United States Patent [19]

Daniels

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[45] **Feb. 20, 1973**

[54] PUNCH PRESS

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[52] **U.S. Cl.** **83/409**, 83/552

[51] **Int. Cl.** **B26d 7/26**

[58] **Field of Search** ....83/552, 409, 151, 71; 234/59; 408/91; 143/132 B

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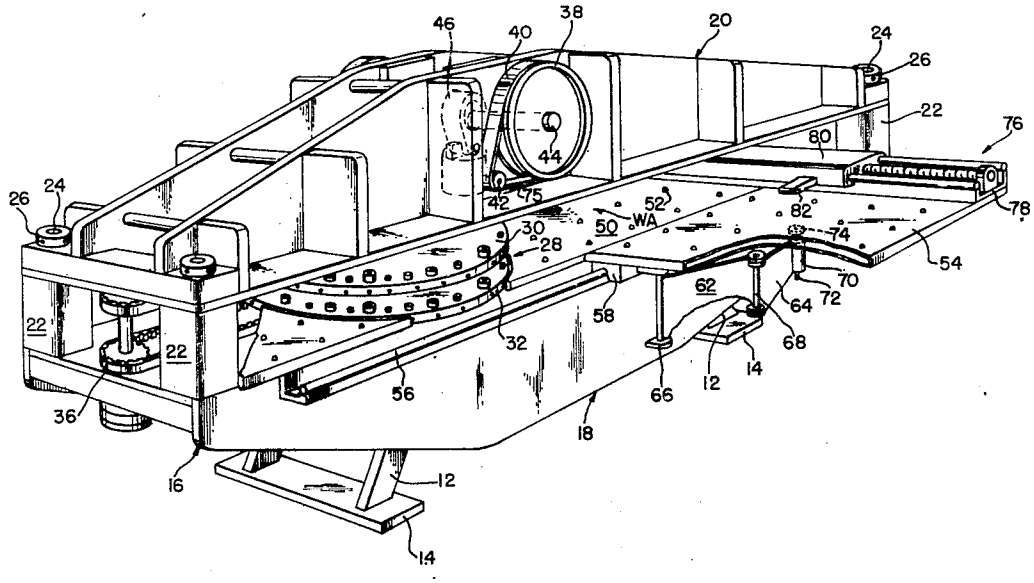
[57] **ABSTRACT**

A turret punch press of the type in which the workpiece is movable in both the X and Y axes within a work area defined by upper and lower aligned frames joined at their four corners. The workpiece is supported on a fixed table and laterally extending movable side tables. The workpiece is moved relative to the fixed central and movable side tables along the X axis and is moved relative to the central table but with the side tables in the Y axis. The side tables are supported by swinging support members which allow movement only in the horizontal plane. Workpiece supporting rollers are lowered out of the path of the workpiece holding clamps.

