July 14, 1970 J. C. JUREIT ET AL 3,520,252

TOGGLE PRESS

Filed Oct. 13, 1967 2 Sheets-Sheet 1

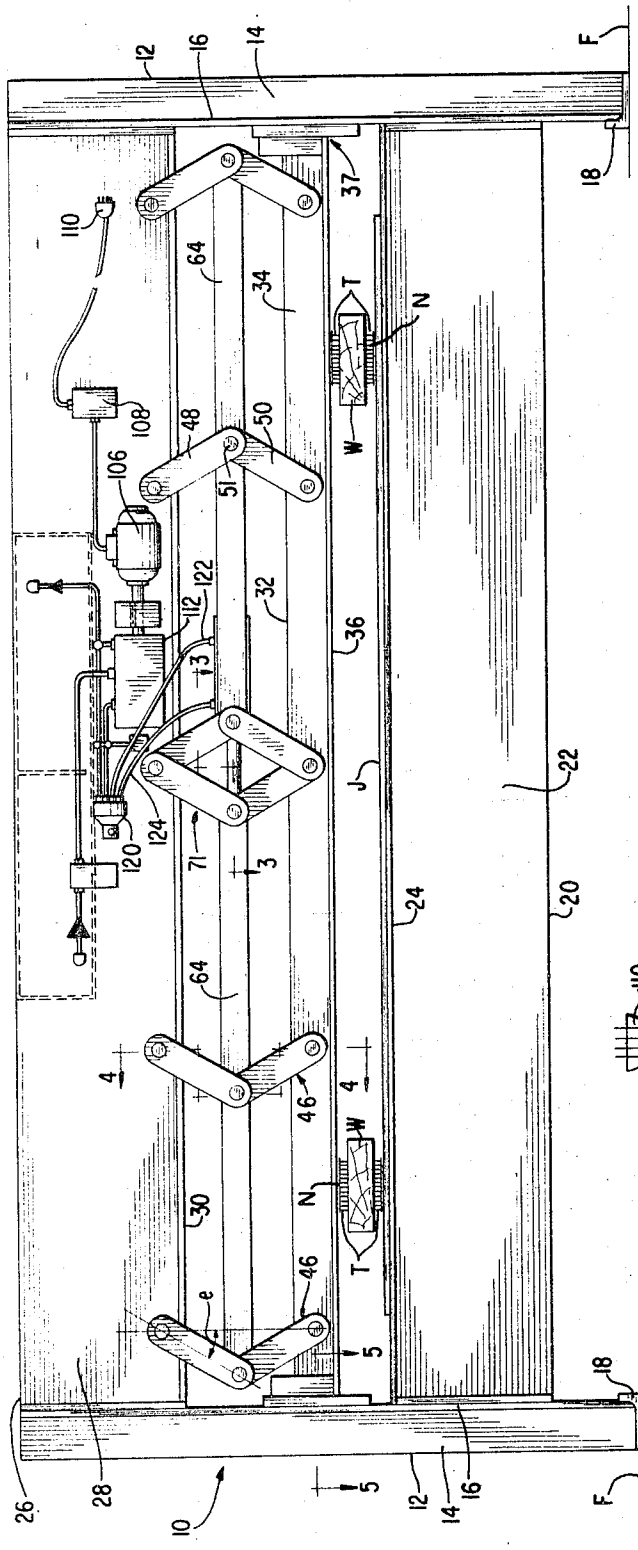

FIG 1

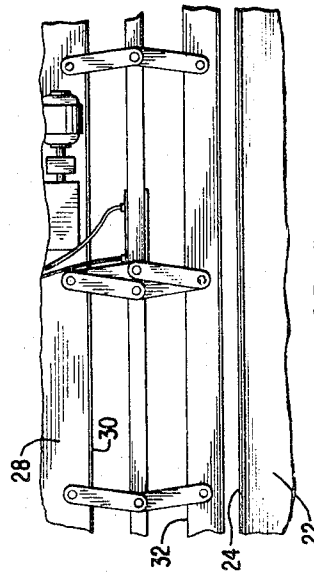

FIG 2

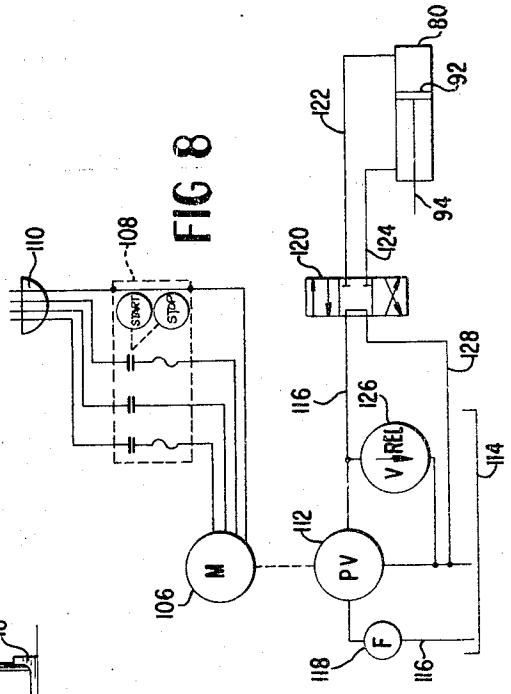

FIG 8

INVENTORS
JOHN C. JUREIT
OSCAR CSAKVARY

BY LeBlanc & Shur

ATTORNEYS

July 14, 1970 J. C. JUREIT ET AL 3,520,252

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Filed Oct. 13, 1967 2 Sheets-Sheet 2

