There is described a paper conveying apparatus that deflects a conveying direction of a paper at substantially 90 degree relative to a conveyance direction of the paper. The apparatus includes: a first conveying section to convey the paper in a first conveyance direction; a second conveying section that includes a conveyance belt, including a conveying nail, to deflect the conveying direction of the paper and conveys the paper in a second conveyance direction, which is substantially orthogonal to a longitudinal direction of a leading edge of the paper; a stopper member for stopping and releasing a side edge portion of the paper in a width direction of the paper; and a driving section to drive both the conveyance belt and the stopper member. The driving section moves the conveying nail and/or the stopper member from an outside of a paper conveying area, to achieve a width truing operation.
FIG. 2

(FOLDING THREE PROCESSING) SA

SB (SADDLE STITCH PROCESSING)

SB

(FORE EDGE CUTTING) SB

(EJECTION)

Bf

18F

18E

18D

18C

18B

18A

40

41

42

30

50

51

60

SB

SA (MIDDLE FOLDING)

SA (MIDDLE FOLDING)

SB

(SP)

B

43

12

19

r7

r6

r5

r2

FIG. 2
PAPER CONVEYING APPARATUS, PAPER FINISHING APPARATUS AND IMAGE FORMING APPARATUS


BACKGROUND OF THE INVENTION

[0002] The present invention relates to a paper conveying apparatus for truing papers to be conveyed and for conveying the papers after deflecting a conveying direction of them, and a paper finishing apparatus and an image forming apparatus, which are provided with the paper conveying apparatus.

[0003] In recent years, there has been available a paper finishing apparatus that receives the papers on which images are formed by an image-forming apparatus, such as a copier, a printer, a facsimile and a compound apparatus constituted by those devices, and applies a folding processing, a stitching processing and a collating processing for every printing number to quite a few papers, and then, staples them by means of a stapler so as to achieve a bookbinding operation of the paper. The paper finishing apparatus conducts such processing as folding, stitching, perforating, stapching, fore-edge cutting, tight sealing, etc.

[0004] Patent Document 1 sets forth the paper finishing apparatus that receives and conveys the papers delivered from the image-forming apparatus properly, and stacks a plurality of papers onto the paper stacking tray, and then, buts the leading edge of the papers in a conveying direction of the papers against the butting member and also buts the side edge in a width direction of the papers by means of the width truing member so as to position and align the papers at the predetermined position, and then, applies the stapling processing to the papers by means of the stapler, and finally, ejects the stapled papers outside the apparatus.

[0005] In the paper finishing apparatus mentioned in the above, the driving source of the width truing member, the other driving source of the driving means for ejecting the bundle of the papers which are already stapled, a driving section for driving the butting member against which the leading edge of the papers in a conveying direction of the papers are butted, etc., are separately equipped.

[0006] Accordingly, there has been a problem that the complicated mechanism employing a motor, a solenoid, etc. is necessary for each of such the driving sources, resulting in an increase of the manufacturing cost due to the increase of a number of parts to be employed in the apparatus.

[0007] In recent years, the system, that conducts the whole bookbinding processes from the printing process to the stapling and cutting processes within a single image-forming apparatus, has been proposed as the on-demand printing system. In such the system, the requested are to improve the accuracy of the finishing process for the papers and to conduct the truing operation of the paper without lowering the productivity of the image-forming apparatus proper.

[0008] [Patent Document]


SUMMARY OF THE INVENTION

[0010] To overcome the abovementioned drawbacks in conventional paper conveying apparatus, paper finishing apparatus and image forming apparatus, it is an object of the present invention to provide a paper conveying apparatus, which makes it possible to simplify the mechanism of truing means and to improve a truing performance for papers without increasing a number of driving sources, by adding a truing function to a certain conveying process.

[0011] Specifically, another object of the present invention is to create a high-grade section by making the paper truing operation for the section accurate, wherein the section is acquired by applying the folding processing to a plurality of papers after stacking the plurality of papers and applying the width truing operation to them. Further, still another object of the present invention is to create a high-grade book by making the paper truing operation for the book accurate, wherein the book is created by applying the staple processing to the section acquired by applying the folding processing to a plurality of papers.

[0012] Further, still another object of the present invention is to provide a paper finishing apparatus or an image forming apparatus, which conducts the paper truing operation without lowering the productivity of the image forming apparatus proper so as to attain a stabilization and high velocity of the converting operation of the paper conveying direction even with a relatively simple mechanism.

[0013] Accordingly, to overcome the cited shortcomings, the abovementioned object of the present invention can be attained by paper conveying apparatus, paper finishing apparatus and image forming apparatus described as follow.

