(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) EP 0 731 044 A2

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
11.09.1996 Bulletin 1996/37

(51) Int Cl.[6]: **B65H 3/32**

(21) Application number: **96830091.3**

(22) Date of filing: **29.02.1996**

(84) Designated Contracting States:
CH DE IT LI SE

(30) Priority: **08.03.1995 IT BO950084**

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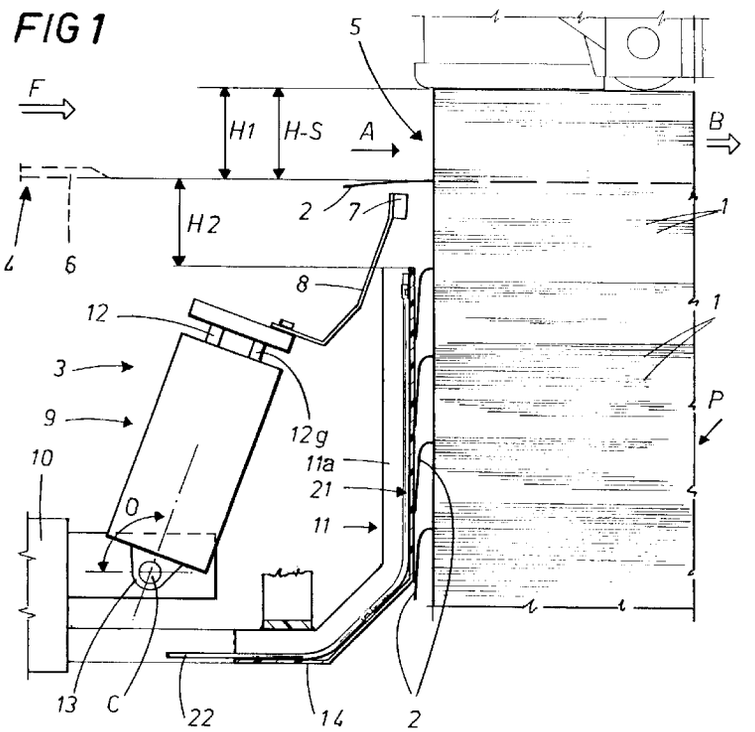
(54) A method and equipment for the automatic selection of large size loose reams from a stack of single sheets provided with ream markers

(57) Single sheets (1) of paper are separated automatically from a stack (P) into reams (5), already divided by markers (2), exploiting the frictional properties of a pressure element (7) which is mounted to the end of an arm (8) associated with an actuator (9) and capable of movement in a direction angled upwardly and toward the front face (A) of the stack (P). The upward motion of the arm (8) causes the pressure element (7) to impinge on the underside of the topmost marker (2), which is bent upwards and flattened against the vertical face of the first and topmost ream (5); as the arm extends further, the corresponding edge of the ream is raised forcibly under the lifting action of the marker (2) induced by the pressure element (7), at which point the sheets can be engaged and pushed sideways by a set of blades (6) advancing on a level separated from the topmost surface of the stack (P) by a distance (H1) equivalent to the height (H) of the ream (5).

FIG 1



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Description

The present invention relates to a method of selecting reams automatically from a stack of loose large size sheets, in which the reams are divided by markers, and to equipment for the implementation of such a method.

Among the problems experienced in the art field of papermaking, with regard in particular to large sheets (typically ISO size A0) as used for layout and design drawings and artwork generally, is that of how best to separate stacked sheets into reams for handling by the relative wrapping machinery.

Sheets of paper to be wrapped in reams are stacked, palletized and conveyed from the papermaking machine to the wrapping machine; the loaded pallet is placed on an elevator which rises automatically each time a ream (i.e. a parcel of sheets equivalent in number to one ream) is removed from the top by an operator, so that the height at which the reams are separated from the stack remains constant.

The prior art embraces essentially two methods of selecting reams from the palletized stack of sheets.

