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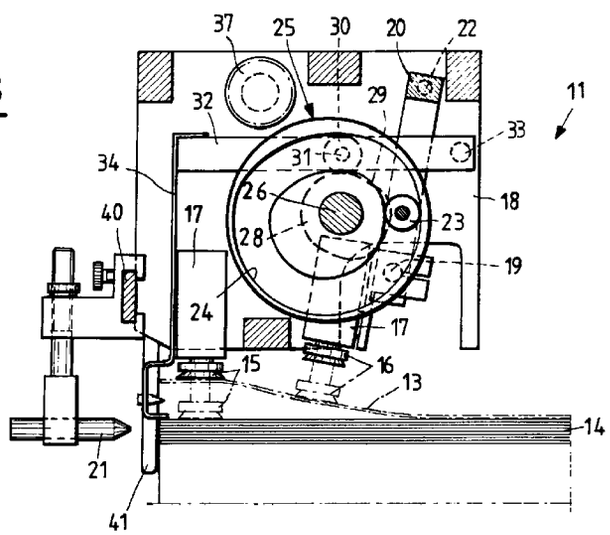
(54) Sheet feeder device for the single handling and feeding of stacked sheets

(57) A sheet feeder device for the single handling and feeding of stacked sheets, comprising a supporting structure (12) which includes at least one set of suction grabbing elements (15, 16) capable of acting on the upper face of a sheet (13) to be grabbed and transferred, placed at the top of a stack of sheets (14), where at least one group of suction elements (16) oscillates between a grabbing position on the stack and a forward releasing position, while being placed below a supporting structure (12) on an oscillating arm (20) hinged at its top end (in 22) on the shoulders (18) of the structure (12), and where the oscillation is determined by a first recessed cam assembly (23, 24) which draws its motion from a external motorized source acting through a positive mechanical transmission (35-37). A second set of suction elements (15) may be provided and rigidly connected to the same supporting structure (12).

Fig.3



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Description

This invention refers to a sheet feeder device for the single handling and feeding of stacked sheets.

The industry processing paper in sheet form, such as for instance the plastifying or printing industry, needs to be capable of handling large volumes of sheets.

These sheets are generally arranged in a stack and associated with the printing machine, the plastifying machine etc., to perform the work required by the particular treating process.

The sheets must therefore be picked up from the stack one at a time and conveyed to the next processing unit. For this purpose, grabbing devices for a single sheet on top of a stack are known and generally designated as sheet feeders.

These sheet feeder devices are provided with arms which generally pick-up the single sheet by suction grabbing elements to lift it from the stack and shift it for example to a downstream processing or simply receiving unit. In particular, the arm or arms move the relative suction grabbing devices toward the face of the sheet to be grabbed and transferred, using a vacuum or similar effect. Some blowing nozzles are simultaneously activated to favor the detachment of the sheet from the underlying sheets in the stack, to be followed immediately by shifting the grabbed sheet toward the next unit.

The known devices, such as for instance the Italian patent 1.251.227, are particularly complex in that they present a complicated arrangement of springs and levers which must interact to function properly, and are economically expensive.

Moreover, the very fact of having a complex kinematic construction prevents the known devices from operating at high speeds, while causing vibrations between their parts; such known devices may not even have a uniform operating behavior, while grabbing the sheets in slightly differing positions.

The purpose of the present invention is to achieve a sheet feeder device for the single handling and feeding of stacked sheets capable of overcoming the technical and economic problems generated by the known, particularly complex controlling and moving structure.

A further purpose is to produce a sheet feeder device for the single handling and feeding of stacked sheets, capable of handling them without error, with an absolutely uniform action of grabbing a single sheet from the stack and performing a fixed stroke, and also capable of operating at high speeds.