[0014] (1) An apparatus for conveying a paper while deflecting a long side and a short side of the paper at substantially 90 degree relative to a current conveyance direction of the paper, the apparatus comprising: a first conveying section to convey the paper in a first conveyance direction; a second conveying section that includes a conveyance belt to deflect the current conveying direction of the paper so as to convey the paper in a second conveyance direction, which is substantially orthogonal to a longitudinal direction of a leading edge of the paper conveyed in the first conveying section, wherein the conveyance belt includes a conveying nail formed as a protrusion protruded from the conveyance belt; a stopper member that is movable to stop and release a side edge portion of the paper, conveyed by the first conveying section, in a width direction of the paper; and a driving section to drive both the conveyance belt and the stopper member, wherein the driving section moves the conveying nail and/or the stopper member from an external area outside a paper conveying area, so that a width truing operation is achieved by butting the conveying nail and the stopper member against both side edge portions of the paper.

[0015] (2) The apparatus of item 1, wherein the conveying nail and the stopper member are positioned to a truing position at which the conveying nail and the stopper member are batted against the both side edge portions of the paper, or a standby position at which a gap between the conveying nail and the stopper member is wider than that at the truing position.
[0016] (3) The apparatus of item 2, wherein the driving section moves the conveying nail and/or the stopper member from the standby position to the truing position in order to conduct the width truing operation, and after the width truing operation is completed, the driving section again moves the conveying nail and/or the stopper member from the truing position to the standby position.

[0017] (4) A paper finishing apparatus for applying finish processing to a paper or a plurality of papers while conveying the paper or the plurality of papers, the paper finishing apparatus comprising: a conveying mechanism to convey and stack the paper or the plurality of papers; a stopper member, being movable, to stop a side edge portion of the paper or the plurality of papers conveyed and stacked by the conveying mechanism so as to achieve a width truing operation; a truing section that includes a conveying nail, being movable and disposed in parallel with the stopper member in such a manner that the stopper member and the conveying nail oppose to each other; a driving section to drive both the stopper member and the conveying nail; and a finish processing section to apply the finish processing to the paper or the plurality of papers trued by the truing section; wherein the driving section moves the stopper member and/or the conveying nail from an external area outside a paper conveying area, so that the width truing operation is achieved by butting the stopper member and/or the conveying nail against both side edge portions of the paper or the plurality of papers.

[0018] (5) The paper finishing apparatus of item 4, wherein the conveying mechanism includes: a first conveying section to convey the paper or the plurality of papers in a first conveyance direction; a second conveying section that includes a conveyance belt to deflect the first conveying direction of the paper or the plurality of papers so as to convey the paper or the plurality of papers in a second conveyance direction, which is substantially orthogonal to a longitudinal direction of a leading edge of the paper or the plurality of papers conveyed in the first conveying section.

[0019] (6) The paper finishing apparatus of item 5, wherein the conveyance belt includes the conveying nail formed as a protrusion protruded from the conveyance belt.

[0020] (7) The paper finishing apparatus of item 6, wherein the conveying nail and the stopper member are positioned to a truing position at which the conveying nail and the stopper member are batted against both side edge portions of the paper or the plurality of papers, or a standby position at which a gap between the conveying nail and the stopper member is wider than that at the truing position.

[0021] (8) The paper finishing apparatus of item 7, wherein the driving section moves the conveying nail and/or the stopper member from the standby position to the truing position in order to conduct the width truing operation, and after the width truing operation is completed, the driving section again moves the conveying nail and/or the stopper member from the truing position to the standby position.

[0022] (9) The paper finishing apparatus of item 4, wherein the finish processing section includes: a folding device to fold the paper or the plurality of papers conveyed by the conveying mechanism and trued by the truing section.

[0023] (10) The paper finishing apparatus of item 9, wherein the folding device applies a folding two processing or a folding three processing to the paper or the plurality of papers trued by the truing section.

[0024] (11) A system for forming an image on a paper or a plurality of papers, comprising: an image forming apparatus that forms the image on the paper or the plurality of papers and ejects the paper or the plurality of papers; a paper finishing apparatus that receives the paper or the plurality of papers, ejected by the image forming apparatus, and applies finish processing to the paper or the plurality of papers, while conveying the paper or the plurality of papers; wherein the paper finishing apparatus includes: a conveying mechanism to convey and stack the paper or the plurality of papers; a stopper member, being movable, to stop a side edge portion of the paper or the plurality of papers conveyed and stacked by the conveying mechanism so as to achieve a width truing operation; a truing section that includes a conveying nail, being movable and disposed in parallel with the stopper member in such a manner that the stopper member and the conveying nail oppose to each other; a driving section to drive both the stopper member and the conveying nail; and a finish processing section to apply the finish processing to the paper or the plurality of papers trued by the truing section; wherein the driving section moves the stopper member and/or the conveying nail from an external area outside a paper conveying area, so that the width truing operation is achieved by butting the stopper member and/or the conveying nail against both side edge portions of the paper or the plurality of papers.

[0025] (12) The system of item 11, wherein the conveying mechanism includes: a first conveying section to convey the paper or the plurality of papers in a first conveyance direction; a second conveying section that includes a conveyance belt to deflect the first conveying direction of the paper or the plurality of papers so as to convey the paper or the plurality of papers in a second conveyance direction, which is substantially orthogonal to a longitudinal direction of a leading edge of the paper or the plurality of papers conveyed in the first conveying section.

