The press disclosed is employed for straightening heavy rolled sections and essentially comprises a hydraulically actuated press for exerting pressure on a rolled section supported by liberally spaced supports. The press and supports are each carried by platens that are adjustably interconnected by threaded tie-rods adapted for rotation. The platens are, in turn, slidably carried by a rotatable frame that is also adjustable in height. By rotating and adjusting the height of the frame, the press is located in a desired position for receiving and straightening the rolled section without imposing bending forces on associated roller tables or the like.

BACKGROUND OF THE INVENTION

Straightening machines known in the art have support blocks and gages retained in a frame and are effective in a plane determined by said frame. To straighten beams with these machines a manipulator is required to turn the structural section so that the plane of the bend in such a section is coincidental with the straightening plane of the machine. To obtain a higher rate of output, other known means are provided for the rolled sections cooled on a cooling bed and advanced on a roller table. From the table the sections are passed through two press gages installed on a horizontal plane, the straightening plane of the one being at an angle of ninety degrees to that of the other.

Another straightening machine known in the art is provided with two sets of support blocks and gages, one set being employed to straighten in the vertical plane and the other straightens in the horizontal plane. To keep the considerable cost of such plane within reasonable bounds, the straightening machine frame and the rolls are arranged so that a large straightening force can be exerted on only one of the two planes and the force that can be induced in the other plane is much smaller. Here, use is made of the fact that, normally, the modulus of structural section shape differs in the horizontal and vertical. But manipulators cannot be eliminated since not all of the beams can be located in the gap press in the preferred position and must, therefore, be manipulated into the preferred position.

SUMMARY OF THE INVENTION

The object of the present invention is to provide a press that can be manufactured at reasonable cost and will exert optimum force on beams to be straightened in a manner that will permit rational operation and short positioning times. This object is achieved according to the present invention by the provision of at least one platen mounting two support blocks and a ram associated with a gap which is retained in a frame that is supported by means of two bearing rings on two pairs of rollers. The longitudinal axis of the two bearing rings should coincide with the center line of the rolled sections positioned for straightening and should preferably pass centrally through the working area.

To facilitate operation, the support rollers are equipped with driving means, it is also advantageous to provide the frame with one or more gear segments that mesh with mechanically driven pinions. Control of the driving means is facilitated by coupling it with synchro-units provided with contacts to control the driving means for locating the frame in preferred positions. It is preferred to make the platen or platens adjustable in the stressing direction. The adjustment can be obtained by means of threaded spindles, which should preferably be of self-locking design and be provided with a driving means rated to permit adjustment in an unloaded condition.

Straightening operations can be shortened and the construction of the frame and supporting structure made relatively simple, without reinforcement, by arranging each pair of platens and rams mounting the gages opposite each other on a common plane. It is desirable to have one ram to act on each platen.

To simplify the relatively lightweight structure which accommodates the large straightening forces, the platens and the members mounting the oppositely located rams are connected by tie bars extending in the direction of stressing. In the event the rams are arranged to act on the platens, then the oppositely disposed platens may be connected by tie bars. These tie bars should preferably take the form of threaded spindles, and the threads to secure the oppositely arranged members should be of opposite hands.

The frame substantially comprises bearing rings produced from rolled sections secured in a spaced-apart relation by cross-beams. Additional significant adjustment facilities are afforded by providing pairs of supporting roller designed to be jointly raised and lowered by an equal amount. These supporting rollers should be displaceable on guides inclined in the direction of stressing. A construction feature of importance is that the frame should be provided with slide-ways to guide and relieve the load on the platens. These slide-ways can be affixed to or machined on brackets.

FIG. 1 illustrates the side elevation of a gap press incorporating the present invention.

FIG. 2 is a plan view of the gap press shown in FIG. 1.

FIG. 3 is a front view of the gap press shown in FIG. 1.

FIG. 4 is a sectional view taken along lines IV—IV of FIG. 1.

FIG. 5 is an electrical diagram of the motor—can limit switch—selector switch employed in connection with the present invention.