These purposes are achieved, according to the present invention, by producing a sheet feeder device for the single handling and feeding of stacked sheets comprising a supporting structure which holds at least one set of suction grabbing elements capable of acting on the upper face of a sheet to be grabbed and transferred, placed at the top of a stack of sheets, where at least one set of the suction elements oscillates between a grabbing position on said stack and a forward releasing position, characterized in that said at least one group of suction elements is provided below an oscillating arm hinged at its top end to the shoulders of said structure, and that the said oscillation is determined by a first recessed cam assembly which draws its motion from an external motorized device, using a positive mechanical transmission.

An alternative embodiment also provides for a further set of suction elements which are rigidly connected to said supporting structure and cooperate with said at least one set of oscillating suction elements.

Said first recessed cam assembly preferably includes an idle roller rigidly connected to said oscillating arm which fits into a cam-shaped recess carved out in a plate pulled into a rotating motion by the said positive mechanical transmission.

Such a device is particularly simple, non-vibrating and also capable of operating at high speeds.

The characteristics and the advantages of a sheet feeder device for the handling and feeding of single stacked sheets according to the present invention will become more evident from the following non-limiting description referred to the accompanying schematic drawings, in which:

Figure 1 is a front view of the sheet feeder device according to the present invention,

Figure 2 is a view similar to that shown in Figure 1, partially sectionalized and shown without the frontal portion referring to a pair of suction grabbing elements,

Figure 3 is a transversal cross section of the device in a first operating position, and

Figure 4 is a cross section similar to that previously shown, arranged as in Figure 1 to show a second operating position of the device according to the invention.

With reference to the figures, a sheet feeder device for the single handling and feeding of stacked sheets built according to the invention is shown and designated as a whole by the numeral 11.

This device 11 comprises a box-like supporting structure 12 holding two groups of grabbing elements which act on the upper face of a sheet 13 to be picked up and transferred, placed at the top of a stack of sheets 14.

These grabbing elements generally comprise suction elements 15 and 16 performing this function by a vacuum or similar principle. Some internal telescopic suction-cups are held in a housing 17 and activated to emerge from the same when a vacuum is created in the interior. Once these suction cups reach the sheet 13, the sheet grabbing motion is performed and the suction cups are simultaneously lifted.

In particular, a first set of grabbing elements comprises two suction elements 15 which are rigidly connected to the vertical shoulders 18 of the supporting

structure 12. On the other hand, the second set of grabbing elements comprises the suction elements 16 rigidly connected to the two rods 19 and carried by an arm 20 oscillating between at least one pair of extreme positions. The second set of suction elements 16 can in fact oscillate between a grabbing position on top of the stack 14 and a releasing position of the single sheet 13, moved forward toward a next sheet processing or simply receiving unit.

Both the suction elements 15 and the suction elements 16 can be fitted with blowing nozzles 21 actuated to favor the detachment of the sheet 13 from the underlying sheets of the stack 14 during the picking-up process. Provision is also made for a cross beam 40 which supports some adjusting elements 41 set vertically before the stack 14.

The figures show that the arm 20 is shaped to resemble an upturned U, hinged at the bottom of the U, placed at its top end, by shafts 22 to the shoulders 18 and oscillated by a first cam-equipped assembly. A vertical branch 20a of this arm 20 is in fact free to rotate a roller 23 which fits into a cam-shaped recess 24 carved out in a plate 25, thus creating the first cam-equipped assembly. The plate 25 is in turn rigidly connected to a shaft 26 supported at its extremities by bearings 27 provided inside the shoulders 18.

Moreover, the shaft 26 carries a further plate 28, created for example by extending the plate 25 and having a smaller diameter, which presents a cam-shaped peripheral surface 29. The latter surface 29 engages with a roller 30 supported on a lever 32 and free to rotate in 31, so as to create a second cam-equipped assembly. This lever 32 is at one end hinged by a pin 33 to the shoulders 18, while its other end carries a rod 34, arranged as a bracket and turned toward the bottom. This rod 34 rests on the stack 14 noting the presence of the sheets and possibly lifting of the stack, if any sheets are found missing at the height required for their pick-up.