[0026] (13) The system of item 12, wherein the conveyance belt includes the conveying nail formed as a protrusion protruded from the conveyance belt.

[0027] (14) The system of item 13, wherein the conveying nail and the stopper member are positioned to a truing position at which the conveying nail and the stopper member are batted against both side edge portions of the paper or the plurality of papers, or a standby position at which a gap between the conveying nail and the stopper member is wider than that at the truing position.

[0028] (15) The system of item 14, wherein the driving section moves the conveying nail and/or the stopper member from the standby position to the truing position in order to conduct the width truing operation, and after the width truing operation is completed, the driving section again moves the conveying nail and/or the stopper member from the truing position to the standby position.
The system of item 11, wherein the finish processing section includes: a folding device to fold the paper or the plurality of papers conveyed by the conveying mechanism and trusted by the trusting section.

The system of item 16, wherein the folding device applies a folding two processing or a folding three processing to the paper or the plurality of papers trusted by the trusting section.

An apparatus for conveying a paper while deflection a long side and a short side of the paper at substantially 90 degree relative to a current conveying direction of the paper, the apparatus comprising: first conveying means for conveying the paper in a first conveying direction; second conveying means, including a conveying belt to deflect the current conveying direction of the paper, for conveying the paper in a second conveying direction, which is substantially orthogonal to a longitudinal direction of a leading edge of the paper conveyed in the first conveying means, wherein the conveying belt includes a conveying nail formed as a protrusion protruded from the conveying belt; stopper means, being movable, for stopping and releasing a side edge portion of the paper, conveyed by the first conveying means, in a width direction of the paper; and driving means for driving both the conveying belt and the stopper member; wherein the driving means moves the conveying nail and/or the stopper means from an external area outside a paper conveying area, so that a width truing operation is achieved by batting the conveying nail and the stopper means against both side edge portions of the paper.

Incidentally, in the present specification, the term of the “width direction of the paper” is defined as a horizontal direction of the paper when the viewer views the image formed on the paper at a normal position.

According to the present invention, the following effects can be attained.

1). In the paper conveying apparatus that deflects a long side direction and a short side direction of the paper, to be conveyed, at 90 degree in a conveying direction of the paper, by moving the conveying nail fixed on the conveying belt rotated by the driving means and the stopper means fixed on the truing belt rotated by the same driving means from the standby position located at outside of the paper conveying area to the truing position at which the conveying nail and the stopper means contact both side edge portions of the paper, so as to conduct the width truing operation by batting them against both side edge portions of the paper, it becomes possible to add the truing function to the paper conveying process, resulting in an improvement of the truing-ability for conducting the width adjustment for a plurality of papers, without increasing the driving source.

2). After completing the finish processing for a plurality of papers conveyed and stacked by the paper conveying apparatus, such as the folding processing, etc., by moving the conveying nail fixed on the conveying belt rotated by the driving means and the stopper means fixed on the truing belt rotated by the same driving means from the standby position located at outside of the paper conveying area to the truing position at which the conveying nail and the stopper means contact both side edge portions of the plurality of papers, so as to conduct the width truing operation by batting them against both side edge portions of the plurality of papers, it becomes possible to provide the paper finishing apparatus, which makes it possible to add the truing function to the paper conveying process, and to improve the truing-ability for conducting the width adjustment for a plurality of papers, without increasing the driving source.

3). The conveying direction of the paper, ejected from the image forming apparatus proper after forming the image on it, is converted in the paper finishing apparatus coupled to the image forming apparatus proper to apply the finishing operation, and the plurality of stacked papers are trued in its width direction. Accordingly, the image forming operation and the finishing operation are conducted on high-productivity and on-demand basis, without decreasing the productivity of the image forming apparatus proper.
BRIEF DESCRIPTION OF THE DRAWINGS

[0039] Other objects and advantages of the present invention will become apparent upon reading the following detailed description and upon reference to the drawings in which:

[0040] FIG. 1 shows an overall structure of an image-forming apparatus and the paper finishing apparatus provided with a paper conveying device embodied in the present invention;

[0041] FIG. 2 shows a schematic diagram showing a paper conveying operation performed in the middle folding and saddle stitch processing step of a paper finishing apparatus;

[0042] FIG. 3 shows a front view of the paper finishing apparatus;

[0043] FIG. 4 shows a right side view of the paper finishing apparatus;

[0044] FIG. 5 shows a right side view of a folding means and a conveying means;

[0045] FIG. 6 shows a front view of a conveying means;

[0046] FIG. 7 shows a plan view of the conveying means;

[0047] FIG. 8 shows a front view of the conveying means, indicating the paper width truing processes;

[0048] FIG. 9(a), FIG. 9(b), FIG. 9(c), FIG. 9(d), FIG. 9(e) and FIG. 9(f) show schematic diagrams of a folding means, indicating folding three processes;

[0049] FIG. 10 shows a schematic diagram of a folding means, indicating a middle fold processing performed prior to the saddle stitch processing; and

[0050] FIG. 11 shows a left side view of the paper finishing apparatus.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0051] Referring to the drawings, examples of the paper conveying apparatus, the paper finishing apparatus and the image forming apparatus, embodied in the present invention, will be detailed in the following.

