Jan. 14, 1964 L. ROBBINS ETAL 3,117,330

BUILDING-IN MACHINE PRESS FOR BOOKS

Filed Oct. 30, 1961 7 Sheets-Sheet 1

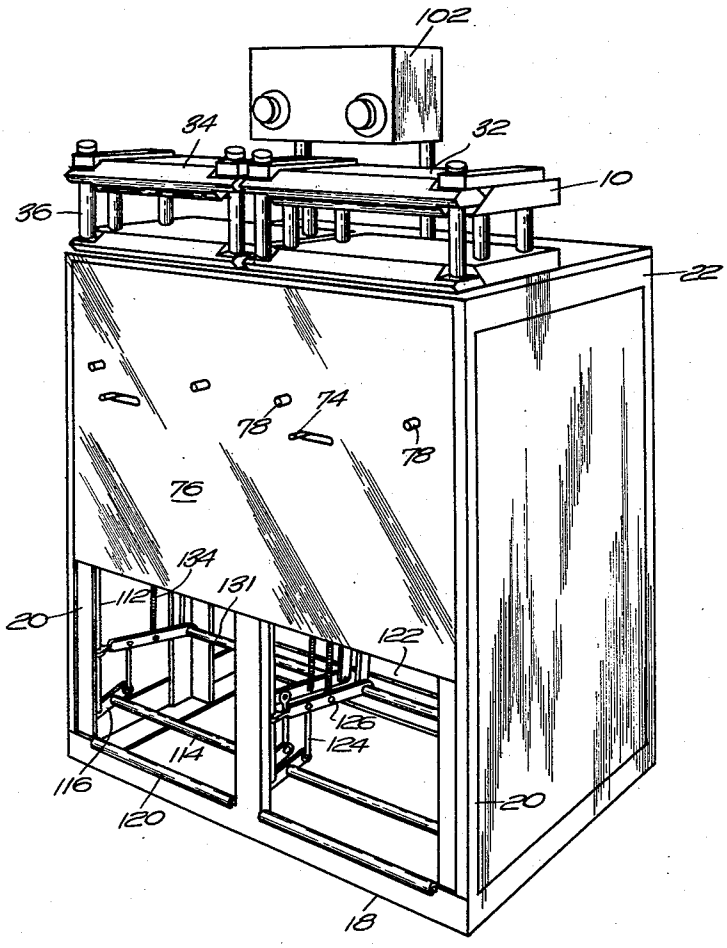


FIG. 1

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BUILDING-IN MACHINE PRESS FOR BOOKS

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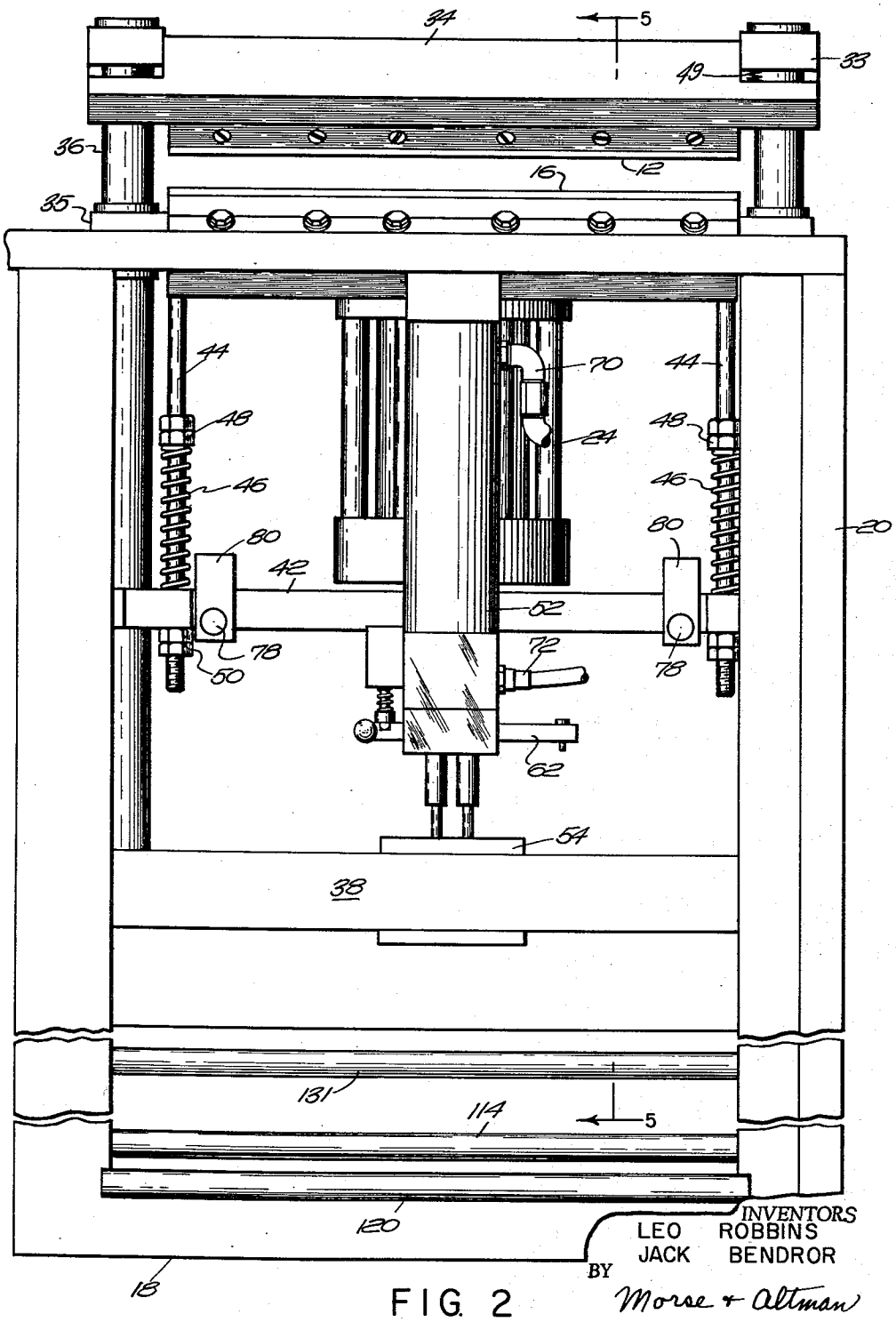


