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C. D. KNOWLTON

CONTROLLING MECHANISM

Filed April 18, 1924

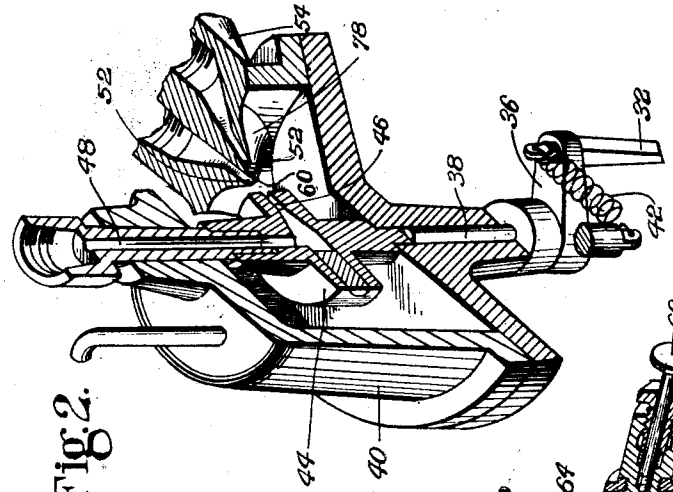


Fig. 2.

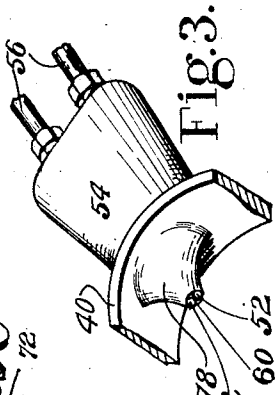


Fig. 3.

