A method and an apparatus convey sheets onto a stack which reduces the risk of damaging a sheet or the conveying elements. The sheets are conveyed over the stack one after another and aligned on the side edge by moving a surface of at least one stop. A position of the side edge of the respective sheet in relation to the stop surface is monitored, and a signal is output if the side edge lies behind the stop surface. The apparatus contains a detector for detecting the position of the side edge in relation to the stop surface.
METHOD AND APPARATUS FOR CONVEYING SHEETS ONTO A STACK

BACKGROUND OF THE INVENTION

Field of the Invention

[0001] The invention relates to a method for conveying sheets onto a stack, in which the sheets are conveyed over the stack one after another and aligned on a side edge by moving a surface of at least one stop. The invention further relates to an apparatus for implementing the method.

[0002] Published, non-prosecuted German patent application DE 43 28 445 A1, corresponding to U.S. Pat. No. 5,582,400, discloses an apparatus for conveying sheets onto a stack in which, in the region of a deliverer of a sheet-fed press, there are various sensors registering a fluttering movement of a sheet. The sensor signals are evaluated in a fuzzy controller. In the event of undesired fluttering, blowing or vacuum actuators are actuated, which settles the run of the sheet. The sheets are deposited onto the stack by being allowed to fall.

[0003] During manual setting of blowing or vacuum actuators, it is possible for sheets to arrive from the conveying path provided and be deposited on straight joggers, which can be moved to and fro laterally on the stack for correct stack formation. The deposition on the straight joggers can lead to an accumulation of a plurality of sheets, so there is a risk of collision with gripper bars running past, which hold the sheet during the conveyance.

SUMMARY OF THE INVENTION

[0004] It is accordingly an object of the invention to provide a method and an apparatus for conveying sheets onto a stack which overcomes the above-mentioned disadvantages of the prior art methods and devices of this general type, which reduce the risk of damage to a sheet or to the conveying elements.

[0005] With the foregoing and other objects in view there is provided, in accordance with the invention, a method for conveying sheets onto a stack. The method includes conveying the sheets over the stack one after another and aligned on a side edge by moving a stop surface of at least one stop, monitoring a position of the side edge of the sheets in relation to the stop surface, and outputting a signal if the side edge lies behind the stop surface.

[0006] According to the invention, at least one detector, in particular an ultrasonic distance sensor, is used to monitor whether a sheet is deposited on lateral sheet stops. If a sheet projects in the horizontal direction over a vertical stop surface of a stop, then a signal is generated in a control device, by which the conveyance of sheets is adjusted or actuating elements for the position or alignment of the sheet are controlled in such a way that the projecting sheet falls onto the stack and sheets arriving later are no longer deposited on the stop.

[0007] For the sheets, a permissible path region can be defined in which each sheet should be located during proper conveyance. The action of leaving the path region is detected by the detector. If sheets are conveyed one after another by grippers on gripper bars then, according to a first variant, the action of leaving the path region can be detected by a check being made as to whether, during a conveying cycle, no gripper bar is detected, since the gripper bar is concealed by a sheet lying wrongly in the registration direction of the detector. In a second variant, the detector is aimed directly at the sheet lying wrongly.

[0008] If straight joggers moving to and fro at the side of the stack are provided as a sheet stop, then if a sheet lies wrongly on the straight joggers, the straight jogger can be accelerated in the lateral direction in a manner deviating from its periodic movement sequence, so that, as a result of inertia, the sheet slides off the straight jogger and falls onto the stack. The unusual lateral movement of the straight jogger provides the sheet with sufficient clearance for the sheet to fall freely.

[0009] In the event of a sheet lying wrongly on a straight jogger, a slide, a blowing or vacuum device or another conveying device can also be actuated, so that the sheet is guided back into the permissible path region.

