

July 31, 1962

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3,046,874

PRESS BRAKE

Filed March 21, 1960

4 Sheets-Sheet 1

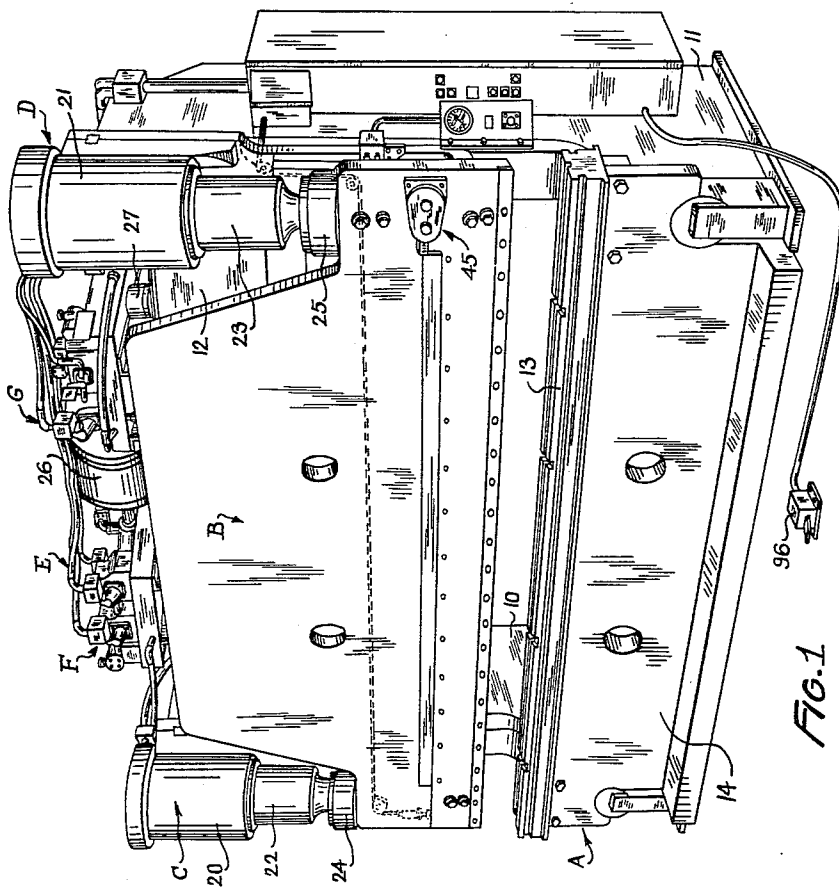


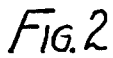
FIG. 1

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4 Sheets-Sheet 4

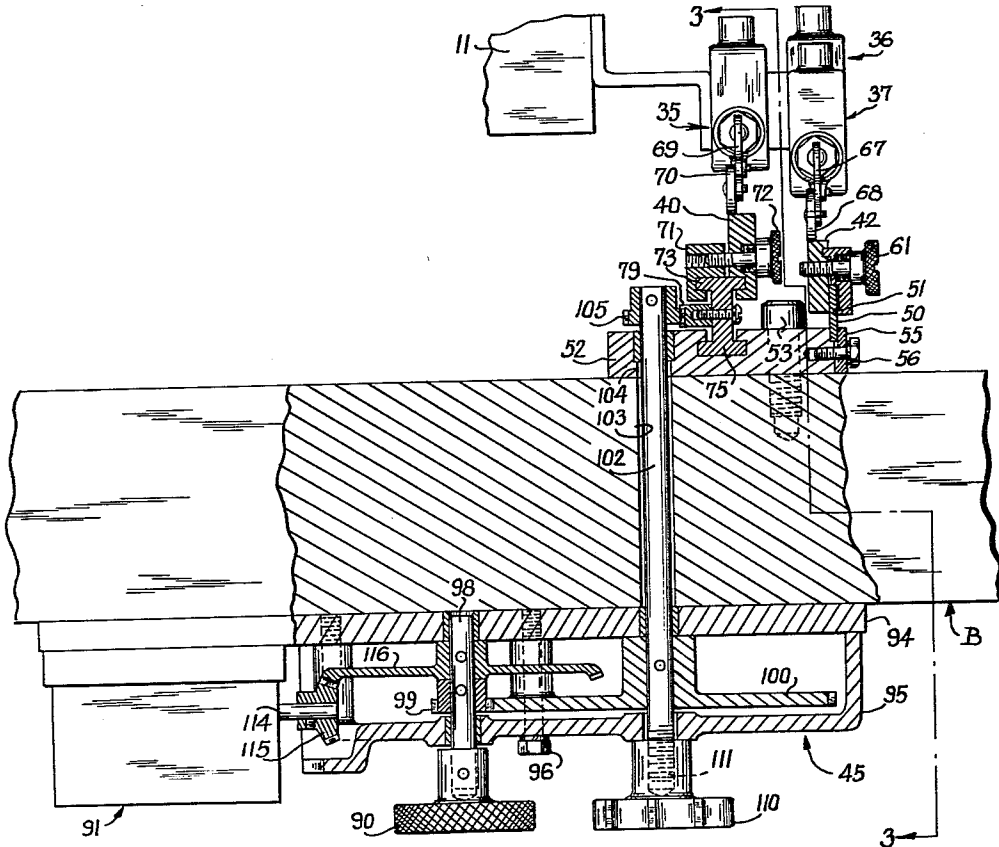


FIG. 4

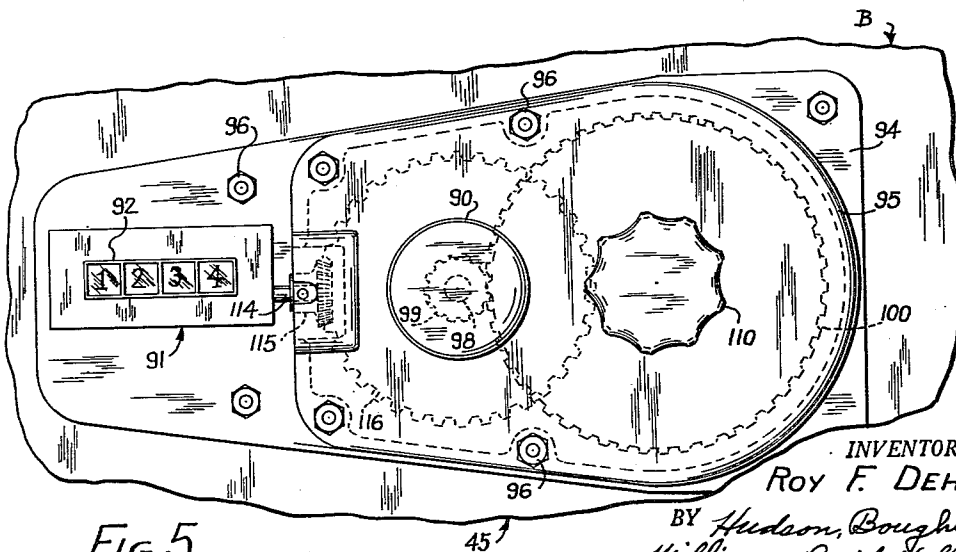


FIG. 5

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PRESS BRAKE

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This invention relates to press brakes, platen presses, or like devices having a movable work performing member actuated by a drive motor through power and return strokes, and having predetermined characteristics of rate and extent of movement of the movable member.

One of the principal objects of the present invention is the provision of a novel and improved device such as a press or the like having a motor operated ram member for carrying tool or punch means for stamping, punching, bending or otherwise fabricating sheet material or the like, and which device includes ram motor control means for changing the rate of movement of the ram member to a faster or slower speed during a predetermined portion of the power stroke and for stopping or limiting the movement of the ram member at the bottom or end of the power stroke.

A more specific object of the present invention is the provision of a new and improved press or metal working device having a reciprocable ram member operated by a reversible motor means such as a fluid pressure motor which is responsive to control means including first, second and third switch means for respectively determining the end or bottom of the power stroke, the end or top of the return stroke, and for effecting a change in speed or rate of movement of the ram member during the power stroke, and switch actuating means mounted for movement with the ram member and including adjustably positioned cams at least one of which is movable by cam positioning and indicating means by which the cam can be readily and accurately set or adjusted to predetermined positions whereby the press brake can be rapidly conditioned to perform a series or sequence of different work strokes without undue loss of time between strokes for adjustment purposes.