FIG. 2

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BUILDING-IN MACHINE PRESS FOR BOOKS

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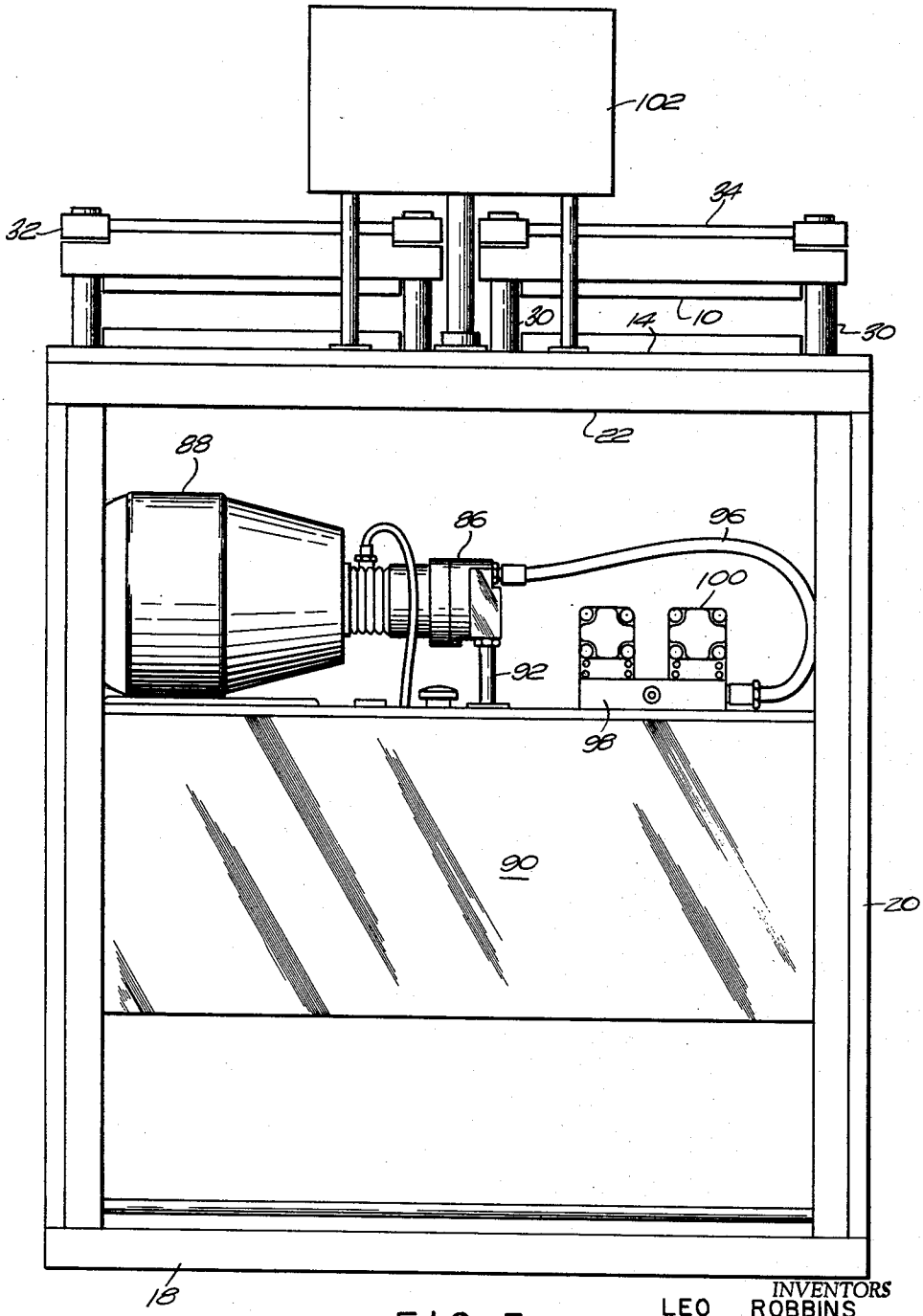


FIG. 3

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BUILDING-IN MACHINE PRESS FOR BOOKS

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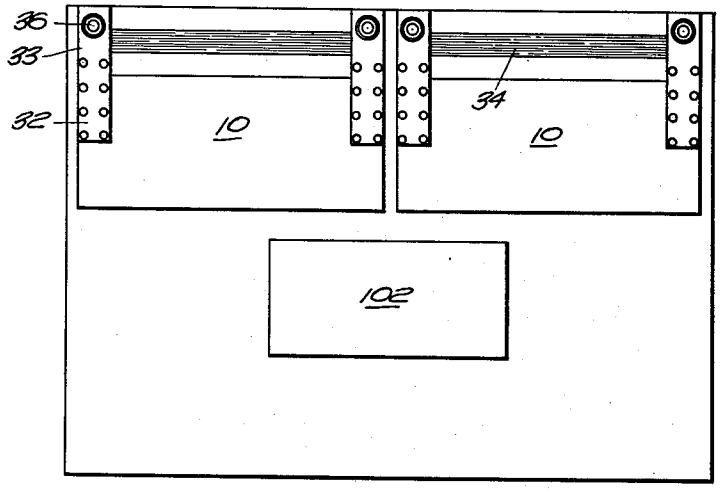


