This invention relates to devices such as presses, hydraulic press brakes, or the like having a reciprocable ram member operable by reciprocating drive means through power and return strokes, and having predetermined characteristics of rate and extent of movement of the ram member.

One of the principal objects of the present invention is the provision of a novel and improved device of the above mentioned character such as a press having a movable ram member driven means for carrying tools or punchers through a power stroke for effecting the bending or fabricating of sheet material or the like and including control means to which the drive means are responsive for changing the rate of movement of the ram member to a slow speed after a predetermined portion of the power stroke and for stopping or limiting the movement of the ram member at the end of the power stroke.

A more specific object of this invention is the provision of a novel and improved press or metal working device having a reciprocable ram member operated by reversible drive means such as a fluid pressure motor which is responsive to drive control means for determining the rate and extent of movement of the ram member and wherein the drive control means includes control switch means and a series of switch actuating means which can be individually adjusted and set to provide different desired characteristics of ram travel and which can be selectively shifted into different operative positions whereby the press or other device can be rapidly conditioned to perform a series or sequence of different work strokes without undue loss of time therebetween for readjustment purposes.

Another of the objects of this invention is the provision of a novel and improved press structure including a press and a selectible means comprising a slow down switch and a down position limit switch for controlling movement of the press ram member, the switches being operable by a plurality of switch actuating elements or tripers which are adapted to be selectively brought into operative relation to the switches by a rugged and efficient selector mechanism, and which switches are connected by means for effecting actuation of the slow-down switch a short time after the actuation of the down limit switch so that the stopping of the ram member need only be effected from a slow speed thereby assuring uniform and accurate performance of the press.

The invention resides in certain constructions and combinations and arrangements of parts and further objects and advantages will be apparent to those skilled in the art to which it relates from the following detailed description of the preferred illustrative embodiment of the invention described with reference to the accompanying drawings forming a part of this specification, and in which:

FIG. 1 is a front elevational view of a plate bending brake or press embodying the present invention;
FIG. 2 is a side elevational view on an enlarged scale of the stroke control means of the press of FIG. 1 as viewed from the right;
FIG. 3 is a top plan view of the stroke control means of FIG. 2;
FIG. 4 is an elevational view of a portion of the stroke control means viewed along the line 4—4 of FIG. 3;
FIG. 5 is a sectional view of the same taken substantially along line 5—5 of FIG. 4;
FIG. 6 is a sectional view taken substantially along line 6—6 of FIG. 3;
FIG. 7 is a plan view of the portion of the stroke control means illustrated in FIG. 4;
FIG. 8 is an elevational view of a control handle;
FIG. 9 is an elevational view of a different embodiment of a portion of the stroke control means; and
FIG. 10 is a fragmentary view of a limit switch taken substantially along line 10—10 of FIG. 2.

The present invention is especially applicable to bending presses or brakes and is herein shown as embodied in such a press, and which press utilized fluid operated reciprocating type drive motors. It is, however, to be understood that the invention is applicable to various types of presses and other machines utilizing other types of drive means such as electric motors or the like and the present showing is intended to be merely illustrative of the invention and not to be restrictive in any manner.

Referring to the drawings, the press shown comprises a frame including stress-resistant, plate-like end members or side housings 13, 14 having aligned openings 15, 16 in their front edges; a combination reservoir and sump 17 interposed between and supported by the upper ends of the side housings 15, 16, and a table or die support 18 supported and fixedly secured to the top of a heavy plate or stationary blade 20 extending between and fixedly secured to the side housings 13, 14.

A movable ram or upper blade, designated generally by the reference character 25, located directly above the table or die support 18 is slidably supported by the side housings for linear movement towards and from the table or die support through power and return strokes. The lower edge of the ram 25 is adapted to carry a suitable punch or other tool.

The ram or movable blade 25 is adapted to be reciprocated towards and from the table or die support 18 by reciprocating type double acting hydraulic pressure motors 26, 27, the cylinders 30, 31 of which are connected to the side housings 13, 14 of the press, and the piston rods 32, 33 of which are connected by ball and socket connections or joints 34, 35 to opposite ends of the blade 25. Hydraulic fluid preferably oil, for operating the hydraulic motors 26, 27 is supplied by two constant volume unidirectional main high pressure pumps 36, 37 and two constant volume unidirectional auxiliary low pressure pumps 40, 41 driven by electric motors 42, 43 and a constant volume unidirectional leveling high pressure pump driven by an electric motor 45. The high pressure pump 36 and the low pressure pump 40 are driven by the motor 42 and the pumps 37, 41 are driven by the motor 43. The pumps and motors as well as a number of the other parts of the hydraulic system are supported upon the top of the sump 17 which is in the form of an elongated rectangular hollow member extending between and connected to the upper end of the opposite end housings 13, 14.

The rate and extent of movement of the power and return strokes of the ram member or blade 25 are controlled or established by hydraulic and electrical circuits for operating the above mentioned pumps and motors, and these circuits may advantageously be substantially the same as are disclosed in copending application Serial No. 818,411 filed June 5, 1959, and assigned to the same assignee to which this present application is assigned.