As mentioned, the plates 25 and 28, or alternatively the only plate-type element identifying them are provided on the shaft 26, which carries, in its section close to one of the shoulders 18, a keyed-on first gear 35 that forms part of the group controlling the rotation of the same shaft 26. This control or positive mechanical transmission group comprises a further idle intermediate gear 36 and a third gear 37 provided on a shaft 38 which draws its motion from an external motorized device, not shown.

The latter shaft 38, at its end opposite to that connecting to the motorized device, commands an air distributing and vacuum-actuating complex shown by the number 39, which determines the air emission and aspiration phases on both the suction cups 15, 16 and the blowing nozzles 21.

It can thus be seen that a sheet feeder device according to the present invention, while acting and operating like a traditional sheet feeder device, solves all the technical problems typical of the complex and delicate structures of the device heretofore known.

It is immediately apparent that having provided for a cam-type control of the oscillating suction elements prevents the occurrence of vibrations during operation. Moreover, the engagement of the roller 23 inside the cam-shaped recess 24 guarantees an always exact motion, precisely because of the positive mechanical engagement that cannot be loosened or altered.

This mechanical engagement also allows to achieve particularly high speeds of picking up and shifting the sheets, which cannot be reliably performed by the complex devices already known.

It can also be seen that all the springs found on the known devices to ensure the return of the elements to their operating positions have advantageously been eliminated, and that in addition all the control leverages have been reduced to the minimum.

In an alternative embodiment, the air and vacuum actuating complex designated by the number 39, which determines the air emission and aspiration phases and needs to be connected to an appropriate pump, can simply be replaced by a venturimeter.

Figures 3 and 4 clearly show the operation of the exemplified device according to the present invention.

The actuating of the two suction elements 15 causes the grabbing of a sheet 13 and its lifting when the suction-cups 15 are returned toward the top into their housings 17. This motion evolves from the dashed and pointed position of the fixed suction cup 15 shown in Figure 3 to the lifted position pictured as a solid line, in which the sheet 13 shown as dashes and points is grabbed and picked-up by the same fixed suction-cup 15. This phase is also aided by the nozzles 21, which assist the separation of the sheet 13 from the underlying stack 14.

The second suction cups 16 are in this phase placed in the position of Figure 4 in which they have moved the former sheet 13 toward a downstream sheet processing or simply receiving unit (dashes and points in Figure 4).

After leaving this former sheet the suction cups 16 are taken back to the fixed suction cups 15 and grab the following sheet which has in the meantime been lifted, as clearly shown in a dashed and pointed form in Figure 3.

The operation continues by the fixed suction cups 15 release of the sheet 13 and the forward motion of the sheet 13 as a result of the oscillation of the suction cups 16 induced by the first cam-equipped assembly mentioned above. This is followed by a sequence of repeating phases which promotes the shifting of the single sheets 13 from the stack 14 to the downstream processing or receiving unit.

These motions are then accompanied by the vertical oscillation in a lifting and lowering phase of the rod 34 which controls the presence of the sheets at an appropriate height in the stack, and if these are missing

takes care to lift the stack in the usual manner.

This clarifies the already mentioned advantages of a device according to the present invention, which operates in a simple and continuous manner without a chance for errors even at high speeds.

It is obvious that a simplified execution of the invention can have only a group of oscillating suction elements 16, thus simplifying the entire sheet feeder device even further.

Claims

1. A sheet feeder device for the single handling and feeding of stacked sheets comprising a supporting structure (12) holding at least one set of suction grabbing elements (15, 16) which acts on the upper face of a sheet (13) to be grabbed and transferred, placed on top of a stack of sheets (14), where at least one set of suction elements (16) can oscillate between a grabbing position on said stack and a forward releasing position, characterized in that said at least one set of suction elements (16) is placed below an oscillating arm (20) hinged at its top end (in 22) to shoulders (18) of the said structure (12), and that said oscillation is determined by a first recessed cam assembly (23, 24) which draws its motion from an external motorized device, using a positive mechanical transmission (35-37).