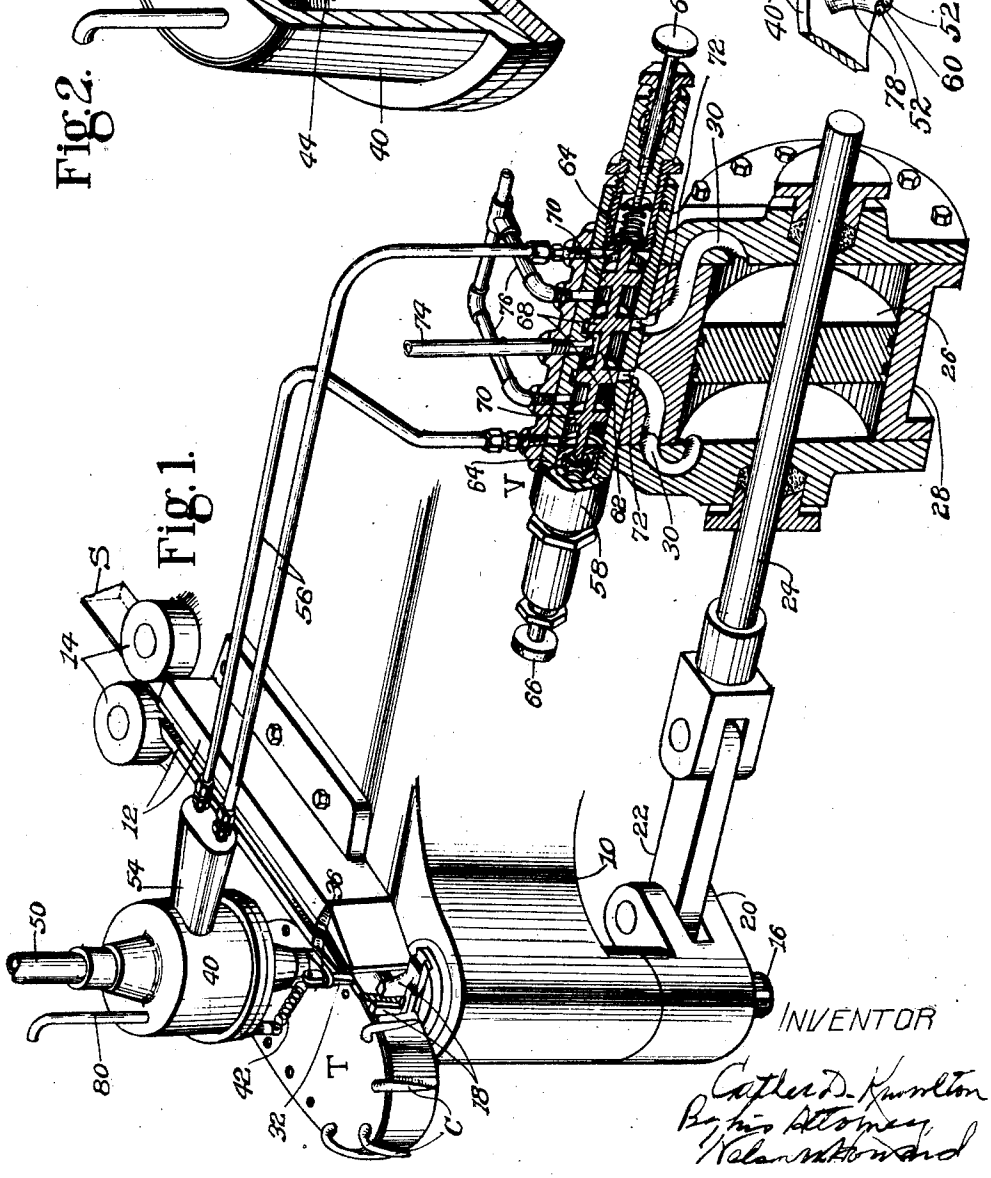


Fig. 1.

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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.

CONTROLLING MECHANISM.

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This invention relates to controlling mechanisms, being particularly useful in connection with the governing of the movement of operating members, as those which act upon work-pieces to effect their bending.

In machines of the type disclosed in application Serial No. 631,491, filed in my name on April 12, 1923, a strip of die-stock, or other work-piece, is bent to the contour of a templet by an operating member, the extent of movement of which is determined by a feeler or controlling member movable in accordance with the position of the work as this varies in its relation to the templet. Heretofore, the action of such machines, as far as I am aware, has been to apply to the operating member, as soon as the movement of the feeler is sufficient to exercise control, a force acting at a substantially constant rate to restore coincidence between the stock and templet. This movement of the operating member should be at such a speed that considerable departures of the stock from the templet shall be quickly corrected. But when this rate of movement is applied to the counteracting of a relatively slight separation, it may tend to cause overbending, which must be followed by an opposite corrective movement. The general result of this procedure is toward an irregular action, which is not always most advantageous. An object of the present invention is to effect a more continuous and gradual control of the operating member. To this end, I combine with this member and its controlling member, means arranged to move the operating member at a rate varying progressively as the position of the controlling member varies, said rate of movement preferably corresponding to the position of the controlling member throughout its movement. Thus, in a bending machine, if the separation between the stock and templet is slight, the bending member is caused to move at a comparatively slow speed, so that when coincidence is again established, the bender will not overrun. On the other hand, if the divergence to be overcome is considerable, the initial movement of the bender will be correspondingly rapid, this being reduced as the separation between the stock and templet decreases. The preferred means employed for thus moving the operating member includes motor mechanism governed by a member movable by the controlling member and provided with a conduit arranged to transmit an actuating fluid, which may be applied as a jet. As herein illustrated, the motor mechanism, which may consist of a piston operating in a cylinder, is governed by a valve actuated by the pressure created by the jet.

One of a number of forms which my invention may assume is illustrated in the accompanying drawing, in which

Figure 1 shows, in broken perspective, a portion of a bending machine to which the invention is applied;

Fig. 2 similarly shows, on a larger scale, the feeler and the jet device which it actuates; and

Fig. 3 is a perspective view of the head containing the receiving openings for the jet.

At 10 appears the frame of a die-bending machine, which may be of the character of that made the subject of the previously-mentioned application. Upon the frame are carried abutments 12, 12, spaced from each other to give a channel permitting the passage of a strip S of such material as the stock from which clicking dies are to be formed. Through this channel, the strip may be fed by any suitable means, as a pair of power-driven rolls 14, 14 situated at the rear extremity of the abutments and arranged to contact with opposite sides of the strip. Mounted to turn in the frame about a vertical axis is a spindle 16, and fixed at the upper extremity of this spindle are separated bending projections 18, 18. These projections lie, respectively, at opposite sides of the channel, and, when the spindle is rotated, are carried into contact with the stock as this is retained against lateral movement by the abutments, to bend it in one direction or the other across the forward ends of said abutments. To impart to the projections 18 their bending movement, there is secured at the bottom of the spindle 16 an arm 20 joined by a link 22 to motor mechanism having, as its principal element, a fluid-actuated piston. The link is articulated to a piston-rod 24, this carrying a piston 26 traveling in its cylinder 28. Movement may be imparted to the piston by a fluid, as oil under pressure, introduced into the cylinder at either side of the piston through passages 30, 30 governed by a valve V.