13 Claims, 3 Drawing Figures



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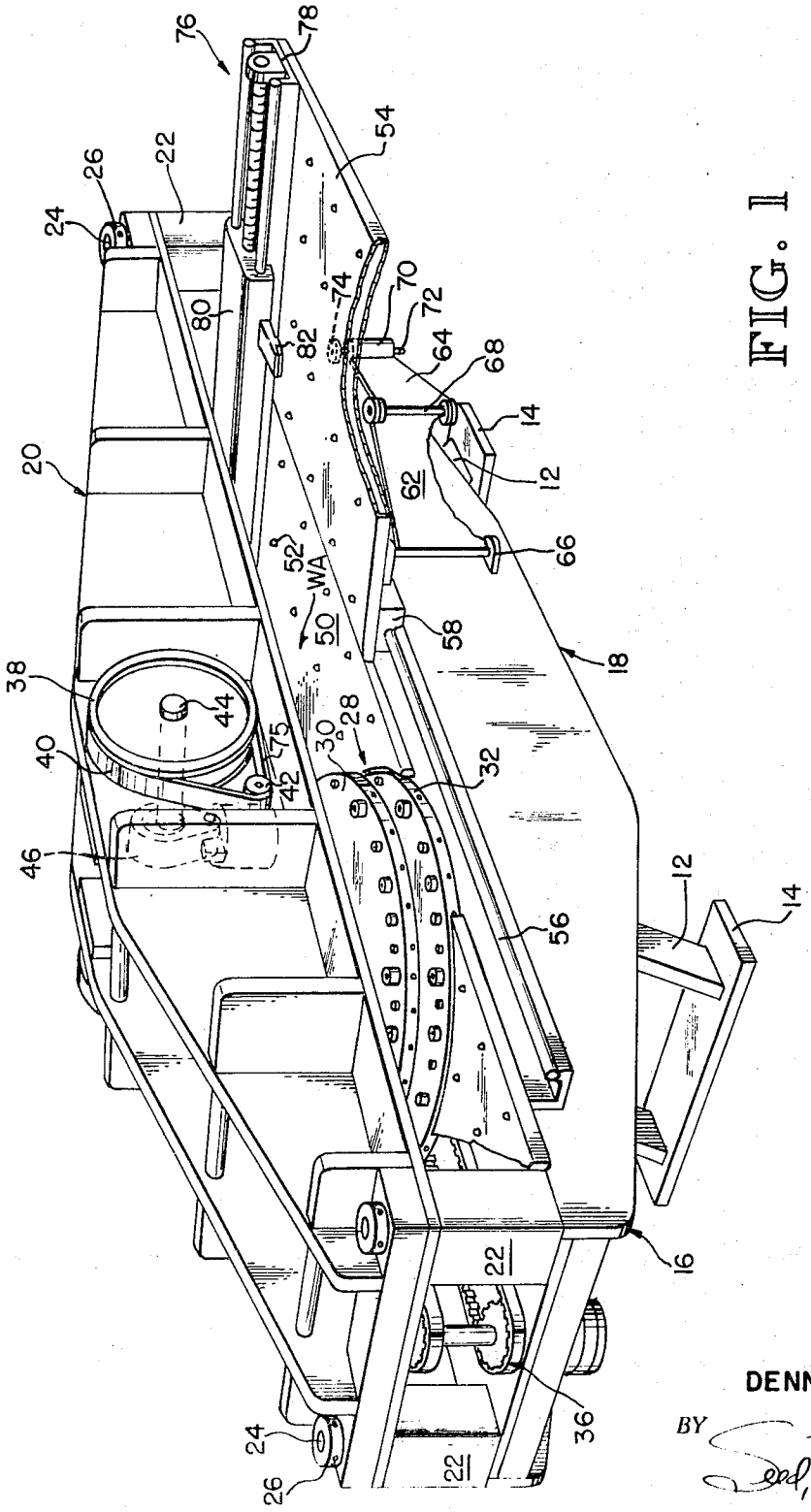

