UNDERREACH PRESTRETCH FIXTURE AND COMBINATION THEREOF WITH DRAWING THE PRESS
Stanley M. Dolney, Parma, Ohio, assignor to The Cyril Bath Company, Solon, Ohio, a corporation of Ohio Filed Feb. 28, 1964, Ser. No. 348,011
3 Claims. (Cl. 72—297)

This invention relates to a prestretch and draw die combination of the general character described in United States Letters Patent of Cyril J. Bath, No. 3,116,780, issued January 7, 1964.

The present structure has to do with a different arrangement of the stretch forming units, particularly the gripping heads and their supports, whereby they can be disposed readily in selected positions within the die space beneath the ram relatively close to the midpoint of the space in the tensioning dimension, so as to cooperate with dies which are narrow in said dimension, and can be moved or withdrawn from that position positions to the outer side of the die space, selectively, for forming stock on dies which are substantially coextensive with the die space in that dimension or extend therebeyond.

Another specific object is to effect a better distribution of stresses so as to reduce tendencies toward binding of the mechanism for moving the gripping heads.

The specific differences of the inventions will become apparent from the following description wherein reference is made to the drawings, in which:

FIG. 1 is a top plan view of an apparatus embodying the principles of the present invention.

FIG. 2 is a front elevation of a structure illustrated in FIG. 1.

FIG. 3 is a hydraulic diagram for the structure.

Referring first to FIGS. 1 and 2, the apparatus comprises a base 1 on which is provided the suitable bed or bolster 2, having a horizontal upwardly facing supporting face on which a male die D1 may be supported for cooperation with a complementary die D2 on the ram of the press. The press is provided with upright corner posts 3 which guide the platen or ram 4 for vertical movement parallel to its starting position. The platen 4 is adapted to carry the female die D3 for die drawing cooperation with the male die on the bed upon closure of the dies.

The ram 4 is driven by suitable piston rod 5 of a piston 6 operable in a hydraulic cylinder 7 of a reversible hydraulic piston and cylinder assembly 7a mounted in an upper head 8 supported by the posts 3. The head 8 also supports a conventional electric motor, hydraulic pump, and control valves for effecting operation of the ram.

Mounted at opposite sides of the press, in the tensioning dimension are horizontal frame extension portions 10, respectively, each of which supports a stretch unit. Since the frame portions 10 and the units supported thereby are the same in form and function, one only will be described in detail.

The frame portions 10 are aligned with each other and with the bolster 2. Each portion has horizontal parallel slideways 12 on which is mounted a saddle 13 for movement in a horizontal linear path toward and away from the path of the dies. A suitable rack 14 is provided on the portion 10 and is engaged by a pinion 15 driven through suitable gearing by hydraulic motors 16 on the saddle 13, for moving the saddle to predetermined adjusted positions lengthwise of the slideways 12. The drive between the pinion and hydraulic motor 16 is preferably self-locking. Suitable T-slots 17 are provided on each portion 10 in a position to receive bolts 18 carried by the saddle and nuts, not shown, in the T-slots for clamping the saddle in the selected positions.

Each saddle has elongated parallel guideways 20 extending horizontally toward and away from the path of the ram. A stretching jaw carriage 22 is provided and has a horizontal slide portion 23 mounted in the guideways 20 for sliding therealong and has an upright pedestal portion 24 at the end nearest the die path. The pedestal portion 24 is provided with upright guideways 25 spaced laterally of the stretching direction. An elevator 26 is mounted for vertical reciprocation relative to the carriage 22 in the guideways 25. The elevator 26 has integral spaced arms or portions 27 which protrude in a direction toward the midportion of the die space a considerable distance beyond the pedestal so that though the pedestal portion 24 is outside of the path of the ram 4, the inner ends of the elevator arms 27 can be very close to the midportion of the die space in the stretching direction.

Rockably mounted on suitable shafts 28 journaled in the forward end of the arms 27 is a jaw carrying yoke 29, the yoke being supported for rocking movement about a horizontal axis extending transversely of the path of the carriage 22 and of the elevator 26. The yoke 29 carries a composite gripping jaw 30 which is open and closed by a suitable hydraulic piston and cylinder assembly 31, which includes a plurality of units such as described in the above patent.