2. A sheet feeder device according to claim 1, characterized in that it provides for a further set of suction elements (15) rigidly connected to said supporting structure (12).

3. A sheet feeder device according to claim 1, characterized in that said first recessed cam assembly comprises an idle roller (23) rigidly connected to said oscillating arm (20) inserted into a cam-shaped recess (24) carved out of a plate (25) pulled in a rotating motion by said positive mechanical transmission (35-37).

4. A sheet feeder device according to claim 3, characterized in that said first cam-recessed assembly is rigidly connected in a rotating motion to a second cam assembly that actuates the lifting and lowering of a rod (34) turned toward the bottom, which rests on said stack of sheets (14) and causes the lifting of said stack if any sheets are missing at the height required for their pick-up.

5. A sheet feeder device according to claim 4, characterized in that said second cam assembly comprises a plate (28) having a cam-shaped peripheral surface (29) engaging with a roller (30) which is supported on a lever (32), free to rotate (in 31), rigidly connected in turn to a first extremity of a shaft (33) rotating with respect to said structure (12) and carrying said rod (34) on its other extremity.

6. A sheet feeder device according to claim 5, characterized in that said first and said second cam assembly are produced as a single piece in their plates (25) and (28).

7. A sheet feeder device according to claim 1, characterized in that said oscillating arm (20) hinged at its top end (in 22) to the shoulders (18) is shaped in the form of an upturned U.

8. A sheet feeder device according to claims 1 or 2, characterized in that said suction grabbing elements (15, 16) are connected to and actuated by an air distributing and vacuum-generating complex (39).

9. A sheet feeder device according to claim 1 or 2, characterized in that said suction grabbing elements (15, 16) are connected to and actuated by a venturimeter.