DESCRIPTION OF THE PREFERRED EMBODIMENT

The gap press depicted in the drawings has a rotatable frame, the principal components of which are the bearing rings 1 and 2 that are suitably dimensioned and shaped to accommodate the forces developed. The bearing rings are interconnected by cross-beams 3 and 4 and are supported by rollers 5 and 6 that are rotatably mounted in bracket supports 7, which in turn are adjustable in height by displacement on inclined slide-ways 8. The supports 7 are provided with racks 9 which mesh with pinions or wormwheels (not shown in the figures) driven by drive motors 10. The drives are interconnected in such a manner, by shaft 11, for example, that the supports 7 are al-
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3 ways displaced by the same amounts. By suitably controlling these drives the frame, including the bearing rings and cross-beams, can be elevated by any desired amount within given limits.

In the illustrated embodiment of the present invention, means are provided for powered rotation of the frame, which means includes gear segments 13 secured to the bearing rings 1 and 2. The segments 12 mesh with pinions 13. The pitch circles of the gear segments and pinions correspond to the rolling circles of the bearing rings and supporting rollers. The supporting rollers 6 and their associated pinions 13 are controlled by means for driving the pinions 13 in conjunction with cam operated limit switches 15 and gear units 16. Synchronous operation for the height adjustment of the bracket supports 7 by means of shafts 11 is electrically effected by the cam operated limit switches 15. The limit switches 15 also include control contacts to be actuated for automatic height adjustment to preferred positions.

As shown in FIGS. 2, 3 and 4, tie-rods or spindles 17 are located between the cross-beams 3 and 4. These rods are threaded at their ends with threads of opposite hands. Receiving the ends of the tie-rods 17 are nuts 18 located in projections forming part of the cross-beams 3 and 4. The tie-rods are provided at both ends with support blocks 20 against which the beam section is supported during the application of a gag 21.

As illustrated in FIGS. 3 and 4, the platens are symmetrically arranged and each incorporates a piston cylinder assembly 22; its piston, or the ram, mounts the gags 21. The cross-beam 3 is provided with drive means 23 for driving the threaded spindles 17. The drive means illustrate include a gear 24 and outer pinions 24a for transmitting power to the tie-rods and means for synchronizing their rotation.

The tie-rods 17 can be spaced closer together or further apart by the driving means 23 in conjunction with the right and left-hand threaded portions 18a of spindles 17 and nuts 18. As the straightening forces are not applied during such spacing movements, the power output of the driving means 23 need not be highly rated. Only a relatively small motor that can be easily mounted on the cross-beam, will be required, especially if used in conjunction with high-ratio reduction gears having a high output speed. The spindles 17 thus permit quick traversing of the platens into the desired position. A noteworthy feature is that the platens are always equispaced on either side of the center line of rollers 26 forming part of a work approach table. A correspondingly rapid advance of the gags 21, for instance, could not be provided at reasonable cost since high-pressure pumps capable of high delivery rates would be needed.

The threaded spindles 17 also constitute tie-rods for tying together the oppositely arranged platens and for accommodating the forces applied when straightening the beams. Both the threads and the nuts on the spindles are exposed to these forces, but as the platens are not under load when adjusted, the threads need be dimensioned to accommodate only the actual compressive or shear stress. The frame itself, comprising the bearing rings 1 and 2 and cross-beams 3 and 4, is not stressed at all by the straightening forces so that it can be a relatively lightweight construction. It is the platens themselves and the tie-rods that resist the high stresses. The weight of the platens and arms is supported by the slideways on brackets 25. This arrangement relieves the threaded spindles 17 of bending stresses.

If a rolled shape, such as an I-beam 27 shown in cross-section in FIG. 3, is to be straightened, it is advanced to the gag press on the rollers 26 of the approach table and is positioned between the support blocks 20 on the platens 12 and the gags 21. The position illustrated in the figures is for straightening out a bend in the horizontal plane. If the bend is in the vertical plane, the frame is rotated through 90 degrees by the driving means 14 and 16, pinions 13 and gear segments 12 so that the rams apply their force in the vertical plane or direction. Any intermediate position can be set to remove bends occurring at any angle in rounds or special sections.