Paper Finishing Apparatus and Image Forming Apparatus

[0052] Hereinafter, the term of “the paper finishing apparatus, provided with the paper conveying device, and the image forming apparatus” is defined as a paper finishing apparatus incorporating a paper conveying device, or an image-forming apparatus integrated with an external paper finishing apparatus incorporating a paper conveying device as shown in the drawings. Incidentally, it is also possible to configure the paper finishing apparatus provided with the paper conveying device, embodied in the present invention, as an independently usable structure. Further, the scope of the paper finishing apparatus and the image-forming apparatus provided with the paper finishing device, embodied in the present invention, is not limited to the embodiments detailed in the following.

Image Forming Apparatus

[0053] FIG. 1 shows an overall structure of an image-forming apparatus and the paper finishing apparatus provided with a paper conveying device embodied in the present invention.

[0054] The image forming apparatus is constituted by the image forming apparatus proper A, the automatic document feeder DF, the paper finishing apparatus B, and the large volume paper feeding device LT.

[0055] The image forming apparatus proper A, shown in FIG. 1, is provided with an image reading section 1, an image processing section 2, an image writing section 3, an image forming section 4, paper feeding cassettes 5A, 5B and 5C, a manual feed tray 5D, first paper feeding sections 6A, 6B, 6C and 6D, a second paper feeding section 6E; a fixing device 7, a paper discharge section 8 and an automatic double-sided copy paper feeding section 83 (ADU).

[0056] A paper processing device B is connected to the paper discharge section 8 located at the left side surface of the image forming apparatus proper A, as shown in the FIG. 1.

[0057] Images on one surface or both surfaces of the documents stacked on the document tray of the automatic document feeder DF are read by the optical system of the image reading section 1, and then read in by the CCD image sensor 1A, and the analog signals which have been subjected to photoelectric conversion are sent to the image writing section 3 after being subjected to processing such as analog processing, A/D conversion, shading correction, image compression and the like in the image processing section 2.

[0058] In the image writing section 3, the output light from the semiconductor laser is irradiated onto the photoreceptor drum of the image forming section 4A, and a latent image is formed. In the image forming section 4, processes such as charging, exposure, development, transfer, separation, cleaning and the like are performed. The image on the sheet S which is fed by each of the first paper feeding sections 6A to 6C of the paper feeding cassettes 5A to 5C, the first feeding section 6D of the manual feeding tray 5D and the first paper feeding section 6E of the large volume paper feeding device LT is transferred by the transfer means 43 via the second paper feeding section 6E. The sheet S carrying the image is fixed by the fixing device and then sent from the paper discharge section to the paper finishing apparatus B. Alternatively, the sheet S whose one side has undergone image processing and which was sent to the automatic double-sided copy paper feeding section 83 by the conveying path switching plate 8A is sent once again to the image forming section 4 and after image formation on both surfaces, is discharged from the paper discharge section 8.

[0059] The operation section 9 selects and sets the processing functions of the image forming device which is formed from the image forming apparatus proper A and the paper finishing apparatus B and the like.

[0060] The main controlling means 10 of the image forming apparatus proper A is connected to the paper post processing control means 10C of the paper finishing apparatus B through the communication section 10A and the communication circuit 10B.

Paper Finishing Apparatus

[0061] FIG. 2 is a schematic diagram showing a paper conveying operation performed in the middle folding and saddle stitch processing step of the paper finishing apparatus B. FIG. 3 shows a front view of the paper finishing apparatus B, while FIG. 4 shows a right side view of the same.

[0062] First the paper conveyance steps from the introduction of the paper to the step before the paper folding will be detailed in the following.
[0063] As shown in FIG. 2 and FIG. 3, when the sheet S which is discharged from the image forming apparatus proper A is introduced into the entrance section 11 of the paper finishing apparatus B, the sheet S is nippled by the entrance roller 12 and is conveyed into one of the upper paper conveying path r1 and the lower paper conveying path r2 located above the conveying path switching means G1.

<Straight Paper Discharging Operation>

[0064] The sheet S, which has branched to the paper conveying path r1, is nippled and conveyed by the conveyance rollers 13A-13E, and then, conveyed into the upper paper conveying path r3 located above the conveying path switching means G2 or the lower paper conveying path r4 located below the conveying path switching means conveying paper conveying means G2 (refer to FIG. 3).

[0065] The sheet S, which is advanced on the upper paper conveying path r3, is discharged by the discharge roller 14 and is stacked on the sub-discharge tray 15, which is disposed on the upper portion of the paper finishing apparatus B.