A first such method involves the use of an instrument similar to a calliper gauge, of which the measuring arms consist in a fixed reference element functioning as a stop, and a moving element resembling a blade insertable between two adjacent sheets. The operator sets the depth of the ream to be separated from the stack, according to the number and the thickness of the sheets, then, offering the reference arm to the topmost sheet, slides the gauge forward to the point at which the blade penetrates between two sheets and thus separates a ream of the selected size from the remainder of the stack beneath.

In a second method, use is made of a stacking machine such as will count off the single sheets of paper and insert a marker between one sheet and the next each time the count increases by a number corresponding to one ream; the marker is quite simply a slip of paper or similar material, coloured or otherwise, of which one end projects from the stack and a significantly large portion is retained between two adjacent sheets.

Thus, it remains only for the operator to raise the part of the stack lying above the marker and direct it toward the wrapping machine.

This second method affords great precision, albeit with the drawback that the markers may not always be inserted in exactly the same position, by reason of the dissimilarities that occur both in sheet sizes and in different stacking machines.

Efforts have been made in the past to find solutions or methods such as will allow the automatic separation of a palletized stack of sheets into reams indicated by suitable markers of the type mentioned above; one example of a machine reflecting the outcome of such efforts is that disclosed by the present applicant in patent IT 1 201 601: this employs equipment affording means by which to grip and tension the markers, also a selection element, and associated with the selection element, a follower element that is hinged in its turn to a supporting element capable of movement toward and away from the stack of sheets in such a manner that the follower element can slide along each successive marker to the point of penetrating the stack at each division between successive reams.

In order to ensure reliable and accurate operation, at all events, the machine in question is dependent on a somewhat elaborate architecture incorporating elements invested with relative motion of a precise and complex nature; in locating and sliding along the tensioned marker, moreover, the slender blade of the selection element is caused necessarily to penetrate the stack above the marker, functioning as a guide, and below the bottom sheet of the selected ream, with the risk that the bottom sheet may suffer defacement or damage which though superficial may not always be acceptable.

Accordingly, the object of the present invention is to provide a method, and equipment for the implementation of such a method, whereby a single palletized stack of sheets can be separated into reams selected initially by the insertion of markers located in such a way as to divide each two consecutive reams one from another, adopting an extremely simple and effective solution. The invention will now be described in detail, by way of example, with the aid of the accompanying drawings, in which:

- figs 1, 2 and 3 illustrate the steps of a method according to the present invention for the selection of large size loose reams from a stack of sheets, as performed by equipment likewise according to the invention, all of which viewed in side elevation;
- figs 4, 5 and 6 illustrate an alternative embodiment of equipment according to the invention, seen in the same side elevation and performing the same steps of the method as shown in figs 1 to 3.

Referring to the accompanying drawings, the present invention relates to a method of selecting large size loose reams automatically from a stack P of single sheets 1. The reams are divided one from another by a plurality of markers 2 inserted into a front face A of the stack P.

To detach a ream from the stack P of sheets 1, use is made of a selection device 3 operating in conjunction with handling means 4 by which the preselected ream 5 will be distanced in a direction normal to the front face A of the stack P; such handling means 4 comprise pushing elements 6 of blade-like embodiment by which the ream 5 is engaged directly and separated from the stack. The selection device 3 is used only in part in the solution disclosed and has not been described and illustrated in detail, not being strictly central to the subject matter of the present invention, though a preferred and unlimitative embodiment of such a device is discussed more fully in Italian patent application n° BO94A000371.

The aforesaid pushing elements 6 are adjustable for height, to the end that they can be set at a nominal distance H1 from the topmost surface of the stack P equivalent to the height H of the ream 5, and capable of movement in such a way as to penetrate the stack P of sheets (see arrow F in fig 1) between the bottom sheet of the selected ream 5 indicated by the marker 2 and the topmost sheet of the remainder. In effect, the pushing elements 6 are caused to advance horizontally by the handling means 4, and in such a manner that the selected ream 5 is pushed and translated along a feed direction B extending at right angles to the front face A of the stack P of sheets 1.

