Title: AN ARRANGEMENT FOR A DOUBLE-ACTING PRESS

Abstract: Described is an arrangement for a double acting press, whereby a press is constructed with vertically opposed moving faces, both faces are capable of converging in a substantially parallel motion towards a predetermined point between them and then exert a compressive load. The press has a frame arrangement that contains the load. When a time period has elapsed the vertically opposed faces both diverge in a substantially parallel motion away from the predetermined point to a position from which they may begin the sequence again.
An arrangement for a double-acting press

Background to the invention.
The present invention relates to the art of presses and more particularly to
double acting presses constructed with vertically opposed moving faces.
Wherein double acting describes a press with two working faces or platens
that both have converging and diverging motion to and from a
predetermined position between the working faces.
Commonly it is advantageous when loading a press with material to be
processed that the material has unobstructed access into the compression
area of the press. Equally after the press has completed a compression
cycle, the processed material should exit the press unobstructed.
A press is commonly used in conjunction with tooling and the processed
material may exit the press in a different form or shape to that which it
originally entered. Often after processing the material a greater clearance
between the tooling is required to effect an efficient unloading or ejection
of the material (or then component or product) from the press than it did
prior to it's processing.
Vertically opposed double acting presses are often employed in processes
where a material is loaded and removed from a press using an automated
feed system.

In such an arrangement the operation of the press and the feed system are
normally synchronised. An automatic feed system may intermittently
index continuous or discontinuous materials into and out of the press, to
simplify the feed system's arrangement and therefore operation its vertical
orientation to the press or ground may often remain substantially constant
while the material enters and exits the press.

In such arrangements double-acting presses have distinct advantages over
single acting presses in allowing greater clearance between the material or
component and tooling. This facilitates efficient and rapid loading and
unloading of the press, which decreases cycle times and so increases
production outputs.

Conventional vertically opposed double acting presses have two separately
supported faces (platens or slides) that are independently powered to
actuate converging and diverging parallel motion of the faces within the
frame of the press. Commonly the press arrangement is effectively two
opposing single acting presses combined within a single press frame.

The present invention by means of a simple arrangement allows the
construction of a vertically opposed single acting press with one separately
supported face which is actuated for parallel motion within the frame of
the press. to operate with the dual face motion of a double acting press.

Wherein the actuation system's employed are not vertically opposed units
but positioned to one side of the separately supported face that is actuated
for parallel motion the side that is not the working face.

A further advantage of this arrangement, typically for larger presses of
both single acting up-stroke and double acting presses is the necessity to
accommodate the press in a dug-out pit or to artificially raise the floor
level to create a usable working height for the press. This requirement may
no longer be a prerequisite with such a configuration.

Known prior art of particular reference describing the mechanical
arrangements of double acting presses include GB1398611 Le Carbone,
US3818825, GB1396746 Przedzieb. Wherein US3818825, GB1396746
Przedzieb discloses a press in which the press frame (2,3,11,12,14,17)
moves however there are four working faces in this arrangement and the
member (3) alternates between two separate working zones therefore only one working face actuates per zone.

Wherein GB1398611 Le Carbone discloses a double acting press with two permutations (Fig1 and Fig2) respectively. The first permutation shown in (Fig1) has a press frame (Fig1, 1,2,3, and 4) that does not actuate and therefore the upper working face of the press (Fig1, 7) does not move. In the second permutation (shown in Fig2) a double acting press is described wherein the press frame (Fig2, 1,2,3,4) moves and the working faces or 'rams' exhibit converging and diverging motion. However the press frame within this embodiment requires three rigidly spaced apart members (Fig2, 2,3,4, page 3 lines 117-130) to operate. In addition the press arrangement as disclosed in (Fig2) employs a reciprocal motion actuation device that remains substantially constant in its overall dimensions whilst operating. The two rods (9,11) are connected to a common piston (17) and the rods and piston all move in the same direction simultaneously when actuated. Whereas in the present embodiment the actuator employed increases/decreases its overall dimensions as it expands and contracts during its operation. During expansion the actuator moves sequentially in one direction then maintains its expansion in a second continuing motion in the opposite direction to the first direction of movement. The operation of the device (g) when contracting is comparable to that of its expansion although the directions of movement are then reversed.

