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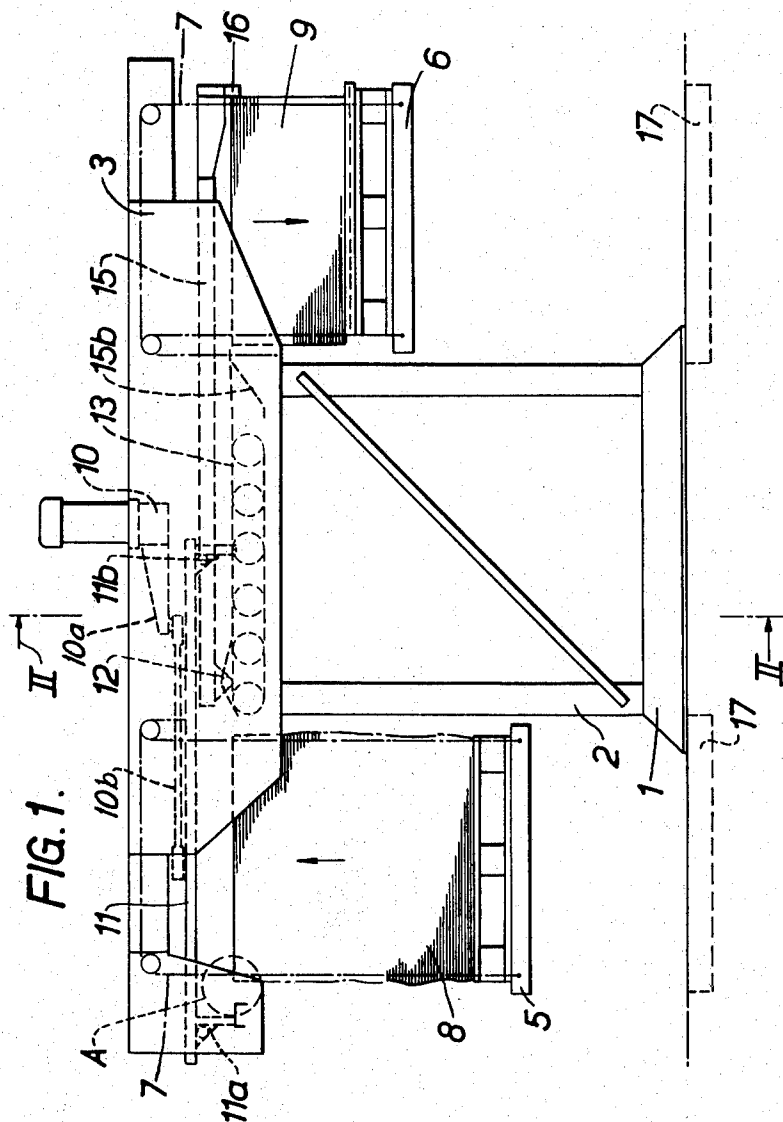
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3,371,803

