April 11, 1944. G. L. BOXELL 2,346,352

CAM OPERATED MACHINE

Filed Dec. 30, 1941 2 Sheets-Sheet 1

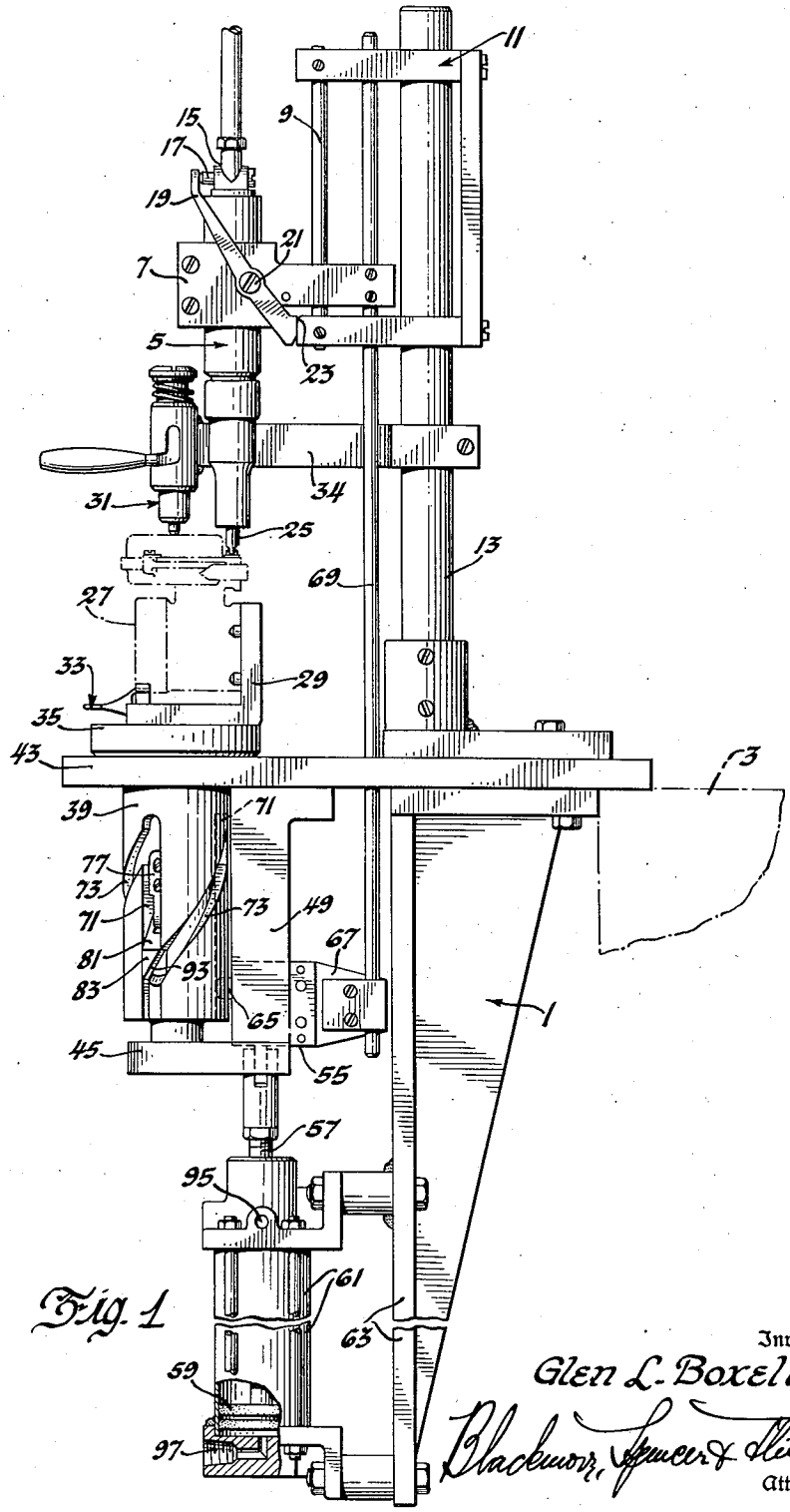

Fig. 1

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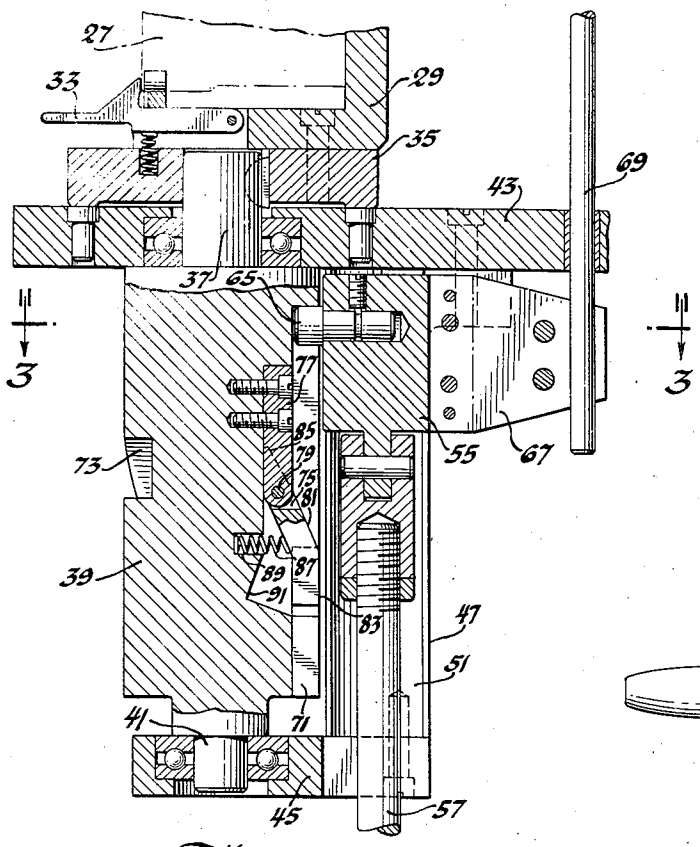

Fig. 2

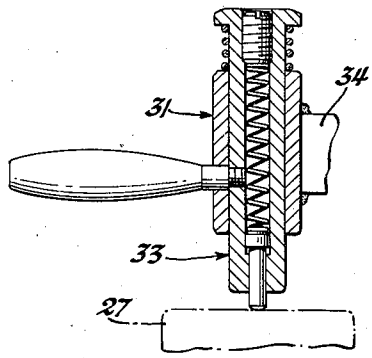

Fig. 4

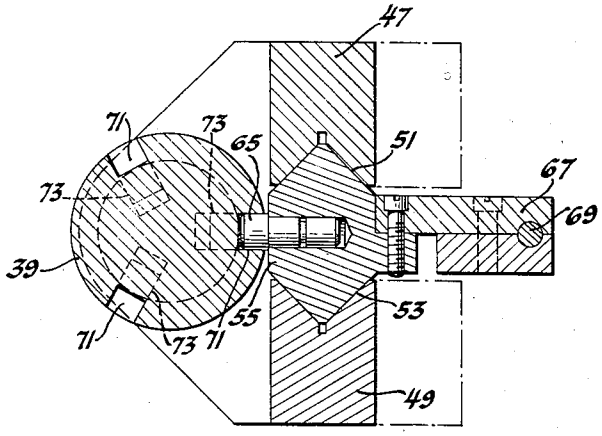

Fig. 3

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UNITED STATES PATENT OFFICE

2,346,352

CAM OPERATED MACHINE

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Application December 30, 1941, Serial No. 424,897

6 Claims. (Cl. 29—84)

The present invention relates to improvements in assembling machines and more specifically to machines used in production to assemble a plurality of parts into a unit.

In production of assemblies in which a number of parts are secured together to form a unit it is necessary to provide means to clamp the members together. Various means may be used, such as rivets, screws, bolts, etc. In mass production it is necessary to assemble the units as far as possible automatically.

It is therefore an object of my invention to provide a means for applying securing means to a plurality of parts to fasten them together in a unit.

It is a further object of my invention to provide an assembly machine for tightening a plurality of securing means to fasten assembly parts together.

It is a still further object of my invention to provide an assembly machine as described above which is automatic in its operation.

