Dec. 23, 1969 C. O. JONES, JR 3,485,071

MULTIPLE STROKE DEPTH SELECTOR FOR HYDRAULIC PRESS BRAKES

Filed March 9, 1967 2 Sheets-Sheet 1

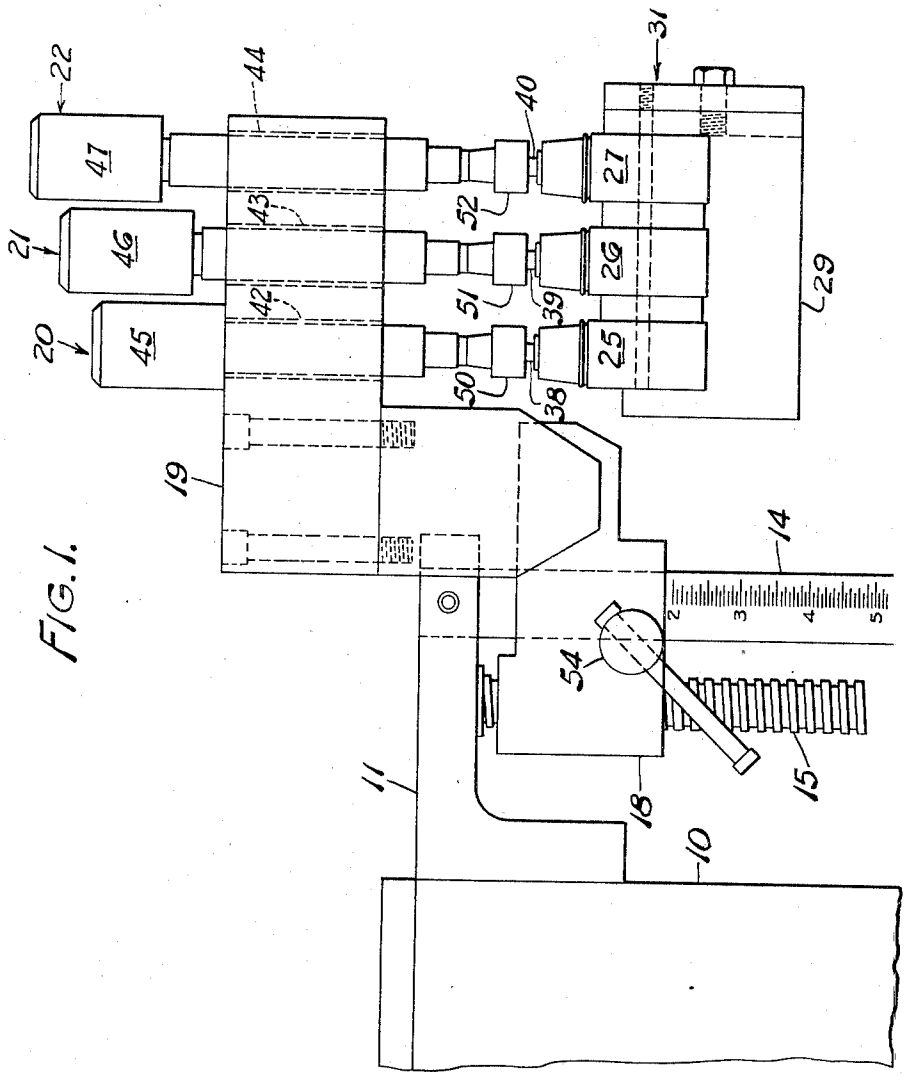


FIG. 1.

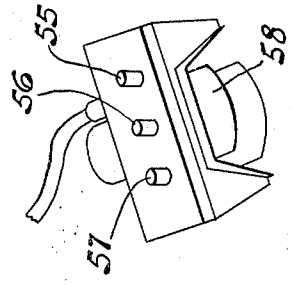


FIG. 4.

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FIG. 2.

