ROTATING-TYPE PRESSURE APPLYING APPARATUS

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7 Claims, 2 Drawing Figures

ABSTRACT

A rotating pressure applying apparatus for clamping and pressing a plurality of workpieces. The apparatus includes a rotatable apparatus having a plurality of viselike clamping devices mounted thereon and spaced circumferentially around the rotational axis thereof. Each clamping device is moved into a clamping position by a suitable power device, such as a fluid pressure cylinder. A control structure, such as a cam and switch arrangement, coacts with the rotatable apparatus for causing automatic releasing of the clamping devices at a first location, and for causing automatic clamping of the clamping devices at a second location which is angularly spaced from the first location. A workman can position new workpieces into the apparatus between these two locations.
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ROTATING-TYPE PRESSURE APPLYING APPARATUS

FIELD OF THE INVENTION

The present invention relates to a rotating-type pressure applying apparatus that permits continuous pressure applying operations and arbitrary control of the time during which pressure is applied to the workpieces, while holding and pressing a plurality of workpieces in a small space.

BACKGROUND OF THE INVENTION

In the conventional operation for bonding members together, for instance bonding wooden pieces under pressure, pressure has been applied using a manually operated vise or other similar clamping means after applying a bonding agent on one of the surfaces thereof. With this method, it is difficult to control the amount of pressure at will. Also, it requires a considerable duration of pressure applying time before the completion of adhesion, and this thus makes the pressure bonding operation intermittent and inefficient. In an attempt to solve such shortcomings, a plurality of vises have been used, but this has resulted in an increase not only in the floor space for equipment but also in the space to store the work being pressed.

Accordingly, the present invention has been developed to eliminate the aforementioned shortcomings. Particularly, the present invention relates to an improved apparatus which is rotatable and permits a plurality of workpieces to be simultaneously clamped at a plurality of locations which are spaced circumferentially around the periphery of a rotatable device. The apparatus of the present invention thus enables not only a plurality of workpieces to be simultaneously pressed and clamped, but also enables the pressing operation to extend over a substantial period of time while the resulting device occupies only a small amount of space. The device also includes an automatically actuated power device so that extremely high pressure can be developed to permit the simultaneous pressing of one or a plurality of workpieces. The device of the present invention is also highly desirable since a single operator can be utilized for loading or unloading the workpieces from the device in an efficient and simple manner.

Other objects and purposes of the present invention will be apparent upon reading the following description and inspecting the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 is a front elevational view of an embodiment of the pressure applying apparatus constructed according to the present invention.

FIG. 2 is an end elevational view of the apparatus, same being taken from the left side as appearing in FIG. 1.

Certain terminology will be used in the following description for convenience in reference only and will not be limiting. For example, the words “upwardly,” “downwardly,” “rightwardly” and “leftwardly” will refer to directions in the drawings to which reference is made. The words “inwardly” and “outwardly” will refer to directions toward and away, respectively, the geometric center of the apparatus and designated parts thereof. Said terminology will include the words above specifically mentioned, derivaties thereof and words of similar import.

SUMMARY OF THE INVENTION

The objects and purpose of the present invention are met by providing a rotatable apparatus having a plurality of clamping devices mounted thereon, which clamping devices extend axially of the apparatus and are spaced circumferentially around the rotational axis thereof. A power member, such as a fluid pressure cylinder, actuates each of said clamping devices. Control structure is provided for permitting automatic actuation of the fluid pressure cylinders, which control structure in a preferred embodiment includes a plurality of pilot valves, each being associated with a respective one of the power cylinders. A fixed cam extends over a limited arcuate extent and is positioned for actuating the pilot valves. The cam causes deenergization of the power cylinders when the respective pilot valves are actuated by the cam, whereupon further rotation of the apparatus causes the cam to disengage the pilot valves so that the power cylinders are again actuated. During this limited arcuate extent wherein the pilot valves engage the cam, the respective clamping devices are opened at the beginning of contact with the cam for discharging the workpieces, whereupon further workpieces are loaded into the clamping devices prior to the disengagement of the pilot valves from the cam. During the remainder of the rotation of the apparatus, the workpieces are maintained under pressure to permit suitable adhesion or bonding of the workpieces.

