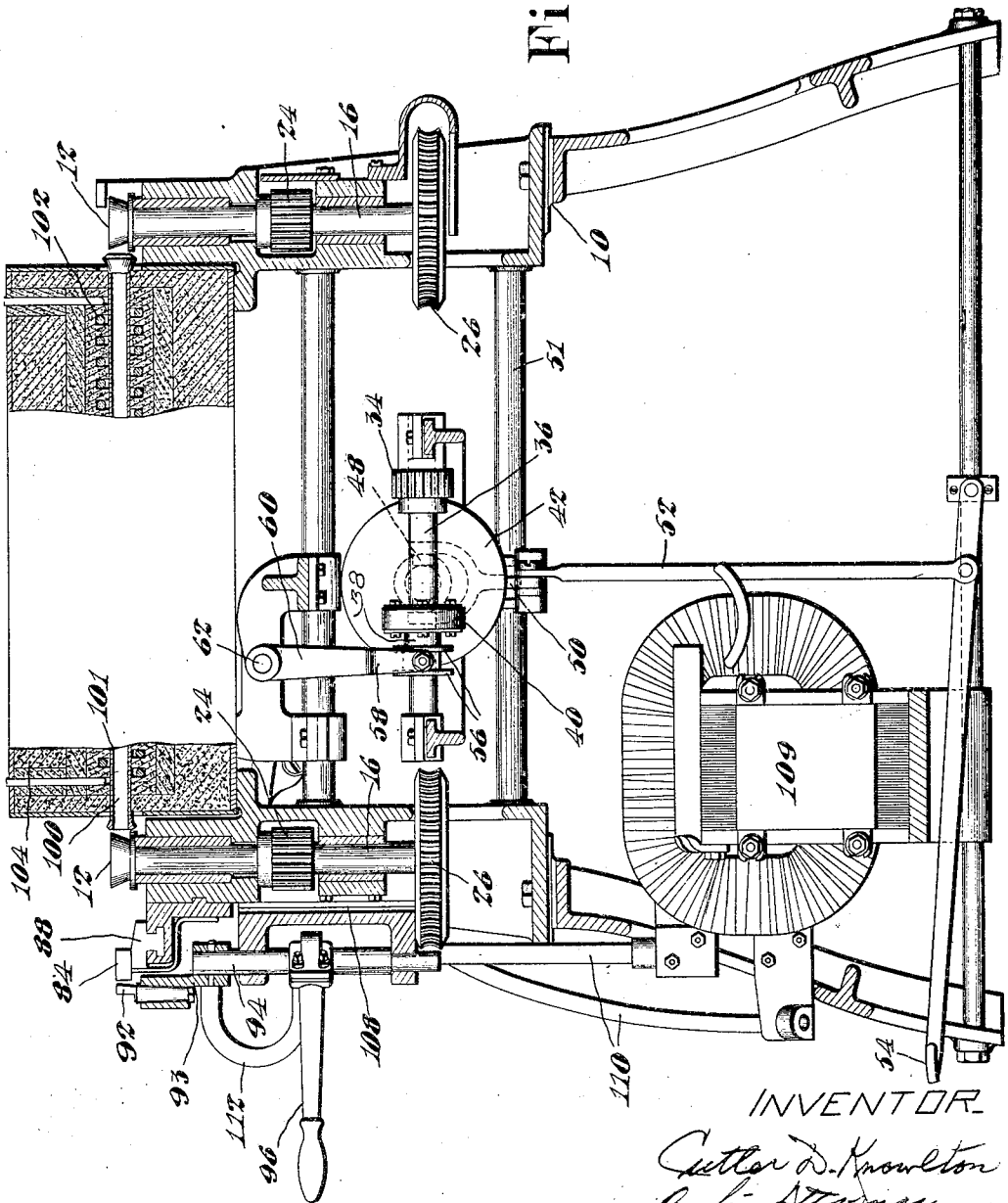
Nelson W. Ashland

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Fig. 2.