The yoke 29 and jaws 30 are so arranged that the jaws can be advanced to a position very close to the center of the die space in a direction endwise of the slideways while the carriage 22 remains outside of the die space.

Thus the structure can be used for operations on dies of various dimensions in the stretching direction. On the other hand, by retracting the saddle 13, the jaws 30 can be positioned so that they can grip the ends of the sheets outwardly beyond the platen, if desired, and can be intermediate spaces between these inner and outer positions.

In order to apply stretch forming tension to the stock so as to stress it above its elastic limit, suitable piston and cylinder assemblies 35, each including a cylinder 36, are provided, mounted in brackets on the saddle 13 at the opposite sides of the saddle. Each assembly includes a piston rod 37 having a piston rod 38 connected to the carriage 22.

In order to raise and lower the elevator 26, the carriage 22 is provided with a pair of reversible hydraulic piston and cylinder assemblies 40, each assembly comprising a cylinder 41 mounted on the pedestal 24 and in which is reciprocable a piston 42 having a piston rod 43 connected to the elevator 26.

Thus stretching tension can be applied to the jaws 30 by the assembly 35 at the same time the jaws are raised and lowered by the assemblies 40.

A distinct advantage of this arrangement is a better distribution of stress. For example, the force on the jaws in the tensioning direction is usually much greater than the downward force applied to the elevator. However, there is ample space to make the carriage slide portion 23 and saddle guideways 22 as long as desired without interfering with die operation, so as to better withstand turning moments, due to tensioning forces, tending to rock the carriage about a transverse horizontal axis. The lesser turning moment imposed by the forces lowering the elevator can be withstood readily by the shorter upright guideway 25. But even this latter guideway can be made as long vertically as necessary.

Thus neither guidelines need be so short as to cause high binding stresses, yet the jaws can cooperate with very narrow dies.

In such structures it is sometimes desirable that the direction in which the jaws should be disposed as they...
approach the dies, is other than horizontal. To rock the jaws, the shafts 28 of the yoke 29 carry suitable crank arms 45. Each crank arm is connected to a piston rod 49 by a pivot 48. A rod 49 is pivotally connected to the associated crank arm 45. Thus, during the operation of the jaws and their movement to different horizontal and vertical positions, their angularity about the axis of the shafts 28 may be changed at such times as desired so as to bring to the stock to the exact position desired during the forming operation.

In order to operate the structure, suitable power means are provided as best illustrated in FIG. 3. These power means comprise the piston and cylinder assembly 45 for operating the ram 4. Such are connected in a hydraulic circuit, through a combined stop and reversing valve 50, to a hydraulic pump 51 driven by an electric motor 52. A flow regulator 53, driven by a control motor 54, and a pressure regulator 55, are connected in series between the pump and the valve 50 for controlling the rate of flow and the pressure of the fluid supplied for operating the press.

For operating the assemblages 35, 40, and 46, the pressure fluid is supplied by a suitable pump 57 driven by a motor 58. One pressure line from the pump 57 leads to a pressure regulator 59 operated by a control motor 60. Beyond the pressure regulator, the line leads to a flow regulator 61 driven by a motor 62 by which pressure fluid is supplied to a solenoid operated reversing stop valve 63 which controls admission of fluid to opposite ends of the elevator piston and cylinder assembly 40.

From between the pressure regulator 59 and the flow regulator 61 a by-pass line 64 leads to a flow regulator 65 driven by a control motor 66. The flow regulator supplies pressure fluid to the inlet side of the solenoid operated reversing stop valve 67 which controls the piston and cylinder assembly 46 for rocking the jaws.

Leading from the pressure side of the pump 57, at a point between the pump and pressure regulator 59 is a by-pass line 65 which leads through a suitable pressure regulator 70 driven by a control motor 71 to a solenoid operated reversing stop valve 72 which controls the flow of pressure fluid to the assembly 35, as illustrated.