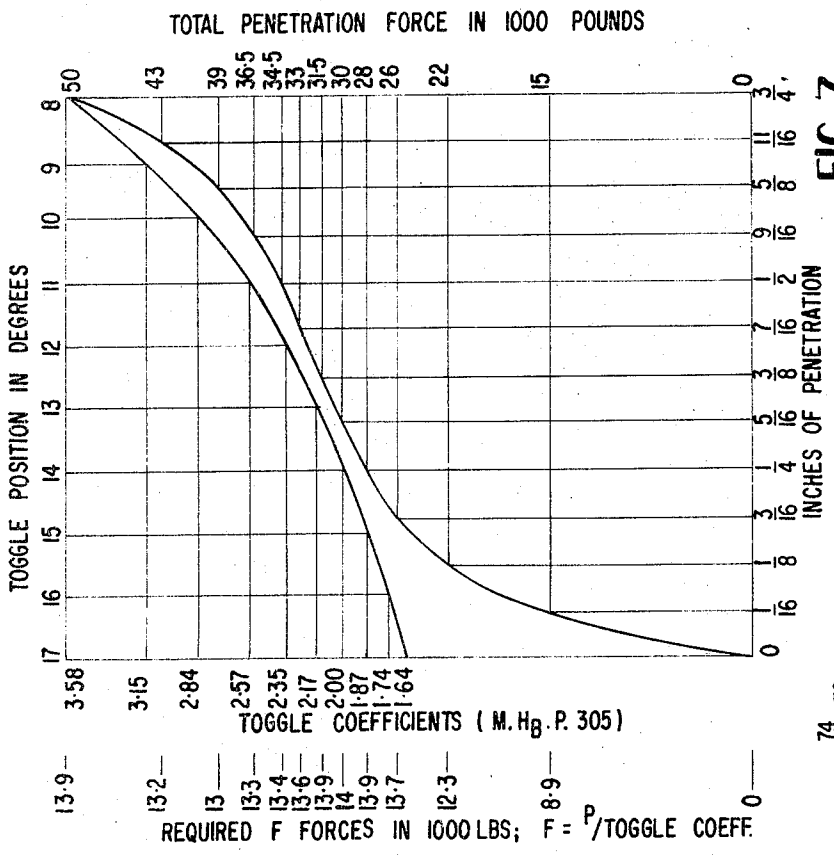

FIG 7

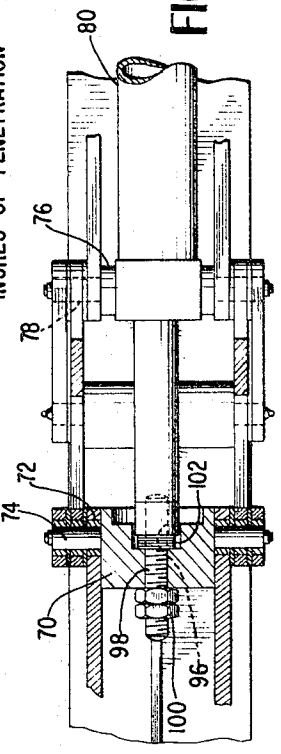

FIG 3

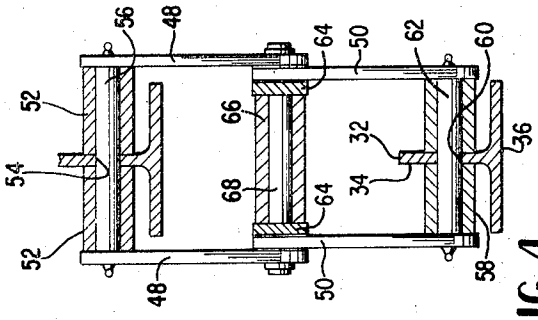

FIG 4

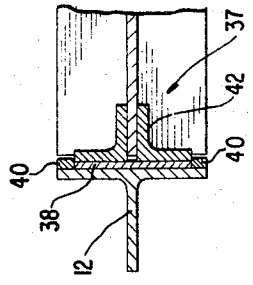

FIG 5

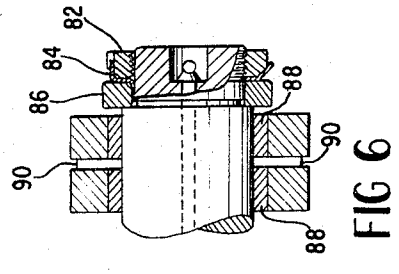

FIG 6

INVENTORS
JOHN C. JUREIT
OSCAR CSAKVARY

BY LeBlanc & Shur

ATTORNEYS

United States Patent Office 3,520,252 Patented July 14, 1970

3,520,252

TOGGLE PRESS

John C. Jureit, Coral Gables, and Oscar Csakvary, Miami, Fla., assignors to Automated Building Components, Inc., Miami, Fla., a corporation of Florida

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Int. Cl. B30b 1/16
U.S. Cl. 100—272 10 Claims

ABSTRACT OF THE DISCLOSURE

The toggle press comprises a pair of elongated press platens, the upper platen being mounted in guides on a frame for movement toward and away from the lower press platen. Pairs of longitudinally spaced toggle links suspend the movable platen from a fixed frame spaced above the upper press platen. The intermediate joints of the next adjacent spaced toggle links joining one end portion of the press platen to the frame lie to identical sides of straight lines intersecting the pivotal connections of the respective toggle links with the frame portion and the movable platen while the intermediate joints of the spaced, next adjacent toggle links joining the opposite end portion of the press platen to the frame lie to the opposite sides of straight lines intersecting the pivotal connections of the respective latter toggle links with the frame and the movable platen. Transfer bars interconnect the intermediate joints of the toggle links of each press end portion and a piston and cylinder arrangement drives the transfer bars horizontally toward and away from each other to reciprocate the movable press platen in the vertical direction.

BACKGROUND OF THE INVENTION

The present invention relates to presses, and particularly to a toggle-actuated press for embedding connector plates of the type having nail-like teeth struck therefrom into wooden structural members forming trusses, wooden panels, or the like.

In the construction of prefabricated wooden panels, trusses, or the like, hereinafter referred to as trusses, for use in building construction, it has been found that one of the simplest methods of forming these trusses is to preposition the wooden structural members on a jig table in the desired pattern, locate fasteners such as those disclosed in applicant's U.S. Pat. No. 2,877,520, issued Mar. 17, 1959, at the butt joints of the wooden members on opposite sides thereof, and then drive the fasteners into the members, thereby forming a completed