Summary of the invention.

There is disclosed a vertically arranged double-acting press.

Wherein the configuration of such a press comprises in combination: a substantially rigid frame (a,b,c,d) which is moveable, having two vertically spaced-apart structural members (a,b) each structural member has an inner and an outer face. The proximity of the inner faces with regard to one another being substantially fixed or coupled by structural braces (c,d) when containing a compressive load. Between the two fixed structural member's (a,b) is a vertically movable rigid structural member (e) with upper and lower faces. Positioned between one of the spaced-apart structural members of the frame and one of the faces of the vertically moveable rigid member (e) is a powered linear actuator, device (g) capable of exerting a load greater than the mass of the press frame. The relative motions of the members (a,b,c,d) and (e) are attained and or initiated by the actuation device (g). The press is arranged with vertically moving faces in which the two working faces of the press (h,i) are both capable of converging in a substantially parallel motion towards a position between the working faces. A compressive load or force or pressure is then exerted. The press frame (a,b,c,d) contains the load. After a time interval the faces diverge in a substantially parallel motion away from each other to a position from which they may begin the sequence again. The motion of the working face (h) that is, substantially a part of the vertically movable rigid structural member (e) is attained or initiated by the powered actuator. The other working face (j) is substantially part of the press frame (Fig1,b, Fig2,a) its motion is also attained or initiated by the powered actuator. When the motion of the vertically movable rigid structural member (e) and the device (g) is restricted with relationship to the vertical proximity to the ground, floor or base (m) on which the press is situated. The actuator is arranged to expand and contract in at least two major and substantially opposite directions. The vertical motion inhibitors (L,m) which restrict the
vertical motions of the press are rigid structural members capable of supporting a mass greater than the total mass of the press. They are arranged so as to permit the shock absorber or buffer devices (k) to mechanically deform when inhibiting the vertical motions of the press and therefore de-accelerate/accelerate the vertical motions of the working faces (j.k). During the operation of the press the direction of the linear actuators' initial motion is constrained and the resultant direction of the actuators' continuing motion is reversed. This occurs during the expansion and contraction of the actuator.

10 Brief description of the drawings.

Figure 1, A general schematic arrangement showing a partial cut-away section of a press with primary powered down-stroke actuation.

Figure 2, A general schematic arrangement showing a partial cut-away section of a press with primary powered up-stroke actuation.

Figure 3, A general schematic arrangement showing a sequence of typical press operation, to close the working faces for a press with primary powered down-stroke actuation, shows working faces open.

Figure 4, A general schematic arrangement showing a sequence of typical press operation, to close the working faces for a press with primary powered down-stroke actuation, shows upper working face closed.

Figure 5, A general schematic arrangement showing a sequence of typical press operation, to close the working faces for a press with primary powered down-stroke actuation, shows both upper and lower working faces closed. (To open both faces the sequence is reversed.)

Figure 6, A general schematic arrangement showing a sequence of typical press operation to close working faces for a press with primary powered up-stroke actuation, shows working faces open.

Figure 7, A general schematic arrangement showing a sequence of typical press operation to close working faces for a press with primary powered up-stroke actuation, shows lower working face closed.

Figure 8, A general schematic arrangement showing a sequence of typical press operation to close working faces for a press with primary powered up-stroke actuation, shows both lower and upper working faces closed. (To open both faces the sequence is reversed.)

Detailed Description

A description of the invention with reference to the drawing figures. According to the first aspect of the invention there is disclosed an arrangement for a double acting press. Whereby a press constructed with vertically opposed moving faces in which both faces are capable of converging in a substantially parallel motion towards a position between the faces. A contained compressive load is then exerted. The press is configured with a frame arrangement that contains the load. After a time period has elapsed the vertically opposed faces both diverge in a substantially parallel motion away from each other to a position from which they may begin the sequence again. The motion of one of the faces is attained by powered actuation. The opposing face is an integral part of the press frame and its motion is actuated when the powered face's vertical motion is restricted with relationship to its vertical proximity to the ground, floor or base on which the press is situated. The vertical restriction of the powered face creates an opposite resulting motion from the powered
actuator this subsequently displaces the mass of the press's frame which one of the two faces is an integral part of.

