June 8, 1971 L. HEIN 3,583,053

CLINCHING MACHINE

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FIG. 1

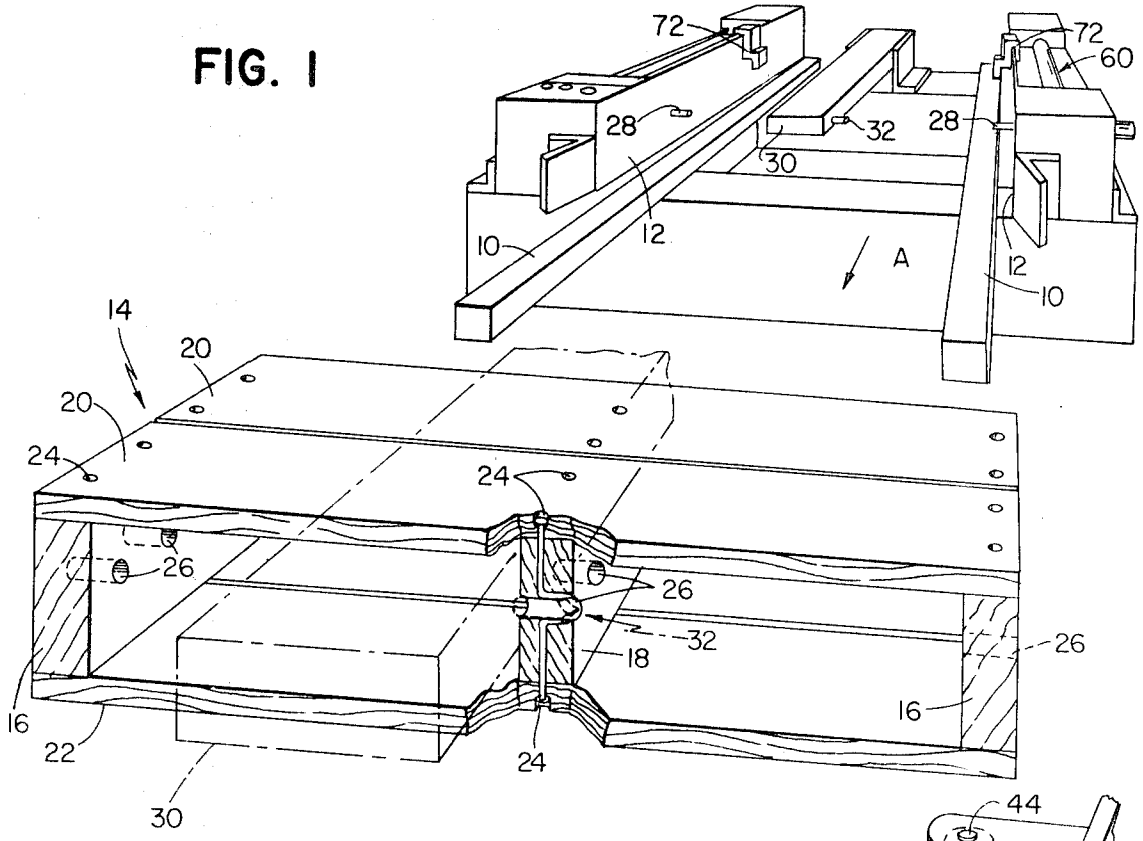
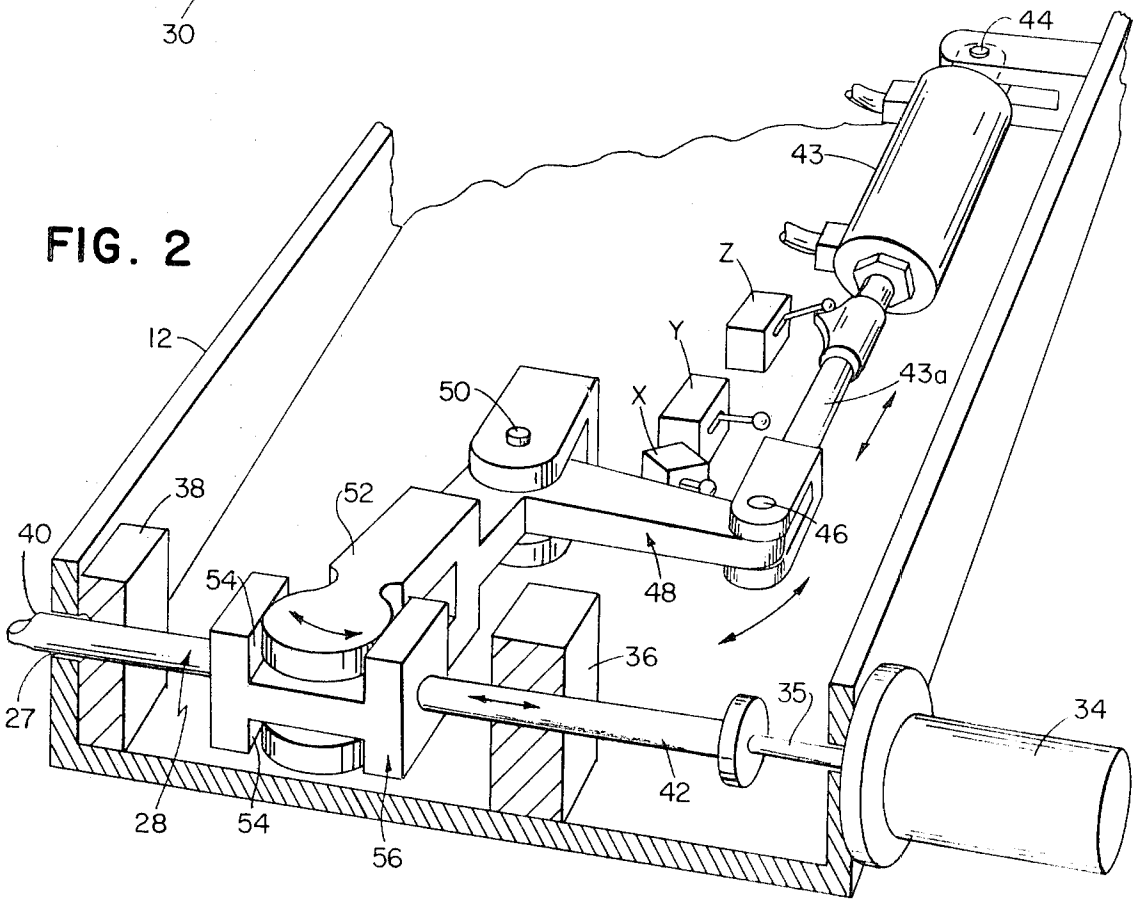