PROCESS AND APPARATUS FOR RESTACKING, LOOSENING
AND ALIGNING MATERIAL IN SHEET FORM

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3 Sheets-Sheet 1



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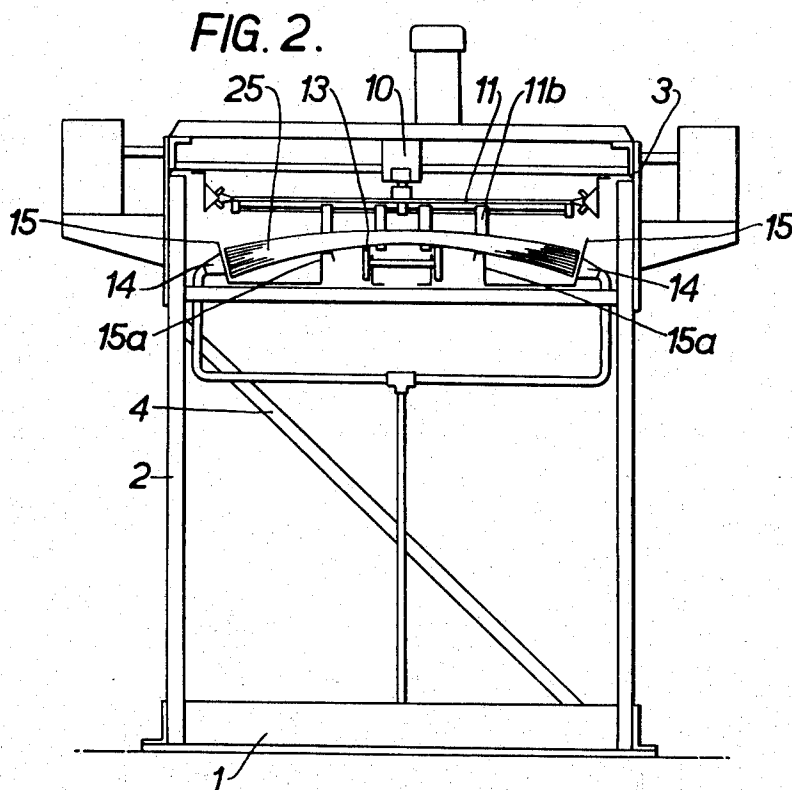
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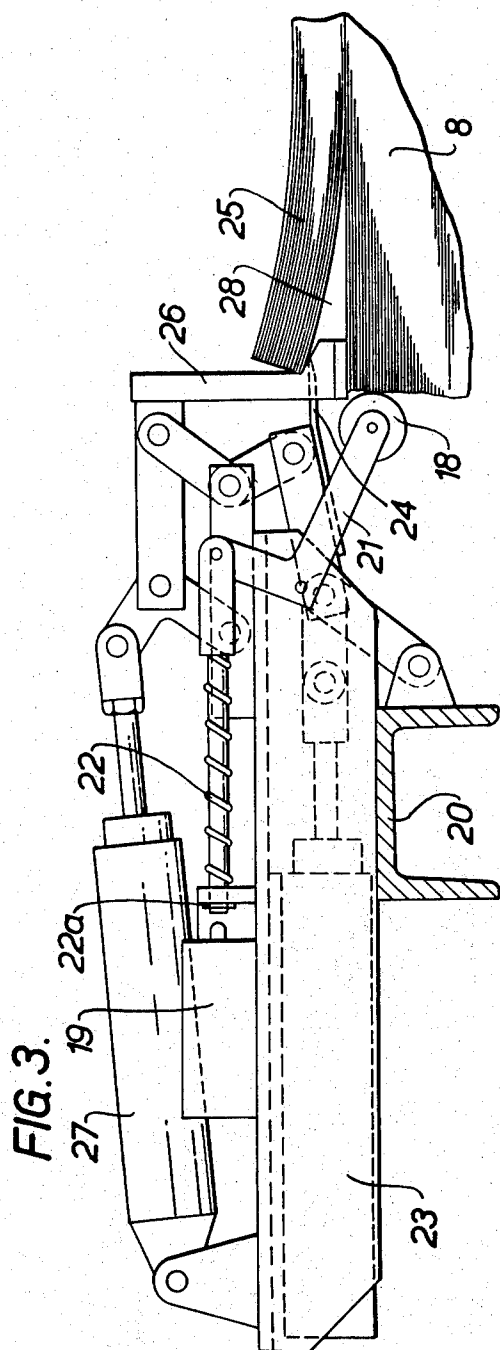
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3 Sheets-Sheet 3



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PROCESS AND APPARATUS FOR RESTACKING, LOOSENING AND ALIGNING MATERIAL IN SHEET FORM

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ABSTRACT OF THE DISCLOSURE

Apparatus for loosening stacked sheets operates to separate small piles in succession from a supply stack, transfer the separated piles to a conveyor which supports the piles centrally, with their overhanging lateral edge regions hanging down so that sheet edges fan out and separate, assisted by compressed air jets. The small piles are aligned crosswise by lateral guides and lengthwise by a stop frame and are re-united to form a delivery stack.