Typically the frame is a rigid construction having two spaced-apart structural members (Fig1&2,a,b) each structural member having an inner and an outer face. The proximity of both the said inner faces with regard to one another being typically fixed when containing a compressive load.

Structural brace/s (Fig1&2,c,d) typically constrain the two said spaced-apart rigid members in a fixed adjustable or non-adjustable spatial relationship. Between the said fixed structural member's inner faces is a vertically movable rigid structural member with upper and lower faces (Fig1&2,e). The structural brace/s of the press's frame may also act as vertical guides for the vertically moveable rigid structural member (Fig1&2,f). Positioned between one of the said spaced-apart structural members of the frame and one of the faces of the vertically moveable rigid member is a powered linear actuator capable of exerting substantial loading (Fig1&2,g). The actuator causes the vertical motion of the moveable rigid structure. The opposite face of the vertically moveable structural member where the actuator is positioned represents one of the two working faces of the press (Fig1&2,h). The other working face (Fig1&2,i) of the press is the opposite inner face of the press frame's structural member.

The actuator may be one or more of the following mechanisms creating a mechanical advantage, a rotating helix or screw thread, an expanding knuckle arrangement, a rotating crank mechanism or pressurised fluids or gases increasing or decreasing in volume within an expanding or contracting container. Preferably a pressurised hydraulic system is used with a container constructed as an expanding or contracting interlocking cylinder and plunger arrangement with a sealed interface into which is fed pressurised fluid. Commonly referred to as a hydraulic ram. Such a device can also be constructed to have two cylinders with a common plunger or two plungers and a common cylinder. A plunger may also be known as a piston or ram.

One or more actuators may be utilised. These devices/mechanisms are well documented to those skilled in the art.

In a press arrangement configured using hydraulic ram/s as the actuator/s the normally static portion of the ram this may be either the cylinder or the plunger then becomes the dynamic portion of the actuator once the actuator and the vertically moveable member (e) motion has been restricted. An actuator when expanding initially moves in one direction until the initial direction of movement is restrained relative to the base (n) and then continues its expansion in the opposite direction to the first direction of movement, as the actuator contracts this also applies. The sequence is the same during the contraction of the actuator however the directions of motion are reversed. The actuator is arranged to move in at least two major directions while expanding and at least in two major directions while contracting. Where the directions of a continuing single motion are substantially opposite and substantially sequential. The actuation system employed may have variable or adjustable stages of constant, accelerating and de-accelerating velocities during its extending and contracting vertical motion. With such a press arrangement the main components of the actuator (g) are positioned vertically to substantially one side of the moveable member (e). The upper or lower side, dependent upon the press's operating configuration. Independent of the actuation system the vertical motion of the press's faces may also be de-accelerated / accelerated with the use devices such as shock absorbers or buffers.
(Fig 1&2,k). The kinetic energy within the vertical motion of the faces and frames mass is dissipated by mechanical deformation, such as by spring/s or elastomers or by using the resistance of a fluid or gas in a hydraulic or pneumatic cylinder, cushion or dashpot.

The faces located upon and between the two opposed working faces of the press tooling will commonly be securely and adjustably positioned. The faces are used to support tooling which may perform a variety of functions such as shaping, punching, cutting, forming, drawing, moulding and others, processing a variety of materials such as ceramics, rubbers, metals, glass, textiles and others including materials consisting of or containing thermoplastic and/or thermosetting polymers such as closed cell sheets of thermoplastic polyolefin and/or ethylene vinyl acetate polymer materials. The materials structure may be in one or more of the following forms sheet, cellular, powder, granules, pellets or dough. Where the materials structure is cellular in composition the cell structure of the material may be either contain or consist of wholly or partially a closed cell structure or an open cell structure or a combination of both. The above lists of processes and materials should not be considered as limiting.

The device (g) is arranged to expand and contract successively during an operating cycle of the press. During both the expansion and contraction of the device (g) the actuator moves in one direction then maintains its expansion in a continuing motion in another direction to the first direction of movement. When the faces converge the upper face reduces its altitude and the lower face increases its altitude.