FIG. 2

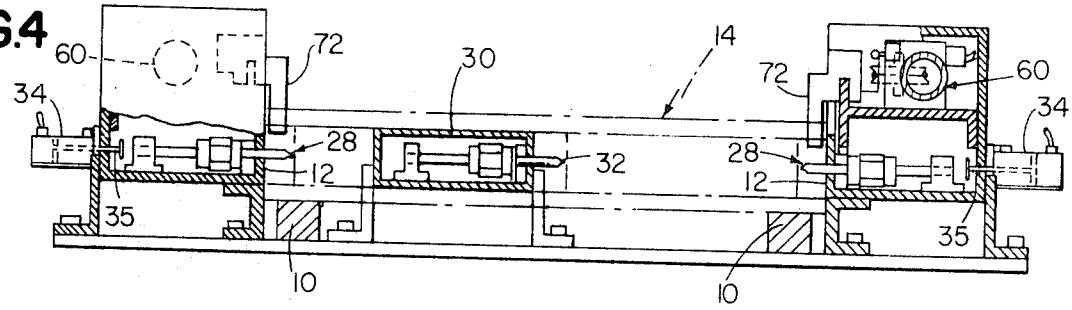


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CLINCHING MACHINE

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FIG.4



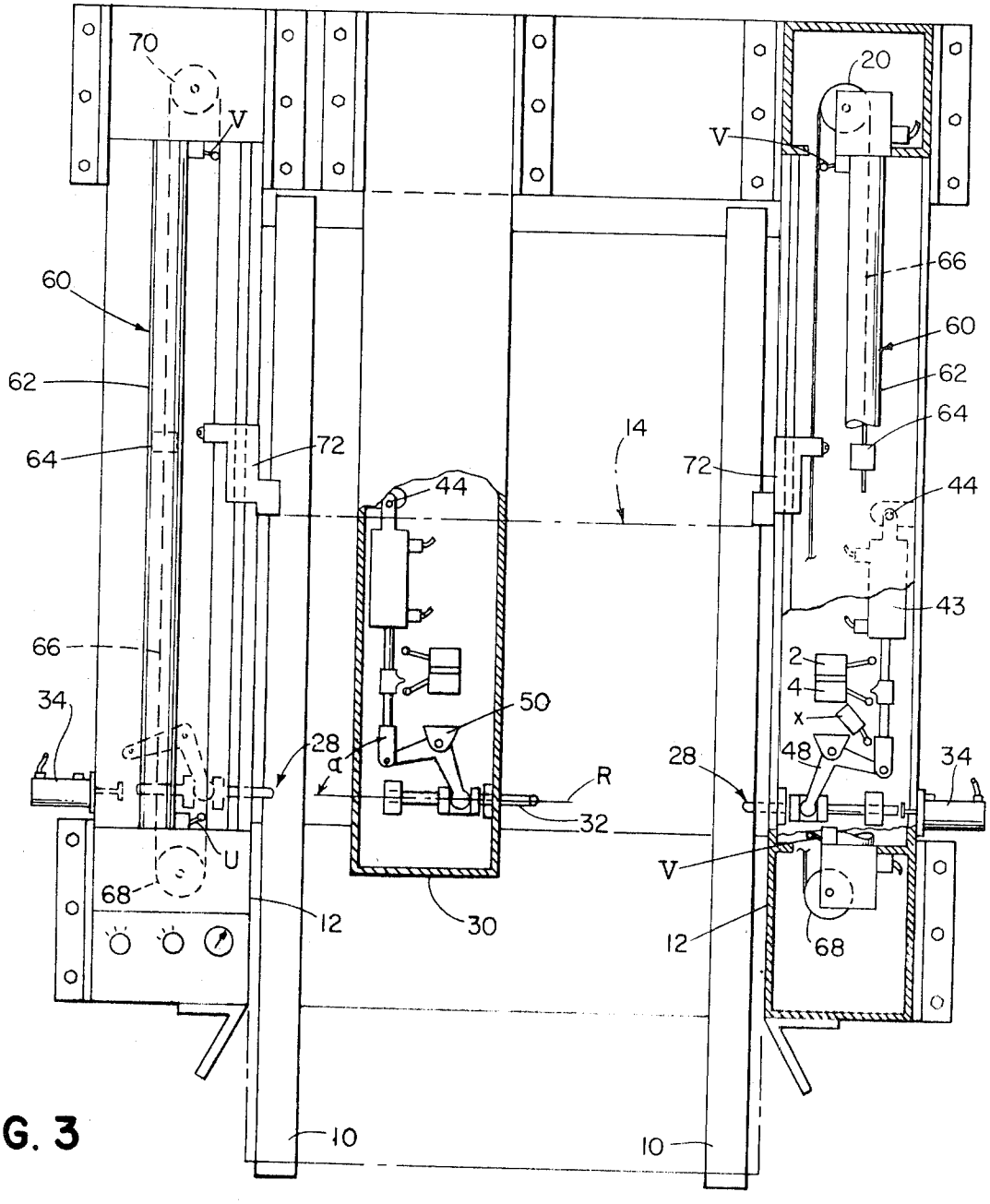


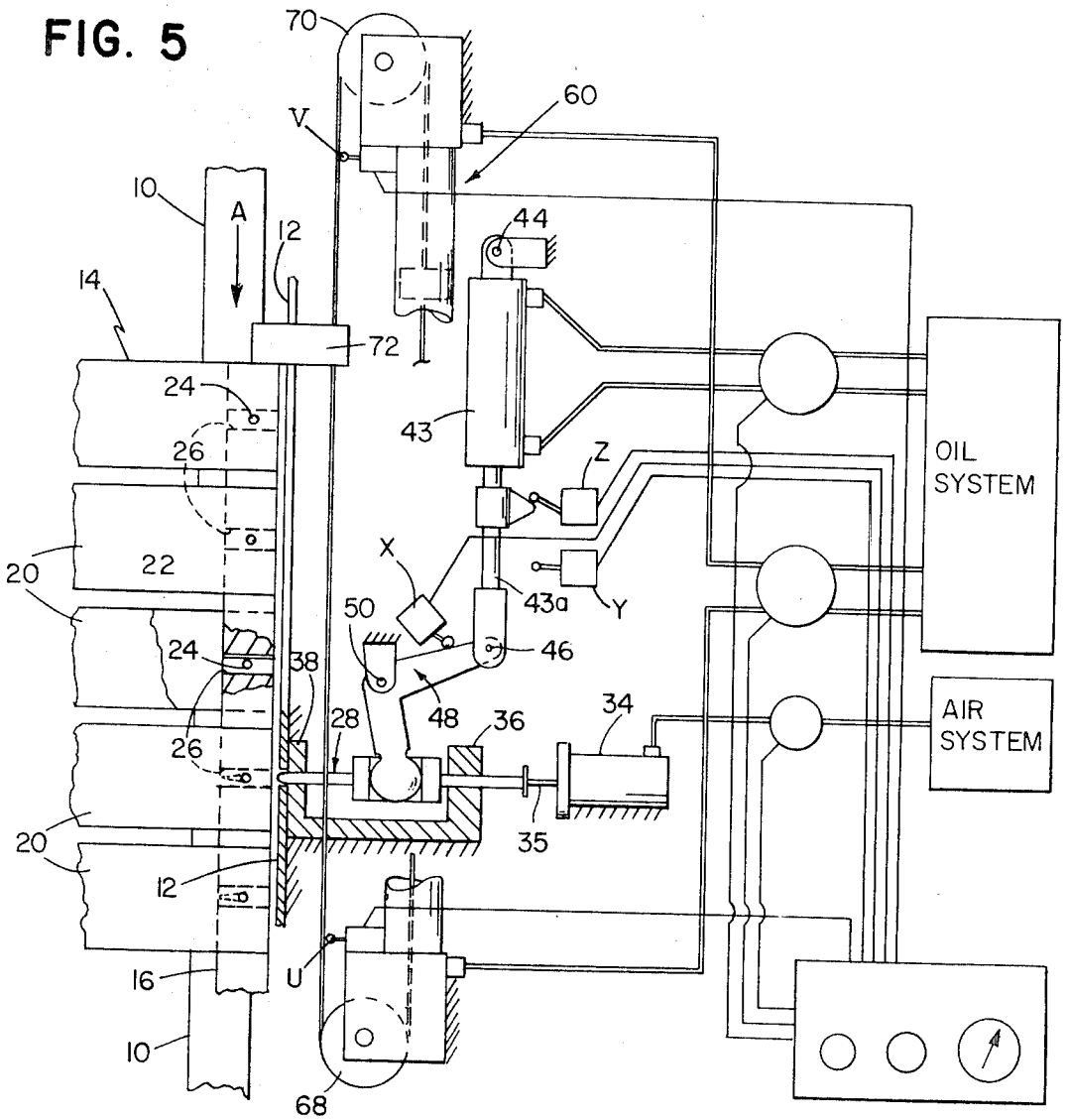
FIG. 3

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FIG. 5



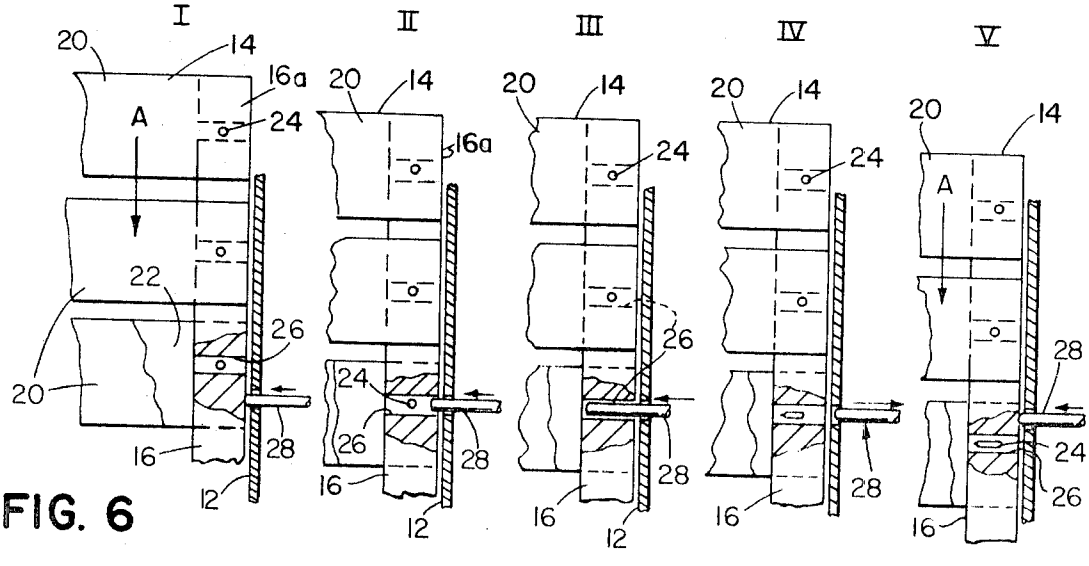


FIG. 6

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3,583,053

CLINCHING MACHINE

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Int. Cl. B25c 7/00
U.S. Cl. 29—200 11 Claims

ABSTRACT OF THE DISCLOSURE

A nail clinching machine in which the clinching ram initially presses against and slides relative to a travelling workpiece until it enters with preliminary movement a hole in which there are nails to be clinched. A control responsive to such preliminary movement actuates the ram drive. For initial pressing an air cylinder, and for ram drive, a hydraulic cylinder are shown. Also, the air cylinder acting on the ram end and the hydraulic cylinder linked to the ram, and vented initially to avoid resistance to the air cylinder, are shown. A workpiece feeder, shown as a hydraulic cylinder, is stopped in response to the preliminary movement of the ram. For a pair of laterally spaced clinching rams there are two spaced apart feeders, all clinching being delayed until both feeders stop by means of a linked control system. Drive of the clinching ram can be achieved by a pivoted cylinder disposed at an angle, connected by a bell-crank to the clincher ram, used to advantage on a cantilevered clincher extending into the interior of a pallet for clinching nails in the middle stringer.

This invention relates to clinching machines of the type in which, after a workpiece is moved to align its hole with the ram, the ram forces its way through the hole to clinch nails protruding therein. Of particular concern are machines using a plurality of simultaneously actuated rams including cantilever-mounted interior-fitting middle rams, for clinching the nails in elongated stringers of pallets.

A principal object of the invention is to provide fast machines and ones which are simple in construction and operation, require little operator skill, and are useful with workpieces of various sizes.