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 a portion of the stroke control means of the press of FIG. 1 as viewed from the right;

FIG. 3 is a side view, partly in section, of a portion of the stroke control means taken substantially along line 3—3 of FIG. 4;

FIG. 4 is a sectional view of the stroke control means taken along lines 4—4 of FIGS. 2 and 3, and

FIG. 5 is a front elevation of the adjusting and indicating portion of the stroke control means.

The present invention is considered especially applicable to bending presses or brakes and is herein shown as embodied in such a press. It is, however, to be understood that the invention is applicable to various types of presses and other machines 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 reference character A designates a frame comprising stress-resisting, plate-like end members or side housings 10, 11 having aligned openings in their front edges; a combination reservoir and a

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sump 12 interposed between and supported by the upper ends of the side housings 10, 11; and a table or die support 13 supported and fixedly secured to the top of a heavy plate or stationary blade 14 extending between and fixedly secured to the side housings 10, 11.

A movable ram or upper blade, designated generally by the reference character B, located directly above the table or die support 13, is slidably supported by the side housings for linear movement toward and away from the table or die support. The lower edge of the ram B is adapted to carry a suitable punch or other tool.

The ram or movable blade B is adapted to be reciprocated toward and away from the table or die support 13 by reciprocating type double acting fluid pressure motors designated generally by reference characters C, D. The cylinders 20, 21 of the motors C and D, respectively, are connected to the side housings 10, 11 respectively, of the press frame and the piston rods 22, 23 of the motors are connected by ball and socket connections or joints 24, 25 to the blade B adjacent to opposite ends thereof. The principal pressure fluid, preferably oil, for operating the hydraulic motors C, D is supplied by two constant volume unidirectional main pumps E, F driven by an electric motor 26. The pumps E, F supply pressure fluid to the hydraulic motors C, D respectively. An auxiliary or third constant volume unidirectional pump G driven by an electric motor 27, in conjunction with an electronic control, supplies pressure fluid to the hydraulic motors C, D for maintaining a predetermined blade or ram attitude. The pumps and motors supported upon the top of the reservoir 12 which is in the form of an elongated rectangular oil tank or sump extending between and connected to opposite end housing members 10, 11.

The hydraulic and electrical circuits for controlling the reciprocation of the blade B through its power and return strokes may be substantially the same as are described in United States Patent No. 2,958,199, issued November 1, 1960, and assigned to the same assignee to which this application is assigned.

The circuits described in the mentioned copending application include switch means to which the ram drive means are responsive to end or limit the down or power stroke; to end or limit the up or return stroke; and to effect a change in speed or rate of movement of the ram or blade member. In the press described hereinafter as embodying the present invention, switch means corresponding to the just mentioned switch means are referred to as a down limit switch 35; an up limit switch 36; and a rapid advance switch 37; as are best illustrated in FIGS. 2, 3 and 4 hereof.

The down limit switch 35 is mounted or fixed by suitable bracket means to one side housing 11 of the press frame and is adapted to be actuated by an adjustably positioned cam 40 which is mounted for movement with the ram or blade B.

The up limit switch 36 and the rapid advance switch 37 are also mounted by suitable bracket means to the side housing 11 and are adapted to be actuated by adjustably positioned cams 41 and 42 respectively which are mounted for movement with the ram or blade B.

Adjusting and indicating means, generally indicated at 45, are provided for accurately positioning the down limit switch actuating cam 40 with respect to the blade B for predetermining or controlling the down or bottom position of the blade B with respect to the die means 13 when the blade is at the bottom or extreme down position thereof at the end of a power or working stroke. The adjusting and indicating means 45 will be described in more detail hereinafter. Suffice it to say for the present that it permits the rapid and accurate changing of the stroke length characteristics between strokes or series of strokes

without the expenditure of undue amounts of time therebetween.

The up limit switch actuating cam 41 and the rapid advance switch actuating cam 42 are mounted on an elongated scale 50 having a groove 51 on one side thereof and having graduation markings inscribed or printed thereon. The scale 50 is clamped to one edge of a mounting block 52 which is suitably secured to the blade B as by screws 53. The clamping of the scale to the block 52 is effected by clamp elements 55 and screws 56.