FIG. 4

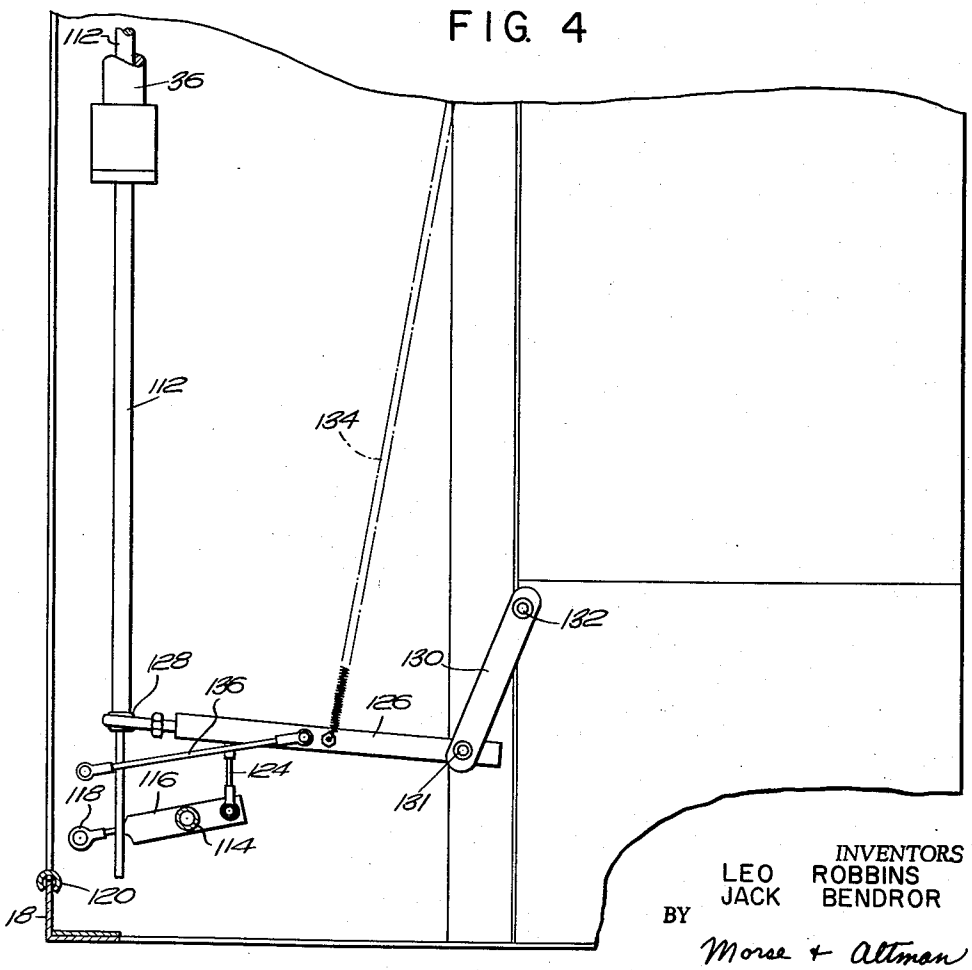


FIG. 6

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BUILDING-IN MACHINE PRESS FOR BOOKS

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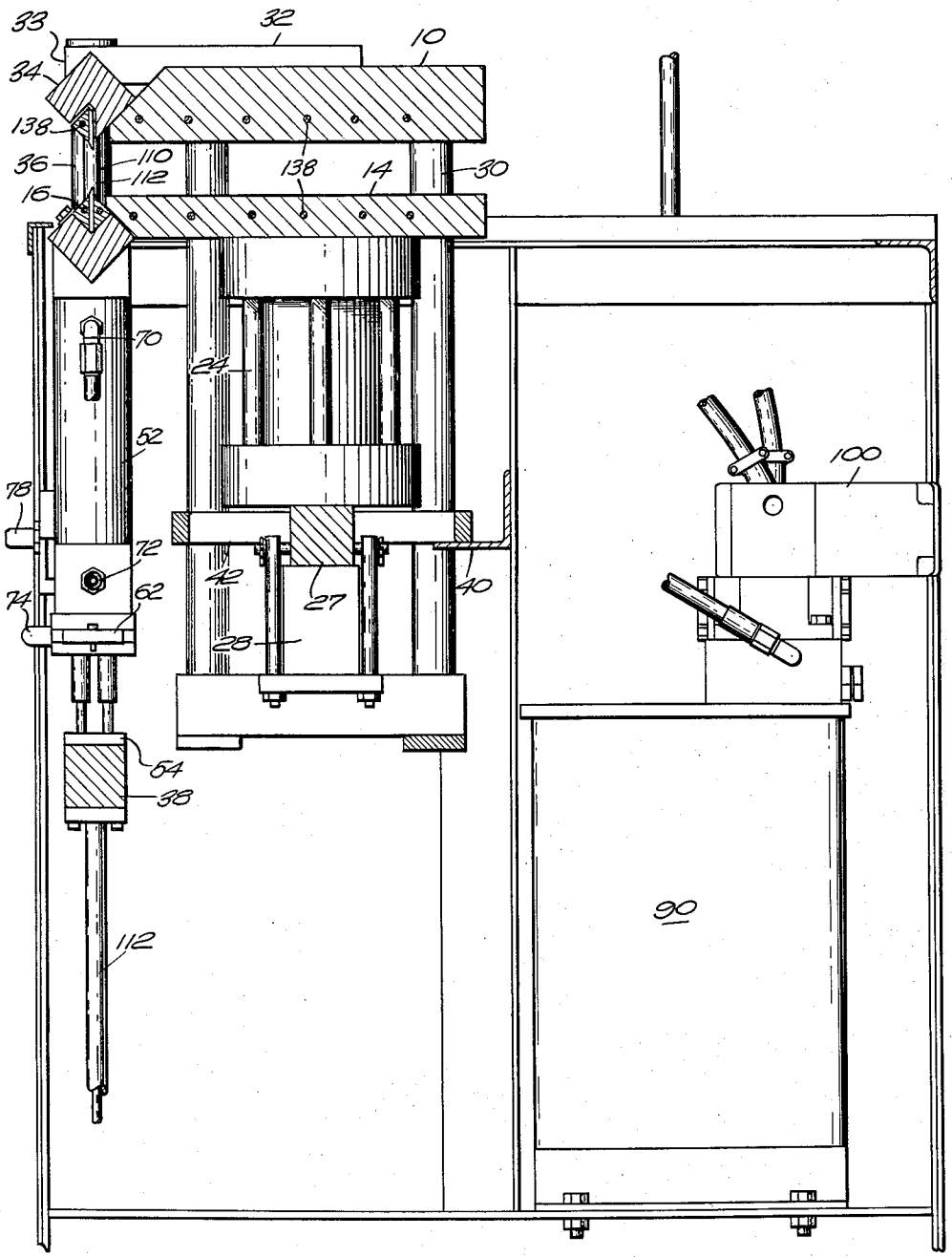