The invention relates to a process and apparatus for restacking, loosening and aligning material in sheet form, preferably by injecting compressed air between the sheets to be straightened.

In order to achieve extremely accurate printing, stamping, grooving, scoring and the like during the processing of sheets of material it is necessary to align a rough stack beforehand. Furthermore it is frequently necessary to separate the individual sheets, which because of the cutting process stick together at the cut edges, before they can be further processed.

Hitherto the aligning of rough stacks has been carried out by hand. This was done by straightening smaller partial stacks by striking the side with a flat piece of wood. Since manual labour is time-consuming and expensive, however, proposals have already been made to undertake this alignment by machine. Various processes are known for this. It has, for example, been suggested that the alignment be carried out by shaking a stack while it rests on an inclined supporting plate fitted with stop members. In this way, however, it is only possible to straighten piles which are of not too great a weight. According to another known process the sheets of the rough stack are separated and then taken via a conveyor device on to a table where they are made up into a stack again, the alignment being carried out by means of stops on the edges of the table. The process is already known of blowing a current of air between individual sheets in order to eliminate mutual adhesion. Even if machine straightening results in a saving of labour as compared with manual straightening, the known processes nevertheless have a disadvantage that the amount of time which they save is comparatively small since the separated sheets are each straightened individually.

The process according to the invention for restacking, loosening and straightening materials in sheet form is characterized in that small piles are taken in succession from the top of a supply stack and conveyed in a substantially horizontal direction while supported essentially only in the centre, and each small pile, while it is being carried along is loosened and straightened and finally reunited with previously straightened piles to form a receiver stack. Because of the central support of the pile the overhanging edges of the pile hang down in such a way that the individual sheets fan out, whereby the sheet edges, which stick together as a result of cutting, are spread and separated. In order to aid the separation, compressed air is blown simultaneously from opposite sides between the spread sheets so that they float, as it were, on

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a cushion of air and can slide easily. It is advantageous, particularly for printed sheets, to assist and augment the loosening by means of a vibrating shaking movement. The conveyed pile receives secondary support from adjustable guide strips which extend along both sides of the conveyor path, and is then pushed on to a receiver stack, whereby at the end of the conveyor path the pile is aligned length-wise and crosswise to the conveyor path by means of an adjustable stop frame. The ease of mobility of the individual sheets of the pile, which is caused by the injection of the compressed air, permits the sheets to be easily and exactly aligned.

An example of apparatus for carrying out the process according to the invention is described below with the aid of diagrams.

FIG. 1 shows a longitudinal section, in schematic form, of the construction of the apparatus.

FIG. 2 shows a cross-section along line II—II through the device.

FIG. 3 shows a section A (FIG. 1) on an enlarged scale.

The frame of the apparatus consists essentially of a base-plate 1, on the four corners of which are provided four supports 2 which carry opposed mounting plates 3 the ends of which overhang the frame. It is preferable to connect these supports together by cross-bars 4 in order to strengthen them. Grids 5 and 6 are suspended in a well-known manner on chains 7 on the overhanging ends of the mounting plates 3. These grids serve as support tables for the stack of sheets 8 and 9, e.g. paper, before and after restacking. The grids can be moved upwards and downwards, also in well-known manner, by driving mechanisms which are not shown, and these movements can be carried out at quick and slow speeds, the arrangement, well-known in the paper-stacking art, being such that the grid 5 moves upwards with a supply stack 8 and the grid 6 moves downwards in a corresponding way with a delivery stack 9. Supported by the mounting plate 3, on the side of the frame at which the grid 5 hangs, is a mechanism for separating off small piles from the supply stack 8. This mechanism, indicated diagrammatically as to its location by the reference A in FIG. 1, is represented on an enlarged scale in FIG. 3 and will be explained later. In FIG. 1, reference numeral 10 indicates a driving motor which reciprocates a horizontal sliding frame 11 in its own plane by means of a crank arm 10a and a connecting rod 10b. The sliding frame 11 carries sets of vertically depending pusher fingers 11a and 11b which are pivotal from their operative vertical positions into horizontal inoperative positions. The sliding frame and pusher fingers 11a operate to push small piles separated from the stack 8 through an intermediate transfer section 12 and on to a conveyor belt 13 driven by its supporting rollers, i.e., when the sliding frame 11 moves to the right as seen in FIG. 1 forwardly from the starting position. When the sliding frame 11 returns to its starting position the pusher fingers 11a and 11b are pivoted into horizontal positions so that the fingers 11a clear the upper surface of the stack 8 and the fingers 11b clear the upper surface of the small pile previously fed on to the belt 13. On the next forward movement of the sliding frame 11 the fingers 11b push the small pile on the belt 13 into a stop frame 16, while the fingers 11a advance another small pile from the top of the supply stack 8. Jets 14 (FIG. 2), which are fixed to guide strips 15 (for the lateral edges of the piles on the conveyor belt 13), serve to blow air into the pile, and are supplied with compressed air from a compressor which is not shown. The guide strips 15 and stop frame 16 can, moreover, be adjusted to the size of the paper to be restacked, and they serve to guide the pile of paper laterally and to act as stops for the lengthwise and crosswise straightening.