truss. Presses particularly adapted for driving nailplates of this type are known, an example of which is U.S. Pat. No. 3,079,607, dated Mar. 5, 1963. The press disclosed therein and other known presses usually apply a constant load to the nailplates throughout the range of penetration of the plural nail-like teeth or nails thereof into the wooden members without regard to the required force actually necessary to dirve the nails of the plates at the various depths of penetration thereof throughout the entire range of penetration for further penetration into the wooden members unil fully driven.

The actuating mechanism for these known presses normally comprise fluid-actuated piston and cylinder arrangements wherein the fluid is pumped into one or more hydraulic or penumatic cylinders to displace a like number of pistons connected to a press platen mounted for movement toward and away from a press bed. The force applied by these fluid-operated press platens is a direct function of the applied pressure and is in no way related to the actual penetration force required to drive nailplates of the foregoing type into the wooden members

at the various depths of penetration thereof throughout the full range of penetration. Moreover, these presses require large power inputs as the power is normally determined by the maximum force or press tonnage required without regard to the power requirements at each stage of the press stroke necessary to drive the nails at various depths of penetration thereof.

SUMMARY OF THE INVENTION

The present invention provides a toggle-actuated press comprising a lower press platen facing upwardly on the lower portion of a frame and an upper press platen suspended from an upper portion of the frame by a plurality of toggle links, the upper press platen being guided for vertical movement toward and away from the lower press platen. The toggle links are arranged in spaced pairs on opposite sides of the press, the paired toggle links on one side of the press having their respective intermediate joints located to one side of straight lines intersecting the end pivotal connections at opposite ends of the associated toggle links, while the respective intermediate joints of the toggle links on the other side of the press are located to the opposite sides of the straight lines intersecting the pivotal connections at opposite ends of the associated toggle links. Thus, actuation of the toggle links such that the intermediate joints of the toggle links on each side of the press move toward and away from one another reciprocates the lower platen vertically toward and away from the fixed platen.