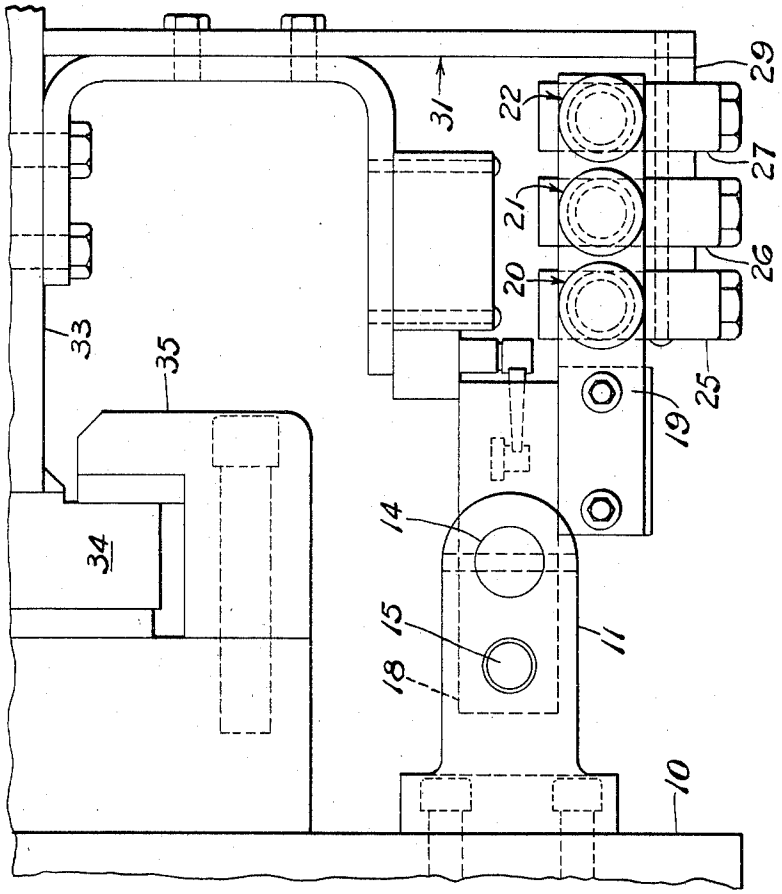
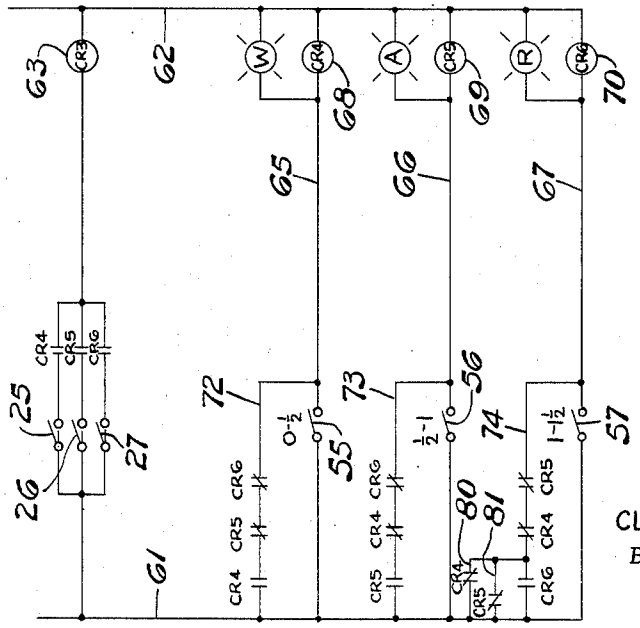


FIG. 3.



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MULTIPLE STROKE DEPTH SELECTOR FOR HYDRAULIC PRESS BRAKES

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U.S. Cl. 72—26 3 Claims

ABSTRACT OF THE DISCLOSURE

A circuit arrangement controlling hydraulic press brakes so that an operator may manually select a stroke depth by actuating any one of a number of manual switches which correspond to various adjusted stroke depths of the ram of the press brake. A series of limit switch operators are set for various depths and each is arranged to engage a limit switch at a predetermined stroke depth to actuate the same and then rest thereon as the ram continues downwardly. Only the limit switch which is conditioned by previous manual actuation of its associated manual switch is operative to terminate the stroke of the ram at the selected stroke depth.