Another by-pass line 73 leads from between the pressure side of the pump and the pressure regulator 70 to a suitable pressure regulator 74 driven by a motor 75. The flow from the pressure regulator 74 is delivered to the inlet side of a solenoid operated reversing stop valve 76 which controls the operation of the assembly 31 for opening and closing the jaws.

Thus it will be seen that the rise and fall of the ram, the raising and lowering of the elevators, the movement of the carriage horizontally toward and away from the path of the dies, the tensioning force applied thereto, the rocking of the jaws, and the clamping of the jaws, all can be controlled independently of each other.

In operation, therefore, when it is desired to form a sheet, the carriages 22 can be retracted by the assemblages 35, and the jaws 30 opened to receive the opposite margin of the sheet to be gripped by the jaws, whereupon the assemblages 31 are operated to clamp the jaws onto the sheet as previously desired, fluid pressure is applied to move the carriages 22 relatively away from each other to apply yieldable tension to the stock to stress it above the elastic limit. During the installation of the stock, the elevators 26 are in raised position, opposite from the lower position shown in FIG. 2. After the stock is stretched, the elevators are lowered to effect a partial wrapping of the stock about the male die and at the same time the ram is operated until the female die is being lowered. If necessary, the jaws 30 can be rocked by the assemblages 46 during their lowering operation, depending upon the configuration of the die. Lowering of the ram continues until the stock, while held under tension by the jaws, is formed by cooperation of the male and female dies, after which tension is released and the ram then raised to free the workpiece. Upon raising the ram, the elevators 26 are raised so that the jaws operate to strip the workpiece from the male die and hold it thereabove in a position for ready removal from the press.

It is apparent that with this structure the jaws 30 can be positioned almost at the midportion of the platen for very narrow dies and at the same time can be moved out of such position so that, in their most outward operating positions, they are outside of the path of the dies. Any number of intermediate operating positions are obtainable, thus providing a very flexible and practical structure.

The horizontal component of tensioning force applied to the jaws is normal to the vertical guideways 25 and imposes no turning moment on the elevator 26 relative to its guideways. The only turning moment imposed by such horizontal component is on the carriage 22.

Having thus described my invention, I claim:

1. In a drawing press and prestretch unit combination, a ram movable along an upright path, ram power means for driving the ram, a frame at one side of the ram path, a carriage mounted on the frame and for movement relative thereto in opposite directions transversely of said ram path along a fixed horizontal path, an elevator mounted on the carriage for movement relative to the carriage along an upright path to raised and lowered positions, selectively, elevators power means interconnecting the carriage and elevator for moving the elevator to said positions, selectively, a stock gripper mounted on the elevator, yieldable stretch power means interconnecting the frame and carriage for yieldably urging the carriage, and thereby the elevator and gripper, along said horizontal path in a direction away from said ram path, and said ram power means, elevator power means, yieldable stretch power means each being operable independently of the others for effecting said movements of the gripper, ram, and elevator independently of each other, and stock gripping means at the opposite side of the ram path.

2. The structure according to claim 1 wherein said carriage includes an upright guideway for the elevator and which guideway can be positioned adjacent to, but outside of, the ram path by movement of the carriage forwardly toward the ram path to a predetermined position, said elevator has a guide portion which is mounted on said upright guideway and supports said elevator for said movement along its upright path, and an arm portion is carried by said guide portion and extends forwardly therefrom so as to be positioned in the path of the ram in said predetermined position of the carriage, and said gripper is mounted on the forward end of said arm portion.

3. The structure according to claim 2 wherein the mounting of the gripper on said forward portion of the arm comprises a pivot means having a horizontal axis extending transversely of the path of the carriage and connecting the gripper to said forward position for rocking about said axis, and pivot means are provided and connected to the gripper for rocking the gripper about said axis.

References Cited by the Examiner

UNITED STATES PATENTS

3,224,241 9/1964 Bath ---------------- 72—207

3,116,780 11/1964 Bath ---------------- 72—206

3,116,780 1/1964 Bath ---------------- 72—207

3,116,780 1/1964 Bath ---------------- 72—207

3,116,780 1/1964 Bath ---------------- 72—207

CHARLES W. LANHAM, Primary Examiner.

L. A. LARSON, Assistant Examiner.