The press operating circuits of the above co-pending application include a down limit switch, an up limit switch, and a rapid advance switch for respectively controlling the bottom position of the blade 25 at the end of the power stroke, for controlling the up position of the blade at the end of a return stroke, and for increasing
and decreasing the rate of movement of the blade during portions of strokes thereof.

In the present described embodiment of this invention, a down limit switch 56, an up limit switch 51, and a rapid advance switch 52, corresponding in function to the above noted switches of the mentioned impending application. In addition, the present invention includes a slow-down switch 53 which will be described more in detail as the description proceeds. Suffice it to say for the present that the slow down switch 53 is adapted to be actuated just prior to actuation of the down limit switch 56 and serves to decrease the speed of the ram member or blade 25 so that the stopping thereof can be effected from a slow speed, thereby lessening the tendency of the blade to coast or drift and increasing the accuracy and uniformity of the down position of the blade upon each power stroke thereof.

The up limit switch 51 and the rapid advance switch 52 are mounted by suitable bracket means to the end housing 14, and are adapted to be actuated by an up limit switch actuating cam 55 and an elongated rapid advance switch actuating cam 56.

The cams 55 and 56 are adjustably mounted on an elongated blade or scale 58 having graduations printed or engraved thereon. The scale 58 extends in a direction parallel to the stroke of the blade 25 and is clamped to a mount 59 as by clamp members 61 and spring member 62. The block 60 is secured to the plate 25 for movement therewith. The cams 55 and 56 are releasably held to the scale 58 by clamps 63, 64 and thumb screws 65, 66 respectively, so that they can be readily slidable positioned along the scale.

The up limit switch 51 is provided with a pivotal arm 70 and a roller 71 which is adapted to be engaged by the cam 55 and to be moved to its dotted line position of FIG. 2 for limiting upward movement of the blade 25 and determining the end of its return stroke. The rapid advance switch 52 is similarly provided with a pivotal arm 72 and a roller 73 which is adapted to be moved to its dotted line position of FIG. 2 upon engagement by the elongated cam 56, and to move to its full line position upon being released by the cam 56 during a down or power stroke of the blade 25. During that portion of a power stroke in which the switch 52 is held in an actuated position by the cam 56, the blade 25 is moved at a rapid rate and, upon that switch being released by the cam 56 the drive means respond by moving the blade at a reduced speed.

The bottom or down limit switch 50 and the slow-down switch 53 are provided with a common actuating lever means indicated generally at 75 and having an arm 76 for engagement by cams or tripers 80a, 80b, 80c and 80d. The lever means 75 is pivoted at 81 and has an arm 82 against which a roller 84 of the down limit switch 50 bears. Rotation of the lever means 75 about the pivot 81 upon engagement by one of the tripers 80a, 80b, 80c, 80d will cause the arm 82 to depress the roller 84 and actuate the switch 50 thereby limit or stop the downward movement of the blade 25.

The lever arm 82 is provided with an adjusting screw 99 which is adapted to depress the plunger 91 of the slow-down switch 53 upon movement by a trigger 80. The screw 99 is so adjusted that the slow-down switch 53 will be actuated a split second before the down limit switch 50 is actuated, thereby slowing down the movement of the blade 25 so that the stopping thereof can be effected from a slow speed.

The tripers 80a, 80b, 80c and 80d form part of a rotative assembly indicated generally at 100 and are adapted to be selectively brought into position for engaging the lever arm 76 for tripping or actuating, in sequence, the slow down switch 53 and the down limit switch 50. The assembly 100 includes a pair of disc-like end members 102 and 103, and four elongated blades or scales 104a, 104b, 104c and 104d. The blades or scales 104a, 104b, 104c and 104d are disposed with their lengths in a parallel relationship with one another and each are arranged at their respective ends by respective end members 102 and 103. The scales 104a, 104b, 104c and 104d are equally spaced and positioned so that the tripers 80a, 80b, 80c and 80d, respectively mounted thereon, extend outwardly and are spaced substantially 90° to the housing 14.

A central shaft 106 extends through the tripper assembly 106 and is secured to the end members 102, 103 thereof. The shaft 106 extends parallel to the stroke or direction of movement of the blade 25 and is journaled for rotation in a bracket 107 which is secured to the blade 25 by screws 108. A selecting and indexing means indicated generally at 110 comprises a handle 111 which is adapted through gearing described hereinabove to rotate the shaft 106 and the tripper assembly 106 secured thereto into four rotative positions for selecting which of the tripers 80a, 80b, 80c and 80d will be positioned for engagement with the lever arm 76.

As is best illustrated in FIG. 6, the tripper assembly mounting bracket 107 is provided at the lower end thereof with a gear housing 112 and a cover plate 113. The handle 111 is supported by suitable bearing or bushing means for rotation with respect to the gear housing 112 and the cover plate 114 which is secured to the face of the blade 25 by screws 115. A shaft 117 is connected to the selecting handle 111 for rotation thereby and extends through an opening 118 in the blade 25 and is supported for rotation by bearing means 119 in the bracket 107.