Fig.1

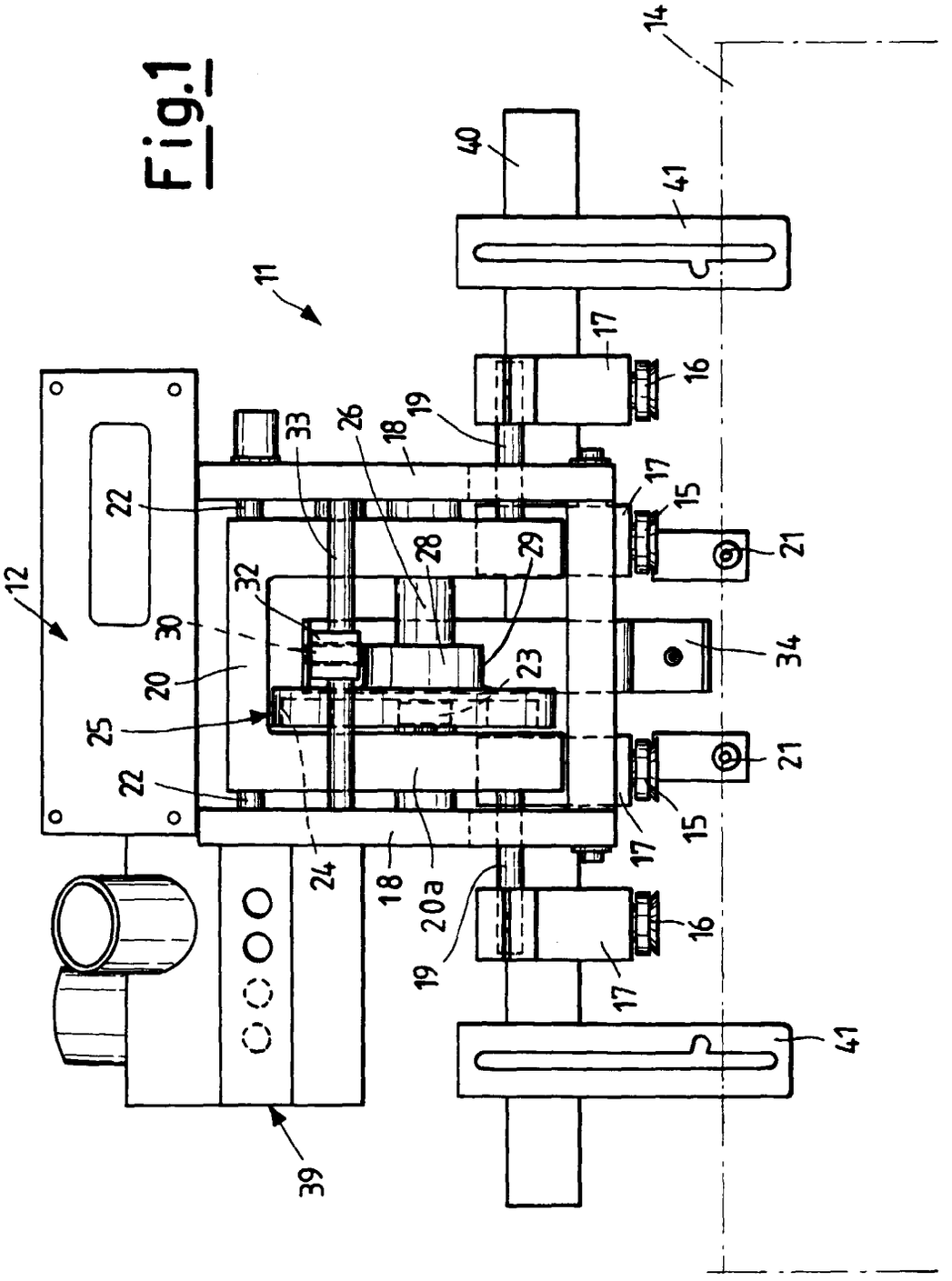
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Fig.2