FIG. 5

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BUILDING-IN MACHINE PRESS FOR BOOKS

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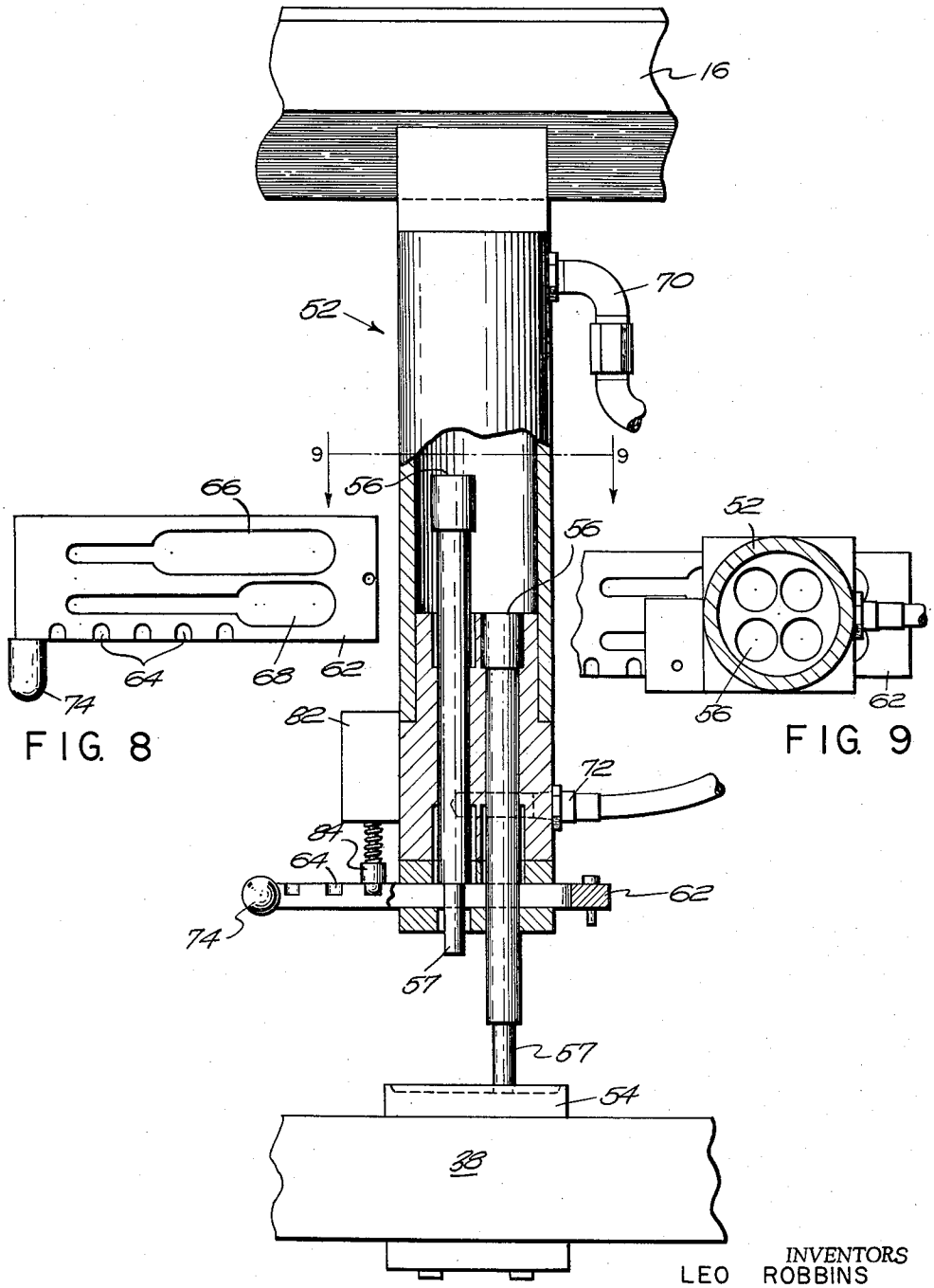


FIG. 8

FIG. 9

FIG. 7

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BUILDING-IN MACHINE PRESS FOR BOOKS