Within this framework, departing from a situation in which the markers 2 will have been deflected downwards initially and therefore toward the front face A of the stack P, the method disclosed comprises essentially two steps: a first step in which the topmost marker 2 identifying the first and topmost ream 5 is released, subjected to a blowing action and caused as a result to assume a configuration of readiness, for example angled downwards (see fig 1), and thereafter a second step in which a pressure element 7, possessing a high coefficient of friction and carried by the end of an elastically deformable arm 8, is caused to impinge on the marker 2 from beneath (see fig 2).

The arm 8 is associated with actuator means 9 by which it can be invested with movement upwards in an angled direction, toward the front face A of the stack P, in such a manner that the marker 2 will be forced upwards initially (see arrow F1 in fig 2) and then flattened against the vertical front face A of the stack P, or effectively of the first and topmost ream 5, whereupon the front portion of the selected ream 5 is caused to bend upwards under the lifting action of the marker 2 induced by way of the pressure element 7 (see arrow F2 in fig 3). The bending and lifting action is rendered possible by virtue also of the fact that the marker 2 remains held firmly within the stack P of sheets 1, being inserted to a suitable depth at the outset.

Finally, the pushing elements 6 are caused to advance, separated from the top of the stack by the distance H1 mentioned above which corresponds to the height H, or thickness S, of the selected ream 5.

As discernible from fig 1, the deflecting action is applied continuously to a plurality of markers 2 set out along the front face A of the stack P and within the operating compass of the pressure element 7, the markers then being released singly and in succession each time the pressure element 7 is brought to bear.

The method thus described is implemented by equipment (still observing figs 1 to 3) in which the pushing elements 6 are carried by a relative height-adjustable structure 10 forming part of the selection device 3 referred to above.

The aforementioned pressure element 7 forms part of an assembly positioned below the pushing elements 6 and further comprising a restraint, denoted 11, together with blowing means denoted 21.

More precisely, the restraint 11 is supported by the same height-adjustable structure 10 and offered thus to the markers 2 in a position separated by a fixed distance from the pushing elements 6; in practice, the restraint 11 exhibits an operative end portion 11a disposed substantially parallel and in close proximity to the face A of the stack P, with which the blowing means 21 are associated in such a way as to direct air at the marker 2 identifying the ream 5 selected for removal by the pushing elements 6.

Observing fig 1, the restraint 11 will be seen to consist essentially in a rigid plate 14 associated with the height-adjustable structure 10 in such a way that it can be positioned stably in close proximity to the stack P of sheets 1, separated from the pushing elements 6 by a distance H2 (see fig 1), such as will allow the release of the single marker 2 identifying the ream 5 currently selected. The blowing means 21 extend alongside the plate 14, and comprise an air duct 22 rigidly associated with the operative end portion 11a of the restraint 11.

The pressure element 7 brought to bear against the marker 2 of the currently selected ream possesses a high coefficient of friction, as already intimated, and will consist preferably in a block of rubbery material permanently associated with the free end of the arm 8, which in turn would consist in a suitably thin laminar element.

The laminar element 8 is thus elastically deformable and, as already intimated, associated with actuator means 9 which in turn are anchored to a bottom portion of the height-adjustable structure 10 (conventional in embodiment and therefore indicated only in part). Such actuator means 9 comprise a piston 12 and a relative guide rod 12g, rigidly associated with a mounting 13 that is connected pivotably to the height-adjustable structure 10 by way of a fulcrum denoted C in such a way as will allow a stable adjustment of its angular position in relation to the stack P of sheets 1: this means that the actuator means 9 can be angled upwards and toward the front face A of the stack P (as shown in figs 1 to 3), and the arm 8 rendered capable thus of movement from an at-rest position (see fig 1), in which the pressure element 7 remains distanced from the topmost marker 2, toward an operating position in which the pressure element 7 engages in contact with the topmost marker (see figs 2 and 3).

The degree of tilt given to the mounting 13 (of which the angle is indeterminately denoted 0 in fig 1) will depend on the distance between successive markers 2 (which may vary from one stack to another) and on the length of the arm 8 supporting the pressure element 7. In addition, the deformability of the laminar material adopted for the arm 8 will be instrumental in enabling the pressure element 7 to remain in contact with the marker 2 and continue supporting the front portion of the ream 5 during the lifting action.