With the above and other objects in view, which will become apparent as the specification proceeds, my invention will be best understood by reference to the following specification and claims and the illustrations in the accompanying drawings, in which

Figure 1 shows a side elevation of the machine;

Figure 2 is a vertical sectional view of the indexing mechanism;

Figure 3 is a sectional view taken on line 3—3 of Figure 2; and

Figure 4 is a vertical sectional view of one of the clamping means for the work piece.

Referring now to Figure 1, the frame of the machine shown generally at 1 comprises a number of members rigidly bolted together and fixed in a vertical position on a bench 3 in any well known manner. An air-operated driving mechanism, of any well known type, such as that used for driving screws, is shown generally at 5, and is fixed to a support member 7 slidably mounted for vertical movement on a vertical guide rod 9 fixed to a bracket shown generally at 11 which is, in turn, fixed to a vertical frame post shown at 13. An air valve 15 for the air-operated driving mechanism has a valve stem 17 which is operated by a lever 19 pivoted at 21 to the support member 7. When the lower beveled end of the lever 19 contacts the beveled portion 23 of the bracket 11 it admits air to the driving means and causes rotation of the driver bit 25 in a well known manner. The driving mechanism is shown in its depressed position with the bit 25 engaged in a screw of the assembly or work piece shown generally at 27, in which position the air valve 15 is opened and rotation of the bit 25 takes place.