[0066] The sheet S, which is advanced on the lower paper conveying path r4, is nippled and conveyed by conveyance rollers 16A to 16D, and then, discharged by the discharge roller 17.

<First Right Angle Deflection Conveyance>

[0067] The sheet S, which is conveyed on the lower paper conveying path r2 located below the conveying path switching means G1, descends substantially at a right angle and temporarily stops at a prescribed position and is stored. At this stop position, the plurality of following sheets S are overlapped and stored.

<Second Right Angle Deflection Conveyance>

[0068] The stored sheet S is deflectively moved in the right-angle front direction with respect to the paper surface shown in FIG. 3, by the conveyance roller pairs 18A and 18B, the first conveyance roller pairs 18C and 18D, and a guide plate (not shown in the drawings). The sheet S then passes the paper conveying path r5 which goes around the front surface side of the inside of the paper finishing apparatus B in a state, in which sheet surface is upright, and then, stops at a prescribed position.

<Third Right Angle Deflection Conveyance>

[0069] Next, after the sheet S is conveyed upwards perpendicularly by the second conveyance roller pair 18E, it is inclined in the horizontal direction and then moved by the conveyance roller pair 19 and the conveyance alignment belt 20 (refer to the paper conveying path r6, shown in FIG. 4).

<Positioning of the Conveyance Direction Before Folding Processing>

[0070] The first conveyance means, disposed at downstream side of the conveying direction in the paper conveying path r6, holds and conveys the paper S traveling upward in the paper conveying path r6 constituted by the third conveyance roller pair 19 and two sets of the conveyance alignment belt 20.

[0071] The first adjusting means is constituted by an adjusting member 20A, which is movably fixed onto conveyance alignment belt 20 so as to push the trailing edge portion of paper S, and a stopper member 21 to which the leading edge portion of paper S is butted so as to position paper S. The adjusting member 20A pushes the trailing edge portion of paper S, which is conveyed by the third conveyance roller pair 19, disposed at upstream side of the conveying direction in the paper conveying path r6, to move paper S to the stopper member 21, and makes the leading edge portion of paper S butted against the stopper member 21 in order to align the paper S (refer to FIG. 4).

[0072] The position of the stopper member 21 is set in advance at a predetermined position, depending on the states of the paper size and the folding processing to be employed.

<Adjustment in the Paper Width Direction Before Folding Three Processing>

[0073] FIG. 5 shows a right side view of a folding means 30 and a conveying means 40. FIG. 6 shows a front view of the conveying means 40 and FIG. 7 shows a plan view of the conveying means 40.

[0074] The conveying means 40 (the second conveying means) conveys the paper S after deflecting the long side and the short side by substantially 90 degree in the conveying direction. The conveying means 40 is configured in such a manner that two conveyance belts 41, each of which has a conveying nail 42, are arranged in parallel (refer to FIG. 3 and FIG. 7).

[0075] The conveyance belts 41 are threaded on a driving pulley 41A and a driven pulley 41B. The driving pulley 41A is coupled to a motor M. The driving force generated by the motor M is transmitted through a gear train constituted by gears Z1-Z6, Z9 and Z10 (the driving force transmitting means), so as to rotate the conveyance belts 41 fixed on the same axis of gear Z10, and as a result, makes the conveyance belts 41, threaded on a driving pulley 41A and a driven pulley 41B, rotate (refer to FIG. 6).

[0076] The second adjusting means has butting members 43 (the adjusting member) fixed onto two adjusting belts 44. The two adjusting belts 44 are aligned in parallel with the two conveyance belts 41.

[0077] Numerals 46A and 46B indicate guide plates for guiding paper S passed through the paper conveying path r6 in the horizontal direction.

[0078] The driving force generated by the motor M is transmitted through a gear train constituted by gears Z1-Z7, so as to rotate a driving pulley 44A fixed on the same axis of a gear Z8 through a torque limiter 45, and as a result, makes the adjusting belts 44, threaded on a driving pulley 44A and a driven pulley 44B, rotate (refer to FIG. 6).

[0079] The driving means, constituted by the motor M, the gear train and the torque limiter 45, makes the conveyance belts 41 and the adjusting belts 44 rotate in either forward or reverse direction, and conducts a tripping operation of paper S in its width direction and a conveying operation of it. In other words, in response to the driving action of motor M in either forward or reverse direction, the conveyance belts 41 rotates clockwise (right rotation) when conducting a tripping operation for the folding three processing described later, while the conveyance belts 41 rotates counterclockwise (left rotation) when conducting the saddle stitch processing described later (refer to FIG. 6).
FIG. 8 shows a front view of the conveying means 40 indicating the paper width truing processes.

When the operator sets the folding three processing and inputs the width of paper S form the operation section 9 of the image forming apparatus proper A, the motor M is driven so that the conveying nail 42 passes through an initial position Q0 in response to the right rotation of conveyance belts 41, and then, stops at a standby position Q1. At the same time, in response to the driving operation of motor M, the butting members 43 passes through an initial position P0 and then, stops at a standby position P1. The initial position Q0 of the conveying nail 42 is detected by sensor PS.