The straightening drive can be simply and quickly applied to the rolled section 27. Bracket supports 7 are first shifted on their slideways 8 to bring the center of the frame to the level of the center line of the rolled section and to advantageously utilize symmetrical application of the straightening force for all sections. By employing the drive means 23 the platens 19 are rapidly advanced to a point just short of engagement with the flanges of the beams 27. When the drive means 23 is stopped, it automatically interlocks and, at this point, the straightening process proper starts by admitting hydraulic fluid to the cylinder 22 of the respective ram. Once the rolled section has been gripped, the bracket 7 can be further elevated together with the supporting rollers 5 and 6 so as to take most of the load off the approach table. As a result, the axial forces on the rollers of the approach table will be commensurately reduced. Moreover, by raising the frame, local overloading of the output table can be obviated. If the lower ram 22 is actuated when the frame or threaded spindles are in the vertical position, the middle section of the beam will be lifted up, but reaction forces will be directed toward the roller table by the sections of the beam beyond the support blocks 20. These forces can be reduced or eliminated by raising the frame.

Another advantage is the possibility of providing the gag press with a simply constructed and easily operated control system. Valves to admit hydraulic fluid to one side of the ram cylinders can be mechanically, electrically or hydraulically actuated in parallel with other valves that cause the hydraulic fluid to flow from the other side of the ram cylinder or to be admitted to or expelled from the cylinder of the opposite ram. Therefore, a control system is capable of effecting the advance of one gag accompanied by the return travel or withdrawal of the other gag. The drive for rotation of the frames 1 and 2 and, if necessary, the drive for the elevation of the supporting rollers 5 and 6 can be controlled by the limit switches which could also take the form of transmitters connected with the prime movers. The limit switches or transmitters can be employed in a known manner for the synchronous control of a plurality of motors. In both cases, they enable previously determined preferred positions to be selected by means of an automatic control or control circuit, when selector switch 20 is operated. Thus, when the command is given by positioning a switch 20, the frame can be automatically rotated through 90 degrees or raised to suit the height of a given size of section frequently handled. The respective movement is then powered by the symmetrical drive.

A simplified electrical circuit for the automatic control of the motor 14 by the cam-type limit switch 15 and the selector switch 30 is diagrammatically illustrated in FIG. 5. The circuit comprises power lines L1 and L2 which feed current to the selector switch 30 and the limit switch 15. The selector switch comprises a three-position selector dial 31, each position having a circuit defined by lines L3, L4 and L5. In FIG. 5 the selector is positioned so as to move the frames 1 and 2 to a vertical position so that its contact 32 is closed. The limit switch 15 has three primary contacts in addition to several contacts being included in the circuit defined by the lines L3, L4 and L5. FIG. 5 also shows one of a number of cams 33 of the limit switch to be associated with the gearing 34 which causes the cam to rotate at the same speed as the frames 1 and 2. As shown in FIG. 5, the contact 35 of the limit switch 15 is closed, thereby completing the circuit to a control relay 36. The start button 38 includes a by-pass circuit having two contacts 39 and 41, the contact 39 belonging to a motor contactor.
42 and the contact 41 belonging to the control relay 36. The motor contactor 42 is connected also to the line 16. It will be appreciated that many components, such as fuses, relays, etc., which are normally supplied with such a circuit have not been illustrated. On operation, a operator will press the start button after he has placed the dial 31 of the selector 30 in the desired position, for example, to bring the gags 21 to the vertical position. This will close contacts 32 and 33 which, through the control relay 36, will begin operation of the motor 14. Once the required rotation and the vertical positioning of the gags have been completed, as defined by one of thecams 33, operation of the motor will be interrupted by an opening of the contact 35 and the relay 36. If so required, the automatic positioning of the gags can be achieved by instructions stored in data processing equipment, with the aid of punched cards, magnetic or paper tapes or a process computer. For the same purpose, the drive to the threaded spindles can be equipped with a limit switch or transmitter. When contact is made with the flanges of a beam the ram approach movement can be cut out by limit switches or pressure-sensitive switches mounted on the support blocks, for example.