A principal feature of the invention is a control system for the movements of the machine. In this system the clinching ram (feels) for the hole it is to enter, this being achieved by a pressing means that urges the clinching ram against the workpiece with pressure sufficiently light to permit the workpiece to slide past the ram. This pressure causes preliminary movement of the ram into a workpiece hole when the latter comes into registry with the ram. A ram drive control system responsive to this preliminary movement activates the drive device to force the ram to clinch the nails.

Preferred embodiments of the invention feature the use of air cylinders for creating the initial pressure on the ram, hydraulic cylinders for finally actuating the ram and hydraulic cylinders for feeding the workpieces, all interconnected through a control system that responds to the preliminary movement of the rams.

Preferred embodiments also feature a ram drive including a fluid cylinder set at an angle to the ram, connected by a bell crank, which occupies no more lateral space than that occupied by the ram. It is used advantageously in a cantilevered assembly for fitting within pallets.

These and numerous other objects and features will be understood in the light of the following description of a preferred embodiment, in connection with the drawings wherein:

FIG. 1 is a perspective view, in somewhat schematic form, of a preferred embodiment of the clinching machine, showing a pallet (shown partly broken away) being withdrawn;

FIG. 2 is a perspective view, partly broken away of the clinching ram pressing and drive devices for one side of the machine;

FIGS. 3 and 4 are plan and front elevation views respectively of the machine of FIG. 1;

FIG. 5 is a plan view on an enlarged scale, of a portion of the machine showing schematically the control system;

FIG. 6 is a diagrammatic view of the relation of the clinching ram to the pallet during various stages of the operation of the machine.

Referring to the drawings there is shown a clinching machine for use in fabricating pallets.

Supports **10** and side rails **12** define guides for movement of the pallet **14** in the longitudinal direction, parallel to outside stringers **16** and middle stringer **18** of the pallet. Deck boards **20** and bottom boards **22** have previously been nailed to these stringers and the nails **24** protrude into lateral holes **26** in the stringers. The purpose of the machine is to clinch these nails.

To this end there are laterally aligned openings **27** in the side rails **12** through which clinching rams or mandrels **28** are arranged to be driven, to force their way through holes **26**. Likewise a cantilever support **30** fixed at the rear of the machine is sized (by virtue of the compact ram drive mechanism to be described) to protrude forwardly inside the pallet, between the deck boards, bottom boards and stringers, for clinching the nails of the middle stringer **18**. This mechanism includes ram **32** mounted on the end of the cantilever.

It can thus be seen that sliding of the pallet from a rearward position forwardly, in the direction of the arrow A, will bring the holes **26** of the stringers in alignment with the openings **27** in the side rails and the associated clinching rams **28**.

The control system feature of this embodiment employs air cylinders **34**, one associated with each outside ram **28**. The rams are of rod form slideably mounted in slide bearings **36, 38**. The forward end **40** of the ram is shaped to clinch the nails and the rearward ends **42** of the rams are exposed. The air cylinders are mounted so that their pistons **35** can engage the rearward ram ends **42** when the rams are in their retracted positions.

The driving device for each ram, including middle ram **32**, comprises a hydraulic cylinder **43** set substantially at a right angle α to the axis R of the ram. The cylinder housing end is pivotally mounted to the frame at **44** while the piston end is pivotally connected at **46** to one arm of bell crank **48**. This bell crank is pivoted to the frame at **50** and has its other end of the form of a yoke **52**. The upper and lower bars of this yoke are fitted into matching slots **54** of adaptor **56** which is fixed to the ram **28** or **32**. The ends of the yoke bars are of circular form in plan, and thus engage the front and rear walls of the adaptor slots with a pivotal-sliding contact. It will thus be seen that movement of the piston **43***a* of the hydraulic cylinder imparts axial movement to the rams.