A bevel gear 120 is secured to the shaft 117 for rotation therewith inside the housing 112, and is in driving engagement with a bevel gear 121 which is secured to the end of the shaft 106 extending into the housing 112. The gear 120 is larger than the gear 121 will be recognized that rotation of the handle 111, and the shaft 117 therewith, through a small angle rotation of the shaft 106 and the tripper assembly 106 through a greater angle. The difference in size of the gears 120, 121 is conveniently such that a full revolution of the tripper assembly 106 requires but a half revolution or less of the selector handle 111.

The plate 114 is provided with a bore 125 extending radially with respect to the shaft 117, and a spring biased detent or plunger 126 is reciprocally mounted therein. The detent 126 is adapted to resiliently engage in a plurality of depressions or indentations 127 formed in the periphery of a rounded portion 128 of the selector handle 111. The detent 126 acts to yield movement of the selector handle 111 out of four operative positions corresponding to four positions of the tripper assembly 100 for selectively presenting the tripers 80a, 80b, 80c and 80d to the lever arm 76. The selector handle 111 is conveniently provided with a pointer 130 which is adapted to cooperate with indicating numerals or the like printed or inscribed on the plate 114 to denote which of the four operative positions the tripper assembly 100 is occupying.

The tripers 80a, 80b, 80c and 80d each comprises a slide member 135, which is releasably held by a clamp 136 and screw 137 for adjustable positioning thereof along the scales 104a, 104b, 104c and 104d, and a screw member 138 which is threadedly engaged in the slide member 135 for effecting fine adjustment of the actuation of the down limit switch 50.

FIG. 9 illustrates a modification 140 of the tripers 80a, 80b, 80c and 80d in which a micrometer head 141 is mounted in a slide member 142 which is releasably held by a clamp 143 and a screw 144 for adjustable positioning thereof along the scales 104a, 104b, 104c and 104d. The micrometer head 141 can be screwed in or out to achieve fine adjustment of the position of the blade 25 upon actuation of the down limit switch 50.

In setting up the press for carrying out a sequence of
four or less operations requiring a corresponding number of different stroke lengths or down positions of the blade 25, the tripers 80a, 80b, 80c and 80d (or 140) are each clamped in a position along their respective supporting scales to effect actuation of the switches 59 and 53 at the proper time to end the power stroke of the ram member or blade. By simply moving the selector lever to each of its four indicated positions the press operator can rotate the triper assembly 100 to bring each of the tripers selectively into operative position without requiring any additional expenditure of time in measuring and adjusting.

From the foregoing detailed description of a presently preferred embodiment of the invention, and from the accompanying sheets of drawings, it will be appreciated that there has been provided thereby a press having a particularly effective, rugged and simple stroke control construction, and that the invention has thereby provided an improved press which can be rapidly and accurately conditioned to perform a series of different work strokes with a minimal expenditure of time and requirement of skill on the part of the operator.

Although the invention has been described in detail and with reference to a preferred embodiment thereof, it is understood that the invention is not limited thereto but rather the invention includes all such adaptations, modifications and uses thereof as are reasonably embraced by the scope of the claims hereof.

Having described my invention, I claim:

1. In a press of the character described including a frame, a plate-like ram member mounted for reciprocating movement through power and return strokes with respect to said frame, drive means including double acting reciprocating-type pressure fluid motors connecting said frame and ram member for effecting said movement of the latter, control means for selectively controlling the rate and length of said strokes, said control means including first and second switches carried by said frame to which said drive means is responsive to sequentially reduce the rate of movement of said ram member and to end said power stroke, switch actuating means for sequentially actuating said first and second switches, said switch actuating means including tripper means carried by said ram member, a bellcrank lever pivotally mounted in said frame, said bellcrank lever comprising a first arm extending into the path of movement of said tripper means and a second arm extending adjacent to said first and second switches, said second arm being moved toward said first and second switches by engagement of said tripper means with said first arm causing pivotal movement thereof, an adjustable screw member threadedly engaging said second arm for adjustment relative thereto for actuating one of said switches prior to actuation of the other of said switches by said second arm thereby predetermining the distance said ram member can move between actuation of said first switch and actuation of said second switch.

2. A device as defined in claim 1 and wherein said tripper means comprises a plurality of tripers, and means for bringing said tripers selectively into operating position for engaging said lever means.

3. A device as defined in claim 2 and wherein said tripers comprise elements each being slidable along a scale for adjustment, and said tripers comprise micrometer screw means for fine adjustment.

References Cited in the file of this patent

UNITED STATES PATENTS

1,503,165 Lautenschlager ------------ July 29, 1924
1,997,798 Kucer ------------ April 16, 1935
2,483,712 Schaefer ------------- Oct. 4, 1949
2,765,626 Ashley -------------- Oct. 9, 1956

FOREIGN PATENTS

590,981 Great Britain ---------- July 31, 1947
288,537 Switzerland ------------ Jan. 31, 1933