The work is formed in accordance with

a pattern, which may consist of a templet T secured to the stock as its bending progresses by a series of clips C. The valve V, and therefore the motor mechanism which effects the bending of the stock, is governed by mechanism which determines the departure of the stock from the desired form. Of this mechanism, there is shown at 32 a feeler or controlling member depending from an arm 36 fast upon the lower extremity of a spindle 38 turning in a casing 40 mounted upon the frame above the forward ends of the abutments. A spring 42, connecting the arm 36 to a relatively fixed portion of the apparatus, serves to draw the feeler yieldably into engagement with the templet. Within the casing, the spindle has an enlarged portion 44, in which is a horizontal passage 46 opening through one side, to which passage connects a vertical passage 48. To the conduit composed of the passages 46 and 48 is supplied a fluid under pressure, as oil, through a pipe 50. The horizontal portion of the conduit furnishes a nozzle, through which a jet of fluid is discharged. The jet may be received by either or both of openings 52, 52, in conduits which terminate in a head 54, shown as formed upon one side of the casing, the conduits being continued by pipes 56, 56 to the casing 58 of the valve V. In the head, the conduits converge until the openings 52 are closely adjacent in a horizontal plane in which the jet-nozzle oscillates, they being separated only by a sharp-edged wall 60.

In the casing 58 moves a valve-plunger 62, normally held balanced in a central position between springs 64, 64, these exerting upon the plunger equal and opposite forces. The spring-pressures may be varied to adjust the position of the plunger by screws 66, 66, against which the outer ends abut. The plunger has heads 68, 68, separated equally upon each side of its center, and spaced symmetrically outside the head 68 are heads 70, 70. In the normal position of the plunger, the heads 68 close ports 72, 72 through the wall of the casing 58, which ports communicate with the cylinder-passages 30, 30. Between the heads 68 opens an inlet-pipe 74 supplying oil under appropriate pressure, and between each of the pairs of heads 68, 70, an exhaust-pipe 76 is connected. The pipes 56, 56 from the casing 40 communicate with the valve-casing outside the respective heads 70, 70.

The elements are so related that, in the neutral position of the feeler 32, or that in which the stock and templet coincide near the point of engagement of the feeler, the delivery-opening of the passage 46 directs its jet equally into the openings 52, 52. This creates the same pressure in each of the pipes 56, and maintains the balanced condition of the plunger 62, the ports 72 thus being closed, and the piston 26 remaining inactive. Under these conditions, the bending projections 18 may be held, as is shown in Fig. 1 of the drawing, out of contact with the strip S. If, however, as the strip is fed forward, it separates from the templet, the feeler 32 is moved either by the pressure of said templet or by the tension of its spring, and correspondingly changes the angle of the jet-passage 46. The equality of delivery of the fluid into the openings 52 is thereby destroyed, creating an excess of pressure in one or the other. This difference is communicated through the pipes 56 to the valve-plunger 62, causing this to move to open one of the ports 72, which will admit into the cylinder fluid from the pipe 74. The port thus affected is that which will cause the piston 26 to be shifted to turn the projections 18 in the direction bending the stock to cause its return to conformity with the templet. If the just-described movement of the feeler were slight, the difference in pressure produced in the conduits 56, 56 by the movement of the jet-passage would be also small, resulting in a comparatively slow and limited movement of the valve-plunger. This would lead to a restricted opening of the port 72, and a corresponding slow movement of the piston and of the bending projections under the influence of the thus-throttled fluid. If the space between the strip and templet were, instead, relatively great, the angle through which the jet-passage 46 was turned might be such as to direct the discharge wholly into one of the openings 52, thus giving the greatest effective pressure to move the valve-plunger. By this, the proper port 72 would be at once fully uncovered, and the actuating fluid admitted at its maximum rate to the cylinder, to most accelerate the bending effect. In either case, as agreement between the stock and templet is being re-established, the feeler is returned toward neutral, and the jet-passage carried back toward its central position of delivery to both of the receiving openings 52. As the pressure lessens in one and is augmented in the other, the centering effect of the springs 64 comes into action, so that when the feeler again arrives at neutral, the plunger 62 is promptly centered, to stop the bending. In the delivery of the jet to the receiving openings, any fluid which fails to pass into one or the other of the conduits 56 is received within the casing, being preferably deflected by a surface 78, so inclined as to carry the fluid away from the path of the jet, and thus prevent interference with the latter. Any excess within the casing may escape through an overflow-pipe 80.

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

1. The combination with an operating

member movable in its action upon the work, of a controlling member governed in its movement by the work in accordance with the position thereof, and means arranged to move the operating member at a rate varying progressively as the position of the controlling member varies.