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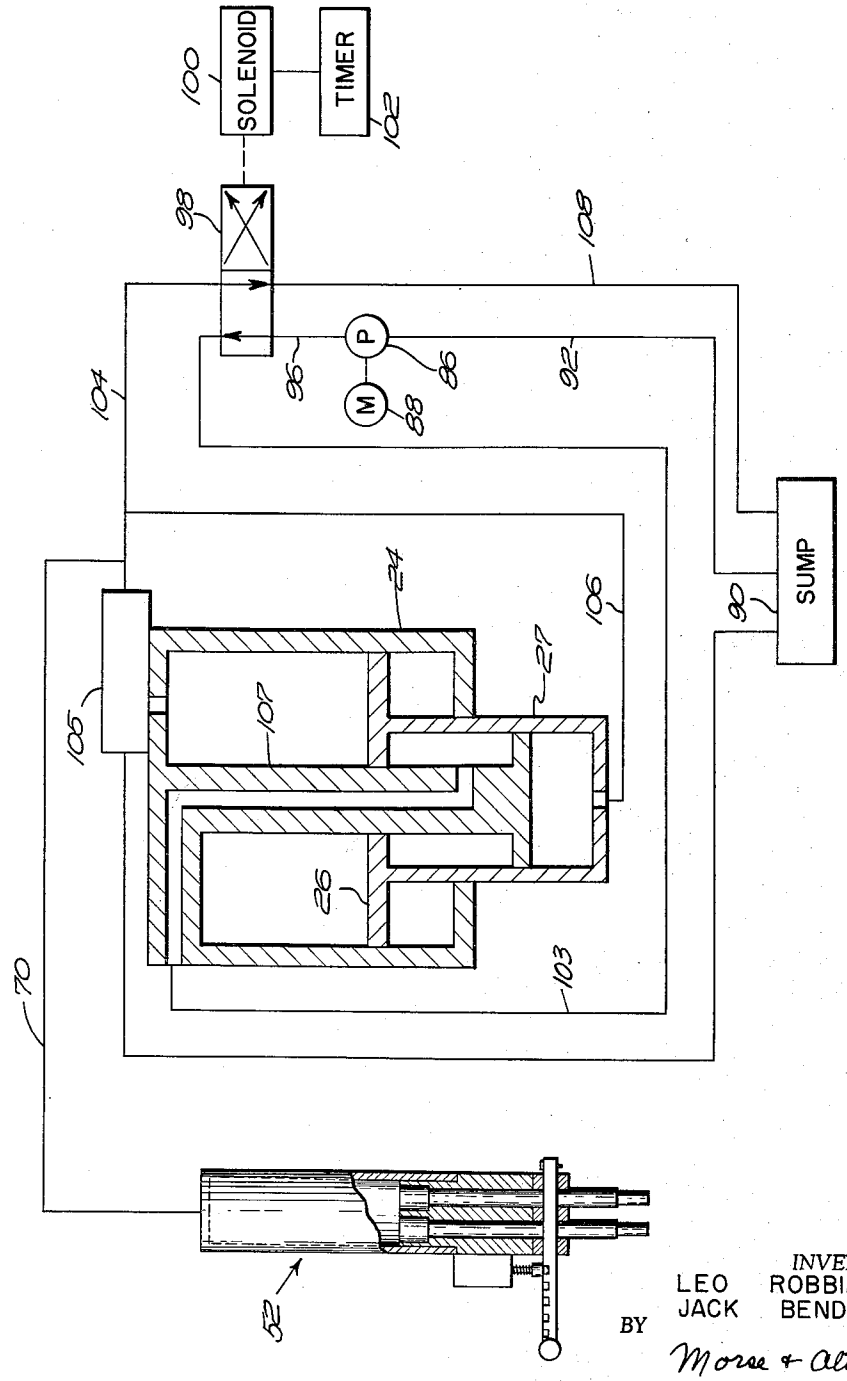


FIG. 10

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United States Patent Office 3,117,330 Patented Jan. 14, 1964

3,117,330

BUILDING-IN MACHINE PRESS FOR BOOKS

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Filed Oct. 30, 1961, Ser. No. 148,622
12 Claims. (Cl. 11—1)

This invention relates in general to bookbinding machines and more particularly concerns a new and improved combination book press and building-in machine.

In the manufacture of hard covered books, a number of page blocks, or fillers, are assembled in their proper order and joined along one edge by stitching or other means. The end sheets of the sewn book are then coated with a layer of liquid adhesive by a casing-in machine, and the separately formed hard outer cover is mounted in place. Subsequently, the book, and its cover, are flattened and the adhesive set by transferring the assembled book to a press where the combination of high pressure and elevated temperatures finishes the book within a short time. Simultaneously, creases may be pressed into the cover adjacent the rounded end of the book and along opposite sides thereof in order to form joints or hinge lines for the cover.

Although there are a number of power operated combination pressing and creasing machines commercially available, none of them is particularly satisfactory from the standpoint of operating convenience, flexibility of control, wide utility and high productivity.

Accordingly, it is an object of the present invention to provide improvements in combination book presses and building-in machines.

Another object of this invention is to provide a combination book press and building-in machine which is capable of pressing a book under high pressure and simultaneously forming creases along opposite sides of the book adjacent the rounded end.

Yet another object of this invention is to provide a combination book press and building-in machine in which a pair of platens and a pair of separately actuated crease-forming nipper jaws operate simultaneously under pressure to press and build in the joints of a book.

Still another object of this invention is to provide a combination book press and building-in machine in which the nipper jaw pressure may be readily adjusted to accommodate books of various thicknesses.

A further object of this invention is to provide in a combination book press and building-in machine an improved treadle assembly for manually aligning the nipper jaws with the joints on the book.

More particularly this invention features a combination book press and building-in machine wherein independently actuated platens and nipper jaws function simultaneously to press a book and form crease lines along the joints. In a preferred embodiment of this invention, the pressure applied by the platens to the book is constant whereas the pressure applied by the nipper jaws may be varied as desired by manipulation of a hydraulic cylinder of unique design. This invention also features a novel foot treadle which is operatively connected with one of the nipper jaws and characterized by extreme ease of operation with a short stroke of the treadle producing a relatively large stroke of the jaw.

Still another feature of this invention relates to an improved hydraulic system for operating the several parts of the machine.

But these and other features of the invention, along with further objects and advantages thereof, will become more fully apparent from the following detailed description, with reference being made to the accompanying drawings in which:

FIG. 1 is a view in perspective of a combination book press and building-in machine made according to the invention,

FIG. 2 is a front elevation of the machine with the front panels removed to show details of construction,

FIG. 3 is a rear elevation of the machine, also with the panels removed,

FIG. 4 is a top plan view of the machine,

FIG. 5 is a cross sectional view taken along the line 5—5 of FIG. 2,

FIG. 6 is a detail side view of the treadle assembly,

FIG. 7 is a sectional view of the nipper jaw hydraulic control assembly,

FIG. 8 is a plan view of the slide plate for the nipper jaw control assembly,

FIG. 9 is a cross-sectional view taken along the line 9—9 of FIG. 7, and,

FIG. 10 is a schematic diagram of the hydraulic system and control circuit for the machine.

Referring now to the drawings, there is illustrated in FIG. 1 a double station combination book press and building-in machine in which a flat moveable pressure plate 10 is located on the upper portion of the machine adapted to reciprocate in unison with an independently moveable upper nipper jaw 12.

The plate 10 and the jaw 12 are in register respectively with a flat, fixed platen 14 and a lower nipper jaw 16 that may be adjusted to apply various pressures to the crease lines of a book that is placed in the bite of the nipper jaws.

