

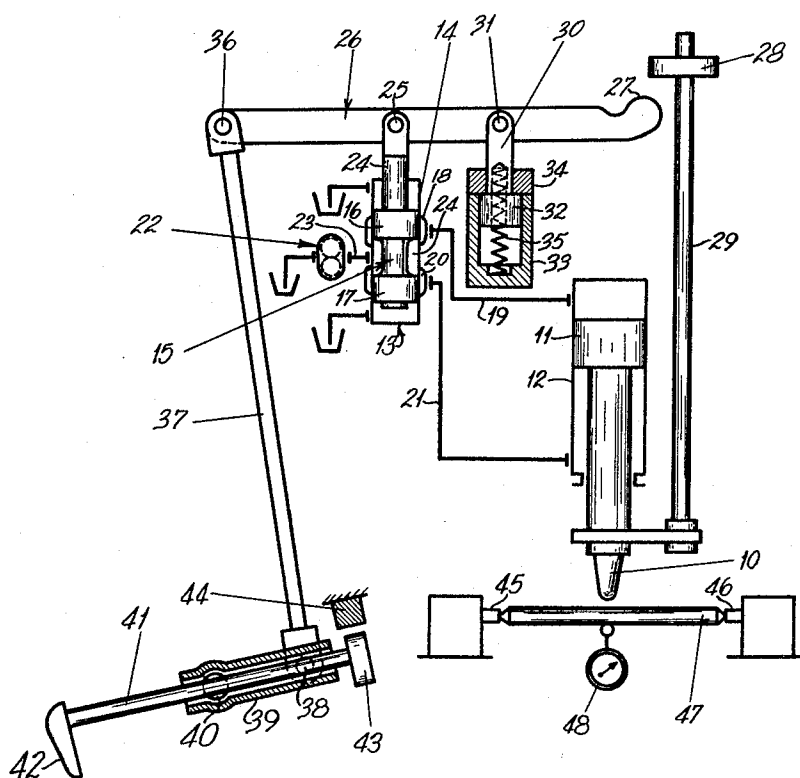
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HYDRAULIC STRAIGHTENING PRESS

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HYDRAULIC STRAIGHTENING PRESS

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This invention relates to a hydraulic straightening press having a stationary control device for the hydraulic drive for the upward and downward movement of the straightening ram, the control member of the said control device being adjustable by means of a manually operated adjusting device to a position determining the depth of the stroke of the straightening ram and being returned by a member connected to the straightening ram to its starting position in which it stops the drive of the ram when the latter has reached the adjusted depth of stroke.

Hydraulic straightening presses are used in particular for workpieces, for example shafts or other rod-like parts which have a curvature in the longitudinal direction, caused for example by distortion, for the purpose of re-shaping the said workpieces, after they have been clamped in fixed securing devices in the straightening press, by an amount which as accurately as possible eliminates the distortion by means of pressure applied by the straightening ram in the press in the opposite direction to the existing distortion. Since the workpiece is first elastically bent by the pressure of the straightening ram before the re-shaping occurs, the depth of bending of the workpiece during the straightening operation must be carefully watched.

In many known straightening presses the force applied by the straightening ram to the workpiece is used for checking the re-shaping of the workpiece. This however entails the disadvantage that the force is not a clear measure of the magnitude of the depth of bending, since the latter is dependent on various factors relating to the workpiece and can be related to the force only in an approximate manner, so that every straightening operation constitutes an experiment and the straightening itself requires very great experience.

Straightening presses are also already known in which the depth of stroke of the straightening ram is limited by adjustable fixed stops. The adjustment of these stops however, is relatively complicated. Since during the straightening operation the workpiece may have to be relieved of load several times in order to measure the re-shaping which has actually occurred and the stops must then be re-adjusted in accordance with the re-shaping still required, the use of adjustable fixed stops for limiting the depth of stroke of the straightening ram takes up an undesirably large amount of time.

Finally, in a straightening press having a hydraulic control it is no longer novel to limit the depth of stroke of the straightening ram by adjusting the control valve of the hydraulic drive of the straightening ram to a position determining the desired depth of stroke by means of a manually operated adjusting device, by means of which during the forward movement of the ram the control valve is returned, by an actuating member connected to the straightening ram, to a position in which it neutralizes the drive when the ram has reached the adjusted limit of its forward movement.