In such a press arrangement where the powered actuator is restricted, the working faces movement is substantially sequential and in variations of the disclosed press arrangement the upper or lower working faces may wish to actuate first. During its operation the actuation device (g) may be partially assisted in the relevant directions of motion by gravity. Partial or full simultaneous movement of both of the working faces can be attained with the use of linear de-accelerators when arranged inline or incorporated as apart of the vertical motion inhibitor/s (Fig 1&2,k).

The vertical motion inhibitor/s restricting the vertical motion of the press's primary powered actuation are rigid structural members capable of supporting a mass greater than the total mass of the press (Fig 1&2,b).

The vertical motion inhibitor/s may be fixed or adjustable in length/height, they may be configured too be secured to the press or the ground/floor/base (Fig 1&2,n) or a part of both.

The working height of such a press arrangement may be fixed or adjustable by employing vertical supports to the press frame, which may also incorporate linear de-accelerators (Fig 1&2,m).

The press may be arranged to operate as both a primary powered actuation down-stroke press (Fig 1) or as a primary powered up-stroke press (Fig 2).

With such a press arrangement and by optionally completely inhibiting the vertically moveable faces motion a conventional up-stroking press will be converted into a down-stroking press without inverting it and so a conventional down-stroking press will be converted into an up-stroking press without inverting it. The working faces of the press may commonly be referred to as platens, tables or slides. With such a press arrangement the load capacity of the powered actuated face must always be greater than the mass of the displaced press frame. Typically the maximum compressive load capacity of the press is reduced by the mass of the press frame. The arrangement disclosed is a vertical configuration a horizontal configuration is also possible.
Claims

1. An arrangement for a double acting press is disclosed, wherein double acting describes a press with oppositely positioned working faces (h,i) that each demonstrate converging and then diverging motion to and from a position between the working faces. Disclosed is a vertically arranged double acting press wherein the press is for shaping materials consisting of or containing thermoplastic and/or thermosetting polymers, a press is arranged with moveable members (a,b) that are connected and rigidly spaced apart, between the members (a,b) is a moveable member (e). The relative movement of the members (a,b and e) is attained or initiated by the device (g) this is a powered actuator that is arranged to successively expand and contract during an operating cycle of the press. The device (g) is arranged to expand substantially sequentially in at least two directions. Initially the actuator exhibits a first direction of motion until the first direction of motion is restricted relative to the base (n), then the actuator maintains its expansion in a second and substantially opposite direction to the first direction of movement. The operation of the device (g) when contracting is comparable to that of its expansion although the directions of movement are reversed. This arrangement facilitates the double acting motion of the press.

2. In a press arrangement as claimed in Claim 1, wherein for both the expansion and contraction of the device (g) the actuator moves in one direction then maintains its expansion in a continuing motion in another direction to the first direction of movement.

3. In a press arrangement as claimed in Claims 1 and 2, wherein the main components of the actuation device (g) are vertically positioned substantially to one side of the moveable member (e). This may be either the upper or lower side, dependent upon the press's operating configuration (Fig1, Fig2).

4. In a press arrangement as claimed in Claim 1 and 3, the actuation device (g) motion is constrained by the vertical motion inhibitor/s (l) and the vertical supports (m); these can be fixed or adjustable in length and can be configured to be secured to the press or the press's base (n) or partly to both.

5. In a press arrangement as claimed in Claims 1 and 4, wherein the press frame is arranged with two members (a,b) that are connected and rigidly spaced apart.

6. In a press arrangement as claimed in Claims 1 and 5, wherein the press is arranged with one a moveable member (e) which is located between the members (a,b).

7. In a press arrangement as claimed in Claims 1 to 6, simultaneous movement of the working faces (h,i) can be partially or fully attained with the use of linear de-accelerators (k) when arranged as a part of the motion inhibitor/s and support/s (l,m).