Referring e.g. to FIGS. 2 and 5, three limit switches X, Y and Z are associated with the outside rams **28**. Switch X is arranged to detect the preliminary movement of the rams **28**. This occurs when the ram, pressed forward by air cylinder **34** and sliding on surface **16***a* of stringer **16** (FIG. 6, position I) registers with hole **26** in the stringer, and moves into the hole under the influence of air cylinder **34** (FIG. 6, position II). Switch X then activates the hydraulic cylinder **43**. Switch Y detects completion of the travel of the ram (FIG. 6, position III) at which clinching of nail **24** is assured. This reverses the movement of hydraulic cylinder **43** and releases the air cylinder

for return. Switch Z detects completion of the return travel of the ram beyond the plane of the side **16***a* of the stringer (FIG. 6, position IV). This vents both ends of the hydraulic cylinder and also maintains air cylinder **34** under vented condition. It also reinitiates movement of the feeder to be described, after which air pressure is reapplied to the air cylinder, the hydraulic cylinder **43** remaining vented, and the ram is again pressed against the side of the stringer (FIG. 6, position V) sliding therealong until the next hole is encountered.

If there were but one ram **28** the above would be the entire sequence. According to the invention, when two outside rams **28** are employed, the rams are axially aligned for opposite movement, and the drive of the cylinders **43** is delayed until both rams undergo the preliminary movement illustrated in FIG. 6, this event actuating the drive. Thereupon both are activated, countering the force of each other.

Referring e.g. to FIGS. 1 and 3, the particular angled relationship of hydraulic cylinder **43** and middle ram **32** with the intermediate bell crank **48**, is so compact that it can be employed in a cantilever structure to enter the interior of conventional pallets (e.g. pallets having 2" x 4" stringers with deck and bottom boards secured directly thereto, with spacings on the order of 20" or less between stringers). As shown, no air cylinders are associated with such middle rams, these being aligned with and activated at the time of actuation of the outer rams, **28**.

The feeder system in the preferred embodiment of the drawings also plays a part in the control system. The feeder here is comprised of two cable cylinders **60**, one mounted along each side rail **12**. These, as is known, are hydraulic devices having cylinders **62** of a length approximating the desired length of travel, a short length piston **64**, and a cable. The cable extends from one side of the piston through the hydraulic fluid, out one end of the cylinder, around a pulley **68**, back the length of the cylinder, around a second pulley **70**, into the opposite end of the cylinder and through the fluid to the other side of the piston. A pallet-dragging arm **72** is attached to each cable and protrudes to engage, near the adjacent corner, the rear of the pallet (FIG. 5) to pull it forward. Front and rear limit switches, U and V (FIGS. 3, 5) are associated with the cable cylinder **60** to limit its movement.

In this embodiment the hydraulic control valves are constructed and arranged so that whenever preliminary movement of one of the side rams **28** occurs, the activation of its switch X stops hydraulic fluid flow to the cable cylinder **60** on the corresponding side, but flow continues to the cable cylinder **60** on the other side. This continued movement of the other side adjusts the position of the pallet on the machine, with sliding of the other ram on the stringer until it enters a hole, with the preliminary movement that has been mentioned. Activation of its X switch secures the corresponding cable cylinder, thus stopping the pallet, and X also activates all rams. The clinching cycle activates switches Y and the return movement activates switches Z. The latter reactivate the two cable cylinders, and after a short delay allowing for the pallet to be moved so the holes no longer align with the rams, air cylinders **34** are re-energized, pressing the rams forward to permit their sliding movement along the sides of the stringers.

Numerous variations of the specific details are within the spirit and scope of the invention.

What I claim is:

1. In a clinching machine having a ram that is forced by a drive device into holes in the side of an elongated workpiece to secure fastening elements therein, and means permitting longitudinal feeding movement of the workpiece sideways relative to the ram, the improvement comprising pressing means adapted to urge the ram against the side of the workpiece with pressure sufficiently light to permit the workpiece in its feeding movement to slide past said ram, said pressing means adapted to move said ram preliminarily into a hole in the workpiece when the hole registers with the ram, and a ram drive control system responsive to said preliminary movement to activate said drive device to force said ram to clinch said fastening elements.