The work piece 27 is clamped in position on an L-shaped jig member 29 by means of manually operable spring engaged and released clamping means, shown generally at 31 and in detail in Figure 4, and another spring operated manually released clamping means shown generally at 33 and in detail in Figure 2. The clamping means 31 is adjustably fixed to the frame post 13 by a clamp member 34 to exert downward pressure on the work piece 27 and hold it in engagement with the horizontal surface of the jig. The clamping means 33, shown in detail in Figure 2, is pivoted to the jig member 29 and serves to exert horizontal force on the work piece to hold it in engagement with the vertical surface of the jig. Suitable locating means are provided on the jig surfaces, such as shown, which extend into depressions in the work piece.

As best shown in Figure 2, this jig number 29 is fixed to a table 35 keyed on the upper journal portion 37 of a cylindrical cam member 39. The cam member also has a lower journal portion 41 and both of these journal portions are shown supported for rotation by anti-friction bearings located in horizontally extending frame members 43 and 45 interconnected by vertical frame members 47 and 49, each having vertical V-shaped guideways 51 and 53, respectively, as best shown in Figure 3. A crosshead 55 is shown movably mounted in these guideways and is operably connected to a piston rod 57 and piston 59 which is slidably mounted in an air cylinder 61 fixed to a downwardly extending frame member 63, as shown best in Figures 1 and 2.

The crosshead 55 is provided with a cam operating stud 65, and a clamp 67 is connected to both the crosshead and a connecting rod 69 which is slidably mounted for vertical movement in aligned bearings in the frame member 43 and the horizontally extending portions of the bracket 11. The upper end of the connecting rod 69 is connected to the support member 7 for the air-operated driving mechanism 5.

The cylindrical cam member 39 is provided with a plurality of straight and curved slots in the periphery thereof. The straight slots 71 are shown extending vertically or parallel to the axis of the cylindrical cam member and the curved slots 73 are shown extending angularly with respect to the axis of the cam member between adjacent vertical slots 71. Each curved slot 73 extends from a point near the lower extremity of one of the vertical slots 71 to the top of the ad-

jacent vertical slot and the cam stud 65 in the crosshead 55 is shown extending into the bottom portion of one of the vertical slots 71 below the point where an angular slot 73 intersects this vertical slot as best shown in Figure 1. In each vertical slot there is located a movable frog or switch point 75 and frog supporting means 77, the details of which are best shown in Figure 2. The frog 75 is pivoted at 79 to the supporting means 77 which is fixed to the bottom surface of the slot by machine screws.

The frog is provided with a ramp surface 81 extending angularly outward and downward from a point in the slot below the peripheral surface of the cam member 39 to a portion 83 of the frog which is flush with the peripheral surface of the cam member 39. The frog is also provided with a tail or stop portion 85 which contacts the bottom of the slot to maintain the portion 83 flush with the peripheral surface of the cam member. The portions of the frog are urged to the above mentioned position by a compression spring 87, the inner end of which is carried in a counterbore 89 in the bottom of the slot and the outer end presses outwardly on the inner surface of the frog 75. The bottom of the slot is undercut at 91 to allow sufficient inward movement of the lower end of the frog by downward movement of the cam stud in each vertical slot 71 past the ramp surface 81 and flush portion 83 of the frog. The portion 83 of each frog is provided with an angular surface cut therein, shown at 93 in Figure 1, which is flush with one wall of an angular slot 73 extending into a vertical slot when the frog is urged to its outer position so that after downward movement of the cam stud in a vertical slot past the frog the angular surface 93 thereof serves as a switch point and causes the cam stud to move upward through an angular slot 73 to rotate and index the cam member 39 and therefore the table 35, jig 29 and work piece 27 carried by the cam member.

Any number of vertical or straight slots 71 may be provided in the cam member, as desired, with an angular or curved slot 73 connecting the straight slots, and the straight slots may be spaced angularly so that the work piece may be indexed to any position desired for the entrance of the driver bit into a screw of the work piece when the cam stud is moved successively upward through an angular slot 73 to an adjacent vertical slot 71 and then downwardly to the bottom of a vertical slot. As the cam stud 65 is carried by the crosshead 55 and the driving machine is also connected with the crosshead by the connecting rod 69, upward movement of the crosshead causes the driving machine to be moved upward away from one screw and the work to be indexed for driving of another screw by the next down stroke of the crosshead.