To confirm the effectiveness of the solution described thus far, fig 4 indicates an alternative embodi-

ment of the equipment wherein the same pressure element 7 is associated directly with the top part of the selection device 3, and in effect, a part of the device which in equipment as disclosed in Italian patent application n° BO94A 000371, designed to implement a method making no use of markers 2, would support a knife by which the reams are selected directly. In this instance (see figs 4, 5 and 6) the pressure element 7 is associated with the bottom end of a vertically disposed arm 30 (presenting an "L" profile) connected by its top end to actuator means 9, again consisting in a piston 31 and a relative horizontal guide rod 31g, in such a way that the pressure element 7 can be directed against the marker 2 (see arrow F3 in fig 5) and the marker flattened ultimately against the ream. Also indicated is an angled piston denoted 32 producing an upwardly directed action, by which the actuator means 9 are caused to rotate in relation to the front face A of the stack P (see arrow F4 in fig 6) and thus elevate the front portion of the selected ream 5 as already described. In order to bring about the flattening and lifting action in this solution, the marker 2 must be angled upwards following release rather than downwards as intimated previously, and accordingly, the action of the blowing means 21 will need to be sustained at least until the pressure element 7 has entered into contact with the marker 2.

The method and equipment described and illustrated are able to ensure a swift and reliable selection of reams from a stack of single sheets, given that there is no contact between blades and sheets until the ream has been lifted. The invention also affords advantages of economy, and with no need to alter the basic structure of the existing automatic selection device.

Claims

1. A method for the automatic selection of large size loose reams from a stack (P) of single sheets (1), wherein the reams (5) are identified initially by markers (2) emerging from a front face (A) of the stack and the stacked sheets (1) of each ream then separated from the remainder by a selection device (3) operating in conjunction with handling means (4) such as will distance the single successive reams (5) from the stack in a direction normal to the front face (A) through the agency of relative pushing elements (6) adjustable for height, positionable at a distance from the top of the stack that corresponds to the nominal height (H) of the ream (5) and designed to penetrate between the bottom sheet (1) of a ream (5) resting on a relative marker (2) and the topmost of the remaining sheets in the stack (P); the handling means (4) and the relative pushing elements (6) being capable of movement whereby the ream (5) can be pushed and thus translated in a feed direction (B) extending at right angles to the front face (A) of the stack,
   characterized
   in that it comprises the steps of:

   - subjecting the marker (2) to the action, applied from beneath, of a pressure element (7) having a high coefficient of friction and carried by the end of an arm (8) associated with actuator means (9) generating movement in a direction angled upwardly and toward the front face (A) of the stack (P), in such a way that the marker (2) is first bent upwards and flattened against the vertical front face (A) of the stack (P), hence against the first and topmost ream (5), and the front portion of the selfsame ream then bent upwards under the lifting action of the marker (2) induced by the pressure element (7);
   - causing the pushing elements (6) to advance toward the front face (A) within a plane separated from the topmost surface of the stack (P) by a distance (H1) corresponding substantially to the height (H) of the ream (5).

2. A method as in claim 1, wherein the step of applying the action of a pressure element (7) from beneath is preceded by a step in which at least the topmost marker (2), identifying the first and uppermost ream (5), is first deflected downwards and toward the front face (A) of the stack (P) then released and exposed to a forcing action such as will constrain it to assume a configuration of readiness, substantially angled downwards.

3. A method as in claim 1, wherein the step of applying the action of a pressure element (7) from beneath is preceded by a step in which at least the topmost marker (2), identifying the first and uppermost ream (5), is first deflected downwards and toward the front face (A) of the stack (P) then released and exposed to a forcing action such as will constrain it to assume a configuration of readiness, substantially angled upwards.

4. A method as in claims 2 and 3, wherein the deflection step is implemented continuously on a plurality of markers (2) distributed along the front face (A) of the stack (P) and within the operating compass of the pressure element (7), in such a manner that a single marker (2) can be released each time the action of the pressure element (7) is applied.