BACKGROUND OF THE INVENTION

This invention relates to a multiple depth stop device for hydraulic press brakes and like machines wherein the machine may be set up to perform working strokes of several different depths and wherein the operator may select any of the stroke depths thus provided for and perform one or any number of operations at the stroke depth thus selected.

Sheet metal bending operations performed on a press brake often involve the employment of various stroke depths to perform a series of operations on a single workpiece. Strokes of various depths may be effected purely by manual control of the machine by the operator but reliance upon such control is very rough and inaccurate and is quite unsatisfactory. A second method is to set the press brake for a given stroke depth, perform the bending operations at such depth on a number of work pieces, alter the depth setting, then perform a second bending operation on the series of workpieces, and so on. The repeated handling of the workpieces which this involves is obvious.

Means have been proposed wherein a press brake is so arranged that it automatically performs a sequence of strokes of varying depths; that is, a stroke of one depth, a second stroke at another depth, a third stroke at still another depth, and then an automatic repetition of this three stroke cycle. This arrangement requires a fairly complex mechanical or electrical setup and is not fully satisfactory for the reason that it is often desired to repeat successive strokes at one of the depths for which the press brake is set, or to vary the sequence in some other respect, whereas this automatic sequence arrangement is not readily applicable to such repetition and is usable only where it is possible to adhere strictly to the pre-set sequence of successive working strokes.

SUMMARY OF THE INVENTION

The present invention provides a simple electrical and mechanical arrangement whereby the press brake stroke depth control may be set for strokes at several different depths, for instance, three separate depths. The operator is provided with three manual or foot-operated depth selector elements such as control buttons, in addition to the usual manual button or treadle for initiating a working stroke. The operator may then press a depth selector button corresponding to any of the available depth settings and then perform one or any number of working strokes at such selected stroke depth by actuation of the usual manual button or treadle.

When a different depth stroke is required the operator merely presses another depth selector button and then again proceeds to perform one or any number of strokes at such second selected depth. The versatility of control thus afforded is believed to be obvious and the practical advantages are also believed to be clear.

The invention has as a further object the provision of means for attaining the foregoing multiple depth selector control in a simple and economical fashion and in such a way that adjustment of the apparatus to various stroke depths may be accomplished readily, securely and with great accuracy. Other objects and advantages will be apparent from a consideration of the following specification and the accompanying drawings which disclose a representative embodiment of the principles of the invention. Various modifications which may be made within the scope of the present invention will be apparent to those skilled in the art.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a fragmentary side elevational view of the rear portion of the ram of a conventional hydraulic press brake provided with one form of the stroke depth control arrangement of the present invention;

FIG. 2 is a top plan view of the structure illustrated in FIG. 1;

FIG. 3 is a wiring diagram of a portion of the press brake control circuitry showing the cooperation of the present depth control arrangement therewith; and

FIG. 4 is a detailed perspective view of a foot control device for use in the control system of FIGS. 1 through 3.

DESCRIPTION OF THE PREFERRED EMBODIMENT

In FIGS. 1 and 2 the reference numeral **10** designates the ram member of a hydraulic press brake which, apart from the control arrangement disclosed herein, may be of conventional design such as shown, for instance, in United States Letters Patent No. 3,165,140 dated Jan. 12, 1965. Fixed to the rear wall of ram **10** is a bearing bracket **11** and a graduated scale rod **14** and a lead screw **15** are fixed at their upper ends to bracket **11** as clearly shown in FIG. 1. A bracket (not shown) similar to bracket **11** is provided at a lower portion of ram **10** in vertical alignment with bracket **11** for securing the lower ends of scale rod **14** and lead screw **15**.

A vertically adjustable bracket **18** is bored and threaded to engage scale rod **14** and lead screw **15** and a support member **19** for a series of switch operating members is fixed to and carried by bracket **18** for vertical adjustment therewith, the switch operating members being designated generally by the reference numerals **20**, **21** and **22** in FIGS. 1 and 2. A series of micro-switches, in the present instance normally open, are designated **25**, **26** and **27** and are disposed beneath and in vertical alignment with the operating members **20**, **21** and **22**, respectively. Micro-switches **25**, **26** and **27** are mounted upon a block **9** which is attached to a stationary portion of the hydraulic press brake framework as by means of bracket structure generally designated **31** in the drawings.