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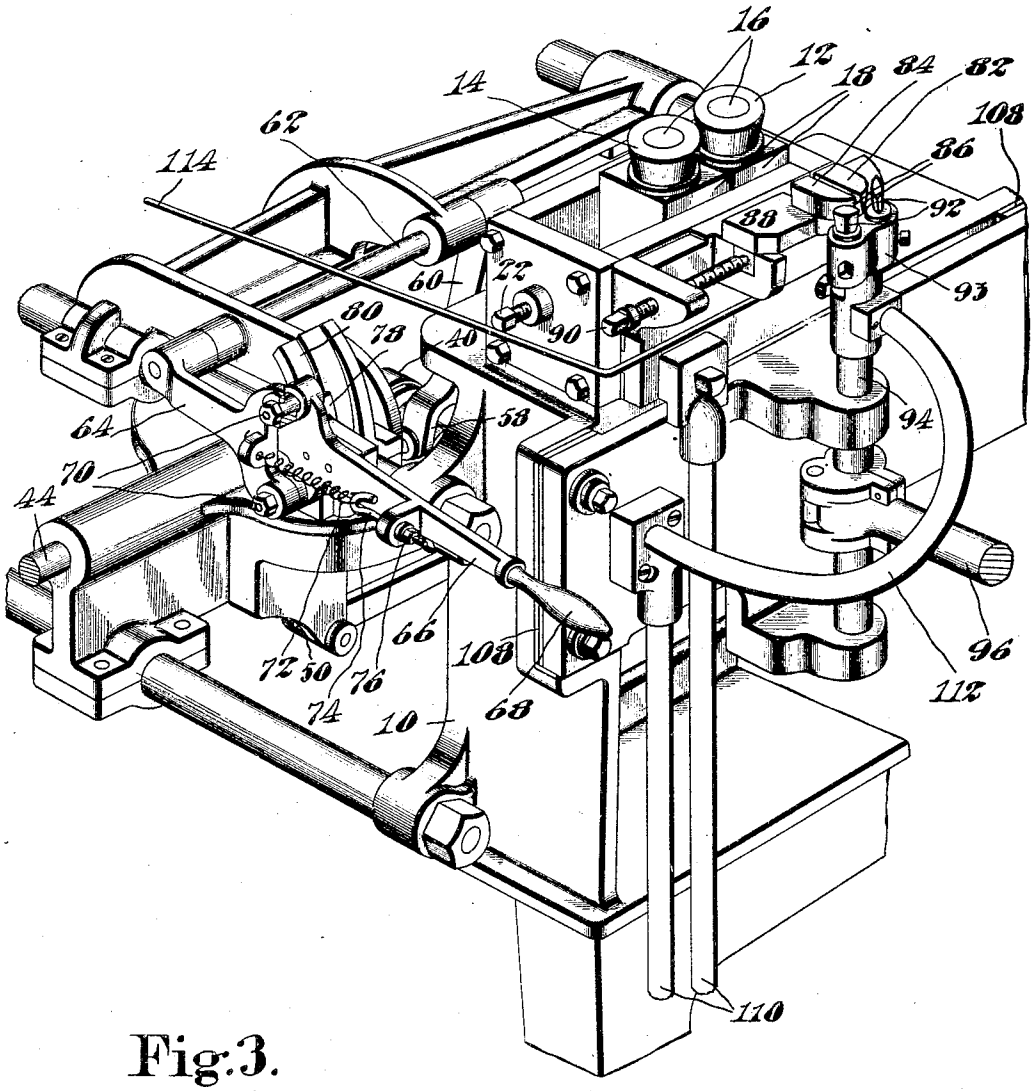


Fig. 3.

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UNITED STATES PATENT OFFICE

CUTLER D. KNOWLTON, OF BEVERLY, MASSACHUSETTS, ASSIGNOR TO UNITED SHOE MACHINERY CORPORATION, OF PATERSON, NEW JERSEY A CORPORATION OF NEW JERSEY

METHOD OF FORMING MATERIAL

Application filed April 8, 1921, Serial No. 459,783. Renewed July 22, 1927.

My invention relates to methods of imparting to material, especially when in strips, various forms, which may correspond to patterns. An example of such a procedure, to which this invention is peculiarly applicable, may be found in the bending of clicking dies to the templets which determine their contour. In Letters Patent of the United States No. 1,657,015, granted January 24, 1928, on an application filed in my name, there is described and claimed broadly a method of this character, in which, to facilitate the formation of the die-stock, it is heated locally between the points of application of bending pressure. When the stock is treated in this manner, a certain interval must intervene, considering any particular construction of forming instrumentalities not unduly massive, before the stock is sufficiently flexible to bend to the best advantage.