FIG. 1

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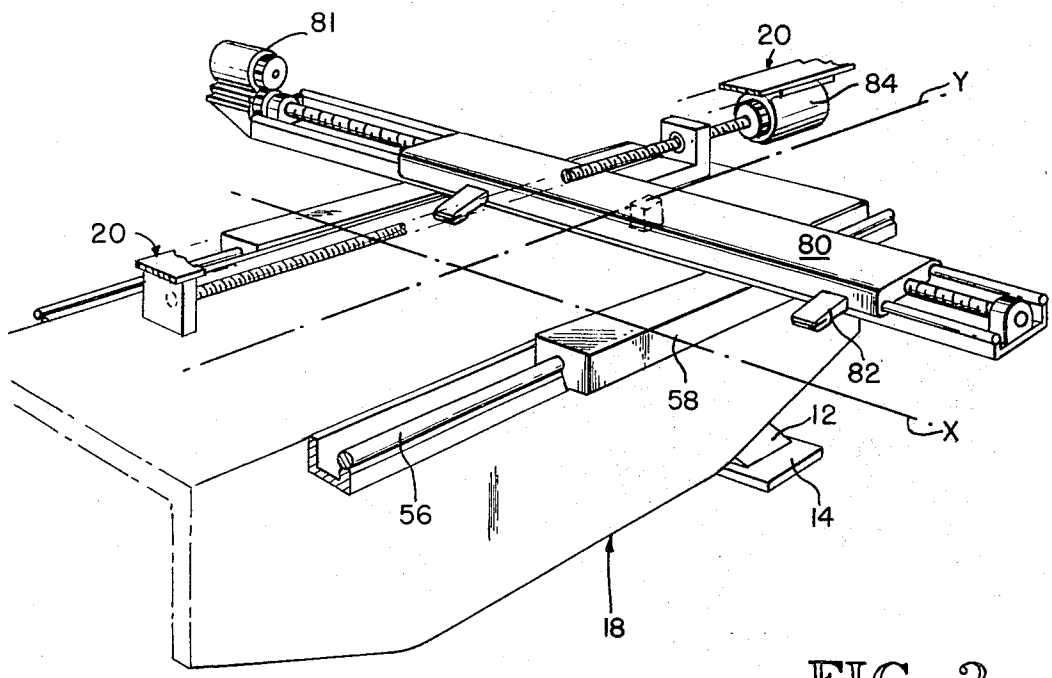

FIG. 2

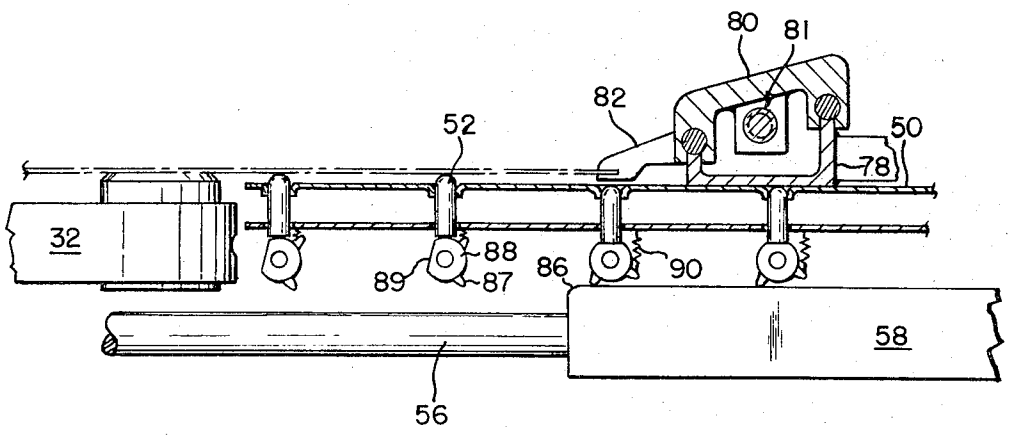

FIG. 3

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PUNCH PRESS

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention pertains to heavy-duty turret punch presses of the numerically controlled type and, more particularly, to turret punch presses in which the workpiece is movable along both the X and Y axes.

2. Description of the Prior Art

Numerically controlled punch presses of the type in which the workpiece is moved along the X and Y axes have heretofore employed conventional C-shaped frame configurations. This standard C-shaped frame configuration press has several distinct disadvantages. One is that under punching load the C-frame structure is subjected to deflection between the upper and lower arms of the C-frame. This deflection takes a pivotal motion at approximately the center position of the back upright of the C-frame. Secondly the deep-throat C-frame used for large workpieces is further subjected to a side-to-side movement, causing change in alignment of the upper and lower pressarms. Both of these conditions result in poor hole quality and short punch and die life.

In the past it has been the general practice of the industry to use massive proportions for these C-frame structures to overcome the above disadvantages or at least minimize them within some useable limits. The massive proportions, of course, increase substantially the cost of the press and where deep throats are needed to increase the capacity of the machine the massive proportions take up a substantial amount of the press users floorspace. Another disadvantage with prior art machines has been that their massive size has required the workpiece supporting tables be separate from the punch press frame. As a result installation of the press and table at the users plant has required elaborate and expansive bed preparation and highly skilled installers to assure that the press and table are accurately aligned relative to one another.