The apparatus according to the invention works in the following way: a stack 8 is brought on to the grid 5 which is sunk into a recess 17 provided in the floor. For this purpose it is advantageous to use a fork-lift stacker and a pallet as a base. The stack is raised on the grid 5 at a fast speed until it touches against a feeler roller 18 (FIG. 3) to move that roller upward. The upward roller movement shifts bell crank lever 21 to compress a previously relaxed spring 22 connected at one end to a setting ring 22a, and, further, to operate a limit switch 19 which stops the upwards movement of the grid 5. The feeler roller 18 and associated elements are mounted on a slidably movable cross-carrier member 20, together with other components for separating off small piles from the stack 8. This cross-carrier member 20 is spring-loaded (by means not shown), so that it is urged horizontally towards the machine frame. In order to bring the mechanism A, shown on an enlarged scale in FIG. 3, to the correct distance from the raised stack 8 and into the working position for separating small piles from stack 8, the cross-carrier 20 is pushed back by hand (i.e. to the left in FIG. 1), against the force of the spring loading thereon, until the feeler roller 18 clears the left hand top edge (FIG. 3) of the raised stack 8. Roller 18 is then moved downward by the compression in spring 22 until that spring again becomes relaxed. Next, cross-carrier 20 is released and is propelled rightward by the spring loading thereon until roller 18 comes to rest against the leftward side face (FIG. 3) of the stack of paper 8. The spring loading on cross-carrier 20 then produces a further rightward movement thereof and a consequent downward movement of bell crank lever 21 so as to cause the coil spring 22 to be held under tension by the setting ring 22a. This sprung arrangement of the roller 18 effects the removal of unevenness from the stack side as stack 8 rises relative to the roller 18.

When the machine has been adjusted to suit the size of the sheets to be restacked, the apparatus can be set in operation. The operation of the various mechanisms at the right time and in the correct sequence can be carried out automatically by employing adjustable, preferably electrically operated switchgear, which is not shown, is well-known in the art, and forms no part of the present invention, it being sufficient to state that automatic and synchronous operation is provided for a motor for an air compressor, not shown, motors, likewise not shown, for the lifting and lowering of the stacks 8 and 9 and for the conveyor belt 13, and the driving motor 10 for the sliding frame 11. Provision can also be made, however, for the possibility of setting the individual co-operating mechanisms in motion separately, each independently of automatic control.

Referring to FIG. 3, the operation of the pile-separating mechanism is that, a cylinder 23 is first supplied with compressed air, the result of which is that a separating member, in the form of a blade 24, controlled via levers, penetrates the stack 8 and lifts a pile 25.

Whilst this pile 25 is being lifted a second cylinder 27 is supplied with compressed air and the sheets lying below this pile 25 are held down by a member 26 which is moved via further levers. The pusher fingers 11a mounted on the leading edge of the sliding frame 11 (FIG. 1) then move with the first forward movement of the sliding frame 11, to engage behind the raised edge of the separated pile 25 and advance it through the intermediate transfer section 12 and on to the conveyor belt 13. When the separated small pile 25 has been pushed away, the grid 5 with the supply stack 8 is raised by an amount corresponding to the height of the pile 25 removed. At the same time the grid 6 with the receiver stack 9 is lowered by a corresponding amount.