When the paper S is introduced into the conveying means 40, in accordance with the right rotating action of the conveyance belts 41 driven by motor M, the conveying nail 42 starts to move from the standby position Q1 and stops at a truing position Q2. At the same time, in accordance with the right rotating action of the adjusting belts 44 driven by motor M, the butting members 43 starts to move from the standby position P1 and stops at a truing position P2.

Then, both sides of paper S are held in a state of being clipped between the truing position Q2 of the conveying nail 42 and the truing position P2 of the butting members 43 so as to achieve the paper width truing operation.

The driving means, constituted by the motor M and the driving force transmitting means, makes the conveying nail 42 and the butting members 43 move from the standby positions Q1, P1 to the truing positions Q2, P2 so as to achieve the paper width truing operation, and then, return to the standby positions Q1, P1.

<Inside Folding Three Processing>

The folding means 30 is disposed at downstream side of the conveyance alignment belt 20 in a paper conveying direction. Folding rollers 31, 32, 33, a first folding plate 34 and a second folding plate 35 constitute the folding means 30 (refer to FIG. 4 and FIG. 5).

When conducting the folding three processing, a first folding crease section la is formed in paper S by employing the folding rollers 31, 32 and the first folding plate 34, and then, a second folding crease section lb is formed in paper S by employing the folding rollers 32, 33 and the second folding plate 35. The folded three section SA is ejected onto an ejecting tray 38 by an ejecting roller 37 after passing through a paper conveying path 8, which is constituted by a plurality of conveying rollers 36 and a guide plate (refer to FIG. 4).

FIGS. 9(a) through 9(f) show schematic diagrams, indicating an inside folding three processing performed by the folding means 30.

(1) A single paper S or a plurality of papers S (hereinafter, also referred to as paper S, namely, the term of the “paper S” means a single paper or a plurality of papers, for simplicity) being trued in its width direction is/are conveyed through the paper conveying path located between guide plates 46A and 46B, and then, the leading edge portion of the single paper S or the plurality of papers S is batted against the stopper member 21 to stop thereat. The stopper member 21 is disposed at such a position that is ⅔ of a full length L of the paper S from a pressing position N of a pair of the folding rollers 31, 32 (refer to FIG. 9(a)).

(2) The combined operation of the rotating action of the folding rollers 31, 32 and the forwarding action of the first folding plate 34 forms the first folding crease section la in the paper S (the first folding processing, refer to FIG. 9(b)).

(3) The rotating action of the folding rollers 31, 32 elevates the paper S processed by the first folding processing in such a manner that the first folding crease section la is the leading portion, and travels through the guide surface of the guide plate 39 (refer to FIG. 9(c)).

(4) After the first folding crease section la reaches the predetermined position, which is ⅔ of the full length L of the paper S from the pressing position N of the pair of the folding rollers 31, 32, the second folding plate 35 moves forward toward the position opposite to the folding rollers 32, 33, in order to form the second folding crease section lb (refer to FIG. 9(d)).

(5) The folded three section SA created by forming the first folding crease section la and the second folding crease section lb in paper S is ejected by the folding rollers 32, 33 (refer to FIG. 9(e)). The folded three section SA ejected by the folding rollers 32 is further conveyed by the conveying rollers 36, which holds the folded three section SA between them, and is ejected by the ejecting roller 37 onto ejecting tray 38 on which the folded three section SA is stored (refer to FIG. 4).

FIG. 9(f) shows a perspective view of the inside folded-three section SA.

The middle fold processing, the saddle stitch processing and the fore edge cut processing, to be applied to paper S in the paper finishing apparatus B, will be detailed in the following.

<Middle Fold Processing>

FIG. 10 shows a schematic diagram of a folding means, indicating a middle fold processing performed prior to the saddle stitch processing.

The paper S arrived at the folding means 30 is press-clipped between the folding rollers 31, 32, which rotate in directions opposite relative to each other, by using the first folding plate 34, so as to achieve the folding two processing. Then, the folded section SA, in which a folding crease section lc is formed over the paper width direction at the center of the paper conveying direction, is formed.

The folded section SA, in which a first folding crease section lc is formed by conducting the folding two processing employing the folding rollers 31, 32 and the first folding plate 34, is released from the nip position between the folding rollers 31, 32 by rotating them in reverse directions, and is returned to the horizontal conveying path formed by guide plates 46A, 46B.

Successively, the folded section SA is conveyed to the paper conveying path 7 in a direction of extended line of the folding crease section lc, to introduce it into the saddle stitch means 60 (refer to FIG. 2 and FIG. 3).
As described in the above, a small number of papers S, including one paper or three papers, is/are tightly folded by the folding means 30 so as to clearly form the folding crease section 1a, and successively introduced into the saddle stitch means 60. Accordingly, it becomes possible to produce a high-quality booklet SB (a bookbinding product) having a little swelling at the folding crease section 1c.