5. A method as in claims 2 and 3, wherein the forcing action applied to the marker (2) is a blowing action.

6. Equipment for implementing a method as in claims 1 to 5, wherein the pushing elements (6) are carried by a relative height-adjustable structure (10) forming a part of the selection device (3),
   characterized

in that it comprises:

- a restraint (11) supported by the height-adjustable structure (10), positioned beneath and at a fixed height (H2) in relation to the pushing elements (6) and serving to deflect the ream markers (2), of which at least one operative end portion (11a) is disposed substantially parallel and in close proximity to the stack (P) of sheets (1), also means (21) associated with the restraint (11) by which to apply a forcing action to the markers (2);
- a pressure element (7) possessing a high coefficient of friction, positioned likewise beneath the pushing elements (6) in such a manner as to impinge on the topmost marker (2) identifying the first and uppermost ream (5), and mounted to the end of an elastically deformable arm (8) associated with and operated by actuator means (9) associated in turn with the height adjustable structure (10); and,

in that the actuator means (9) are angled in relation to the front face (A) of the stack (P) in such a way as to render the arm (8) capable of movement between an at-rest position, in which the pressure element (7) remains distanced from the topmost marker (2), and an operating position in which the pressure element (7) engages in contact with the topmost marker (2).

7. Equipment as in claim 6, wherein the pressure element (7) consists in a block of rubbery material associated permanently with the free end of the arm (8).

8. Equipment as in claim 6, wherein the arm (8) is rendered capable of movement by actuator means (9) consisting in a piston (12) associated rigidly with a mounting (13) pivotably associated in turn with the height-adjustable structure (10) by way of a relative fulcrum (C) in such a manner as to allow a stable adjustment of its angular position relative to the stack (P) of sheets (1).

9. Equipment as in claim 6, wherein the restraint (11) is positioned at a height (H2) relative to the pushing elements (6) such as will allow the release of a single marker (2), and consists in a plate (14) of rigid embodiment connected to the height-adjustable structure (10) and occupying a fixed position in close proximity to the stack (P) of sheets (1).

10. Equipment as in claim 6, wherein means (21) by which to apply a forcing action to the markers (2) consist in an air duct (22) of which the free end is rigidly associated at least with the operative end portion (11a) of the restraint (11).