SUMMARY OF THE INVENTION

It is an object of this invention to provide a numerically controlled turret punch press in which deflection will not cause misalignment between the punch and die on the turrets and the punch striker.

It is another object of this invention to provide a numerically controlled turret punch press which requires substantially less floor space than a conventional C-frame press.

It is another object of this invention to provide a numerically controlled turret punch press in which the entire work table is aligned and supported on the punch press frame.

It is another object of this invention to provide a numerically controlled turret punch press in which a portion of the work table moves with the workpiece when positioning the workpiece.

Basically the invention comprises a press frame bridge structure having a shape similar to two C-frames turned face-to-face and both connected in arm-to-arm fashion. This completely eliminates the customary massive proportions required of the back of the C-frame inasmuch as the loads are applied at the center of the span with the result that deflection occurs directly upward and the striker remains true to punch and die alignment. Thus for a similar capacity machine the structural weight and overall size are reduced greatly from the conventional C-frame turret press.

The invention also provides that the lower frame of this bridgetype frame provides a platform for the workpiece supporting table allowing for alignment of the table and the press during manufacture of the combined unit.

Still another feature of the invention is a unique mechanism for lowering the workpiece supporting rollers out of the path of the workpiece holding clamps.

Still another feature of the invention is to use a multisection workpiece supporting table with the central table remaining fixed and with side tables moveable with the workpiece clamping means. A unique swinging support member carries each side table and maintains accurate alignment in the horizontal plane between the central table and the side tables.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is an isometric illustrating a turret punch press embodying the principles of the invention.

FIG. 2 is a schematic illustration of the means for moving the various moveable parts from the turret punch press shown in FIG. 1.

FIG. 3 is an isometric illustration showing the means for lowering the workpiece supporting rollers.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

The turret punch press embodying the principles of the invention includes two sets of legs **12** joined by plates **14** which rest on the floor or other support surface commonly employed at the user's site. The legs are joined to a support frame **16** comprised of a lower frame **18** and an upper frame **20**. The upper frame **20** is supported by the lower frame by four corner posts **22**. Bolts **24** are passed through the upper and lower frames and the corner posts and are provided with nuts **26** to draw the frames tightly together. As thus far described the press frame can be visualized as two C-frames facing one another with their arms joined together at the center. As is readily apparent the upper frame **20** is thus in the form of a bridge spanning the four corner posts and spaced from the lower frame to define a work area WA.

Mounted in the work area WA is a conventional tool holding turret mechanism **28** comprising an upper turret **30** and a lower turret **32**. As is conventional the upper turret holds a plurality of circumferentially spaced punches and the lower turret **32** holds corresponding dies. The turrets are rotated to position a tool at the desired punching location by a sprocket and chain rotary drive **36**.

The upper frame includes a flywheel **38** driven by belts **40** from a motor **42**. A shaft **44** is fixed to the flywheel and extends across the midsection of the upper frame to a similar flywheel on the opposite side of the frame. Mounted on the shaft **44** is a conventional ram and striker **46**. As is well known in the art the striker is driven by the ram against the selected tool and at the precise moment as dictated by the programmed numerical control. Since the striker is moveable only in the vertical plane and is positioned exactly at the midsection of the frame the reaction load on the striker will

be distributed over the upper frame so that the frame is deflected along its entire length. As a result the striker will remain vertically aligned with the tool regardless of the amount of deflection.

The workpiece is supported in the work area WA by a fixed central table **50** having a plurality of workpiece supporting posts **52**. As can be readily seen this central table may be of substantial width along the Y axis resulting in a large capacity but without making the upper and lower frames of massive dimensions to withstand the load.

Joined to the lower frame **18** are side tables **54** which move along the Y axis relative to the fixed central table **50**. It is a unique feature of this invention that the side tables are supported solely by the lower frame so that alignment tolerances between the tables and the tool in the turrets may be obtained accurately during the manufacturing of the press and need not be adjusted during or after installation at the user's site.

