Feb. 25, 1969 E. AKE L. ERIKSSON 3,429,156

DEVICES FOR BOTTOM STROKE STOP IN HYDRAULIC EDGE PRESSES

Filed June 6, 1966 Sheet 1 of 3

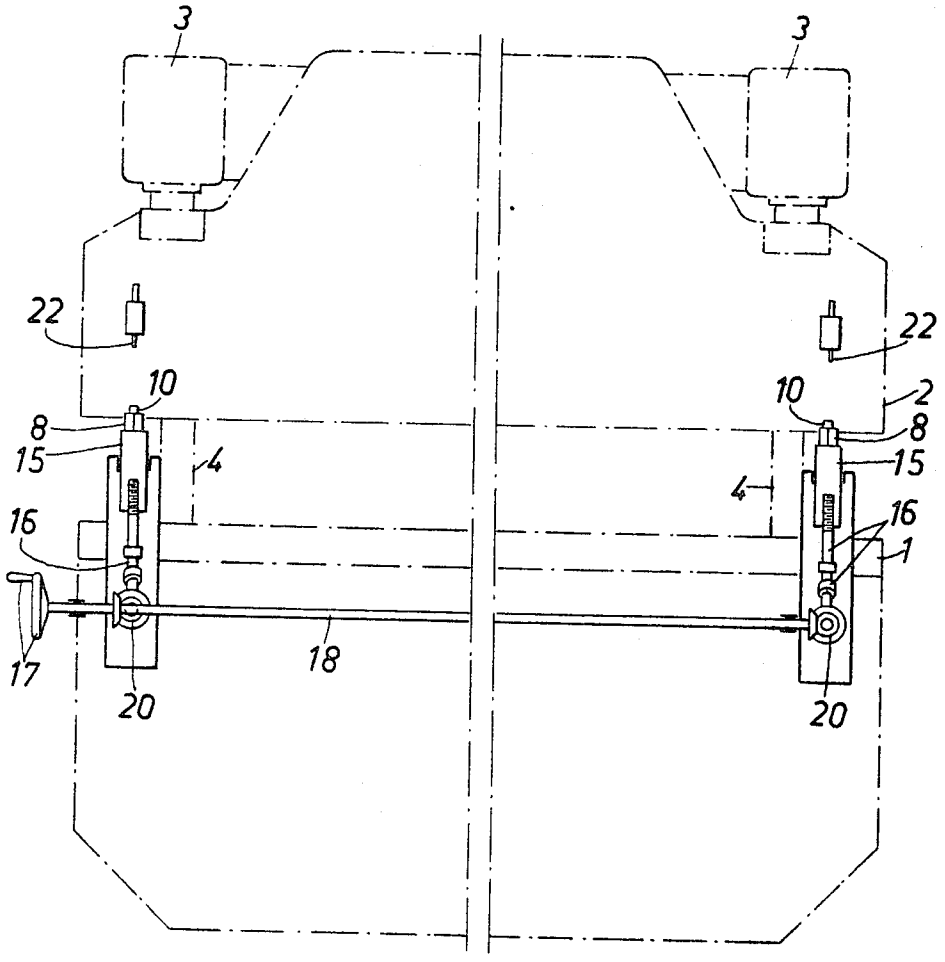

Fig. 1