In FIG. 2 the numeral **33** designates one of the usual stationary side frame members of the press brake which includes a ram guide member **34** upon which the adjacent end of the ram **10** is slidably mounted by means of a gib structure **35**.

The normally open micro-switches **25**, **26** and **27** have operating buttons designated **38**, **39** and **40** respectively and the operating members comprise gravity-biased means for actuating these operating buttons in a man-

ner which will now be described. The operating members 20, 21 and 22 have medial shaft portions 42, 43 and 44, respectively, which slide freely vertically in support member 19, and the upper ends of the operating members comprise enlarged weight members 45, 46 and 47 which also serve as stops to limit the downward sliding movement of the several operating members.

The lower ends of the shaft portions 42, 43 and 44 are fitted with micrometer heads designated 50, 51 and 52, respecively, the lower ends of which comprise rotatable thimble portions for adjusting the effective lengths of the micrometer heads and which engage the micro-switch operating buttons 38, 39 and 40. Such micrometer heads are available commercially and those illustrated in the drawing are Lufkin micrometer heads. In the present instance each such head has a micrometer adjustment range of one half inch and the shaft portions 42, 43 and 44 vary in length by successive increments of one half inch, thus giving a total micrometer range of one and one half inches.

Since the usual hydraulic press brake has a working stroke of much greater magnitude, the major portion of the depth settings is effected by adjustment of bracket 18 to a desired setting with respect to scale rod 14 by rotation of lead screw 15, the desired setting of bracket 18 being secured by a manually operated clamp screw 54. An interchangeable supply of additional operating members 20, 21 and 22 may be provided so that, for instance, two such members having shaft portions of equal lengths may be employed when two depth settings within the same half inch range are desired.

The several stroke depth settings thus made available are selectable by the operator at will and in any desired sequence, including repetitive operations at one depth setting where such is desired. FIG. 4 shows a foot controlled apparatus by the use of which an operator selects a particular stroke depth from among the several depths which the present arrangement makes available and then "steps off" the press to perform an operating stroke in the usual manner. For this purpose three selector switch buttons 55, 56 and 57 are provided and the numeral 58 designates the usual foot treadle for initiating a hydraulic press brake cycle, which, apart from the depth control provisions provided herein, is executed in the usual manner.

Referring now to the wiring diagram, FIG. 3, the three selector switches 55, 56 and 57 are normally open and are connected in parallel with each other by means of conductors 65, 66 and 67, respectively, which extend across the main control circuit. The conductors 61 and 62 of FIG. 3 are the usual supply conductors of the control circuitry of a conventional hydraulic press brake. In such control circuitry there is conventionally provided a bottom stroke limit switch which is actuated when the ram reaches a pre-determined lower-most point to render the control circuit operative to terminate downward movement of the ram. In FIG. 3 a relay winding 63 energizes contacts which are employed in place of the conventional bottom stroke limit switch of the press brake by downward movement of the ram in a manner in which will be presently described. These contacts, when closed, function in the same way as the conventional bottom stroke limit switch to terminate downward movement of the ram.

The three normally open micro-switches 25, 26 and 27 which were previously described in connection with FIG. 1 are connected in parallel with each other and each is in series with the bottom stroke limit switch actuating winding 63 as clearly shown in FIG. 3. The conductors 65, 66 and 67 contain relay windings designated respectively 68, 69 and 70. For clarity these relay windings are designated, respectively, CR4, CR5 and CR6 as clearly shown in FIG. 3.

The several normally-open and normally-closed contacts which are under the control of relay windings CR4, CR5 and CR6 are respectively designated by corresponding symbols, that is, CR4, CR5 and CR6. Certain of these relay-operated contacts are located in conductors 72, 73 and 74 which are in parallel with the depth selector switches 55, 56 and 57, as shown in FIG. 3, and form holding circuits for the relay windings 68, 69 and 70 when the depth selector switches are momentarily energized. Normally open contacts which are respectively under the control of the CR4, CR5 and CR6 relays are also provided in series with the several stroke depth limiting micro-switches 25, 26 and 27.