DETAILED DESCRIPTION

Referring to FIGS. 1 and 2, the apparatus of the present invention comprises a rotatable assembly which includes a pair of spaced discs 6 and 7 which are fixed relative to one another and are additionally fixedly connected to a shaft 5. The shaft 5, which in the illustrated embodiment extends substantially horizontally, is supported for rotation within bearing assemblies 3 and 4, which bearing assemblies in turn are mounted on a pair of frames or pedestals 1 and 2, respectively. The shaft 5 also has a ratchet wheel 8 fixedly connected thereto adjacent one end thereof.

To permit the assembly to be intermittently rotated in a steplike manner, there is provided a hydraulic cylinder 9, the housing of which is mounted on the frame 2. The piston rod of the cylinder 9 is connected to the lower end of an elongated arm or lever 10, which arm 10 adjacent its midpoint is freely rotatably supported on the shaft 5, the arm 10 being positioned directly adjacent the ratchet wheel 8. The other end of the arm 10, namely the upper arm 11. FIGS. 1 and 2, has a pawl 11 pivotally mounted thereon, which pawl is suspended downwardly from the arm 10 so that the lower end of the pawl engages the teeth formed on the periphery of the ratchet wheel 8. Due to the reciprocating movement caused by energization of the doubleacting hydraulic cylinder 9, the arm 10 is caused to swing back and forth, thereby causing the pawl 11 to intermittently drive the ratchet wheel 8 in one direction in a steplike manner. As is conventional, during the return movement of the arm, the pawl 11 will freely pass over the teeth of the ratchet wheel 8 and thus not drive same. In this manner, the ratchet wheel 8 and shaft 5 to which the wheel 8 is fixed are thus intermittently rotated in a steplike manner in a counterclockwise direction as...
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viewed in FIG. 2. Rotation of shaft 5 also causes the disc 6 and 7 to likewise rotate in an intermittent step-like manner as the pawl 11 advances the wheel 8 substantially one tooth at a time.

Around the entire circumference of either of the 5 discs 6 or 7 there are mounted in circumferentially spaced relation a plurality of pilot valves 12 and a plurality of hydraulic cylinders 13. Each pilot valve 12 is connected to a respective one of the hydraulic cylinders 13 for controlling the energization thereof. A number of vising or clamping devices 14 are mounted on and interposed between the discs 6 and 7, which clamping devices 14 are circumferentially spaced around the discs 6 and 7 so that one of said clamping devices is substantially aligned with and operated by a respective one of the hydraulic cylinders 13. As illustrated in FIG. 1, each clamping device 14 includes an elongated rod 14′ which extends between the discs 6 and 7 and is fixed thereto, which rod 14′ supports the workpieces, and a movable pressing plate 19 which is connected to the free end of the piston rod associated with the respective hydraulic cylinder 13, so that upon energization of the hydraulic cylinder and extension of the piston rod, one or a plurality of workpieces 18 are thus clamping held between the pressing plate 19 and the opposite disc 7.

For controlling the energization of the hydraulic cylinders 13, the apparatus is provided with an elongated projection or cam 15 fixedly secured to the frame 1. The cam 15 is of an arcuate configuration and is geared substantially about the rotational axis of the shaft 5, which cam 15 extends through only a small arcuate extent. The cam 15 is positioned so as to contact the actuators associated with the pilot valves 12 for actuating the valves to thus control the energization and de-energization of the cylinders 13. The cam 15, by its opposite extremities, thus controls and determines the positions at which workpieces 18, such as wooden pieces which are to be glued, are loaded into and discharged from the apparatus. Specifically, the cam 15 at its leading edge defines a position designated A in FIG. 2 wherein the workpieces are discharged from the apparatus, so that while the apparatus is moved between positions A and B, the clamping devices located within the arcuate sector A to B can again be loaded with workpieces so that the clamping devices at position B are thus substantially fully loaded. The other end of the cam 15, such as at position B, thus defines the loading or charging position of the apparatus whereupon the clamping devices are again energized for clamping and pressing the workpieces.