The cams 41 and 42 are adjustably secured to the scale 50 by clamp members 58 and 59 respectively, and thumb screws 60, 61 extending through the clamp members into the cams. The thumb screws 60, 61 can be loosened to permit the cams 41, 42 to slide along the scale 50 for adjustment of the upper limit of the return stroke and adjustment of the point of change of the rate of movement of the ram member.

The up limit switch 36 is provided with a pivoted arm member 65 having a roller 66 which is adapted to be engaged and moved by the surface of the cam 41 for actuation of the switch. The rapid advance switch 37 is similarly provided with a pivoted arm member 67 having a roller 68 which is adapted to be engaged and moved by the surface of the cam 42 for actuation of that switch.

The ram member or blade B is illustrated in FIG. 2 in its up position and, when a power stroke is commenced, as by an operator depressing the foot switch 96, the actuating roller 66 of the switch 36 will be released by the cam 41 for movement to its dotted line position. As the blade B returns to its FIG. 2 position, after having made a power stroke as will be described hereafter, the cam 41 actuates the switch 36 stopping upward movement of the blade.

The rate of movement or speed of the blade B during the power and return strokes is under the control of the rapid advance switch 37, and when the elongated cam 42 releases the roller 68 for movement to its dotted line position, the drive means will respond by changing the rate of movement of the blade B to a slower speed. The blade B can be advantageously controlled by the elongated cam 42 to be moved at a rapid rate through the major portion of the power stroke, and to be slowed to a relatively reduced speed during the terminal portion of the power stroke, whereby the down or bottom position of the blade at the end of the power stroke can be more accurately controlled because the blade is then stopped from the slower speed and has less tendency to coast or drift.

During a return stroke of the blade B, the roller 68 of the rapid advance switch 37 will be engaged by the cam 42 and is thereby returned to readiness for operation during the next power stroke and, when the blade reaches its uppermost position, the roller 66 of the up limit switch 36 is moved by the cam 41 to its full line position to thereby determine the end of the return stroke.

The down limit switch 35 is provided with a pivoted arm 69 having a roller 70 which is adapted to be engaged and moved by the surface of the cam 40 for actuation of that switch.

The down limit switch actuating cam 40 is adjustably clamped by means of a clamp member 71 and a thumb screw 72 to an elongated slide member 73.

The latter, slide member 73, extends in a direction parallel to the direction of travel or stroke of the ram member or blade B, and is slidably mounted with respect thereto by means of the mounting block 52.

The slide member 73 is conveniently provided with flanges 75 and 76 connected by a web portion 77, with the flange 75 slidably received in a complementary T-shaped groove in the block 52. An elongated gear rack 79 is provided on one side of the web portion 77 and serves as part of the adjusting and indicating means 45.

The adjusting and indicating means 45 includes a rotatable control knob 90 which is adapted, through gearing more particularly described hereafter, to move the slide

member 73 in the supporting block 52 so as to position the cam 40 and thereby adjust the down position of the blade B at the end of its power stroke. A rotation indicator or counter denoted generally at 91 is coupled to the knob 90 by suitable gearing and is preferably of the type which displays numbers in a window as at 92. The counter 91 is conveniently geared so that the numbers displayed thereby are related to movement of the slide member, and hence the blade down position, in terms of hundredths of an inch.

The adjusting and indicating means 45 includes a housing comprising a base 94 and a cover 95 both secured to the face of the blade B as by screws 96. The knob 90 is secured to a shaft 98 which is supported for rotation in suitable bushings or bearings in the base 94 and cover 95 of the housing. A pinion 99 is secured to the shaft 98 for rotation therewith and is in meshing and driving relation with a larger gear 100.

A shaft 102 is connected to the gear 100 and extends through aligned openings 103 and 104 in the blade B and in the block 52 respectively. The shaft 102 is supported for rotation by suitable bearings in the block 52 and the base member 94, and has connected thereto a pinion 105. The pinion 105 is in meshing engagement with the teeth of the rack 79 and it will be recognized that rotation of the knob 90 will result in reduced rotation of the pinion 105, and consequent movement of the slide member 73 in the block 52.