8. In a press arrangement as claimed in Claims 1 to 7, whereby the press's actuator (g) may be one or more of the following mechanisms: a rotating helix or screw thread, an expanding knuckle arrangement, a rotating crank
mechanism, or pressurised fluids or gases, increasing and decreasing in volume within an expanding and contracting container or ram.

9. In a press arrangement as claimed in Claims 1 to 8, wherein a press arrangement is configured using a cylinder and piston arrangement as an actuator (g), the normally static portion of the device, this may be either the cylinder or the piston then also becomes a dynamic portion of the actuator when the actuators motion has been restricted.

10. In a press arrangement as claimed in Claims 1 to 9, whereby located upon and between the two working faces (h,j) of the press, tools can be securely and adjustably positioned. Whereby the tools can perform a variety of functions such as shaping, punching, cutting, forming, drawing, moulding and others.

11. In a press arrangement as claimed in Claims 1 to 10, whereby shaped components or products that have been produced from sheet materials consisting of or containing closed cell cellular thermoplastic polyolefin and/or ethylene vinyl acetate polymer materials.

12. In a press arrangement as claimed in Claims 1 to 11, whereby shaped components or products have been produced from material consisting of or containing cellular polymers.

13. In a press arrangement as claimed in Claims 1 to 12, whereby shaped components or products that have been produced from sheet materials consisting of or containing thermoplastic and/or thermosetting polymers and have been processed by such a press as described in any of the preceding claims.

14. In a press arrangement as claimed in Claims 1 and 13, wherein shaped components or products have been produced the press is arranged to processing a variety of materials such as ceramics, rubbers, metals, glass, textiles and others and have been processed by such a press as described in any of the preceding claims.

15. An arrangement for a press as substantially described herein with reference to Figures 1-8 of the accompanying drawings.
AMENDED CLAIMS

[Received by the International Bureau on 13 September 2002 (13.09.02): original claims 1-15 have been replaced by amended claims 1-37 (3 pages)]

Claims

1. An arrangement for a double acting press, comprising oppositely positioned working faces (h,j), that each demonstrate converging and then diverging motion to and from a predetermined position between the working faces, where by exerted pressure materials are shaped, the press is arranged with two moveable members (a,b) that are connected and spaced apart, between the members (a,b) is a moveable member (e), during the operation of the press the relative movement of the members (a,b) and (e) is attained by an actuator that is arranged to expand and contract, the actuator moves the moveable member (e) until the movement of member (e) and the working face (h) is constrained relative to the base (n) by devices (k), then the actuation device causes the press frame (a,b,c,d) and working face (j) to move in a substantially opposite direction to the movement of member (e) and the working face (h).

2. In a press arrangement as claimed in Claim 1, whereby after a time period has elapsed the sequence of the press operation is reversed and the working faces (h,j) return to a position from which they may begin the sequence again.

3. In a press arrangement as claimed in Claim 1, whereby for the press arrangement (Fig1) accompanying drawings sequence (Fig3, Fig4, Fig5), the sequence of operation will close both the working faces.

4. In a press arrangement as claimed in Claim 2, whereby for the press arrangement (Fig1) accompanying drawings sequence (Fig3, Fig4, Fig5) reversed, the sequence of operation will open both the working faces.

5. In a press arrangement as claimed in Claim 1, whereby for the press arrangement (Fig2) accompanying drawings sequence (Fig6, Fig7, Fig8) reversed, the sequence of operation will open both the working faces.

6. In a press arrangement as claimed in Claim 2, whereby for the press arrangement (Fig2) accompanying drawings sequence (Fig6, Fig7, Fig8), the sequence of operation will close both the working faces.

7. In a press arrangement as claimed in Claims 1 to 6, whereby the press's actuator is a device consisting of an expanding and contracting container within which pressurised fluid increases/decreases in volume.

8. In a press arrangement as claimed in Claims 1 to 6, whereby the press's actuator is a device consisting of an expanding and contracting container within which pressurised gas increases/decreases in volume.

9. In a press arrangement as claimed in Claims 1 to 6, whereby the press's actuator has a rotating helix or screw thread arrangement.

10. In a press arrangement as claimed in Claims 1 to 6, whereby the press's actuator has an expanding knuckle arrangement.