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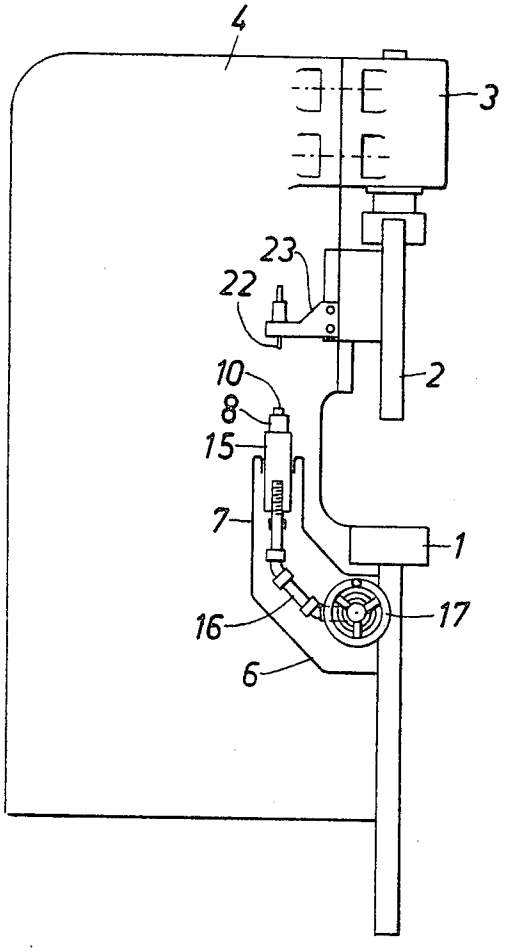

Fig. 2

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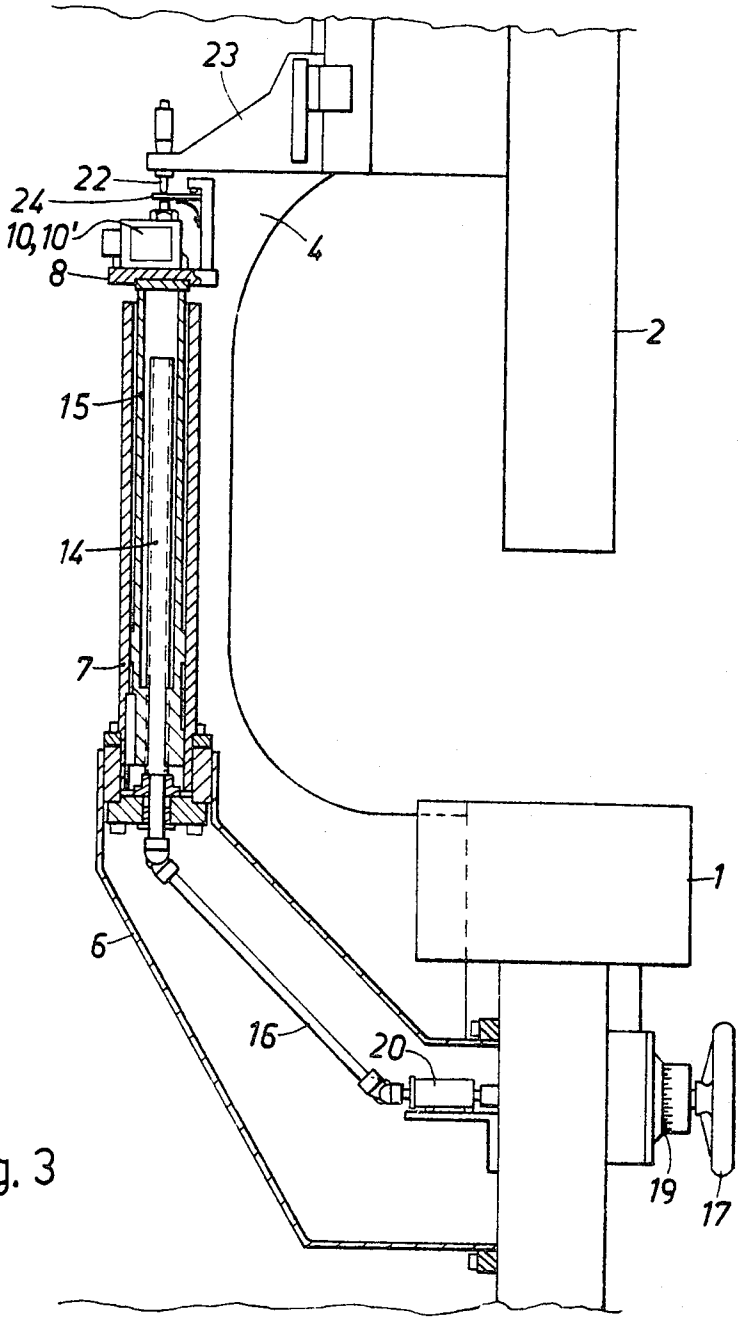