[0010] In presses, sheet brakes are used in the delivery region in order to reduce the speed of the sheets. If the detector has detected a sheet over a straight jogger, the sheet brake can be controlled in such a way that the braking action with respect to the sheet axis of symmetry is different transversely with respect to the sheet running direction. As a result, there is a position change in the following sheets, in particular a slight rotation of the sheets into the permissible path region.

[0011] Other features which are considered as characteristic for the invention are set forth in the appended claims.

[0012] Although the invention is illustrated and described herein as embodied in a method and an apparatus for conveying sheets onto a stack, it is nevertheless not intended to be limited to the details shown, since various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents of the claims.

[0013] The construction and method of operation of the invention, however, together with additional objects and advantages thereof will be best understood from the following description of specific embodiments which are in connection with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

[0014] FIG. 1 is a diagrammatic, side view of a press having an apparatus for conveying sheets onto a stack according to the invention;

[0015] FIG. 2 is a diagrammatic, plan view of the stack;

[0016] FIG. 3 is diagrammatic, plan view of the stack with a sheet lying on a straight jogger board;

[0017] FIG. 4 is a diagrammatic, front view of the stack with the sheet according to FIG. 3; and

[0018] FIG. 5 is a diagrammatic, plan view relating to unusual movement of a straight jogger.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0019] Referring now to the figures of the drawing in detail and first, particularly, to FIG. 1 thereof, there is shown
a printing unit 2 operating in an offset process and having an impression cylinder 2.1. The latter guides a respective sheet in a processing direction indicated by a direction of rotation arrow 5 through a press nip between the impression cylinder 2.1 and a blanket cylinder 2.2 intersecting therewith, and in the present example subsequently transfers it to a gripper row of a single-turn transfer drum 2.3, opening a gripper row disposed on the impression cylinder 2.1 and provided for gripping a sheet 3 at a gripping edge at the leading end of the sheet 3. A corresponding transfer of the sheet 3 is then carried out from the single-turn transfer drum 2.3 to a further transfer drum 2.4, a half-turn transfer drum in the present example, which transfers the sheet 3 to a chain conveyor 4 of the deliverer 1. The chain conveyor 4 includes 2 endless conveyor chains 6, of which a respective one circulates along a closed chain path in the vicinity of a respective side wall of the chain deliverer 1 during operation. A respective conveyor chain 6 in each case runs around one of two synchronously driven drive chain wheels 7, whose axes are aligned with each other and, in the present example, is guided in each case over a deflection chain wheel 8 which is located downstream of the drive chain wheel 7 with respect to the processing direction, so that a respective one of the conveyor chains 6 passes through a closed chain path. Between the two conveyor chains 6 there extend gripper systems 9 carried by the latter and having grippers, which move through gaps between the grippers disposed on the transfer drum 2.4 and in the process pick up a respective sheet 3 by gripping the aforementioned gripping edge at the leading end of the sheet 3 directly before the opening of the grippers disposed on the transfer drum 2.4, transport the sheet over a sheet guide device 10 to a braking station 11 and open after the sheet 3 has been transferred to the braking station 11. In the braking station 11, the sheets are braked to a deposition speed that is reduced with respect to the processing speed and, after reaching the speed, are finally released, so that a respectively now decelerated sheet 3 finally strikes leading edge stops 12 and, being aligned with the latter and with trailing edge stops 13 opposite these, together with preceding and/or following sheets 3, forms a stack 14, which can be lowered by a lifting mechanism to the extent to which the stack 14 grows. Of the lifting mechanism, only a platform 15 carrying the stack 14 and lifting chains 16 carrying the platform and indicated dash-dotted are reproduced in FIG. 1. Along their paths between the drive chain wheels 7 on the one hand and the deflection chain wheels 8 on the other hand, the conveyor chains 6 are guided by chain guide rails which determine the chain paths of the chain runs. In the present example, the sheets 3 are transported by the lower chain run in FIG. 1. The section of the chain path through which the latter runs is followed by a sheet guide surface 17 facing the latter and formed on the sheet guide device 10. Between the surface and a sheet 3 respectively guided over it, a supporting air cushion is preferably formed during operation. To this end, the sheet guide device 10 is equipped with blow air nozzles opening into the sheet guide surface 17, of which only one is reproduced in FIG. 1 as representative of them all, and in a symbolic illustration in the form of a connecting piece 18. In order to prevent mutual adhesion of the printed sheets in the stack 14, a dryer 19 and a powdering apparatus 20 are provided on the path of the sheets 3 from the drive chain wheels 7 to the braking station 11. In order to avoid excessive heating of the sheet guide surface 17 by the dryer, a coolant circuit is integrated into the sheet guide device 10, this being indicated symbolically in FIG. 1 by an inlet connecting piece 21 and an outlet connecting piece 22 on a coolant trough 23 assigned to the sheet guide surface 17. Illustration of the aforementioned chain guide rails has been omitted from FIG. 1. However, the path of the same in the present example can be seen from that of the chain runs.