For a pair of typical nailplates, for example, two 20 U.S. Standard gauge nailplates each having nails ⅜ inch long, and of the type disclosed in my copending application Ser. No. 293,949, filed July 10, 1963, it has been found that the total force required to drive the nails of both plates into the wooden members is a nonlinear function of the degree of penetration of the nails in the wooden members. For example, to drive nails of the above-mentioned type simultaneously into opposite sides of wooden members for a combined distance of 3/16 inch from the start thereof, the required force rises sharply in a somewhat hyperbolic curve to a value on the order of 26,000 pounds. For the next ⅜ inch combined penetration to a combined total penetration depth of 9/16 inch, the required penetration force increases substantially linearly from 26,000 pounds to approximately 36,500 pounds. From the 9/16 inch penetration to the full penetration of ¾ inch (⅜ inch per nailplates), the required penetration force increases in a parabolic curve from 36,500 pounds to approximately 50,000 pounds.

By a unique disposition of the toggle links and the actuating means therefor, the toggle press of the present invention provides a press force which varies approximately as the required penetration force varies throughout the full range of penetration of the nails from the starting thereof in the wooden members until fully embedded therein. It has been found that the force applied by the toggle actuated movable press platen to the nailplates may vary nonlinearly similarly as the required penetration force varies with the degree of penetration. It has been found further that a toggle movement of from 17° to 8°, that is, a decrease in the angle formed by the intersection of a straight line joining the opposite ends of the toggle links and a straight line extending through the pivotal axis of the toggle and one end thereof, provides a linear displacement of the press platen of ¾ inch. With this arrangement and for a given force applied to the toggles in the horizontal direction tending to straighten the same, such force, in accordance with the present invention, is multiplied by a toggle coefficient or factor which nonlinearly increases similarly as the total penetration force varies nonlinearly with the degree of penetration.

Additionally, the present toggle press provides a double toggle action in which the force applied in the horizontal direction acts between at least a pair of toggles to halve the required horizontal force for a given force in the vertical direction. To this end, a centrally disposed piston and cylinder is connected respectively to the intermediate joints of the toggle links located on opposite sides of the press. In this manner, extension or retraction of the piston within the cylinder operates to simultaneously drive the intermediate joints of the toggle links on opposite sides of the press and on opposite sides of the horizontally applied force toward and away from one another to thereby vertically reciprocate the press platen. The piston and cylinder is wholly supported by the toggle links and is displaced vertically as the intermediate joints of the toggle links are displaced.

Accordingly, it is an object of the present invention to provide an improved press particularly adapted for driving nailplates of the type having teeth struck therefrom into wooden structural members to form trusses, panels, or the like.

It is another object of the present invention to provide an improved press adapted for driving nailplates of the type having teeth struck therefrom into wooden structural members to form trusses, panels, or the like, wherein the pressing force varies as the required penetration force varies with the degree of penetration.

It is yet another object of the present invention to provide a toggle actuated press adapted for driving nailplates of the type having teeth struck therefrom into wooden structural members to form trusses, panels, or the like, wherein the pressing force varies nonlinearly as the required penetration force varies nonlinearly with the degree of penetration.

It is yet another object of the present invention to provide a toggle press having a press platen wherein the force applied thereby is an increasing function of the press platen displacement.

It is still another object of the present invention to provide a toggle press having a floating actuator therefor.

It is a further object of the present invention to provide a toggle press having a double toggle action, thereby reducing the required force in the horizontal direction.

It is still a further object of the present invention to provide a toggle press which is simple in construction, easily operated, and low in cost.

These and further objects and advantages of the present invention will become more apparent upon reference to the following specification and claims, and the appended drawings.

DESCRIPTION OF THE DRAWING FIGURES

FIG. 1 is a side elevational view of a toggle press constructed in accordance with the present invention and illustrating a press position immediately prior to driving the nailplates into the wooden members;

FIG. 2 is a fragmentary elevational view on a reduced scale of the press illustrated in FIG. 1 and showing the press at the completion of its driving stroke;

FIG. 3 is an enlarged fragmentary cross sectional view thereof taken about on line 3—3 of FIG. 1;

FIG. 4 is an enlarged fragmentary transverse cross sectional view thereof taken about on line 4—4 of FIG. 1;

FIG. 5 is an enlarged fragmentary cross sectional view thereof taken about on line 5—5 of FIG. 1;

FIG. 6 is an enlarged fragmentary view illustrating the toggle link pivot shaft and retainer nuts with washers;

FIG. 7 is a graphic illustration of the applied and required forces against the toggle link positions in degrees and inches of penetration of the nailplates; and

FIG. 8 is a schematic illustration of the electrical-hydraulic control system for the press hereof.