In order to prevent inadvertent movement of the slide 73 and its associated cam 40, a locking knob 110 is provided. The knob 110 is threadedly engaged on a threaded end 111 of the shaft 102 which extends outwardly of the cover 95. Rotation of the knob 110 in a sense to advance it along the threaded portion 111 of the shaft 102 will draw the shaft and the gear 100 toward the knob 110 until the gear 100 is tightly clamped against the cover 95 thereby preventing rotation of the gear 100 and the shaft 102.

The counter 91 has an input shaft 114 which carries a gear 115. A gear 116 is secured to the shaft 98 for rotation therewith and is in driving relation to the gear 115. The counter 91 is thereby coupled to the knob 90 and is adapted to display or indicate the position of the cam 40.

In setting up the press, the ram member or blade B is run to its uppermost position with respect to the table 14. The locking knob 110 is rotated in a manner to release the gear 100 and the shaft 102 for rotation, and the adjusting knob 90 is rotated in a direction to bring the figures of the indicator 91 to a zero position. In doing so the slide member 73 will be brought to its full line position as shown in FIG. 3. The cam 40 is then adjusted along the flange 76 of the slide member 73 to a position which just trips or actuates the down limit switch 35.

The knob 90 is then rotated in a direction to raise the slide member 73, and the cam 40 carried thereby, to a position where the figures of the indicator 91 indicate the required stroke length to effect the desired bend. At this position, which is represented in dot-dash lines in FIG. 3, the shaft 102 is locked through the agency of the knob 110 thereby securing the cam 40 in its desired position. The reading of the indicator means 91 may then be recorded and it will be recognized that thereafter the cam 40 can be shifted to a subsequent position and then returned to its present position by simply rotating the knob 90 until the recorded number again appears on the indicating means 91.

A series of positions of the cam 40 can be recorded in terms of the figures displayed on the indicating means 91 so that a series of strokes for effecting different bends can be carried out on the press with a minimum of time being expended between such strokes for adjusting the position of the down limit switch actuating cam 40.

The rapid advance switch 37 has been described as effecting an increase in ram speed when actuated by the

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cam 42 and as effecting a decrease in speed when released. It will be apparent that in some work applications of the press the relationship could be reversed so that a decrease in speed would be effected upon actuation of the switch 37. It will also be apparent that although the invention has been described with reference to a press having hydraulic cylinder type motors for moving the ram member, the invention may as well be embodied in presses having ram members driven by electric motors or other means.

From the foregoing detailed description of a specific embodiment of the invention, and from the accompanying sheets of drawings, it will be appreciated that there has been provided by the invention an improved press structure including means for rapidly and accurately changing the effective length of the power or work stroke of the press by adjusting the position of the down limit switch actuating cam. It will also be appreciated that the means for carrying out the adjustment of that cam is embodied in a mechanism which is simple and economical in construction and yet is rugged and well able to withstand repeated shocks during use of the press without impairment of accuracy.

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

Having described my invention, I claim:

1. A device of the character described comprising a frame; a ram member mounted for reciprocating movement through power and return strokes with respect to said frame; drive means for effecting said movement of said ram, and control means for selectively controlling the length of said power stroke including a power stroke limit switch, a slide member mounted on one side of said ram for vertical movement therewith and for sliding movement relative thereto, a cam member for operating said switch, means adjustably mounting said cam member on said slide member, a gear rack on said slide member, a

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shaft extending from a second side of said ram through said ram to said one side thereof on which said slide member is mounted, a pinion mounted on said shaft and meshing with said rack on said slide member, gear means mounted on the end of said shaft adjacent said second side of said ram, means for rotating said gear means and shaft so as to move said slide member for adjustably positioning said cam, and means for locking said shaft to said ram against rotation relative thereto.

2. A device of the character defined in claim 1 wherein said locking means includes a housing member secured to said second side of said ram and means for clamping said gear means against said housing member.

3. A device as defined in claim 1 further including indicator means and means connecting said indicator means to said gear means to cause said indicator means to indicate the position of said cam.

4. A device of the character described in claim 1 further including another switch for effecting a change of speed of said ram member during said power stroke, another cam member mounted for movement with said ram member to actuate said other switch for effecting a change of speed of said ram member during a portion of said power stroke, and means for adjustably positioning said other cam element with respect to said ram member to cause said cam element to actuate said other switch during a selected portion of said power stroke.

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