**<Saddle Stitch Processing>**

**[0100]** FIG. 11 shows a left side view of the paper finishing apparatus B.

**[0101]** At the folding means 30, the middle folded section SA, which have been subjected to middle folding processing, is conveyed in the direction of the paper conveyance path 7 by the conveyance means 40 detailed later, and is stacked on the saddle stacking means 61 of the saddle stitch means 60. Next, the following middle folded section SA, which has undergone middle folding also, passes the paper conveyance path 7 and is stacked on the saddle stacking means 61.

**[0102]** The saddle stacking means 61 includes two guide plates, which intersect each other substantially at a right angle and is fixed on the main body of the paper finishing apparatus B. A pressing member 61A, which is urged by a spring and is elevatable, is disposed in the vicinity of the vertex portion of the saddle stacking means 61 in a state in which it is supported by the stitch receiving mechanism 64 (See FIG. 10).

**[0103]** The vertex portion of the pressing member 61A has substantially a right angular protruded shape. The folding crease section 1a of the middle folded section SA is put on the vertex portion along its edge line.

**[0104]** A plurality of middle folded sections SA, which are stacked on the saddle stacking means 61 and the pressing member 61A, are trued in its position by the width aligning means 62.

**[0105]** A stapling mechanism 63 is fixed above the pressing member 61A. The pressing member 61A and the staple receiving mechanism 64 are supported in a state of being movable in the vertical direction inside the saddle stacking means 61.

**[0106]** Two sets of the binding means having the split structure, constituted by the stapling mechanism 63 and the staple receiving mechanism 64, are disposed in the direction of the folding crease section line. When the binding process is set in the operation section, the staple receiving mechanism 64 moves upwards to perform the binding process. Concretely speaking, the combination of the stapling mechanism 63 and the staple receiving mechanism 64 staples a stapling needle SP at each of two positions equally split from the center along the folding crease section line of the middle folded sections SA putted on the pressing member 61A. The booklet SB, which has undergone the middle folding processing and the saddle stitch partch, is shown in the schematic diagram shown in FIG. 2.

**<Retrieval of Booklet>**

**[0107]** The booklet SB, which has undergone saddle stitch processing at the saddle stitch means 60, is held at the support member 72 which is fixed at the front end of the arm member 71 of the bound book retrieving means 70, and is swung in the direction of the single dot chain arrow by the arm member 71, and is conveyed by the bound book conveyance means 80.

**<Conveying Operation of Booklet>**

**[0108]** The booklet SB, which has been conveyed by the bound book conveyance means 80, is stacked on the conveyance belt 82. The booklet SB is conveyed in the lower incline direction due to the rotation of the conveyor belt 82, and is held in an inclined state, and is moved by the rotating convey belt 83 and stopped at a prescribed position. Subsequently, the conveyor belt 83 swings and is supported in a horizontal state.

**<Booklet Cutting Processing>**

**[0109]** The fore edges (the free end at the opposite side of the folding line portion) a of the booklet SB, which is loaded on the conveyor belt 83 which is in a horizontal state, is not in an aligned state due to the number of sheets in the booklet SB and thus it is cut by the paper cutting device of this invention and the fore edges are aligned.

**[0110]** The booklet SB, that is created by the cutting processing, is stacked on conveyor belt 83 which rotates in the opposite direction, and the rear end of the booklet SB is conveyed in a pressed state by the variable aligning member 84 which is fixed on the conveyor belt 83, and falls in the direction of the arrow from the front end of the conveyor belt 83. The booklet SB, that has dropped, is discharged to the discharge tray 86, which is disposed at the outer side of the front surface side Bf of the paper finishing apparatus B, by the rotating discharge belt 85.

**[0111]** As described in the foregoing, according to the present invention, by adding the paper truing function to the paper conveying means to be employed in the paper post processing without adding another driving source, it becomes possible to simplify the configuration of the apparatus and to improve the stability of the apparatus.

**[0112]** Further, by applying the width truing adjustment to a plurality of papers before applying the post processing, such as the folding processing, etc., it becomes possible to provide a plurality of high-quality folded sections in which the papers are accurately trued and folded in its width direction.

**[0113]** Still further, according to the present invention, since the width truing means waits at a standby position in the vicinity of the truing position being apart from the initial position, it is not necessary to return to the initial position every time of the processing, and therefore, it becomes possible to speedily true the papers in its width direction without lowering the productivity of the image-forming apparatus proper.

**[0114]** Disclosed embodiment can be varied by a skilled person without departing from the spirit and scope of the invention.

1. An apparatus for conveying a paper while deflecting a long side and a short side of said paper at substantially 90 degree relative to a current conveyance direction of said paper, said apparatus comprising:

   a first conveying section to convey said paper in a first conveyance direction;
a second conveying section that includes a conveyance belt to deflect said current conveying direction of said paper so as to convey said paper in a second conveying direction, which is substantially orthogonal to a longitudinal direction of a leading edge of said paper conveyed in said first conveying section, wherein said conveyance belt includes a conveying nail formed as a protrusion protruded from said conveyance belt.

a stopper member that is movable to stop and release a side edge portion of said paper, conveyed by said first conveying section, in a width direction of said paper; and

a driving section to drive both said conveyance belt and said stopper member;

wherein said driving section moves said conveying nail and/or said stopper member from an external area outside a paper conveying area, so that a width truing operation is achieved by batting said conveying nail and said stopper member against both side edge portions of said paper.