The air cylinder 61 and its piston 59 connected to the crosshead serves to reciprocate the crosshead and therefore cause the work to be successively indexed for driving of any number of screws on the work piece in succession and also serves to control the operating mechanism previously described for the air valve 15 to cause the driving machine to operate when the screw driving mechanism is moved to lowest or screw engaging position, as shown in Figure 1.

The air cylinder is provided with air openings 95 and 97 at each end for the entrance of compressed air and exhaust of air therefrom. Any well-known type of foot-operated valve and piping arrangement, not shown, may be used to cause upward or downward movement of the piston in the cylinder to cause successive indexing of the work and successive driving of screws in the work piece for an upward and downward stroke of the piston.

While I have shown the driving means as engaging and tightening a screw it could be used with a rivet or other type of device and should, therefore, not be limited to screws.

I claim:

1. In a machine of the type described comprising a composite frame structure which includes rotatable work supporting and clamping means, an indexing cam fixed to the work supporting and clamping means, said cam being provided with an indexing slot, movable tool driving means and reciprocating power means for moving the tool driving means toward and away from work supporting means and means on said reciprocating means in constant engagement with said indexing cam slot for also causing rotation of the indexing cam only when the tool driving means is moved away from the work supporting and clamping means.

2. In a machine of the type described comprising a composite frame structure which includes movable indexing means comprising a rotatable cylindrical cam having a plurality of intersecting slots extending angularly and parallel to the axis of the cam, a reciprocating stud movable in the slots and movable spring biasing mechanical switching means on said cam to cause the stud to pass successively through adjacent angular and parallel slots to index the cam, work supporting means on the cam, screw driving means movable toward and away from the work supporting means and reciprocating power operated means operatively connected to the cam stud and movable screw driving means to cause indexing of the work supporting means on alternate strokes of the power operated means.

3. In a machine of the type described including a frame, work supporting means rotatably mounted thereon, cam indexing means for the work supporting means, said cam indexing means being provided with parallel and angularly arranged and interconnected slot portions and a stud movable therein, tool driving means movably mounted on the frame and controllable power means operatively connected continuously to the tool supporting means and said stud of said cam indexing means to cause the tool supporting means to move toward and away from the work supporting means and to operate the indexing means only upon movement of the tool supporting means away from the work supporting means.

4. In a machine of the type described including a frame, rotatable work supporting means mounted on the frame, indexing means for the work supporting means, power operated tool driving means movably mounted on the frame, said power operated tool driving means including movable power control means for controlling the application of power thereto, a cam surface on said frame to cause movement of the control means, and controllable power means mounted on said frame and operably connected to the tool driving means and indexing means simultaneously to cause the power operated tool driving means to be moved toward the work supporting means an amount necessary for the power control means to engage the frame cam surface and to cause operation of the tool driving means, said controllable power means also being adapted to

cause the power operated tool driving means and power control means therefor to be moved away from the work supporting means to stop operation thereof and simultaneously cause operation of the indexing means.

5. In a machine of the type described including a stationary frame, work supporting means rotatably mounted on the frame, cam indexing means for said work supporting means, said cam indexing means including a cam operatively connected to said work supporting means and having parallel or locking slot portions and angular or indexing slot portions between said parallel portions and an indexing stud movable in said slot portions, driving means supported for reciprocating movement on said frame, a tool operated by the driving means, and power operated means supported on the frame operatively connected directly to both said indexing stud and said tool driving means to cause reciprocating movement thereof, thereby to cause the driving means and tool to be moved toward the work supporting means without causing indexing of said work supporting means and to cause reverse movement of the driving means and tool and simultaneous indexing of said work supporting means.

6. In a machine of the type described including a supporting frame, a rotatable work supporting member carried by the frame, indexing means connected to the member, the indexing means comprising an indexing cam having intersecting straight and curved slots, a reciprocable cam stud movable in the slots, and movable spring biased mechanical switching means supported on the cam, said switching means being operable by one-way movement of the stud in the straight slots to cause subsequent movement of the stud in the curved slots by reverse movement thereof to index the cam, an air operated screw driving mechanism reciprocably mounted on the frame, said mechanism being operably connected to the cam stud and having an air admission valve operable only by contact with a frame projection upon a predetermined movement of the stud in each straight slot, and a second air operated mechanism operably connected to the cam stud to reciprocate both the stud and interconnected air operated screw driving mechanism relative to the work supporting member.

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