Fig. 3

United States Patent Office 3,429,156
Patented Feb. 25, 1969

3,429,156

DEVICES FOR BOTTOM STROKE STOP IN HYDRAULIC EDGE PRESSES

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Filed June 6, 1966, Ser. No. 555,585
Claims priority, application Sweden, June 10, 1965, 7,668/65
U.S. Cl. 72—26 5 Claims
Int. Cl. B21j 7/26, 9/20, 7/46

ABSTRACT OF THE DISCLOSURE

A bottom stroke stop device for use in hydraulic edge presses or press brakes including a pair of limit switches supported from the bed of a press at opposed ends respectively of the press ram in a selectively adjustable manner, said switches being respectively engageable by respective abutment means at the opposed ends of said press ram, said switches being each operatively coupled to the actuating valves of the respective hydraulic cylinder means for control of such valves to selectively control the location of the lowermost end of the ram stroke and maintain the ram in the desired alignment relative to the press bed.

The present invention relates to a bottom stroke stop device in hydraulic edge presses or press brakes with two hydraulic cylinders for the movement of the press ram to and from the press bed, said cylinders being connected to each end of said ram.

In edge presses of this kind hitherto used, it is a well-recognized difficulty that the deflection of the press frame has a detrimental effect on the accuracy of the bottom stroke stop position and on the parallelism between the ram and the bed. For practical and design reasons, namely, the device utilized in the various structures for determination of the stroke stop mostly is mounted in the upper part of the press adjacent the ram and the hydraulic cylinders thereof and is secured to the frame, unfortunately at a point thereon where the deflection becomes highly observable. For symmetrical loads in such an edge press there will be achieved different press depths dependent on the length of the metal sheet to be treated and on the deflection varying with the non-uniform press force. In an asymmetric load there also occurs a tilting or non-parallelism of the press ram, which is caused by differences in the frame deflection. It is to be stated that the deflection of the end housings of the frame can amount to 1.0–1.5 mm. (about .040–.060 in.).

In order to eliminate as far as possible the detrimental effect of the frame deflection on articles thus resulting from a pressing or bending operation, attempts have been made to make the press frame as stiff and rigid as possible. Furthermore, by utilizing new and different press stop means, attempts have been made to further reduce the influence of the frame deflection. Thus, in one occasion there has e.g. been used a sensitive limit switch which energizes electric actuation valves of the pair of hydraulic cylinders and which is secured at one side of the press closer to the bed than in structures previously known. In operation, an abutment mounted on the press ram will act on said switch when the desired bottom position of the ram is reached. Certainly the limit switch is vertically adjustable from a place at or below the bed through a suitable transmission, but said switch is secured to the frame and therefore the deflection thereof will have quite a considerable influence upon the press

result and the desirable parallelism between the ram and the bed cannot be achieved at all.

On the contrary, another structure that gives sufficient parallelism comprises screw jacks between the press ram and the bed, said jacks being disposed at each end of the ram. These jacks involve, however, several difficulties for the work in the press, particularly for the reason that they may hinder a draw-off laterally of the pressed workpiece which occurs rather often in deeply-pressed profiles. In said stop means the deflection in the end housings of the press is certainly eliminated, but instead, there must be taken into account a non-negligible deflection of the jacks, often amounting to about 0.2 mm. (.008 in.).

The concept forming the basis of the present invention resides therein that only by relating the bottom stroke stop means as well as the parallel-keeping means to the press bed, the position of which of course is completely independent of any deflections in the frame, it is possible to obtain a really sufficient accuracy in the press work. However, only this step alone will not give the proper result, there must also be provided one set of such means at each end of the press ram.