DESCRIPTION OF A PREFERRED EMBODIMENT

Referring to FIG. 1, there is shown a toggle press, generally indicated at **10**, comprising a pair of upstanding structural T-shaped beams **12** having web and flange portions **14** and **16**, respectively, and suitably secured at their lower ends as by welding or the like to a pair of elongated laterally extending beams **18**, preferably anchored to footing F by means not shown. A lower fixed T-shaped member **20**, having an enlarged web **22** and flange **24**, is suitably fastened at opposite ends as by welding or the like to the lower facing portions of flanges **14** of uprights **12**. An upper elongated T-shaped member **26**, having an enlarged web portion **28** and an underlying flange **30**, is suitably secured at its opposite ends as by welding or the like to the upper portions of flanges **16** of uprights **12**. An intermediate T-shaped member **32**, having a web portion **34** and a lower flange **36**, is mounted at its opposite ends in guide formations generally indicated **37** for vertical sliding movement toward and away from flange **24** of the lower fixed T-shaped member. It is thus apparent that flanges **24** and **36** comprise a pair of press platens between which the wooden members W forming the truss, panel, or the like, hereinafter referred to as a truss, may be located for fabrication. As best seen in FIG. 5, guides **37** each comprise a flat wearplate **38** suitably fastened along the inner face of flange **16** and a pair of wearbars **40** suitably secured along the outer margins of the inwardly directed face of flange **16** along opposite edges of wearplate **38**, wearbars **40** projecting inwardly beyond the face of wearplate **38** to form a downwardly extending keyway. A pair of upstanding right angle brackets **42** are suitably fastened on opposite sides of web **32** and project beyond the end of intermediate T-shaped member **32** for sliding engagement in the keyway.

As seen in FIG. 1, wooden framing members W are located between the flanges **36** and **24** of the upper and lower press platens respectively. Nailplates N having nail-like teeth T are disposed on opposite sides of the members W at the butt joints thereof, the truss assembly being supported on a jig table J having suitable clamps for securing the members W in predetermined relation to form the truss. Jig table J may be of any suitable type, such as illustrated in U.S. Pat. No. 3,238,867, dated Mar. 6, 1966. The upper press platen **32** is driven downwardly to simultaneously embed the nailplates N located on opposite sides of each butt joint into the wooden members M hereinafter described.

Movable press platen **32** depends from the upper fixed T-shaped member **26** by means of a plurality of toggles generally indicated at **46**. Each toggle **46** comprises an upper link **48** and a lower link **50** joined together at their opposite ends to form an intermediate pivotal joint **51**. Toggles **46** are arranged on opposite sides of flange **40** and web **34** forming pairs of transversely spaced toggles **46** at longitudinally spaced positions along press **10**. The laterally spaced upper ends of the toggle links **40** are pivotally connected to fixed member **26**. As seen in FIG. 4, each connection comprises a pair of sleeves **52** secured as by welding or the like on opposite sides of web **28** in axial registry with an opening **54** through web **28**. A pin **56** extends through sleeves **52** and opening **54** to project beyond the edges of flange **30** for engagement at its opposite ends with openings formed through the laterally spaced upper ends of the toggle links **48**. Similarly, the laterally spaced ends of the lower ends of the lower toggle links **50** are pivotally connected to movable press platen **32**. Each of these latter connections comprises a pair of axially reduced sleeves **58** secured on opposite sides of web **34** of upper press platen **32** in axial registry with an opening **60** through web **34**. An axially reduced pin **62** extends through sleeves **58** and opening **60** for engagement at its opposite ends within openings formed through the lower ends of lower links **50**.

For reasons noted hereinafter, the longitudinally spaced intermediate joints **51** of the paired toggles on opposite end portions or sides of the press **10** extend in opposite directions from one another. As seen in FIG. 1, the joints **51** of the paired toggles (three being shown) to the left of center of the press extend on respective identical sides of straight lines joining the pivoted ends of links **48** and **50** to the fixed member **26** are movable platen **32**, respectively, while the joints **51** of the paired toggles (three being shown) to the right of center of the press extend on respective identical but opposite sides of straight lines joining their pivoted ends to member **26** and platen **32**. The joints **51** on opposite sides of the press are each joined together by a pair of laterally spaced transfer bars **64**. As seen in FIG. 4, opposite ends of sleeves **66** are secured as by welding or the like to the laterally spaced transfer bars **64** and pins **68** extend through sleeves **66**, through openings in the transfer bars **64** and openings through the upper and lower ends of the lower and upper toggle links **50** and **48**, respectively. Sleeves **66** and pins **68** join the intermediate joints **51** of the toggles **46** intermediate the ends of transfer bars **64** and the outermost toggles **46**, i.e., the two outermost pairs of toggles **46** on each end portion of the press.