2. The combination with an operating member movable in contact with the work, of a controlling member movable in accordance with the position of the work, and means arranged to move the operating member at a rate corresponding to the position of the controlling member throughout its movement.

3. The combination with an operating member oppositely movable in contact with the work, of a controlling member movable only upon a change in the position of the work, and means arranged to move the operating member in both directions at a rate varying progressively according to the position of the controlling member.

4. The combination with an operating member movable in its action upon the work, of a controlling member movable in accordance with the position of the work, motor mechanism for the operating member, and means for governing the motor mechanism and including a member movable by the controlling member and having movable with it a conduit arranged to transmit an actuating fluid.

5. The combination with an operating member movable in its action upon the work, of a controlling member movable in accordance with the position of the work, motor mechanism for the operating member, and means for governing the motor mechanism and including a jet device movable by the controlling member.

6. The combination with an operating member movable in its action upon the work, of a controlling member movable in accordance with the position of the work, motor mechanism for the operating member, a jet-nozzle movable by the controlling member, a conduit having an opening to receive the jet, and mechanism actuated by the pressure created by the jet in the conduit for governing the motor mechanism.

7. The combination with an operating member movable in its action upon the work, of a controlling member movable in accordance with the position of the work, motor mechanism for the operating member, a jet-nozzle movable by the controlling member, conduits having openings arranged to receive the jet from the nozzle, and a valve movable by pressure in the conduits and governing the motor mechanism.

8. The combination with an operating member movable in its action upon the work, of a controlling member movable in accordance with the position of the work and having a delivery-opening, a plurality of conduits to any one of which the opening of the member may deliver to create a pressure therein, and motor mechanism for the operating member governed by such pressure.

9. The combination with an operating member movable in its action upon the work, of a controlling member movable in accordance with the position of the work and having a delivery-opening, adjacent conduits arranged to simultaneously co-operate with the delivery-opening to receive pressure therefrom varying in the movement of the controlling member, and motor mechanism arranged to move the operating member oppositely in accordance with the degree of pressure in the conduits.

10. The combination with an operating member movable in its action upon the work, of motor mechanism for the operating member, a valve for governing the motor mechanism, a member movable in accordance with the position of the work, and means controlled in the movement of the member for simultaneously applying opposite pressures to the valve.

11. The combination with an operating member movable in its action upon the work, of motor mechanism for the operating member, a valve for governing the motor mechanism, a controlling member movable in accordance with the position of the work, and means controlled in the movement of the member for simultaneously applying opposite pressures to the valve, the magnitude of the respective pressures varying oppositely in such movement of the controlling member.

12. In a bending machine, a movable bending member, a piston connected thereto, a cylinder in which the piston operates, a plunger-valve governing the application of pressure to the cylinder, pipes arranged to apply pressure to move the plunger oppositely, said pipes having adjacent receiving openings, a feeler co-operating with the work, and a member arranged for oscillation by the feeler and provided with an opening movable into co-operation with either of the pipes.

13. In a bending machine, a movable bending member, a piston connected thereto, a cylinder in which the piston operates, a plunger-valve governing the application of pressure to the cylinder, pipes arranged to apply pressure to move the plunger oppositely, a head in which the pipes terminate in adjacent openings, there being a surface upon the head inclined rearwardly from the openings, a feeler co-operating with the work, and a member arranged for oscillation by the feeler and provided with an opening movable into co-operation with either of the pipe-openings.

14. In a bending machine, a feeler, a discharge device arranged for oscillation under

the influence of the feeler, conduits having openings arranged to receive the discharge from the device, and operating mechanism governed by pressure produced by the discharge into the conduits.

15. In a bending machine, a casing, a feeler having a portion movable in the casing, said portion being provided with a discharge-opening, conduits terminating in adjacent receiving openings within the casing and with which the discharge-opening may be alined in its movement, and operating mechanism governed by the variation in pressure produced in the conduits by the discharge.

16. The combination with an operating member movable in its action upon the work, of motor mechanism for the operating member, a valve for governing the motor mechanism, spring mechanism tending to hold the valve in its normal position, a member movable in accordance with the position of the work, and means controlled in the movement of the member for simultaneously applying pressures to opposite sides of the valve.

17. In a bending machine, a movable bending member, motor mechanism for the bending member, a valve for governing the motor mechanism, springs exerting their force oppositely upon the valve and tending to maintain its normal position, and means controlled in the movement of the member for simultaneously applying opposite pressures to the valve.

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

CUTLER D. KNOWLTON.