Pressure fluid such as hydraulic oil for operating the cylinder 9 and the cylinders 13 is supplied to the apparatus from a pressure source, such as a hydraulic pump, through a swivel joint 16 mounted at one end of the shaft. The pressure fluid then flows from swivel joint 16 through suitable connecting conduits (not shown) to the pilot valves 12, which valves in turn control the flow of pressure fluid to the cylinders 13. The energization of the respective hydraulic cylinders 13, which occurs when the pilot valves 12 move out of engagement with the cam 15 adjacent position B, results in the individual hydraulic cylinders 13 being energized so that the workpieces loaded within the respective clamping device 14 are subjected to a predetermined clamping pressure while the specified clamping device moves (in the counterclockwise direction in FIG. 2) from the charging position B to the discharge position A. When the respective clamping device 14 reaches the discharging position A, the pilot valve 12 is again engaged by the cam 15, which cam causes a switching of the pilot valve so that the respective hydraulic cylinder 13 is energized in the reverse manner so that the cylinder is thus retracted, causing the clamping device 14 to be opened. The plurality of wooden pieces 18 which have been previously pressed by the respective clamping device 14 are not firmly bonded together and accordingly are discharged from the clamping device upon retraction of the power cylinder 13. The bonded workpieces, as discharged from the respective clamping device, are then transferred to a preselected location by means of a chute or other suitable device.

During the movement of the hydraulic cylinder between extended and retracted positions, the hydraulic oil discharged from the respective cylinders flows through suitable conduits (not shown) to a swivel joint 17 which is mounted adjacent the other end of the shaft 5, which joint 17 is in turn connected by a further conduit to a suitable collection tank or reservoir.

**OPERATION**

The operation of the apparatus of the present invention will be briefly described to insure a complete understanding thereof.

The rotating shaft 5 is driven by the operator by pushing a foot-switch (not shown), whereby a solenoid valve (not shown) is actuated to supply the hydraulic oil from the pressure source to the hydraulic cylinder 9, thus advancing a piston rod therein. This rotates the arm 10, which in turn causes the pawl 11 to rotate the ratchet wheel 8. By releasing the foot-switch, said valve is switched to withdraw the piston rod in the hydraulic cylinder 9. The arm 10 then reversely rotates, with said pawl 11 coming back to its original position. Since the pawl 11 is suspended from the arm 10, the ratchet wheel 8 does not rotate backwards but stops where it has been rotated, whereby being ready to be again advanced by the next driving motion of the pawl.

The operator lays a number of wooden pieces 18 applied with a bonding agent on their bonding surfaces on said clamping device 14 at position B. By pushing said foot-switch, the discs 6 and 7 are rotated correspondingly to the length of one stroke of the piston rod of the hydraulic cylinder 9, thereby disengaging the respective pilot valve 12 from the cam 15. By the means, the hydraulic cylinder 13 is energized and extended so as to exert a given pressure on said many wooden pieces 18 laid on the clamping device 14. When said clamping device reaches position A, the pilot valve 12 again contacts and is actuated by the cam 15, whereby the hydraulic cylinder 13 retracts to open said clamping device. The wooden pieces which have completed the bonding process are then discharged.

When the discs 6 and 7 have rotated one pitch, the operator charges a number of wooden pieces into the next empty clamping device 14 that has come to position B, in the same manner as previously described. Then, the cycle of pushing said foot-switch, pressing and rotating forwardly the wooden pieces, and discharging them, is repeated.

Thus, a number of wooden pieces 18 are continuously charged and discharged at Position A and B, respectively, as said discs rotate one step after another.
Concurrent with this, a number of wooden pieces charged in the clamping devices 14 are maintained under a given pressure as the apparatus rotates from position B to position A, to complete the bonding operation.