It is an object of the present invention to so operate upon the material that its formation may be effected promptly, with the employment of relatively small elements, which apply or resist the bending force. In the accomplishment of this object, the material is first heated, and thereafter its forming proceeds under the guidance of an associated pattern, which may be supported upon it or otherwise maintained in a fixed relation to the formed portion. The material is thus subjected to the forming action in a condition hastening the effect upon it. Having thus prepared the material by this preheating, I preferably further facilitate the bending by heating the already heated material over a more limited extent, as between the points of contact of the bending instrumentalities. As illustrated, the initial heating action is obtained within a chamber, and the secondary heating by the passage of electric current through the bending contacts. There is preferably a progressive movement of the material through the heating chamber and while under the influence of the second heating and bending.

One form of apparatus by which my improved method may be carried out is illustrated in the accompanying drawings, in which

Fig. 1 is a partial top plan view of the apparatus, the rear portion being omitted;

Fig. 2 is a full vertical section on a reduced scale along the line 2—2 of Fig. 1; and

Fig. 3 shows in perspective that portion of the machine illustrated in Fig. 1.

Mounted near the front and rear portions of a suitable supporting frame 10 are pairs of feeding rolls 12—14, 12—14, rotatable about parallel vertical axes. These pairs of rolls each have inclined faces converging upwardly, the angle between them corresponding substantially to the transverse section of the strip-stock from which clicking dies are manufactured. The rolls are fixed upon pairs of vertical shafts 16, 16, journaled in boxes 18 mounted in the frame. The bearings of the rolls 12 are held against movement, while those for the rolls 14 are movable horizontally in ways to permit the distance between the rolls of the pairs to be varied. Each roll 14 is held normally toward the companion roll by a spring 20, the tension of which may be varied by a screw 22 threaded horizontally through a plate secured to the frame, and acting upon the outer end of the corresponding spring. The rolls of each pair are caused to turn together by pairs of pinions 24, 24 secured upon their shafts 16, and upon the shaft of each roll 12 is a worm-wheel 26 meshing with a worm 28 fast upon a horizontal shaft 30 extending from the front to the rear of the frame and journaled therein. This shaft 30 also has secured upon it a gear 32 meshing with a pinion 34 fixed upon a short horizontal shaft 36 rotatable in the frame. Splined upon the shaft 36 for longitudinal movement is a sleeve 38, carrying fast upon it a wheel 40 provided with a peripheral friction surface, which may be of some such material as leather. The friction surface is arranged to contact along a horizontal line with the face of a disk 42 secured upon a shaft 44, which rotates in the frame in a position at right angles to the shaft 36. At the outer end of the shaft 44 is fastened a driving pulley 46, to which power may be applied by a belt from some convenient source. Normally, the wheel 40 and the face of the disk 42 are not in driving contact, but means is provided for press-

ing the disk against the wheel to cause the rotation of the latter. For this purpose the hub of the disk is grooved to receive opposite projections 48, 48 carried by a yoke upon the upwardly extending arm of a bell-crank lever 50 arranged to oscillate about a horizontal spindle 51 fixed upon the frame. Articulated to a horizontal arm of the bell-crank is a link 52, pivoted at its lower end to a treadle 54 fulcrumed upon the lower portion of the frame. When the operator depresses the treadle and turns the bell-crank lever, it forces the driving face of the disk 42 against the friction surface of the wheel 40, causing the wheel to rotate, and through the intermediate gearing drive both pairs of rolls 12—14 slowly at the same speed. To permit the rate of rotation of the rolls to be varied, the sleeve 38 carries spaced flanges 56, between which extend opposite projections from a yoke 58 carried at the end of an arm 60, which is fastened upon a spindle 62 journaled horizontally in the frame. At the outer extremity of the spindle is attached an arm 64, which has at its forward extremity an independent section 66, terminating in a handle 68. The section 66 is arranged for longitudinal movement upon the arm 64, the parts being joined to each other by two slot-and-bolt connections 70. The outer section 66 is drawn normally toward the rear of the machine along the arm 64 by a spring 72, fixed at one end to a lug projecting from the side of the arm, and at the opposite end to a hook 74 which passes through a lug upon the outer section, and has its shank threaded to receive a nut 76. By turning the nut upon the hook-shank, the tension of the spring and the force with which the handle-section is moved upon the arm may be altered. At the inner side of the section 66 is a contact member 78, provided with an arcuate friction surface engaging the adjacent face of a quadrant 80 mounted upon the frame. The spring 72 draws the contact member against the quadrant with sufficient force to hold the arm 64 normally against movement, and therefore the wheel 40 at any position at which it may have been set along the face of the disk 42. When the operator grasps the handle 68 to shift the arm and consequently the wheel, pressure, either upwardly or downwardly, moves the opposite extremity of the contact-face of the member 78, that is the lower or the upper, away from the quadrant by virtue of the movement of one of the bolt-and-slot connections 70. This reduces the frictional engagement sufficiently to permit the arm to be readily shifted, causing a corresponding travel of the wheel 40 along the face of the disk 42. In this manner, the engagement of these elements may be varied from the maximum driving speed, when the wheel is near the periphery of the disk, to the minimum, when it approaches the center, and consequently the stock advanced by the feeding rolls at the proper rate.