Therefore, the main object of the present invention is to provide a bottom stroke stop device that will completely eliminate the detrimental effect of the frame deflections on the accuracy of the press work. Another object is to provide a bottom stroke stop device that secures a better parallelism of the press ram and the press bed during the last portion of the press stroke. A further object of the invention is to provide a bottom stroke stop device that will constitute no obstacle for the work in the press and that is compact, easy adjustable for various work dimensions, reliable in operation and easy and economical in manufacture and maintenance.

These and other objects that will be evident from the following detail disclosure, are obtained by a device distinguished in that two limit switches for control of the actuating valves of the hydraulic cylinders are mounted one at each end of the press ram but supported from the bed, the vertical position of the limit switches being commonly adjustable by transmission means anchored in the bed and entirely separated from the end housings of the press, and in that the press ram at each end carries an abutment corresponding to the limit switch, said pair of abutments being adapted to act on the respective limit switches in direct dependence of the vertical position of the ram ends so as to provide for an exact press depth and particularly a parallelism between the ram and the bed independent of the deflection of the end housings.

By the device according to the invention it is thus achieved a greatly improved result in the press works owing to the fact that it is possible to obtain an accuracy of fine as 0.05 mm. (.002 in.), in the parallelism of the press ram and the press bed and also in the bottom stop positioning. It is further to be noted that in the present device the press bar is forced to continue its operative stroke as long as the limit switches in *both* the bar ends are not engaged thereby.

A preferred embodiment of the invention will now be described with reference to the accompanying drawings on which FIG. 1 is a diagrammatic front elevation and FIG. 2 a side elevation of a press brake with a device according to the invention, while FIG. 3 illustrates a side elevation partly in section and to an enlarged scale, of an embodiment of the very device and its localization on the press.

With reference to the drawings, a hydraulic edge press or press brake of a type known per se comprises a press bed **1** and a ram **2** movable thereto and therefrom and operable by a pair of hydraulic cylinders **3** acting on each end of the ram **2** and supported from a press frame with end housings **4**. The hydraulic cylinders **3** are fed

each from a constant-flow pump (not illustrated) so as to provide for a parallel motion of sufficient accuracy during idling movements.

From the bed **1** at each end thereof and entirely separated from the end housings **4** there extend brackets **6, 7** with a support **8** for a limit switch **10**. The vertical positions of the respective supports **8** and their limit switches **10** are commonly adjustable at the bed **1**, and the supports are entirely separated from the end housings of the press.

In the embodiment illustrated, the transmission means as mentioned comprise an adjustment screw **14** on which moves axially a nut **15** guided in the bracket **7** and carrying in its turn the support **8** for the limit switch **10**. The screw **14** is rotated by a linked transmission shaft **16** from a gearing or pair of bevel gears **20**. Said gearings **20** disposed at each side of the press are mutually connected by an intermediary shaft **18** extending longitudinally below the bed **1**, and one of them is operable by a knob or wheel **17** located below the bed **1**. Suitably, said wheel **17** is provided with an indicia scale **19** and/or a counter (not illustrated) for counting the number of position adjustment turns.

At each end the ram **2** carries an abutment **22** located opposite the limit switches **10**, and said pair of abutments are arranged to act on the respective limit switches **10** in direct relation to the vertical position of the ends of the ram, so that exact stroke length and particularly a good parallelism of the ram **2** to the bed **1** is achieved independently of the deflection of the end housings **4**. Preferably, the abutments **22** are adjustable individually in a direction parallel to the direction of movement of the ram **2** so as to allow an intentional tilting of the ram **2** in cone pressing and other similar operations.

In the embodiment illustrated the abutment **22** consists of a screw, preferably a micrometer, so that the vertical position of the abutment can be micro-adjusted with greatest accuracy. The screw is mounted on a bracket **23**, secured in its turn to the ram **2** for sliding movement in the direction of movement of said ram so as to provide for an easy coarse-adjustment of the position of the abutment **22**.