2. The clinching machine of claim **1** wherein said pressing means comprises an air cylinder.

3. The clinching machine of claim **2** in which said ram comprises a rod form member haing a first end shaped to enter the hole in the workpiece, and there are spaced apart bearings slidably mounting said ram with the second end of said ram exposed, wherein said air cylinder is arranged to engage said second end of said ram to press it forwardly and said drive device for said ram is connected to the rod-form member intermediate its ends.

4. The clinching machine of claim **1** wherein said drive device comprises a hydraulic cylinder linked without lost motion to said ram, said cylinder connectable to a source of pressurized hydraulic fluid through a valve, said valve having a neutral position venting the cylinder, allowing movement of its piston in response to said preliminary movement of said ram, and said control system in response to said preliminary movement adapted to move said valve first to a forward position directing fluid to said cylinder to drive said ram forward for clinching, then to a rearward position to cause said ram to retract, then to said neutral position to permit said pressing means to act again.

5. The clinching machine of claim **4** wherein said hydraulic cylinder has a sufficient return stroke to disengage said ram from said workpiece and said control system is adapted to reactivate said pressing means to urge said ram against the side of said workpiece only after further feeding movement of said workpiece has occurred.

6. The clinching machine of claim **1** wherein said means permitting relative feeding movement of the workpiece sideways relative to the ram includes a driven feeder member and said control system comprises a first control means responsive to said preliminary movement of said ram to stop said feeder member and to activate said ram drive device and a second control means responsive to the return of said ram drive device to start said feeder member to initiate another cycle.

7. The clinching machine of claim **6** comprising a supply of pressurized hydraulic fluid, said feeder comprising a hydraulic piston and said ram drive device comprising a hydraulic piston, said control system operable to connect one and then the other of said pistons to be driven by said hydraulic fluid.

8. The clinching machine of claim **6** having two clincher rams spaced apart in the direction transverse to the feeding direction of said workpiece, adapted to act simultaneously to clinch nails in holes on opposite sides of the workpiece, each of said clinching rams having a drive device and presser means in accordance with claim **1**, and there being two separate feeder members in accordance with claim **6** associated with the respective clinching rams, said control systems adapted to permit each feeder member to operate until said preliminary movement of its respective ram occurs, and said control system adapted to activate the ram drive device only when said preliminary movement of both of said rams has occurred.

9. The clinching machine of claim **8** adapted for the fabrication of pallets in which said two clincher rams are directed towards each other to engage the outer stringers of the pallet and a third clincher ram is mounted on a cantilever support and extends into the pallet to act upon a middle stringers between said outside stringers, wherein the drive device for each of said rams comprises a respective hydraulic cylinder and said control system is adapted to direct pressurized hydraulic fluid to each of said cylinders to cause simultaneous action thereof upon said preliminary movement of the two rams into the outside stringers.

10. In a clincher assembly comprising an elongated clinching rod slidably mounted for entering a hole under the influence of a drive device for clinching nails in the hole, the improvement wherein said drive device comprises a fluid actuated cylinder disposed at a substantial angle to the line of movement of said clinching rod, said cylinder pivoted at one end to stationary structure and pivoted at the other to one of the arms of a bell crank, the other end of said bell crank pivotally connected to said clinching rod in a manner to permit axial movement of the latter.

11. The clincher assembly of claim **10** mounted on a cantilever support in a pallet clinching machine, adapted for insertion into the interior of a pallet for clinching nails in middle stringers thereof, said fluid actuated cylinder

extending generally in the direction of said cantilever support and the line of action of said clinching rod being substantially at a right angle thereto.

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29—432.1, 505; 227—77, 155