As best shown in FIGS. 1, 2 and 5, the machine is constructed with a rugged boxed frame including a base 18 having upright members 20, and top cross pieces 22. The fixed platen 14 is rigidly mounted horizontally across the tops of the cross pieces 22 and mounted beneath the platen 14 is a high pressure master hydraulic cylinder 24 having an annular piston 26 integrated with a hollow slave piston 27 which engages a stout cross arm 28. The cross arm 28 carries at each end a pair of tension rods 30 which pass vertically upward through the fixed platen 14 to engage the moveable plate 10. Reciprocation of the piston 27 serves to move the plate 10 to and away from the platen 14 and is capable of exerting a pressure of 18,000 lbs. or more against a book that is inserted between the plate and the platen.

Fastened securely to the top of the plate 10 is a pair of rectangular bars 32 with bearings inserted in their front ends. Vertically mounted in the front of the machine and passing through the bearings 33 are two cylindrical tubular rods 36 that are fixed to the bracket 34 at their upper ends and carry a horizontal cross bar 38 at their lower ends. Guide bearings 35 extend from opposite ends of the lower nipper jaw 16 and slidably engage the rods 36 to maintain alignment between the jaws.

Mounted in fixed position by means of an angle piece and attached to the front frame of the machine is a web 42 which supports a pair of vertical rods 44 which, in turn, carry the lower nipper jaw 16 at their upper ends and have their lower ends passing through the web 42. Compression springs 45 are disposed over the lower portions of the rods 44 and are held between locking nuts 48 at one end and by the web 42 at the other end. Locking nuts 50 limit the upward movement of the rod so that the normal upward position of rods and lower nipper jaw 16 is substantially as shown in FIG. 2. Small coil springs 49 are mounted between the bearings 33 and the bracket 34 and exert a pressure which is equal to that of the springs 46. With this construction, the lower nipper jaw

is yieldably supported by the frame and, by manipulation of a device now to be described, may be adjusted to vary the pressure made by the bite of the nipper jaws.

It will be noted in FIGS. 2, 5 and 7 that an auxiliary hydraulic cylinder 52 is suspended vertically from the center of the lower nipper jaw 16 and aligns with a pad 54 mounted on the top center of the cross bar 38.

As shown in FIG. 9, the cylinder 52 is formed with four longitudinal chambers 54 in each of which is mounted a piston 56 having reduced end portions 57. The actions of the pistons are determined by means of a slide 62 which is mounted for horizontal movement through the lower end of the cylinder 52. As best seen in FIG. 8, the slide 62 is a rectangular, flat metal plate having a series of detents 64 along one side and a pair of parallel slots 66, 68 formed lengthwise through the slide. It will be observed that both slots, although of equal length, are wide at one portion and narrow at another with the slot 68 having its wide portion somewhat shorter in lentgh than that of the slot 66, but having a longer section of narrow opening. With this arrangement, the number of the pistons 56 which will be in position to exert pressure on the nipper jaws may be selected by the operator. It will be understood that the wide portions of the slots are dimensioned to permit the pistons 56 to pass through as suggested in FIG. 7 whereas the narrow portions will accommodate only the reduced ends 57 of the piston. In the left hand piston, the shoulder, formed between the piston and its reduced end 57, will bear against the top of the slide 62 and will remain in the upward position while the right hand piston will be able to move down and with its lower end bearing against the pad 54, it will exert its force to press the nipper jaws towards each other.

The function of the auxiliary hydraulic cylinder 52 is to make available a selection of pressures for operating the nipper jaws. The particular nipper jaw pressure required to form properly the joint of a book depends upon the thickness of the book and certain other factors. It will be appreciated that if the pressure applied by the nipper jaws to the joints of a book is excessive the joint will be damaged, whereas if the pressure is too low, the joint will not be properly formed. It is therefore desirable that the operator be able to adjust the nipper jaw pressure in order to obtain optimum results.

Assuming that a book has been inserted between the plate and the platen 14 with the joints lined up with the nipper jaws, upon actuation the master cylinder 24 will cause its piston 26 together with its integrated slave piston 27 to telescope downwardly and bring the plate 10 down against the book under a fixed pressure of about 18,000 lbs. Simultaneously the upper nipper jaw 12 will be moved by the plate 10 down against the joint of the book. However, since the lower nipper jaw is yieldably mounted to the frame, the pressure applied to the book joints will be considerably less than that applied to the remaining portion of the book and preferably will be in the order of 300 to 1500 lbs. for example.

The particular pressure that will be applied by the nipper jaws is determined by the number of acting pistons 56. Referring again to FIG. 7, hydraulic fluid is admitted to the auxiliary cylinder through an inlet 70 at the top of the cylinder 52. Every piston which is able to move downward and bear against the pad 57 will exert a definite pressure against the lower nipper jaw 16 and through the cross-bar 38, the vertical rods 36, and the bracket 34 to the opposing upper jaw. It follows that the more pistons are locked in the upward position, the less will be the pressure. In this manner the pressure applied to the joints of a book is reduced and conversely the pressure may be increased by moving the slide 62 to the left so that additional pistons 56 will exert their force.

For convenience in operating the slide 62, a handle 74 is mounted at one end and extends out through an elongated opening formed in a front panel 76. Extending also through the front panel are a pair of widely spaced starter buttons 78 for switches 80 mounted on the web 42. By depressing both switches simultaneously, the hydraulic system is actuated and the plate 10 reciprocated. Since it is necessary that both buttons be depressed at the same time for the machine to cycle, there is no chance that the operator's hands be caught between the nipper jaws or the pressure plates. The starter buttons are spaced sufficiently wide apart as to require both of the operator's hands to work them. Also, these buttons are located at a distance below the nipper jaws and plates as to make it impossible for the operator to move his hands from the buttons to the jaws before they are closed. It will be appreciated that this safety feature removes one of the major risks of injury to personnel.