As described above, the apparatus according to the present invention has a number of clamping devices operated by respective fluid pressure cylinders mounted on the rotating members. The materials to be bonded, which are charged into said clamping devices as said rotating members intermittently rotate in a steplike manner, are pressed by a given pressure, stored until bonding has been completed, and automatically discharged thereafter. Accordingly, the operation is continuous and efficient, and the pressure applied can be kept constant. This is conducive to the manufacture of uniform quality products. Also, the apparatus does not take up much space for installation, since it can store the pieces to be bonded in a small space while they are kept under pressure for a given duration of time. This invention thus offers remarkable effects. Besides, the invention is also applicable to the pressing of general materials, without being limited to the above-described embodiment.

Although a particular preferred embodiment of the invention has been disclosed in detail for illustrative purposes, it will be recognized that variations or modification of the disclosed apparatus, including the arrangement of parts, lie within the scope of the present invention.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A rotatable clamping apparatus for simultaneously pressing and clamping a plurality of workpieces, comprising:
   - stationary base means;
   - a frame assembly rotatably supported on said base means for rotation about an axis, said frame assembly including a pair of axially spaced disks and means fixedly connecting said disks together, said disks projecting radially outwardly from said axis and defining therebetween an annular space which is concentric with said axis and opens radially outwardly;
   - a plurality of clamping devices for applying pressure to workpieces disposed within said annular space defined between said disks, said clamping devices being mounted on said frame assembly for rotation therewith and spaced circumferentially around said axis;
   - each said clamping device including a fluid pressure cylinder mounted on one of said disks for rotation therewith and a pressing member disposed and movable between said disks for permitting a workpiece to be clamped between the pressing member and a disk, said pressing member being connected to and moved by its respective fluid pressure cylinder;
   - control means for controlling the activation of the fluid pressure cylinder associated with each respective clamping device, said control means including a control valve mounted on said frame assembly and associated with each respective cylinder for controlling the energization thereof; and
   - drive means drivingly interconnected to said frame assembly for unidirectionally rotating same in an intermittent steplike manner.

2. An apparatus according to claim 1, wherein each of said control valves comprises a shiftable valve mounted on said one of said disks for rotation therewith, the shiftable valves associated with said plurality of clamping devices being mounted in a circular arrangement on one of said disks, and said means stationarily mounted on said base means and positioned for engaging said shiftable valves for controlling the shifting thereof.

3. An apparatus according to claim 2, wherein each shiftable valve is shiftable from a first to a second control position when the frame assembly is in a first rotational position, and said cam means causing said shiftable valve to be shifted from said second to said first control position when said frame assembly is in a second rotational position which is angularly spaced from said first rotational position by an angle which is substantially less than 90°.

4. An apparatus according to claim 1, wherein said frame assembly includes an elongated shaft rotatably supported on said base means for rotation about said axis, said shaft extending axially between and being fixedly connected to said pair of disks, each of said fluid pressure cylinders being fixedly mounted on said one of said disks adjacent the radially outer edge thereof and positioned in the immediate vicinity of its respective clamping device, each fluid pressure cylinder projecting outwardly from the outer axial end face of said one disk and having a movable power member which is directly connected to said pressing member for synchronous movement thereof, whereby one or more workpieces can be clamping pressed between the pressing member and one of said disks.

5. An apparatus according to claim 4, wherein said control means includes an elongated cam formed as an arcuate segment generated substantially about the rotational axis of said shaft, said cam being fixed to said base means and being disposed for engaging said control valves for controlling the shifting thereof.

6. An apparatus according to claim 4, wherein said drive means includes a ratchet-type, one-way drive mechanism drivingly connected to said shaft for causing steplike rotation of said frame assembly.

7. An apparatus according to claim 1, wherein said frame assembly includes a plurality of elongated rodlike members extending axially between and fixedly connected to said disks, said rodlike members being disposed in a circular arrangement concentric with said axis and located adjacent the radially outer edges of said disks, one of said rodlike members being associated with each of said clamping devices, said rodlike members being adapted to support one or more workpieces thereon, and said movable pressing member being slidably movable along said rodlike member for permitting clamping of workpieces between said pressing member and one of said disks.

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