By the mechanism just described, the die-stock or other strip is fed forward at the time and speed desired between spaced abutments 82, 84, which restrict its movement laterally. The opposite faces of these abutments between which the die-stock travels are parallel to one another along horizontal lines, though they may converge upwardly similarly to the contour of the die-stock in transverse section, to give contact therewith along the full height of the walls. The outer faces of the abutments at 86 are curved upon arcs of a circle to permit bending means to travel about them, as will be described, and may be inclined vertically similarly to the inner faces of the abutments to provide effective contact. The abutment 82 is secured upon the frame against movement. The associated abutment 84 is mounted upon a block 88 arranged to slide upon horizontal ways to carry this last-mentioned abutment toward and from the abutment 82. This movement may be effected by a screw 90 threaded horizontally through a portion of the frame. By thus changing the relative positions of the abutments, they may be caused to best cooperate with the particular stock which is being operated upon.

To impart to the stock emerging from between the abutments the desired form, a pair of bending members 92, 92, each having a lenticular shape in horizontal section, tapered to conform to the die-stock, are mounted together, spaced somewhat from each other upon a carrier 93 fixed upon a vertical spindle 94 arranged to turn in the frame. As the spindle and carrier are rotated, the bending members may be either caused to wholly clear the space between the abutments to allow the emergence therefrom of the die-stock without bending effect, or to exert their influence in one direction or the other to bend the stock about the corresponding abutment. To produce this movement, there is shown, projecting horizontally from the spindle 94, a hand-lever 96, which the operator may grasp, and by means of which he can hold or swing the bending members as may be desired.

Since cold material is difficult to bend, requiring the application of considerable force and the employment of forming and restricting members relatively massive in construction, the forming operation is facilitated and a better apparatus structurally is attained by heating the stock, and I preferably apply this heat both before and during the application of the bending pressure. For preheating the material I have shown, interposed between the forward and rear pairs of feeding rolls, an elongated cylindrical space or chamber 100, the axis of which extends about midway vertically and horizontally be-

tween the adjacent faces of the feeding rolls. The wall of this chamber may consist of a tube of refractory material 101 surrounded by heating means, which I have shown as an electric unit 102. Outside of this unit is a body of refractory heat-insulating material 104. Current of the proper volume may be supplied to the unit 102 from any suitable source. The passage of the stock through this chamber raises its temperature, so that it is presented to the members 82, 84 and 92 in a condition that permits it to be bent with comparative ease. By the separation of the stock from the source of heat and because of the character of said source, the material is entirely protected from the oxidizing, scaling effects of products of combustion or the like. This operation is further aided by the application of heat locally between the points of bending pressure. For this purpose I have shown the members 82 and 84 on the one hand, and 92, 92 on the other as constituting terminals of an electric heating circuit. The bending members may be insulated from the frame and from the abutments at 108, and current delivered to these terminals from the low resistance secondary winding of a transformer 109, which I have illustrated as supported at the lower forward portion of the frame 10, and which is joined to the terminals by conductors 110, 110. In the connection to the bending members, a conducting section 112 may be included, which is sufficiently flexible so that it will not interfere with the operating movement.