Mounted on the side of the auxiliary cylinder 52 is a cutout switch 82 having a spring loaded follower 84 adapted to seat in whatever detent 64 on the slide 62 is moved into register with it. The switch 82 serves to prevent operation of the machine whenever the slide 62 is not properly indexed in position. It will be understood that damage might otherwise occur if the slide were partway between detent stops when the machine is cycled.

Referring now more particularly to FIG. 10, there is illustrated a schematic diagram of the hydraulic control system. This system includes a hydraulic pump 86 driven by a motor 88 and taking suction on a sump 90 through a conduit 92. The pump 86 discharges through a conduit 96 to a four-way valve 98 controlled by a solenoid 100. A timer 102 is mounted conveniently on top of the machine and controls automatically the operation of the solenoid. From the valve 98 a conduit 104 connects through a flow control valve 105 with the upper portion of the master cylinder while a conduit 106 connects with the lower end of the same cylinder. It will be understood that the hollow slave 27 piston within the cylinder 24 will be extended or retracted according to the position in which the solenoid has placed the four way valve 98. A conduit 103 communicates with the annular space formed between the slave piston 27 and an axial extension 107 so that the slave piston may be retracted upon the delivery of fluid under pressure resulting from switching the position of the four way valve 98. A drain line 108 connects to the four way valve to deliver the hydraulic discharge to the sump 90 from the line 104 during a retraction of the piston 27 and from the line 103 during an extension thereof. As indicated previously, the auxiliary cylinder 52 is provided with an inlet 70 directly connected to the conduit 104 so that both the master and auxiliary cylinder operate simultaneously.

Referring more particularly to FIGS. 5 and 6, the treadle assembly will now be described in detail. When a book is placed between the plate and platen it is necessary to locate the book with respect to the nipper jaws so that when the machine is subsequently actuated the jaws will apply pressure exactly along the crease lines. To this end the upper nipper jaw is mechanically supported by the treadle assembly for independent reciprocation with respect to the bracket 34, the plate 10 and lower jaw 16 when the plate is in its normally open position.

The tubular rods 36 are formed with oppositely facing longitudinal slots 110 at their upper portions to accommodate opposite ends of the upper nipper jaw 12. Mounted for axial reciprocation within each of the tubular rods 36 is a connecting rod 112. The upper ends of these rods connect with the ends of the upper nipper jaw 12 while their lower ends are supported by the treadle assembly.

In FIG. 6 it will be seen that the treadle assembly includes a horizontal treadle 114 supported at its ends by

lever arms 116 which are pivotally mounted to the upright frame members 20 by pins 118. The treadle 114 is arranged parallel to a rounded lip 120 which is fastened along the upper edge of the member 18 and serves as a rest for the heel of the operator's foot. The toe or sole of the operator's foot will extend through a rather large opening 122, formed in the lower front of the machine, and will bear comfortably on the treadle 114. Pivotably connected at the extremity of each lever arm 116 is a tie rod 124 which also pivotably engages a rocker arm 126. The rocker arm 126, in turn, is arranged to support at one end, by means of a swivel bushing 128, the lower portion of the connecting rod 112. The other end of the rocker arm 126 is supported by the link 130. The link 130 is suspended from an upright frame member by a pin 132, Each pair of arms 126 are rigidly connected together by tube 131.

Biasing this assembly to a normally upward position is an elongated coil spring 134 which is fastened at its upper end to the frame of the machine and at its lower end to the rocker arm 126. Completing the treadle assembly is a guide rod 136 which is pivoted to the frame member 20 at one end and to the rocker arm 126 at its opposite end.

This unique treadle assembly because of its superior balance, excellent mechanical advantage, and straight line motion requires only a very light pressure against the treadle 114 to produce a rather long stroke of the upper nipper jaw 12. It will be readily apparent both from FIG. 6 and from the above description, that depressing of the treadle 114 by the operator's foot biases the rocker arm 126 against the spring 134, letting down the connecting rod 112 and thus closing the nipper jaws. The rod 136, in co-operation with the link 130, serves to guide the treadle mechanism in a fashion to produce a straight vertical movement. In other words, the pedal linkage system converts the arc motion of the treadle 114 into a straight line motion of the bushing 128.

Because the treadle assembly only supports, and is not fastened to the vertical rods 112, the operator can depress the treadle all the way, without exerting any additional pressure on the nipper jaw beyond its weight.

In practice book presses of this type are provided with heated pressing surfaces to accelerate the setting of the liquid adhesive that has been applied between the cover and the outer leaves. Heating elements 138 may be easily located within the plate 10, the plates 14 and the two nipper jaws. Electrical leads for the movable upper jaw may be conveniently passed through the connecting rod 112 if desired.

The machine illustrated and described herein is extremely versatile in operation and is capable of accommodating both books and magazines in a variety of sizes and thicknesses. A run of books of mixed sizes may be readily finished even by an unskilled operator. The operation of the machine is rapid with the joints being nipped simultaneously with the pressing of the book. The treadle mechanism functions in a very smooth manner and, since a very light pressure is required to depress the treadle, operator fatigue is avoided.

While the invention has been described with particular reference to the illustrated embodiment, it will be understood that numerous modifications will appear to those skilled in the art without departing from the scope of the invention.

Having thus described our invention, what we claim and desire to obtain by Letters Patent of the United States is:

1. A combination book press and building-in machine, comprising a frame, a fixed platen mounted on said frame, a pressure plate movably mounted on said frame in parallel register with said platen, master hydraulic means for moving said plate to and away from said platen whereby said plate is adapted to apply pressure on a book placed between said plate and said platen, a first nipper jaw located adjacent a marginal edge of said platen, a second nipper jaw movably mounted in parallel register with said first nipper jaw, means connecting said second nipper jaw yieldably with said plate whereby said nipper jaws close simultaneously with said plate to nip the joints of said book, auxiliary hydraulic means operable in conjunction with said master hydraulic means for furnishing hydraulic force to said first jaw and applied against said second jaw simultaneously with the application of pressure on said book by said plate and means independently of said master hydraulic means for varying the effective force applied to said second jaw.