The side tables **54** are guided for movement in the Y axis on the lower frame **18** by guidebars **56** that are slidably received in a carriage way **58**. The side tables are supported in the vertical plane by inner and outer swinging support members **62** and **64** respectively. Inner support member **62** swings about a pivot **66** secured to the lower frame **18**. The pivot **66** is similar to a door hinge and allows free horizontal swinging movement but prevents vertical movement. The outer support member is coupled to the inner support member by a second hinge or pivot **68** which also precludes movement in the vertical direction but allows the outer member to swing relative to the inner member. The outer support member **64** is provided at its outer end with a sleeve **70** which rotatably receives a support post **72**. The post **72** is secured to a plate **74** on its upper end which is secured to the underside of the side table. As is readily apparent during reciprocating motion of the side table along the lower frame **18** the weight is transferred to the swinging support members with the plate **74** moving in a purely linear direction.

Coupled to the side tables **54** for movement therewith is a workpiece positioning mechanism **76**. The positioning mechanism includes an elongated guideway **78** in which is mounted a slidable carriage **80**. The carriage **80** is slid relative to the side tables in the X axis by a bi-directional motor and screw mechanism **81**. Coupled to the slidable carriage **80** are workpiece clamps **82**. The guideway **78**, carriage **80** and clamps **82** are of conventional construction the details of which will be apparent to one skilled in the art. The numerically controlled programmer, in a manner well known, will position the carriage **80** relative to the tables in the X axis.

The carriage **80** and guideway **78** along with the side tables **54** are moved together in the Y axis by a bi-directional motor and screw mechanism **84**. As is readily apparent movement in the Y axis is guided by the guide bars **56** and carriage way **58**.

As is best shown in FIG. **3** movement of the clamps **82** toward the turrets **28** will bring them past the rows of workpiece support rods **52** so that movement in the X axis would then result in interference between the clamps and rods. It thus becomes necessary to lower the rods on the central table out of the path of the clamps **82**. For this purpose the carriage way **58** is provided with an upper cam edge **86** which engages a cam follower **87** on each of a plurality of elongated cam shafts **88** which extend across the underside of the central table **50**. The cam shafts **88** are provided with flats **89** aligned below each of the workpiece rods **52**. As is readily apparent rotation of a cam shaft will cause simultaneously lowering of a row of workpiece support rods onto the flats. Rotation of the cam shafts to move the rods off the flats will raise the rods. Springs **90** normally bias each cam shaft in a counterclockwise position to raise the rods. Thus movement of the carriage way **58** will automatically lower the rods out of the path of the clamps **82**.

While the preferred form of the invention has been illustrated and described it is capable of modification without departing from the principles herein. Accordingly, the invention is not to be limited to the illustrated embodiment but only by a literal interpretation of the claims appended hereto.

I claim:

1. A punch press having a base and an upper frame spanning said base and defining a workpiece receiving area therebetween, means for supporting a workpiece in said workpiece receiving area, means for positioning the workpiece in the X and Y axes, a ram, a downwardly movable striker beneath said ram, means for holding a punching tool beneath said striker, and means supporting said ram and striker on said upper frame in a position wherein forces on the striker resulting from engagement of the punching tool with said workpiece cause upward deflection of said upper frame substantially equally on both sides of said ram to maintain alignment of said tool and symetrically distribute the load along said upper frame.

2. A punch press for large workpieces in the order of 6 feet by 4 feet or larger comprising an elongated base, an upper frame having opposite ends secured to said base and a central span, a ram positioned on said central span, a striker positioned beneath said ram, workpiece supporting means carried by said base, said workpiece supporting means including a central table fixed on said base and lateral side tables movably supported by said base, and means movable over said central table for positioning the workpiece beneath said tool including first means for moving the workpiece over said central and side tables in the X axis and second means for moving the workpiece and the side tables in the Y axis and wherein the base is the sole support for both the central table and the side tables.