The central four pairs of toggles **46** form a double scissors arrangement indicated at **71** and are pivotally connected at their upper and lower ends similarly as the toggle links spaced endwise therefrom. A block **70** at the left hand intermediate joint **51** of the double scissors toggles, as seen in FIG. 3, laterally spaces transfer bars **64** and has a pair of trunions **72** engaging within openings formed through the inner ends of bars **64**. A pin **74** extends integrally from each trunion **72** and engages within openings formed through the lower and upper ends of the upper and lower toggle links **48** and **50**, respectively, a pair of dowels **76** pivotally receive a pair of trunions (not shown) mounted on a cylinder **80** hereinafter described and mount outwardly extending pins **78** which engage through openings in transfer bars **64** and the upper and lower ends of the lower and upper toggles links **50** and **48**, respectively.

As seen in FIG. 6, the ends of the toggle links **48** and **50** are retained on the ends of pins **56**, **62**, **68**, and **78** by means of locknuts **82** threaded on the ends of the respective pins. Locknuts **82** clamp lockwashers **84** against collars **36** which engage against a shoulder adjacent the ends of the respective pins. Suitable bushings **88** are provided within the openings formed through the ends of the toggle links and thrust bearings **90** are located between the ends of the toggle links and the transfer bars **64**.

A free-floating piston and cylinder are connected between the intermediate joints **51** of the double scissors toggle arrangement **71**. Cylinder **80** is pivotally supported at one end by means of the trunions, not shown, engaging within dowels **76**, with the opposite end thereof otherwise unsupported. The end **94** of piston **92** is axially threaded as at **96** to receive the end of a setscrew **98** which engages through block **70**. Nuts **100** thread on the opposite end of setscrew **98** and a suitable number of washers **102** selectively space end **94** of piston **92** to provide the desired toggle action as hereinafter described. It is thus seen that the sole connection between the intermediate joints **51** of the double scissors toggle arrangement **71** comprises piston and cylinder **92** and **80**, respectively, whereby extension or retraction of piston **92** reciprocates intermediate toggle joints **51** on opposite sides or end portions of the press toward and away from one another. This horizontal reciprocation is translated through the toggle action into vertical reciprocation of the upper press platen **32**.

An electrical-hydraulic control system is provided and comprises an electric motor **106** connected through a suitable stop-start control, indicated at **108**, to a power supply schematically illustrated at **110** for driving a variable displacement hydraulic pump **112**. Pump **112** pressurizes fluid from a reservoir **114** through a fluid conduit **116** having a suitable filter **118** to provide fluid to opposite ends of cylinder **80** through a four-way, three-position control valve **120**. Valve **120** is manually operated by the press operator and can be shifted from the neutral position, as shown, to a position providing fluid to cylinder **80** to extend piston **92** via fluid conduit **122** and to a position providing fluid to the opposite end of cylinder **80** to retract piston **92** via fluid conduit **124**. A suitable relief valve **126** is provided between supply conduit **116** and reservoir **114** and a return conduit **128** is provided between valve **120** and reservoir **114**.

Accordingly, to move upper press platen **32** downwardly to embed nailplates N in the wooden members W forming the butt joints, the operator shifts valve **120** to supply fluid to the left hand end of cylinder **80** as seen in FIGS. 1 and 8 via conduits **116** and **124**, whereupon piston **92** retracts and draws the intermediate joints **51** on opposite sides or end portions of the press toward one another. The lower ends of the toggles thus force press platen **32** downwardly in guideways **37** to engage against and embed the nailplates in wooden members W. When the plates are embedded, the operator shifts valve **120** to provide pressure fluid into the right hand end of cylinder **80** as seen in FIGS. 1 and 8 via conduits **116** and **122** to extend piston **92**, thereby moving intermediate joints **51** of the toggles on opposite sides or end portions of the press away from one another, whereupon press platen **32** is raised in guideways **37**.

It is an important feature hereof that the press force varies approximately as the required penetration force of the nailplates varies throughout the full range of penetration of the nails from the start thereof in the wooden members until fully embedded therein. It is also significant that the force required to drive the piston and cylinder arrangement in the horizontal direction is considerably less than the force applied in the vertical direction to the nailplates. To accomplish this and with reference to FIG. 7, it has been found that the total force required to drive the nails of both plates into wooden members W is a nonlinear function of the degree of penetration of the nails in the wooden members and this can be seen with reference to the lower curve in FIG. 7 employing the lower and right hand scale. It has also been found that the force applied by the toggle actuated press platen **32** may vary nonlinearly in a similar manner forming a substantially matching curve as the required penetration force varies with the degree of penetration and that this occurs at a particular toggle position. For a given penetration of ¾ inch which is the required penetration to fully embed two nailplates of the 20 gauge type each having ⅜ inch long nails, and hence for a ¾ inch downward movement of press platen **32**, it has been found that, by moving the toggles from toggle positions of about 17° to toggle positions of 8° through the angle *e* seen in FIG. 1, the force applied to the nailplates will vary approximately as the force required to drive the teeth thereof into the wooden members throughout the full range of penetration. This is accomplished, moreover, upon application of a constant horizontal force and of a magnitude considerably less than the applied vertical force.