2. A combination book press and building-in machine, comprising a frame, a fixed platen mounted on said frame, a pressure plate movably mounted on said frame in parallel register with said platen, master hydraulic means for moving said plate to and away from said platen whereby said plate is adapted to apply pressure on a book placed between said plate and said platen, a first nipper jaw located adjacent a marginal edge of said platen and yieldably mounted to said frame, a second nipper jaw movably mounted in parallel register wtih said first nipper jaw, means connecting said second nipper jaw yieldably with said plate whereby said nipper jaws close simultaneously with said plate to nip the joints of said book, auxiliary hydraulic means operable in conjunction with said master hydraulic means for furnishing hydraulic force to said first jaw against said second jaw simultaneously with the application of pressure on said plate by said master hydraulic means, a plurality of selectively operable pressure transmitting pistons, means for varying the effective force applied to said first jaw and treadle means for moving said second jaw independently of said plate when said plate is in an open position.

3. A combination book press and building-in machine, comprising a frame, a fixed platen mounted on said frame, a pressure plate movably mounted on said frame in parallel register with said platen, master hydraulic means for moving said plate to and away from said platen whereby said plate is adapted to apply pressure on a book placed between said plate and said platen, a first nipper jaw located adjacent a marginal edge of said platen and yieldably mounted to said frame, a second nipper jaw movably mounted in parallel register with said first nipper jaw, means connecting said second nipper jaw yieldably with said plate whereby said nipper jaws close simultaneously with said plate to nip the joints of said book, auxiliary hydraulic means operable simultaneously in conjunction with said master hydraulic means for furnishing hydraulic force to said first jaw and against said second jaw, an array of axially movable pistons associated with said auxiliary hydraulic means, each of said pistons being adapted to apply a portion of the total force available to said first jaw and against said second jaw and means for selectively actuating said pistons.

4. A combination book press and building-in machine, comprising a frame, a fixed platen mounted on said frame, a pressure plate movably mounted on said frame in parallel register with said platen, master hydraulic means for moving said plate to and away from said platen whereby said plate is adapted to apply a heavy pressure on a book placed between said plate and said platen, a first nipper jaw located adjacent a marginal edge of said platen and yieldably mounted to said frame, a second nipper jaw mounted in parallel register with said first nipper jaw, means connecting said second nipper jaw yieldably with said plate whereby said second nipper jaw is adapted to close simultaneously with said plate to nip the joints of said book, auxiliary hydraulic means interposed between said first jaw and said second jaw and operable simultaneously with said master hydraulic means for furnishing hydraulic force to said first jaw against said second jaw, manually adjustable jaw connecting piston means for varying the effective force trans-

mitted to said jaws and treadle means for moving said second jaw independently of said plate.

5. A hydraulic device for use in a building-in machine having first and second nipper jaws mounted for relative movement to and away from each other, comprising a cylinder mounted on said first jaw, a plurality of pistons slidably mounted within said cylinder, means for selectively locking certain ones of said pistons in an inoperative position, means for delivering a flow of hydraulic fluid under pressure into said cylinder, tension members connected to said second jaw and extending into line with said piston whereby one or more of said pistons may bear against said tension means to apply a selected nipping pressure to said jaws.

6. A hydraulic device according to claim 5 wherein said means for selectively locking certain ones of said pistons includes a plate slidably mounted in said cylinder, said plate being formed with openings dimensioned to permit the passage of a piston when aligned therewith.

7. A hydraulic device according to claim 6 including detent stops formed in said plate and follower means for properly positioning said slide.

8. A device for applying a selected pressure between a pair of abutments, comprising a cylinder mounted to one of said abutments, a plurality of pistons slidably mounted within said cylinder, means for selectively locking certain ones of said pistons in an inoperative condition, means for delivering a flow of fluid under pressure into said cylinder, means connecting one or more of said pistons with the other of said abutments whereby said pistons may apply pressure between said abutments, the effective pressure applied between said abutments being related to the number of pistons in operative condition.

9. Apparatus for exerting pressure against an abutment, comprising a support, a tubular casing mounted to said support, said casing being closed at one end, a plurality of pistons slidably mounted at the opposite end of said casing and adapted for limited axial reciprocation in and out of said casing, said piston being adapted to drivingly engage said abutment when extending outwardly of said casing, means connecting said casing to a source of pressurized fluid for urging said pistons into axially extended positions and means for locking selected ones of said pistons within said casing, whereby the pressure applied to said abutment may be selectively varied.

10. Apparatus according to claim 9 wherein said locking means includes an apertured plate slidably connected to said casing.

11. A treadle mechanism for operating a nipper jaw in a building-in machine, including a frame, an elongated first nipper jaw mounted horizontally on said frame, an elongated second nipper jaw mounted parallel to and vertically above said first nipper jaw and movable to and away from said first jaw, at least one vertically disposed rod depending from said second jaw, a rocker arm having its forward end pivotally engaging the lower end of said rod and extending rearwardly therefrom, a link pivotally engaging the rearward end of said rocker arm at one end and said frame at the other end, a spring connecting said rocker arm to said frame and normally urging said arm and said rod in a raised position, a guide rod pivotally engaging at its rearward end the mid-portion of said rocker arm and said frame at its forward end, a tie rod pivotally engaging at its upper end the mid-portion of said rocker arm and depending therefrom, a lever arm disposed generally parallel to said guide rod and pivotally engaging at its rearward end the lower end of said tie rod and said frame at its forward end at a point spaced below the frame pivot point of said guide rod and a treadle rigidly mounted to the mid-portion of said lever arm whereby pivotal movement of said treadle will cause linear movement of said nipper jaw rod.

12. A treadle mechanism for operating a nipper jaw in a building-in machine, including a frame, a first nipper jaw mounted in horizontal position on said frame, a second nipper jaw mounted vertically above said nipper jaw and movable to and away from said first nipper jaw, vertically disposed rods freely supporting said second jaw, lever means pivoted to said frame and engaging said rods, spring means connecting said frame and said lever means for supporting said second jaw in a normally upward position and a treadle operatively connecting said rods for depressing said rods to permit said second nipper jaw to drop freely towards said first nipper jaw.

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