This invention relates generally to power presses and concerns, more particularly, a tensioning system for the tie rods of such presses.

One step normally taken when conditioning a large power press for operation is the pre-stressing of the tie rods so that the tie rods exert a much greater force holding the press frame together than is likely to be developed in the opposite direction during press operation. One expedient for accomplishing this pre-stressing is to heat the tie rods and tighten the tie rod bolts while the rods are thermally expanded. Upon cooling, the rods develop the desired stress. Heating, however, presents many problems since the rods are difficult to heat, almost impossible to heat uniformly, and often the rod nuts bind on the expanded thread portions of the rods. Moreover, this method requires a long processing period.

The problem of pre-stressing has been proposed to pre-stress the tie rods of a power press, as can be seen by reference to U.S. Patent No. 2,616,543, issued November 4, 1952, to Danly. Hydraulic systems, however, have required relatively elaborate and expensive components and are subject to leakage problems.

Accordingly, it is the primary aim of the invention to provide a simple and inexpensive, but completely reliable, novel system for pre-stressing or tensioning the tie rods of a power press.

A further object is to provide a system of the above referred to type that is easy to manipulate, quite trouble-free, and which avoids the difficulties with heating and prior hydraulic systems mentioned above.

Another object is to provide a tie rod tensioning system as characterized above which readily permits rod tension to be relaxed and the rods even loosened should the press become jammed as a result, for example, of attempting to exceed the capacity of the press.

Other objects and advantages of the invention will become apparent upon reading the following detailed description and upon reference to the drawings, in which:

FIGURE 1 is a perspective of a power press embodying the invention with portions broken away;

FIG. 2 is an enlarged fragmentary section through the press of FIG. 1 showing a single one of the tie rods;

FIG. 3 is a further enlarged section of the lower portion of the tie rods shown in FIG. 2 including a schematic representation of an exemplary hydraulic system for practicing the invention;

FIG. 4 is an enlarged perspective of one of the spacers embodied in the structure shown in FIG. 3; and

FIG. 5 is an enlarged perspective of one of the shims embodied in the structure shown in FIG. 3.

While the invention will be described in connection with a preferred embodiment, it will be understood that I do not intend to limit the invention to that embodiment. On the contrary, I intend to cover all alternatives, modifications and equivalents as may be included within the spirit and scope of the invention as defined by the appended claims.

Turning first to FIG. 1, there is shown a power press 10 of the type with which the present invention is intended to be used. The press includes frame elements comprising a base 11 supporting a crown 12 on a pair of side members 13 and 14. A vertically shiftable ram 15 operates in opposition to a bolster 16.

To hold the frame together when the ram 15 is driven toward the bolster 16 against the work, four tie rods 18 are disposed at the four corners of the press and carry upper and lower nuts 19 and 20, respectively, which sandwich the frame elements together. The aim of pre-stressing the press 10 is to tension the rods 18 so as to exert a greater compressive force on the press frame elements than is likely to be developed in the opposite direction by the ram 15 during press operation.

In accordance with the invention, each tie rod 18 carries a nut embodying a hydraulic motor 22 capable of reacting against the press frame and pre-stressing the rods 18, whereupon shims 23 are interposed between the frame and the nut to maintain the pre-stress. Preferably, the motors 22 are linear actuators formed in the lower nuts 20 with each actuator including an annular cavity 25 in which is slidably fitted an annular piston 26. Fluid seals 27 prevent leakage from the cavity 25 pist the piston 26, and a passage 28 is formed in the nut 20 so as to permit introduction of fluid under pressure behind the piston.

An exemplary hydraulic system for the practice of the invention includes a pump 30 connected to a supply of fluid 31 and coupled by a line 32 to the passage 28. An exhaust valve 33 also connects the line 32 with the fluid supply 31. A line 34 connects the pump 30 to the hydraulic motors 22 in the other nuts 20.

In the preferred construction, the shims 23 are semicircular and two shims are provided for each of the nuts 20. Moreover, the shims are of substantial thickness and are sized in relation to a pair of spacers 40. The spacers are metallic strips intended to be initially placed between the frame and the nuts 20 and are provided with holes 41 so that, when not in use, they can be conveniently stored by being secured to the underside of the nuts 20 by a pair of screws 42, of which only one is shown.

The operation of the above described structure can now be readily appreciated. Upon assembling the frame elements 11-14, the nuts 19 and 20 are fitted onto the tie rods 18. Before the lower nuts 20 are tightened against the frame, a pair of the spacers 40 are interposed between the frame and the lower nuts, whereupon the nuts are tightened so as to hold the frame elements in assembled relation.

The hydraulic system is then connected to the motors 22 by coupling the lines 32 and 34 to the passages in the nuts 20 corresponding to the passage 28. Fluid is introduced under pressure to the hydraulic motors 22 so that the motors drive the nuts downwardly by reacting against the frame base 11, thus pre-stressing the rods and the press frame. The spacers 40 are then removed and the shims 23 are fitted in between the nuts and the frame. The valve 33 is operated to vent fluid from the motors 22 so that the force exerted by the motors is relaxed while the shims 23 maintain the desired pre-stress. The amount of stress maintained can, of course, be easily calculated and predetermines from the thickness difference between the shims 23 and the spacers 40.

Once the rods 18 are under stress and the shims 23 in place, the hydraulic circuitry can be removed if desired. Should it be necessary to remove the stress on the rods 18 and the press frame, the hydraulic circuit is again connected to direct hydraulic fluid to the motors 22 so that sufficient force is developed to free the shims 23 and permit their removal. Once removed, the pressure in the motors 22 is vented, thus eliminating the stress imposed on the press frame. Furthermore, by venting the fluid in the motors 22 without repositioning the spacers 40, it is possible to loosen the frame elements beyond the point initially achieved by tightening of the nuts 19, 20, and this slight additional clearance represented by the thickness of the spacers 40 provides a rapid and conven-
I claim as my invention:

1. The method of pre-stressing the frame and tie rods of a power press comprising the steps of threading nuts onto said tie rods, interposing spacers between said nuts and said frame, tightening said nuts against said spacers so that the rods are anchored against said frame, hydraulically driving said nuts from said frame so as to introduce the desired pre-stress in the rods and the frame, removing said spacers, and interposing shims between said nuts and said frame to maintain said pre-stress upon relieving said hydraulic driving force.

2. The method of pre-stressing the frame and tie rods of a power press comprising the steps of threading nuts embodying hydraulic motor elements onto said tie rods, interposing spacers between said nuts and said frame, tightening said nuts against said spacers so that the rods are anchored against said frame, introducing hydraulic fluid under pressure to said motor elements so as to drive said nuts from said frame and thus introduce the desired pre-stress in the rods and the frame, removing said spacers, and interposing shims between said nuts and said frame to maintain said pre-stress upon venting said fluid from the motor elements.

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