As its controllable drive for the straightening ram, this known straightening press has a special pump which is inserted in the pipes connecting the two working chambers of the hydraulic cylinder of the press and the direction of delivery and the output of which can be regulated

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by adjusting a control member of the control valve of the pump. The manually operated adjusting device and the actuating member connected to the straightening ram act jointly on an input part of a multi-member control linkage, the output of which is connected to the control member of the control valve. The manually operated adjusting device comprises a handwheel and a toothed drive; the large number of intermediate members in this control with their unavoidable play do not permit accurate adjustment of the control valve.

Another essential disadvantage of this known construction of a straightening press control can however be seen in the fact that for the purpose of lifting the straightening ram to measure the permanent re-shaping of the workpiece which has already been achieved, the entire adjusting device must be brought into the position corresponding to the stroke movement of the ram and then, if a residual curvature of the workpiece is still found, must be set to an adjustment differing only slightly from the original adjustment, for the purpose of determining the depth of stroke for the next straightening stroke of the ram. The operation of the adjusting device by handwheels is relatively complicated, since the straightening ram must always be raised to such an extent that the workpiece lies completely free for the purpose of measuring the re-shaping. The re-adjustment consequently also requires the handwheel to be turned through large angles and then a very accurate correcting adjustment. With this straightening press control the time required for the necessary correcting adjustments is consequently relatively great, and the accuracy of the adjustment is frequently insufficient.

The present invention aims at so constructing the control of a straightening press that the above mentioned disadvantages of known straightening presses are eliminated.

Further objects and advantages of the invention will be apparent from the following description taken in conjunction with the accompanying drawing, wherein:

The single figure of the drawing shows more or less diagrammatically a straightening press and control means therefor constructed in accordance with this invention.

With continued reference to the drawing, the straightening press of this invention may include a ram 10 having a piston 11 thereon slidably received in a cylinder 12. A more or less conventional piston valve 13 is utilized to control operation of the ram 10, and the piston valve 13 may well comprise a cylinder 14 having a piston 15 slidably received therein, and the piston 15 is provided with spaced piston heads 16 and 17. The cylinder 14 is provided with an internal annular recess 18 communicating through a conduit 19 with one end of the cylinder 12, and the cylinder 14 is also provided with a second annular recess 20 spaced from the recess 18 and communicating through a conduit 21 with the opposite end of the cylinder 12. A hydraulic pump 22 driven in any suitable manner communicates through a discharge conduit 23 with the space 24 within the cylinder 14, and between the heads 16 and 17 of the piston 15.

The piston valve 15 is provided with a piston rod 24 projecting out of the cylinder 14, and pivotally mounted on the outer end of the piston rod 24 at 25 is a valve actuating control lever 26. One end 27 of the valve actuating lever 26 is disposed in the path of movement of an abutment 28 carried by a rod 29 which is fixed to the ram 10, and is movable therewith. The abutment 28 may be fixed on the rod 29 or may be provided with means for permitting adjustment thereof to various positions on the rod 29.

A plunger 30 is pivotally connected at 31 to the valve

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actuating lever 26 between the pivot point 25 and the end 27, and the plunger 30 is provided with a head 32 thereon slidably received in a cylinder 33, and the cylinder 33 is provided with a cap 34 which engages the head 32 and limits movement thereof in an upward direction as viewed in the drawing, the plunger 30 and head 32 being urged upwardly by a compression spring 35.

The end of the valve actuating lever 26 opposite from the end 27 is pivotally connected at 36 to a rod 37 which is pivotally connected at 38 to a sleeve 39, which is pivotally mounted at 40 on the frame of the press. Rotatably received in the sleeve 39 is a shaft 41 on the outer end of which is provided a handle 42, and on the opposite end of the shaft 41 there is fixed an eccentric 43 disposed opposite an abutment 44 mounted on the frame of the press.

Work supporting means in the form of centers 45 and 46 may be mounted on the frame of the press below the press ram 10, and the centers 45 and 46 serve to support a shaft or rod 47 to be straightened. A suitable measuring device such as a dial indicator 48 may also be provided to indicate the degree of bending of the shaft 47, and also to provide an indication as to when the straightening operation has been completed.