For example, the preferred embodiment employs a hydraulic system capable of developing a maximum of 3,000 p.s.i. in cylinder **80**. A piston area of approximately 2½ square inches on the press lowering stroke provides, in view of the double scissors arrangement **71**, a total horizontal force of approximately 14,000 pounds. Thus, for a ¼ inch penetration which requires 28,000 pounds, a toggle mechanical advantage of 2 is required and this occurs at the 14° position of the toggle. The toggle is arranged such that the vertical distance traveled by the platen **32** between the 17° and 8° positions is equal to ¾ inch. Accordingly, it can be seen that throughout the full range of the depth of penetration of the nails and with a constant applied force in the horizontal direction of 14,000 pounds, the penetration force required divided by the mechanical advantage of the toggles or the toggle

coefficient at the particular positions thereof corresponding with the depth of penetration is approximately equal to the constant applied horizontal force. The angular positions of the toggles are chosen to provide a predetermined distance of press travel, in this instance ¾ inch, while simultaneously affording an increasing mechanical advantage in accordance with the increasing penetration force required throughout the full range of penetration. As will be noted on the graph, 50,000 pounds is required to finally embed the nails and this is provided by a horizontal cylinder force approximating 14,000 pounds. Accordingly, a much smaller power unit is required than heretofore envisioned.

It is thus seen that the objects of the invention have been fully accomplished in that press platen **32** provides a pressing force which is an increasing nonlinear function of the platen displacement and which increases similarly as the required penetration force increases throughout the full range of nail penetration. Moreover, the present press provides a pressing force of a magnitude several times the magnitude of the applied horizontal force, thereby permitting use of smaller power units than heretofore employed with consequent reduction in the overall cost of the press.

What is claimed and desired to be secured by United States Letters Patent is:

1. A press comprising frame means, a pair of press platens carried by said frame means, means mounting at least one of said press platens on said frame means for movement toward and away from the other press platen, and means operable to move said one press platen toward and away from said other press platen including a plurality of toggles connecting said one press platen to said frame means, means connected to said toggles for moving an end thereof toward and away from the other end in a direction parallel to the movement of said one press platen, said toggles each comprising a pair of elongated links, the end of one of said links being pivotally connected to said frame means, the end of the other of said links being pivotally connected to said one press platen, the opposite ends of said links being pivotally connected one to the other to form an intermediate pivotal joint, said toggle connecting means being connected to the several toggles at said intermediate joints thereof and operable to reciprocate said intermediate joints in a direction substantially normal to the direction of movement of said one press platen, said intermediate pivotal connections of at least a pair of said toggles lying on opposite sides of respective straight lines intersecting said end pivotal connections of each said toggle, said reciprocating means including a fluid-operated piston and cylinder and selectively operable valve means arranged in controlling relation to said piston and cylinder, means pivotally connecting said piston to said intermediate joint of one of said toggles, and means pivotally connected said cylinder to said intermediate joint of the other of said toggles.

2. A press according to claim **1** wherein said toggles include a second pair thereof in spaced side by side relation one to the other and a third pair in spaced side by side relation one to the other, said intermediate pivotal connections of said second and third pairs of toggles lying on opposite sides of respective straight lines intersecting said end pivotal connections of each of said second and third pairs of toggles.

3. A press according to claim **2** wherein said toggles include a fourth pair of toggles in spaced side by side relation one to the other, said fourth pair of toggles being spaced longitudinally along said frame means from and next adjacent to said second pair of toggles, the intermediate joints of said fourth pair of toggles lying on the same side of straight lines intersecting said end pivotal connections thereof as said second pair of toggles, a fifth pair of toggles in spaced side by side relation one to the other, said fifth pair of toggles being spaced longitudinally along said frame means from the next adjacent to said third pair of toggles, the intermediate joints of said fourth pair of toggles lying on the same side of straight lines intersecting said end pivotal connections thereof as said third pair of toggles, said toggle connecting means including means connecting said second and fourth pairs of toggles and said third and fifth pairs of toggles for respective unitary movement.

4. A press according to claim **3** wherein said latter connecting means include a pair of laterally spaced transfer bars pivotally connecting the respective intermediate joints of said second and fourth pairs of toggles and said third and fourth pairs of toggles.