In operation and after a suitable pre-setting of the limit switches **10** and the abutments **22** cooperating therewith in regard to the desired press operation, the ram will move towards the bed **1** and it will not stop that movement until it has engaged both the limit switches **10** with both its ends by the abutments **22**, thus completely independent of how much the housings **4** have deflected during this operation due to the pressure applied. By this it is secured not only an accurate parallelism between the ram and the bed but also an efficient and exact determination of the position of the bottom stop for the stroke.

In practice it has turned out that in a press brake with a device according to the present invention, it is possible to achieve such close accuracies that the differences in the reaction time of the electrically operated hydraulic valves will have influence, said differences being caused by variations in the viscosity of the hydraulic fluid due to temperature rise in long operation runs. In order to eliminate the detrimental influence thereof and also for further increasing the accuracy of the pressing operation it is suitable to reduce during the last portion of the stroke of the ram **2**, say e.g. the last millimetre, the speed of movement of the bar to $\frac{1}{5}$ or $\frac{1}{10}$ of the original speed so as to reduce in corresponding extent the occurring errors, if any.

This last-mentioned speed reduction can easily be achieved by mounting adjacent to the stop limit switch **10** on the support **8** also a further speed-reducing limit switch **10'**, adapted to act on particular actuation valves (not shown) of the hydraulic cylinders **3**, such as to reduce the stroke speed of the ram **2** in a suitable extent e.g. to $\frac{1}{5}$ or $\frac{1}{10}$. The last-mentioned limit switch **10'** must be mounted so as to be actuated by the abutment **22**, preferably through a transferring plate **24**, at the desired moment before the first limit switch **10**. In the illustration of FIG. 3, however, the limit switch **10'** conceals the switch **10** lying therebehind, said switch also being mounted on the support **8**.

Although the invention in the afore-mentioned has been described as applied to a non-limiting embodiment by way of example only it will be clear that the present invention also includes any modification within the scope of the appendant claims.

I claim:

1. A bottom stroke stop device in hydraulic edge presses or press brakes comprising at least two hydraulic cylinder means, for the movement of a press ram to and from a press bed, said cylinder means, each including an actuating valve means for starting and stopping the operation of said cylinder means, are respectively connected to said ram, at least two limit switches operatively coupled respectively to said actuating valve means of the respective cylinder means for control of the actuating valve means to selectively stop the operation of said hydraulic cylinder means to selectively control the bottom position of the ram stroke, said switches being mounted one at each end of said ram and supported from the bed, the vertical position of said limit switches being commonly adjustable by transmission means anchored in the bed and entirely separated from the end housings of the press, and said press ram at least at each end carries an abutment corresponding to the limit switch, said pair of abutments being adapted to act on the respective limit switches in direct dependence of the vertical position of the ram ends so as to provide for an exact press depth and particularly a parallelism between the ram and the bed independent of the deflection of the end housings.

2. A device according to claim **1** wherein the vertical position of each of the limit switches is adjustable by the intermediation of an adjustment screw with a nut, said nuts supporting said limiting switches a transmission member operatively coupled at one end to said screw and having a gearing at its opposed end, said gearings being commonly operated by an actuation shaft disposed along the press whereby rotation of said shaft drives each of said transmission members for respective rotation of each of said screws.

3. A device according to claim **1** wherein the abutments are vertically adjustable relatively to the press ram so as to allow a tilting of said ram in cone bending and similar operations.

4. A device according to claim **3** wherein each abutment consists of a screw for fine-adjustment of the vertical position of said abutment, and in that said screw is mounted in a vertically adjustable bracket so as to allow a coarse adjustment, said bracket being mounted to said ram.

5. A device according to claim **1** further including at least two reduction switches mounted on said bed adjacent said limit switches respectively said reduction switches being operatively coupled to said actuating valve means, and wherein the abutments are adapted also to actuate said reduction switches respectively at a selected moment before their actuation of said limit switches, said reduction switches being located adjacent said limit switches and arranged to act on said actuation valve means for suitable reduction of the speed of the ram at the end of the stroke thereof.

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