In operation and assuming that a bent shaft 47 to be straightened is supported between the centers 45 and 46, and further assuming that the degree of bending of the shaft 47 has been ascertained by means of the measuring device 48, the handle 42 and shaft 41 are rotated to position the eccentric 43 at a predetermined location in accordance with the degree of bending of the shaft 47, and thereafter the handle, 42, shaft 41, sleeve 39 and eccentric 43 are pivotally moved counterclockwise about the pivot 40 until the eccentric 43 engages the abutment 44, which prevents further clockwise movement of the sleeve 39. This clockwise movement results in moving the rod 37 upwardly which in turn pivots the valve actuating lever 26 about the pivot point 31 on the plunger 30, which in turn results in moving the piston valve 15 upwardly, thereby admitting fluid pressure from the pump 22 through the conduit 19 into the upper end of cylinder 12 to force piston 11 and ram 10 downwardly into engagement with the shaft 47 to bend the same toward a straightened condition. Downward movement of the ram 10 results in downward movement of the abutment 28 carried by the rod 29, and such abutment 28 will move into engagement with the end 27 of the valve actuating lever 26 which will result in pivoting such actuating lever 26 about the pivot 36 at the end of the lever 26 opposite from the end 27, and this will cause downward movement of the plunger 30 against the action of compression spring 35 and will also cause downward movement of the piston valve 15 until such time as the hydraulic connection between the pump 22, the conduit 19 and the upper end of cylinder 12 is closed and a connection between the pump 22, conduit 21 and the lower end of the cylinder 12 is opened, which will result in upward movement of the piston 11 and ram 10 to original position. Of course, the abutment 28 is positioned on the rod 29 at the proper location to move the valve actuating lever 26 when the ram 10 reaches the lowermost point of travel, and the point at which the return movement of the ram 10 actually begins will be determined by the location of the pivot point 36 which in effect provides a fulcrum for the actuating lever 26 during movement thereof to move the piston valve 15 to a position causing retraction of the ram 10. The position of the pivot point 36 is, of course, determined by the position of the eccentric 43 in engagement with the abutment 44. In other words, there is provided what might be termed a differential action of the valve actuating lever 26, which is determined by the position of the abutment 28 on the rod 29, and by the position of the eccentric 43 in engagement with the abutment 44. When the arm 10 has returned to uppermost position, the abutment 28 will move upwardly out of engagement with the end 27 of the valve

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actuating lever 26, and at this time the compression spring 35 will move the plunger 30 upwardly, and as a result thereof move the actuating lever 26 in a counterclockwise direction about the pivot 36 to move the piston valve 15 upwardly to neutral position, and at this time the handle 42 and sleeve 39 may be manually moved clockwise about the pivot 40 to disengage the eccentric 43 from the abutment 44.

The measuring device 48 may then be utilized to determine whether the shaft 47 is straight, or whether a further straightening operation is required, and in the event such operation is required, the amount of travel of the ram 10 necessary to complete the straightening operation may be determined, and the position of the eccentric 43 adjusted accordingly by rotation of the handle 42, and thereafter the straightening operation is repeated, as described above.

It will be seen that by the above described invention there has been provided a relatively simple yet highly effective straightening press together with a control means therefor which may be conveniently actuated to provide the degree of movement of the press ram desired to effect a proper straightening operation, and control of the press is provided by the mere manual actuation of a single handle which is rotated to provide the proper setting for travel of the press ram, and is moved about a pivot to initiate operation of the press.

It will be obvious to those skilled in the art that various changes may be made in the invention without departing from the spirit and scope thereof, and therefore the invention is not limited by that which is shown in the drawings and described in the specification, but only as indicated in the appended claims.

What I claim is:

1. In a straightening press having a straightening ram, the combination for controlling the length of the stroke of the ram: first means moving with said ram; second means movable in a first direction and a second opposite direction for engagement at a first part thereof by said first means during at least a part of the stroke of the ram to move said second means in said second direction; movable first pivot means located at a second part of said second means for permitting pivotal movement in said first and second directions thereto; third means pivotally connected to said second means intermediate of said first and second parts and movable in said first and second directions when said second means pivots about said first pivot; fourth means including stop means for limiting the movement of said third means in said first direction and means biasing said third means against said stop means; fifth means, the position of which controls said ram, pivotally connected to said second means intermediate of said second part and said third means, whereby the pivoting of said second means controls the position of said fifth means; and sixth means for determining any one of a plurality of fixed positions for said movable first pivot means.

2. The combination of claim 1, wherein said sixth means includes a first member movable about a first axis for determining said fixed positions of said first pivot means and an adjustable stop means.

3. The combination of claim 2, wherein said adjustable stop means includes an eccentric cooperating with a stationary abutment; and means for mounting said first member to rotate about a second axis, whereby to rotate said eccentric.

4. The combination of claim 3, wherein said sixth means includes a second member pivotally connected to said first pivot means and to a third pivot means associated with said first member.

5. The combination of claim 1, wherein said first means includes a member for engaging said second means.

6. The combination of claim 5, wherein said member is adjustable on said first means.

7. The combination of claim 1, wherein said fifth means is a piston means.

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8. The combination of claim 1, wherein said biasing means is a spring.

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