FIG 1

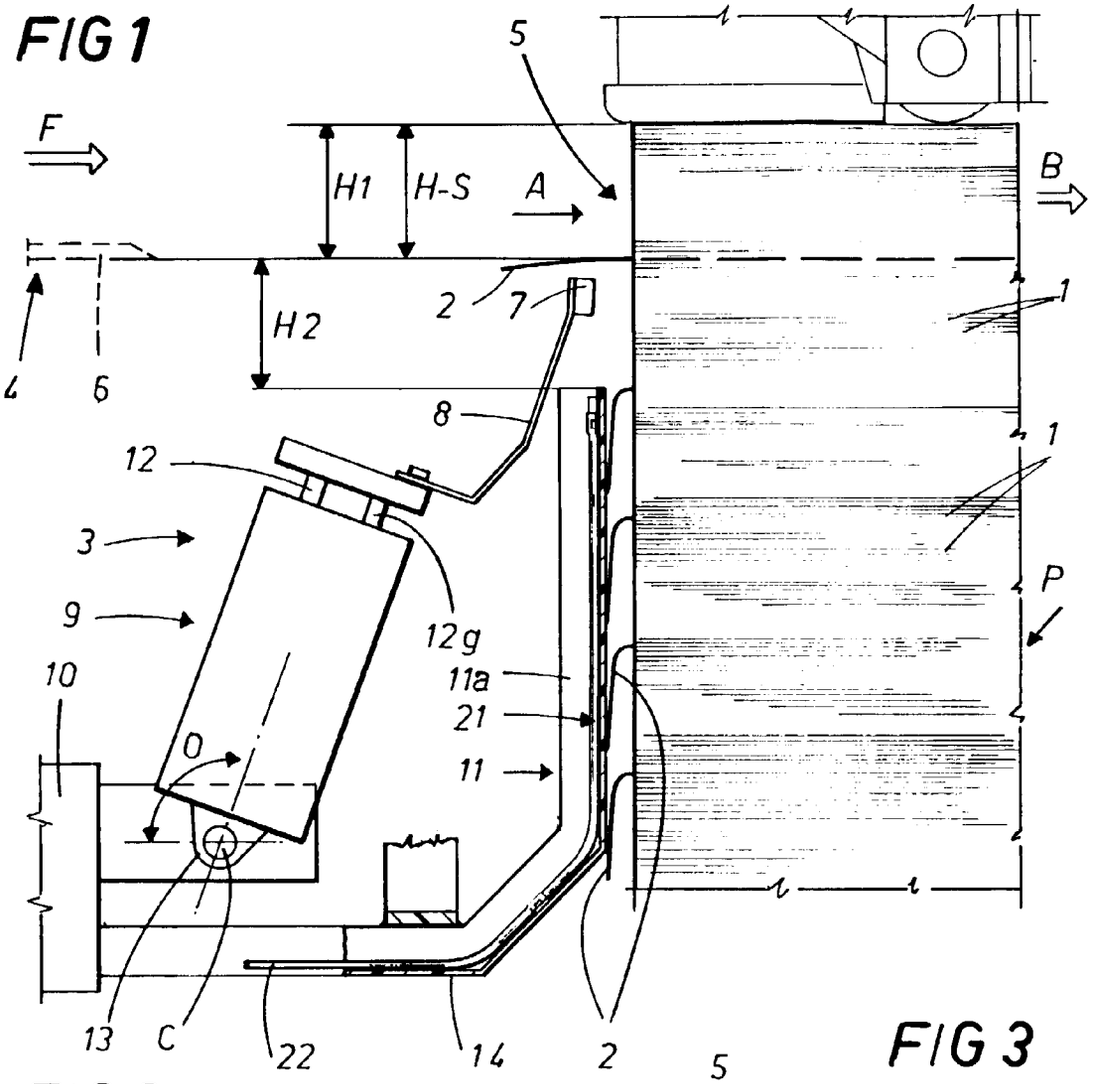


FIG 2

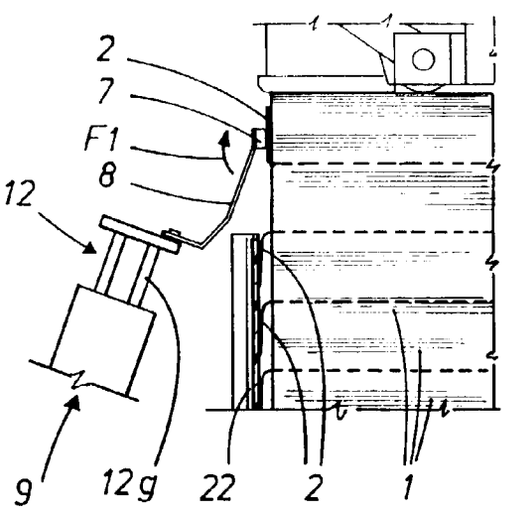
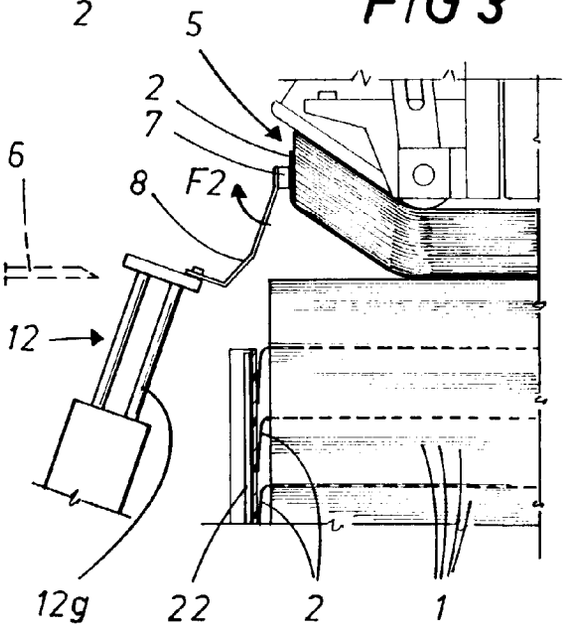