11. In a press arrangement as claimed in Claims 1 to 6, whereby the press's actuator has a rotating crank mechanism.
12. In a press arrangement as claimed in Claims 1 to 6, whereby the actuator moves in at least two major and substantially opposite directions while expanding and also moves in at least two major and substantially opposite directions while contracting.

13. In a press arrangement as claimed in Claims 1 to 6, whereby the actuator is a device capable of exerting a load greater than the mass of the press frame.

14. In a press arrangement as claimed in Claims 1 to 6, whereby the actuator employs variable stages of constant, accelerating and de-accelerating velocities when extending and contracting.

15. In a press arrangement as claimed in Claims 1 to 6, whereby the movement of the working faces (h,i) is constrained by devices (k).

16. In a press arrangement as claimed in Claims 1 to 6, whereby the movement of the working faces (h,i) is constrained by members (l,m).

17. In a press arrangement as claimed in Claim 16, whereby the devices (k) incorporate members (l,m).

18. In a press arrangement as claimed in Claim 16, whereby members (l,m) are rigid structural members capable of supporting a mass greater than the total mass of the press.

19. In a press arrangement as claimed in Claim 16, whereby members (l,m) are fixed in length.

20. In a press arrangement as claimed in Claim 16, whereby members (l,m) are adjustable in length.

21. In a press arrangement as claimed in Claim 16, whereby members (l,m) are configured to be secured to the press or the press base (n) or partly to both.

22. In a press arrangement as claimed in Claim 16, whereby members (l,m) are vertically arranged.

23. In a press arrangement as claimed in Claim 15, whereby devices (k) are buffers.

24. In a press arrangement as claimed in Claim 15, whereby devices (k) are linear de-accelerators.

25. In a press arrangement as claimed in Claim 24, whereby devices (k) operate by mechanical deformation, such as by spring/s or elastomers.

26. In a press arrangement as claimed in Claim 24, whereby devices (k) operate by using the resistance of a fluid in a hydraulic cylinder, cushion or dashpot.

27. In a press arrangement as claimed in Claim 24, whereby devices (k) operate by using the resistance of a gas in a pneumatic cylinder, cushion or dashpot.
28. In a press arrangement as claimed in Claim 24, whereby devices (k) creates simultaneous movement of the working faces (h,j).

29. In a press arrangement as claimed in Claims 1 to 6, whereby the moveable member (e) is arranged with upper and lower faces.

30. In a press arrangement as claimed in Claims 1 to 6, whereby the press is configured so the motion of the working faces (h,j) is substantially parallel and vertical.

31. In a press arrangement as claimed in Claims 1,2,3 and 4 (Fig1, Fig3, Fig4, Fig5) wherein the main components of the actuation device are positioned substantially to the upper side of the moveable member (e).

32. In a press arrangement as claimed in Claims 1,2,5 and 6 (Fig2, Fig6, Fig7, Fig8) wherein the main components of the actuation device are positioned substantially to lower side of the moveable member (e).

33. In a press arrangement as claimed in Claims 1 to 6, whereby the actuation device is constructed as an interlocking cylinder and plunger (g) arrangement with a sealed interface.

34. In a press arrangement as claimed in Claims 1 to 6, whereby cellular materials are shaped.

35. In a press arrangement as claimed in Claims 1 to 6, whereby during relevant directions of motion the actuation device is assisted by gravity.

36. In a press arrangement as claimed in Claims 1 to 6, whereby supported upon the working faces (h,j) tooling is configured to perform a variety of functions such as shaping, punching, cutting, forming, drawing, moulding and others.

37. An arrangement for a press as substantially described herein with reference to Figures 1-8 of the accompanying drawings.
INTERNATIONAL SEARCH REPORT

A. CLASSIFICATION OF SUBJECT MATTER
IPC 7 B30B15/04 B30B7/04 B30B11/02

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED
Minimum documentation searched (classification system followed by classification symbols)
IPC 7 B30B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)
EPO-Internal, WPI Data, PAJ

C. DOCUMENTS CONSIDERED TO BE RELEVANT

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Date of the actual completion of the international search
5 July 2002

Date of mailing of the International search report
16/07/2002

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