The gage press disclosed by the present invention permits rapid, continuous operation in that a previously required manipulator is eliminated and optimum positioning is obtainable automatically. The gage press according to this invention is of remarkably lightweight construction in that the straightening forces are, for the most part, accommodated by the tie-rods in the form of tension stresses. Operation is further facilitated by the fact that the rotational axis of the frame is always in line with the center line of the roller table and that the movable platens are always equipped in relation to the center of the machine. Rapid approach of the platens minimizes the time required for making contact with the beam flanges. Rise and fall adjustment enables the straightening dies to be applied at the most effective height for straightening and to lift the work so that straightening forces do not cause overloading of the roller table.

In accordance with the provisions of the patent statutes, I have explained the principle and operation of my invention and have illustrated and described what I consider to represent the best embodiment thereof. However, I desire to have it understood that within the scope of the appended claims, the invention may be practiced otherwise than as specifically illustrated and described.

I claim:
1. A gage press for straightening heavy rolled sections conveyed by a roller table or the like, comprising:
   a frame including an arcuate bearing surface for supporting said frame;
   a pair of spaced-apart support rollers engaging said bearing surface for supporting said frame,
   means for positioning said frame relative to said roller table,
   a platen carried by said frame,
   a pair of spaced-apart support blocks carried by said platen,
   an hydraulically actuated ram carried by said platen opposite said support blocks, and
   a gage supported by said ram for exerting a straightening force developed by said ram between said gage and said support blocks.
2. A gage press according to claim 1 wherein said means for positioning said frame includes:
   a gear segment secured to said frame,
   a pinion meshing with said gear segment, and
   drive means for rotating said pinion.
3. A gage press according to claim 1 further comprising:
   spindle means having threaded end portions and associated with said gage,
   a nut carried by said platen and receiving said threaded end portions of said spindle,
   drive means for causing relative rotation between said spindle and said nut for positioning said platen relative to said gage.
4. A gage press for straightening heavy rolled sections conveyed by a roller table or the like, comprising:
   a frame including two spaced-apart arcuate bearing surfaces for supporting said frame,
   a pair of spaced-apart support rollers engaging each of said bearing surfaces and supporting said frame,
   means for positioning said frame relative to said roller table,
   a spindle and opposed platens carried by said frame,
   two spaced-apart support blocks carried by each of said platens,
   a hydraulic actuated ram carried by each of said platens between said support blocks, and
   a gage supported by each of said rams for exerting a straightening force developed by one of said rams between said platens.
5. A gage press according to claim 4 further comprising:
   tie-rod means interconnecting said platens for resisting the straightening force developed between the platens.
6. A gage press according to claim 5 further comprising:
   nut means supported by each of said platens, threads formed on each end of said tie-rod means for threadably receiving said nut means, and
   drive means carried by one of said platens for causing relative rotation between said tie-rod means and said nut means to position said platens relative to each other.
7. A gage press according to claim 4 wherein said frame comprises:
   two spaced-apart bearing rings having surfaces forming at least part of said bearing surfaces, and
   a cross member for rigidly securing said bearing rings in their spaced-apart relation.
8. A gage press according to claim 7 further comprising:
   inclined guides for rotatably supporting said support rollers, and
   means for positioning said support rollers relative to said guides to position said frame relative to the roller table.
9. A gage press according to claim 4 further comprising:
   brackets secured to said frame for supporting and guiding said platens.
10. A gage press according to claim 4 wherein said means for positioning include a motor and a control device for controlling the operation of said motor to automatically locate said frame in preselected positions relative to said roller table.

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CHARLES W. LANHAM, Primary Examiner
GENE P. CROSBY, Assistant Examiner

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,570,301 Dated March 16, 1971

Inventor(s) Friedrich Perner

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 4, line 73, beginning with "The start button" cancel all to and including "to the line L6." in column 5, line 2; Column 5, line 5, "a", second occurrence should read -- th line 49, "A gage press" should read -- A gag press --.

Signed and sealed this 7th day of September 1971.

(SEAL)
Attest:

EDWARD M. FLETCHER, JR.
Attesting Officer

ROBERT GOTTSCALK
Acting Commissioner of Patents