[0020] In order to align the sheets 3 on the stack 14, lateral straight joggers 24 are provided.

[0021] FIG. 2 shows a plan view of the stack 14 during proper stack formation. The braking station 11 contains five suction belt modules 26.1-26.5 transversely with respect to the sheet running direction 25. Each suction belt module 26.1-26.5 applies a braking force F1 to the sheet 3. The suction belt modules 26.1-26.5 are located symmetrically with respect to the sheet axis of symmetry in the sheet running direction 25. The side edges 27.1, 27.2 of the sheet 3 lie parallel to the sheet running direction 25. The straight joggers 24 in each case contain a stop plate 28.1, 28.2, a longitudinal guide 29.1, 29.2 and a linear drive 30.1, 30.2. During proper sheet conveyance, the sheet 3 is located centrally with respect to the stop plates 28.1, 28.2. Provided at the sides of the stop plates 28.1, 28.2 are ultrasonic distance sensors 31.1, 31.2, which in each case emit a measuring beam 32.1, 32.2 in the vertical direction on the underside of the sheet. The ultrasonic distance sensors 31.1, 31.2 and the linear drives 30.1, 30.2, are connected to a control device 33.

[0022] FIGS. 3 and 4 show a situation in which a sheet 3 has been deposited on the stop plate 28.2. As can be seen in more detail in FIG. 4, the measuring beam 32.2 strikes the underside of the sheet 3 lying over the stop plate 28.2. In accordance with the propagation time principle, the ultrasonic sensor 31.2 outputs a signal that the sheet 3 is lying obliquely over the stop plate 28.2. A registration depth 34 of the ultrasonic distance sensor 31.2 is dimensioned such that no signal is generated during the passage of a gripper bar of the gripper system 9. The signal is evaluated in the control device 33 together with signals from a rotary encoder 35. In order to correct the skewed position of the sheet 3 above the stack 14, actuating signals are generated in the control device 33 which change the braking forces of the suction belt modules 26.1 and 26.2. As shown in FIG. 3, the braking forces F3, F2 of the suction belt modules 26.1, 26.2 are increased slightly as compared with the braking forces F1 on the suction belt modules 26.3 to 26.5, until the sheet 3 is again guided straight and centrally over the stack 14. During the setting of the braking forces F1, F2, F3, the weight distribution of the sheet 3 specific to the printing image can be taken into account.