FIG 3



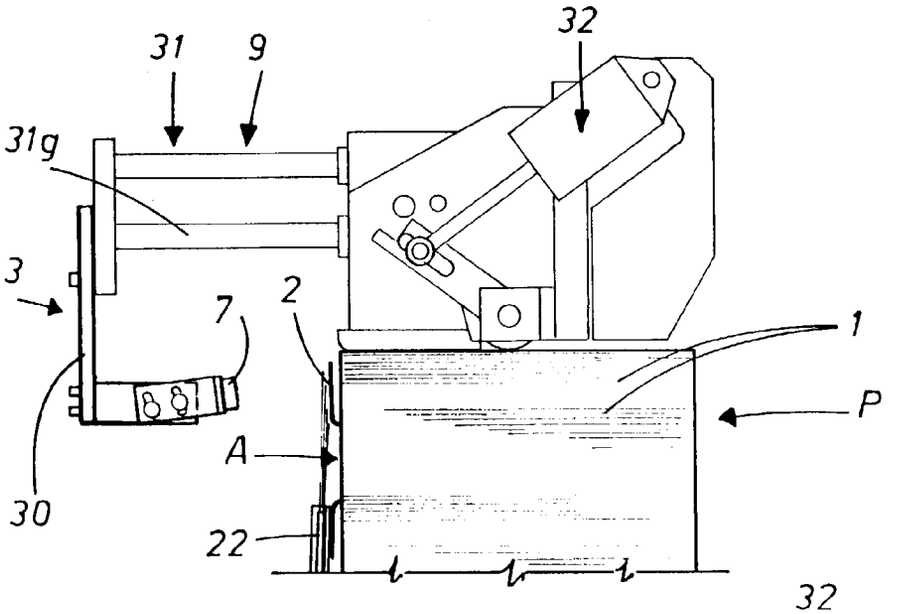


FIG 4

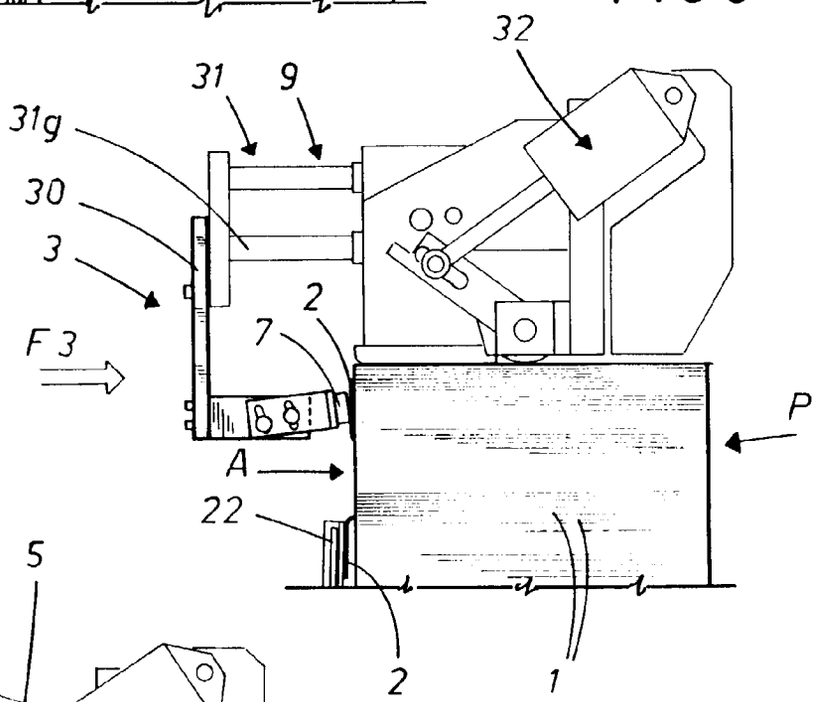


FIG 5

FIG 6