In carrying out my improved method with the apparatus just described, a strip of die-stock S is inserted between the rear feeding rolls 12, 14, and by depression of the treadle 54 is caused to be fed through the chamber 100, which is heated to the desired degree by the unit 102. At the forward extremity of the chamber, the stock is acted upon by the associated pair of rolls and the feed continues, the end of the now heated stock passing between the abutments 82 and 84. Upon this forward portion of the stock a templet, such as appears at T, is secured by means of some such device as a clip C inserted through an opening near the edge of the templet. This application of the templet to the stock is preferably made along a straight, or approximately straight edge of the former. The feeding rolls may now, under the control of the treadle and arm 64, advance the stock and supported templet in a movement of translation to bring said stock between the bending members 92, the height of these being such that the templet may pass over the one on the side of the stock at which it is placed. When in this position, the operator, by moving the hand-lever 96 in one direction or the other, may bring the appropriate bender 92 against the stock, and may continue this until, in connection with the advance due to the feed, the stock will be caused progressively to conform to the templet. As soon as the material comes in contact with a bender, a circuit, including the secondary of the transformer, is in part formed, which also comprises one or both of the abutments 82, 84 and the conductors 110 and 112. To avoid arcing at the points of contact with the material, the completion and subsequent opening of the circuit may be under the control of a properly designed switch. The already heated strip is therefore further heated by the flow of current through it, bringing it to still better condition for bending at the particular point at which the action is to take place. To prevent the introduction of a resistance into the heating circuit by the formation of an oxide or scale upon its surface, the heated portion between the abutments and bending members may be surrounded by an inert envelope, as a flame of illuminating gas supplied through a pipe 114.

Having described my invention, what I claim as new and desire to secure by United States Letters Patent is:

1. The method of forming material in accordance with a pattern, which consists in heating the material, thereafter supporting the pattern solely upon the heated material, feeding the heated material, and forming the material to the supported pattern.

2. The method of forming material in accordance with a pattern, which consists in heating the entire body of material from which the object to be formed is produced, associating the heated material and the pattern, maintaining a fixed relation between the pattern and formed portion of the material while continuing the formation by pressure upon the material independent of the pattern, and separating the formed material and the pattern.

3. The method of forming material in accordance with a pattern, which consists in heating the material, applying the pattern to the heated material, imparting to the heated material a progressive movement of translation to advance the pattern, and forming the material to the pattern during their advance.

4. The method of forming material in accordance with a pattern, which consists in heating the material, thereafter heating the material over a limited extent of the already heated portion, and forming the material to the pattern at the point of this second application of heat.

5. The method of forming material in accordance with a pattern, which consists in heating the material, thereafter heating the material in a limited gradually changing portion, and applying forming pressure to the portion of the material being heated.

6. The method of forming a strip, which consists in progressively heating a portion

of the strip, associating a pattern with the heated strip, progressively heating a more limited extent of the already heated portion, and bending the thus heated strip to the form of the pattern.

7. The method of forming a strip, which consists in progressively heating a portion of the strip, associating a pattern with the heated strip, progressively heating a more limited extent of the already heated portion, and progressively bending the strip at the twice heated portion to the form of the pattern.

8. The method of forming a strip, which consists in progressively heating a portion of the strip, progressively heating a more limited extent of the already heated portion, and progressively bending the twice heated strip at a point coinciding with that at which the second application of heat is made.

9. The method of forming material in accordance with a pattern, which consists in heating the material, advancing the heated material for bending, applying bending pressure to the heated material thus advanced, and applying a heating current of electricity through the bending contact.

10. The method of forming material in accordance with a pattern, which consists in placing in a heated chamber all the material which is to be acted upon to produce the completed object, removing the material from the chamber and associating the pattern with it, imparting to the material and pattern a movement of translation, forming the material to the pattern, and separating the formed material and the pattern.

11. The method of forming material in accordance with a pattern, which consists in placing said material in a heated chamber, removing the material from the chamber and associating the pattern with it, imparting to the material and pattern a movement of translation, forming the material to the pattern, and applying heat to the material simultaneously with the forming operation.

12. The method of forming a strip, which consists in progressively moving the strip through a heating chamber, and selectively applying lateral forming pressure in one direction or the other to the thus heated strip during its advance from the chamber.

13. The method of forming a strip, which consists in progressively moving the strip through a heating chamber, applying forming pressure to the thus heated strip during its advance from the chamber, and applying a heating current of electricity through the forming contact.

14. The method of forming cutting dies to a templet, which consists in heating die-stock over a considerable length to facilitate its formation, advancing the heated stock, and applying pressure to opposite sides of the die-stock to bend it progressively to the contour of the edge of the templet.

15. The method of forming cutting dies to a templet, which consists in heating die-stock over a considerable length to facilitate its formation, advancing the heated stock, and bending it progressively to the templet while simultaneously applying heat locally at the point of bending.

16. The method of forming strip-material, which consists in subjecting said material to advancing forces at points spaced from each other, heating the strip between the points at which the advancing forces are applied, the heat being furnished by a source spaced from the strip, said strip being maintained during the heating free from oxidizing effects originating at the source, and forming the heated strip.

In testimony whereof I have signed my name to this specification.

CUTLER D. KNOWLTON.