The pile 25 rests on the conveyor belt 13 in such a way that its side edge regions hang down since the pile is supported essentially only in the middle, and the edges of the sheet in the pile spread or fan out. It is obvious

that the overhang is greater or smaller depending upon the size of the sheets to be restacked, i.e. the spread edges of the sheets hang down to a greater or lesser extent. This would mean that the air jets 14 fixed to the guide strips 15 would have to be correspondingly raised or lowered when the sheet size is changed. In order, however, to arrive at a constant overhang of the pile edge regions at the same height, independent of the format of the sheets to be restacked secondary supporting plates 15a (FIG. 2) are fitted to the guide strips 15. Between the individual spread or fanned-out sheets hanging down on either side, compressed air is injected with the aid of jets 14. This penetrates between the sheets, loosens them and causes them to "float." In this way the individual sheets which stick together as a result of printing or cutting are separated from each other, so that they can be easily moved relative to each other. In this loosened condition the pile 25 is further pushed, during a repeat forward movement of the sliding frame 11, by the pusher fingers 11b and is carried along the strips 15 which serve as lateral guides. The strips 15 align the sheets in the crosswise direction and the pile is finally straightened lengthwise by coming to rest against the stop frame 16.

In order to prevent the spread sheets hitting against the receiver pile 9 when the individual piles are being transferred, guide plates 15b (FIG. 1) are fitted on the end of the guide strips 15 to facilitate the transfer by raising the drooping side edges of the sheets to a suitable height. The individual piles 25, which are easily and accurately straightened in this way, are recombined into the receiver pile 9 on the grid 6. This process is repeated continuously until the supply stack 8 is exhausted to thereby free roller 18 and bell crank lever 21 to move under the urging of tensioned spring 22. When so freed, lever 21 flies up with momentum enough to actuate limit switch 19 so as to cause the apparatus to be automatically put out of action.

We claim:

1. In apparatus for loosening and aligning a stack of material in sheet form and restacking it, the combination of a stack lifting platform and a stack lowering platform, a pile separator device mounted over the lifting platform, for lifting a topmost pile from a supply-stack lying on the lifting platform, first pusher fingers for pushing the lifted pile from the supply stack, a horizontal conveyor which is provided between the lifting platform and the lowering platform and which receives and supports the pile only in its center, guide strips for guiding and laterally aligning the pile transported by the conveyor belt, air jet means for loosening the pile transported by the conveyor belt, second pusher fingers for transferring the loosened pile from the conveyor belt onto the top of a stack lying on the lowering platform, and a stop frame over the lowering platform for lengthwise alignment of the pile.

2. Apparatus according to claim 1, wherein the mechanism for lifting a topmost pile from a supply-stack lying on the lifting platform comprises an insertion blade which penetrates laterally into the supply-stack, and a device for holding down the remaining portion of the supply-stack.

3. Apparatus according to claim 1, wherein the first pusher fingers for pushing the lifted pile onto the conveyor and the second pusher fingers for transferring the loosened pile onto the top of the stack on the lowering platform are both carried by a sliding platform which reciprocates horizontally.

4. In a process for loosening and aligning a stack of sheets, the steps of separating successive piles from a stack of sheets, conveying each separated pile along a substantially horizontal path while supporting the pile only in the centre, allowing the side edge regions of the pile to hang downwardly unsupported during the conveying step so that the sheet edges tend to fan out and separate from each other, guiding the side edges of the piles at least during part of the conveying step for aligning the

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sheets crosswise, and re-uniting the piles in lengthwise alignment with each other to form a delivery stack.

5. Process according to claim 4, including the further step of injecting compressed air against the downwardly hanging side edge regions of each pile for loosening the sheets of the pile while it is being conveyed horizontally.

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