3. The punch press of claim **1** said upper frame having a central span and opposite ends, said ram being centrally positioned on said central span.

4. The press of claim **2** said side tables each including side table supporting means comprising a pair of hinged inner and outer support members, said inner support member hinged to said base for pivotal movement only in the horizontal plane, said outer support member hinged to said inner support member also for movement only in the horizontal plane, and means rotatably mounting the side table to the outer member whereby said support members are free to swing while the side tables are reciprocated in a linear direction.

5. A turret punch press having a work table including a plurality of rows of workpiece supporting means extending upwardly beyond the upper surface of the ta-

ble, means for positioning the workpiece along the X and Y axes, said positioning means including workpiece engaging means spaced closely to the table surface and extending downwardly below the upper ends of said workpiece supporting means, the improvement comprising means for lowering the workpiece supporting means below the plane of the workpiece engaging means, said lowering means including cam means each extending parallel to the X axis below an entire row of workpiece supporting means and movable into a first position for lowering the workpiece supporting means below the workpiece engaging means and into a second position for raising the the workpiece supporting means above the upper surface of the table, and means for sequentially actuating said rows of cam means for moving them into said first position and thus lowering said workpiece supporting means clear of said workpiece engaging means as the workpiece engaging means is moved in the Y axis.

6. The press of claim 5 wherein said work table includes a central table, lateral side tables slideably movable relative to the central table, guide means for guiding movement of the side tables in the Y axis, said means for sequentially engaging said cam means including a cam surface movable with said side tables so that the workpiece supporting means are lowered as the side tables move toward the turrets along the Y axis.

7. The press of claim 5 said workpiece supporting means including a plurality of rods, said cam means including cam shafts having flats aligned with the rods whereby rotation of the cam shafts will cause the flats to engage the rods to bring the rods below the plane of the workpiece engaging means.

8. The punch press of claim 3 said means for holding a tool including a pair of turrets rotatable about a stationary vertical axis and means for rotating said turrets to position a tool beneath said striker.

9. The punch press of claim 3 said workpiece supporting means including a stationary workpiece supporting table fixed on said base table, said means for positioning the workpiece in the X and Y axes including clamp means movable over said table in both the X and Y axes, said workpiece supporting means including movable side tables mounted on said base for movement with said clamp means along said Y axis.

10. The punch press of claim 9 said side tables including side table supporting means comprising a pair of hinged inner and outer supporting members and mounted for pivotal movement only in the horizontal plane, said outer support member hinged to said inner support member also for movement only in the horizontal plane, and means rotatably mounting the side table to the outer member whereby said support members are free to swing while the side tables are reciprocated in a linear direction.

11. The punch press of claim 3 said base having a central section aligned beneath said central span and opposite ends each having a vertical thickness substantially less than the vertical thickness of said central section, said ends of said upper frame each having a vertical thickness substantially less than said central span whereby said centrally positioned ram and striker for providing said symetrically distributed loading allows a substantial reduction in mass of said base and upper frame.

12. A punch press having a base, workpiece supporting means on said base, a ram and striker unit, a tool positionable beneath said ram and striker unit and engagable by said striker causing an upward reaction force on the ram and striker unit, means for positioning a workpiece in both the X and Y axes in alignment with said tool, and means for fixedly supporting the ram and striker unit over said workpiece supporting means and guiding upward deflection of said ram and striker unit along a straight vertical path whereby the tool is maintained in a vertical alignment while punching.

13. The punch press of claim 12 said means for supporting the ram and striker unit including an upper frame having an elongated central span joining opposite ends, said opposite ends supported by said base, and said ram and striker unit having a ram of limited mass and a width along the length of the central span substantially less than the length of said central span and positioned centrally along the length of the span so that the reaction force is passed to said central span and is distributed symetrically along the central span toward both ends of said upper frame whereby maximum deflection of the central span occurs at the center and is distributed uniformly along the central span toward both said ends.

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