The depth selector switch 55 covers a range from the full stroke depth of the ram to a point one-half inch above that depth; the switch 56 covers a depth from one-half inch to one inch above the full stroke depth of the ram; and the switch 57 covers a stroke depth from one inch to one and one-half inches above the full stroke depth.

The description of one stroke of the press by use of selector switch 57 will now be described, being understood that a substantially similar operation is effected when either of the other two selector switches 55 or 56 are employed. The operator will first momentarily depress the operating button for switch 57 by means of the foot treadle apparatus shown in FIG. 4 which momentarily closes the switch 57 shown in conductor 67 of FIG. 3, thus selecting the shallowest available stroke depth. This energization of the corresponding CR6 relay winding, designated 70 in FIG. 3, opens the normally closed CR6 contacts of the conductors 72 and 73 and closes the normally open CR6 contacts of conductor 74. This latter establishes a holding circuit for relay winding 70 and the operator may at any time depress treadle 58 whereupon the down-stroke operation proceeds until the lower end of micrometer head 52 of operating member 22 engages operating button 40 of microswitch 27 and closes the latter.

Since the CR6 contacts in series with switch 27 were closed upon energization of the CR6 winding 70, the closing of switch 27 by operating member 22 closes a circuit through CR3 winding 63 which closes the normal or conventional bottom stroke limit switch of the press brake to arrest downward movement of the ram 10 at this point.

It will be noted that the holding circuit 74 will remain closed for as many successive working strokes as may be desired until either the power of the control circuitry is cut off or one of the other selector switches 55 or 56 is actuated. In the latter case, if switch 56 is closed, winding CR5, designated 69 in FIG. 3, is energized and the normally closed CR5 contacts of holding circuit conductor 74 will open and thus the holding circuit of the CR6 winding will be deenergized at the same time that the holding circuit 73 for the CR5 winding 69 is established.

The foregoing is a normal operation and is equally applicable whichever of the three selectors 55, 56 or 57 is depressed by the operator prior to actuating the main press operating circuit by depression of treadle 58.

It will be noted in FIG. 3 that parallel conductors 80 and 81 extend about the normally open CR6 contacts of holding circuit conductor 74 and the conductors 80 and 81 contain, respectively, normally closed CR4 and CR5 contacts. This arrangement is provided to prevent malfunction when the power of the system has been turned off and subsequently turned on again, at which time all three of the conductors 65, 66 and 67 would be open, or when an operator initiates a cycle of operation through depression of treadle 58 without making a depth selection. Under any of the foregoing conditions the press brake ram will stop at the first setting, as if the selector switch 57 had been actuated. Current will flow through either conductor 80 or 81 and holding circuit 74 to energize the CR6 winding 70, even though switch 57 has not been operated. Of course if either of the switches 55 or 56 has been operated the corresponding normally closed contacts CR4 or CR5 of conductor 74 will be open and this precautionary operation by way of conductor 80 and 81 will not take place.

What is claimed is:

1. In a press brake having a reciprocable ram, selective stroke depth control means for said ram comprising a main control circuit and manual means for establishing said main control circuit to initiate a working stroke of said ram, electrical means for terminating said working stroke, a plurality of switches each independently operable to activate said electrical means, a mechanical limit device for each of said switches, each such device being independently adjustable to operate one of said plurality of switches at a pre-determined stroke depth, and a series of manual selector devices each operable to condition a selected one of said plurality of switches for activation when operated by its associated limit device, and means whereby manual operation of one of said selector devices to condition one of said switches is operable to deactivate any other previously conditioned switch.

2. Apparatus according to claim 1 wherein each of said plurality of switches has an operating circuit for energizing said stroke terminating electrical means and said

manual selector devices comprise circuit means including each circuit means being operative upon actuation of its operating circuit of the corresponding one of said plurality of electrical means activating switches.

3. Apparatus according to claim 2 wherein each selector switch circuit means includes a holding circuit for holding the associated electrical means operating circuit effective until another selector switch is operated or said main control circuit is deenergized.

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RONALD D. GREFE, Primary Examiner

U.S. Cl. X.R.

72—30