5. A press according to claim **4** wherein said reciprocating means includes a fluid-operated piston and cylinder located within the lateral confines of said transfer bars, means pivotally connecting said piston to the transfer bars associated with said second and fourth pairs of toggles and means pivotally connecting said cylinder to the transfer bars associated with said third and fifth pairs of toggles.

6. A press according to claim **1** wherein said intermediate pivotal connections of at least a pair of said toggles lie on like sides of respective straight lines intersecting said pivotal connections of said latter pair of toggles, said toggle connecting means including a rigid member connecting between the intermediate joints of said latter pair of toggles providing for substantially simultaneous unitary movement of said latter intermediate joints.

7. A press according to claim **1** wherein said press platens have a greater length than width, said toggles being longitudinally spaced along said frame means, the intermediate pivotal connections of at least a second pair of next adjacent longitudinally spaced toggles lying on the same sides of respective straight lines intersecting said end pivotal connections of each said toggles, the intermediate pivotal connections of at least a third pair of next adjacent longitudinally spaced toggles lying on the same sides of respective straight lines intersecting said end pivotal connections of each said toggles of said third pair thereof and on the opposite sides thereof as said second pair of toggles, a pair of elongated bars respectively connecting said second and third pair of toggles, said piston and cylinder being operatively connected to said bars to move the latter axially toward and away from one another.

8. In a fabricating apparatus for joining wooden members one to the other by means of a pair of fastening plates on opposite sides of the wooden members, the plates being of the type having nail-like teeth struck therefrom for embedment into the wooden members with the teeth requiring a penetration force which varies with the depth of penetration in the wooden members, the apparatus comprising a press including frame means, a pair of press platens carried by said frame means, means mounting at least one of said press platens on said frame means for movement toward and away from the other press platen, and means operable to move said one press platen toward and away from said other press platen including a plurality of toggles connecting said one press platen to said frame means, means connected to said toggles for moving an end thereof toward and away from the other end in a direction parallel to the movement of said one press platen, said toggles each comprising a pair of elongated links, the end of one of said links being pivotally connected to said frame means, the end of the other of said links being pivotally connected to said one press platen, the opposite ends of said links being pivotally connected one to the other to form an intermediate pivotal joint, said toggle connecting means being connected to the several toggles at said intermediate joints thereof and operable to reciprocate said intermediate joints in a direction substantially normal to the direction of movement of said one press platen, said

intermediate pivotal connections of at least a pair of said toggles lying on opposite sides of respective straight lines intersecting said end pivotal connections of each said toggle, said reciprocating means including a fluid-operated piston and cylinder and selectively operable valve means arranged in controlling relation to said piston and cylinder, means pivotally connecting said piston to said intermediate joint of one of said toggles, and means pivotally connecting said cylinder to said intermediate joint of the other of said toggles, said toggles and said fluid-operated piston and cylinder being arranged such that said one press platen applies a penetration force to the plates which varies substantially similarly as the required penetration force varies throughout the full range of penetration of the teeth into the wooden members.

9. In the apparatus according to claim **8** wherein the required and applied penetration forces vary nonlinearly.

10. In the apparatus according to claim **8** wherein the plates are formed of 20 U.S. Standard gauge sheet metal and the teeth are ⅜ inch long, said toggle links forming an angle of substantially 17° with a straight line intersecting the end pivotal connections thereof when starting the nails into the wooden members and an angle of substantially 8° when said nails are finally embedded.

References Cited

UNITED STATES PATENTS

3,100,301	8/1963	Black	227—152 XR
3,172,125	3/1965	Sanford	227—152 XR
2,224,968	12/1940	Klocke	100—258
2,243,205	5/1941	Hall	100—272 XR
2,532,672	12/1950	Michael et al.	83—630 XR
2,928,305	3/1960	Heth et al.	83—630 XR
3,198,108	8/1965	Ingold	100—272 XR

FOREIGN PATENTS

613,229	8/1935	Germany.
67,143	2/1915	Switzerland.

BILLY J. WILHITE, Primary Examiner

U.S. Cl. X.R.

227—152

PO-1050
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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,520,252 Dated July 14, 1970

Inventor(s) JOHN C. JUREIT ET AL

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

Column 1, line 59, "dirve" should read -- drive --; line 62, "unil" should read -- until --; line 66, "penumatic" should read -- pneumatic --. Column 2, line 47, "nailplates" should read -- nailplate --. Column 5, line 40, "toggles" should read -- toggle --. Column 8, line 1, "the" should read -- and --; line 44, "pair" should read -- pairs --

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[redacted]1970

(SEAL)
Attest:

Edward M. Fletcher, Jr.
Attesting Officer

WILLIAM E. SCHUYLER, JR.
Commissioner of Patents