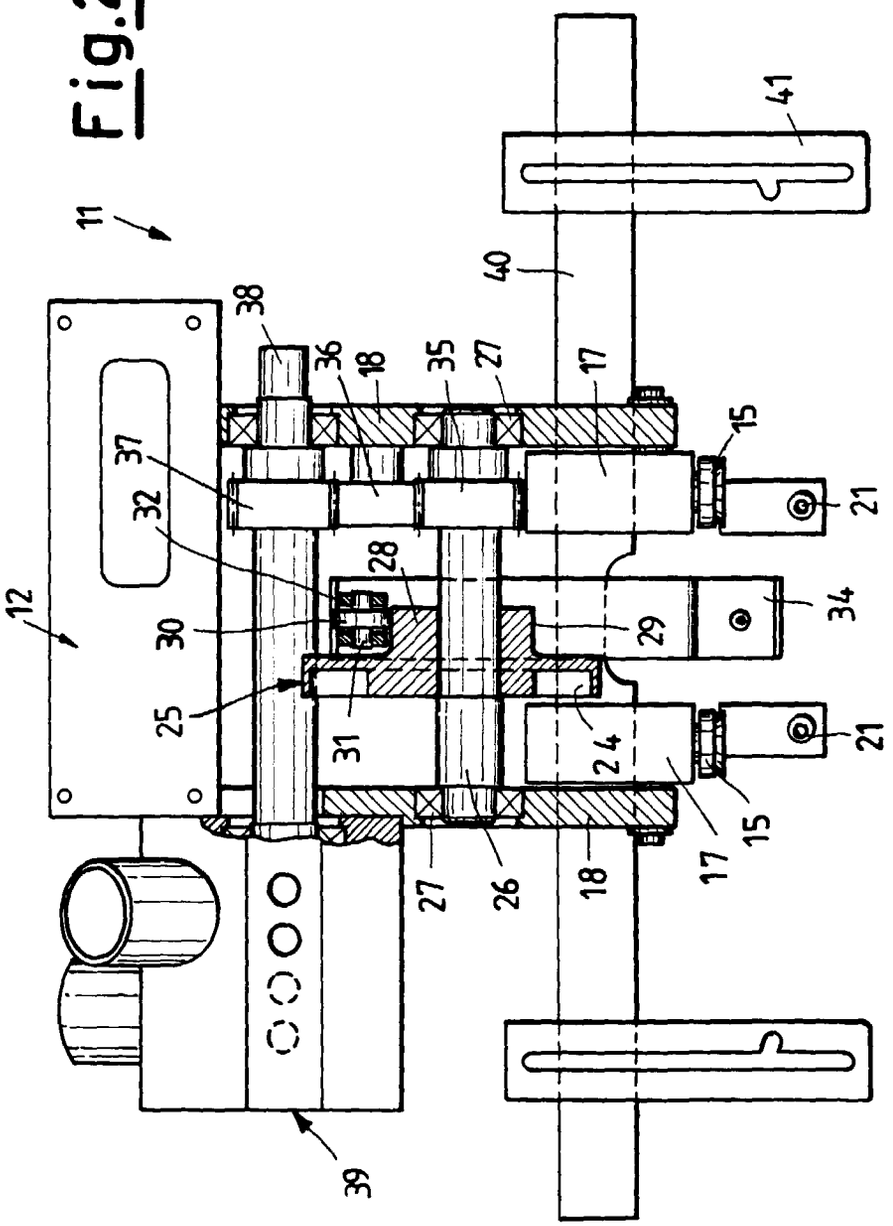

Fig.3

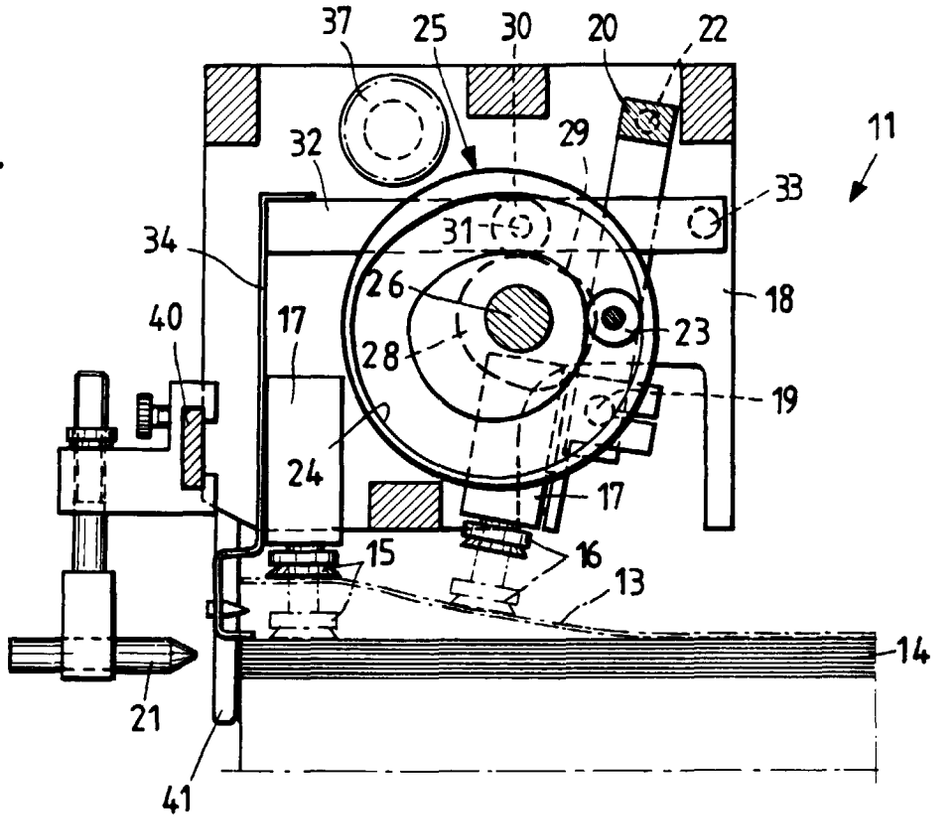
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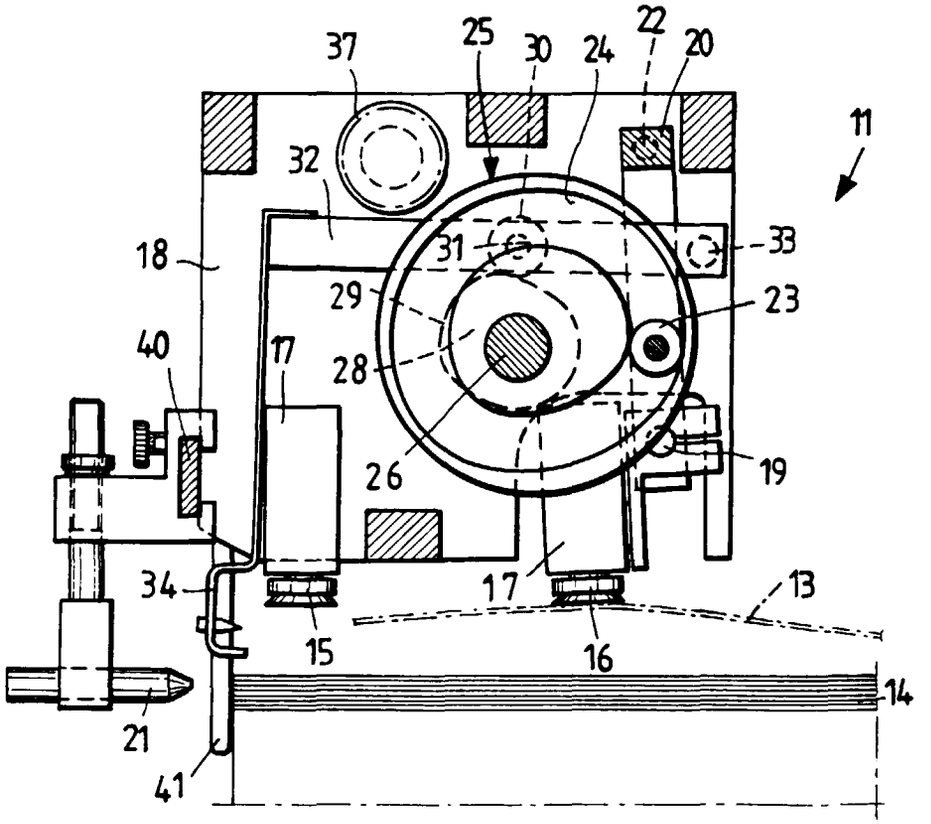
Fig.4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EUROPEAN SEARCH REPORT

Application Number
EP 98 20 2275

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	DE 17 86 117 A (ADAMOVSKE STROJIRNY NP) 18 November 1971	1,2,8	B65H3/08 B65H3/38
Y	* the whole document *	7,9	
A		3-6	
D,Y	EP 0 532 073 A (PEZZINI S N C DI PEZZINI FRANC ;CAD GRAPH S C R L (IT)) 17 March 1993	7,9	
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A	GB 1 348 738 A (MABEG MASCHINENBAU GMBH NACHF) 20 March 1974 * the whole document *	1-9	
A	DE 40 06 635 A (BINNEN GEORG) 5 September 1991 * the whole document *	1-9	

TECHNICAL FIELDS SEARCHED (Int.Cl.6)

B65H

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	29 October 1998	Henningsen, O

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