[0023] Additionally or alternatively, as shown in more detail in FIG. 5, the straight jogger 24.2 can be activated in order to move the sheet 3 down from the stop plate 28.2 onto the stack 14. If the ultrasonic distance sensor 31.2 supplies the signal that a sheet 3 is lying on the stop plate 28.2, then, by the control device 33, the linear drive 30.2 is activated in such a way that the stop plate 28.2 for intercepting the sheet 3 is moved away from the side surface of the stack. As a result of the acceleration of the stop plate 28.2 and the inertia of the sheet 3, the sheet 3 falls down from the stop plate 28.2 onto the surface of the stack 14. As illustrated in FIG. 4, the stop plates 28.1, 28.2 are provided with inclines 36.1, 36.2,
so that the falling sheet 3 falls approximately centrally onto the stack 14. After the sheet 3 has fallen down from the stop plate 28.2, the stop plate 28.2 is displaced in the direction of the side surface of the stack again. The stroke of the lateral intercepting movement of the stop plate 28.2 can be set as a function of the extent of the overlap of the sheet 3 over the stop plate 28.2. For this purpose, use can be made of a detector which, in addition to the presence of a sheet 3, also supplies the overlap. In trouble-free operation of the sheet conveyance, the stop plates 28.1, 28.2 carry out a periodic reciprocating movement for the purpose of straight jogging of the sheets 3 deposited on the stack 14. This reciprocating movement has a substantially lower amplitude than the stroke of the intercepting movement of the stop plate 28.2.

[0024] This application claims the priority, under 35 U.S.C. §119, of German application DE 10 2005 047 177.3, filed Sep. 30, 2005; the prior application is herewith incorporated by reference in its entirety.

We claim:

1. A method for conveying sheets onto a stack, which comprises the steps of:
   - conveying the sheets over the stack one after another and aligned on a side edge by moving a stop surface of at least one stop;
   - monitoring a position of the side edge of the sheets in relation to the stop surface; and
   - outputting a signal if the side edge lies behind the stop surface.

2. The method according to claim 1, which further comprises stopping the conveyance after the signal has been output.

3. The method according to claim 1, which further comprises controlling a movement of the stop such that a sheet falls freely down onto the stack if the sheet lies over the stop.

4. The method according to claim 3, which further comprises moving the stop away from the stack with an acceleration that overcomes an inertia of the sheet.

5. The method according to claim 1, which further comprises actuating a sheet slide such way that a sheet falls freely down onto the stack if the sheet lies over the stop.

6. The method according to claim 1, which further comprises aligning the sheets coming after the output of the signal, during a conveyance of the sheets, by varying a speed of a sheet differently in regions transverse with respect to a conveying direction.

7. The method according to claim 6, which further comprises causing braking forces to act on the sheet by setting a pneumatic brake on both sides with a different braking action at a distance from a sheet axis of symmetry lying in the conveying direction.

8. The method according to claim 7, which further comprises setting a braking action in dependence on a printing image.

9. The method according to claim 1, which further comprises:
   - providing a detector emitting measuring signals in a region of the stop adjacent to the stop surface; and
   - monitoring the position of the side edge by a measurement of a signal propagation time of the measuring signals propagating between the detector and a respective sheet.

10. The method according to claim 9, which further comprises sending out the measuring signals toward an underside of the sheet located behind the stop surface.

11. An apparatus for conveying sheets onto a stack, the apparatus comprising:
   - a device for moving the sheets forward one after another over the stack;
   - at least one stop with a stop surface for a side edge of the sheet, said stop being moved to and fro for aligning the sheets;
   - at least one detector for determining a position of the side edge in relation to the stop surface; and
   - a control device connected to said at least one detector, said control device causing a positioning and/or aligning of the sheets as necessary.

12. The apparatus according to claim 11, wherein:
   - said stop has an edge located at a top; and
   - said detector is aimed at a region in an environment beside the sheet edge.

13. The apparatus according to claim 11, wherein during conveyance of a sheet by grippers disposed on a gripper bar, said detector has an ultrasonic distance sensor with a registration region lying outside a path of the gripper bar.

14. The apparatus according to claim 11, wherein said stop together with said detector can be positioned in a conveying direction of the sheet in accordance with a sheet length.

15. The apparatus according to claim 11, further comprising a pneumatic actuator connected to said control device, said pneumatic actuator provided for accelerating said stop transversely with respect to the conveying direction.

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