2. The apparatus of claim 1,

wherein said conveying nail and said stopper member are positioned to a truing position at which said conveying nail and said stopper member are battéd against said both side edge portions of said paper, or a standby position at which a gap between said conveying nail and said stopper member is wider than that at said truing position.

3. The apparatus of claim 2,

wherein said driving section moves said conveying nail and/or said stopper member from said standby position to said truing position in order to conduct said width truing operation, and after said width truing operation is completed, said driving section again moves said conveying nail and/or said stopper member from said truing position to said standby position.

4. A paper finishing apparatus for applying finish processing to a paper or a plurality of papers while conveying said paper or said plurality of papers, said paper finishing apparatus comprising:

a conveying mechanism to convey and stack said paper or said plurality of papers;

a stopper member, being movable, to stop a side edge portion of said paper or said plurality of papers conveyed and stacked by said conveying mechanism so as to achieve a width truing operation;

a truing section that includes a conveying nail, being movable and disposed in parallel with said stopper member in such a manner that said stopper member and said conveying nail oppose to each other;

a driving section to drive both said stopper member and said conveying nail; and

a finish processing section to apply said finish processing to said paper or said plurality of papers trued by said truing section;

wherein said driving section moves said stopper member and/or said conveying nail from an external area outside a paper conveying area, so that said width truing operation is achieved by batting said stopper member and/or said conveying nail against both side edge portions of said paper or said plurality of papers.

5. The paper finishing apparatus of claim 4,

wherein said conveying mechanism includes:

a first conveying section to convey said paper or said plurality of papers in a first conveying direction;

a second conveying section that includes a conveyance belt to deflect said first conveying direction of said paper or said plurality of papers so as to convey said paper or said plurality of papers in a second conveying direction, which is substantially orthogonal to a longitudinal direction of a leading edge of said paper or said plurality of papers conveyed in said first conveying section.

6. The paper finishing apparatus of claim 5,

wherein said conveyance belt includes said conveying nail formed as a protrusion protruded from said conveyance belt.

7. The paper finishing apparatus of claim 6,

wherein said conveying nail and said stopper member are positioned to a truing position at which said conveying nail and said stopper member are battéd against said both side edge portions of said paper or said plurality of papers, or a standby position at which a gap between said conveying nail and said stopper member is wider than that at said truing position.

8. The paper finishing apparatus of claim 7,

wherein said driving section moves said conveying nail and/or said stopper member from said standby position to said truing position in order to conduct said width truing operation, and after said width truing operation is completed, said driving section again moves said conveying nail and/or said stopper member from said truing position to said standby position.

9. The paper finishing apparatus of claim 4,

wherein said finish processing section includes:

a folding device to fold said paper or said plurality of papers conveyed by said conveying mechanism and trued by said truing section.

10. The paper finishing apparatus of claim 9,

wherein said folding device applies said folding two processing or said folding three processing to said paper or said plurality of papers trued by said truing section.

11. A system for forming an image on a paper or a plurality of papers, comprising:

an image forming apparatus that forms said image on said paper or said plurality of papers and ejects said paper or said plurality of papers; and

a paper finishing apparatus that receives said paper or said plurality of papers, ejected by said image forming apparatus, and applies finish processing to said paper or said plurality of papers, while conveying said paper or said plurality of papers,

wherein said paper finishing apparatus includes:

a conveying mechanism to convey and stack said paper or said plurality of papers;
a stopper member, being movable, to stop a side edge portion of said paper or said plurality of papers conveyed and stacked by said conveying mechanism so as to achieve a width truing operation;

a truing section that includes a conveying nail, being movable and disposed in parallel with said stopper member in such a manner that said stopper member and said conveying nail oppose to each other;

a driving section to drive both said stopper member and said conveying nail; and

a finish processing section to apply said finish processing to said paper or said plurality of papers trued by said truing section;

wherein said driving section moves said stopper member and/or said conveying nail from an external area outside a paper conveying area, so that said width truing operation is achieved by bat ting said stopper member and/or said conveying nail against both side edge portions of said paper or said plurality of papers.

12. The system of claim 11,

wherein said conveying mechanism includes:

a first conveying section to convey said paper or said plurality of papers in a first conveyance direction;

a second conveying section that includes a conveyance belt to deflect said first conveying direction of said paper or said plurality of papers so as to convey said paper or said plurality of papers in a second conveyance direction, which is substantially orthogonal to a longitudinal direction of a leading edge of said paper or said plurality of papers conveyed in said first conveying section.

13. The system of claim 12,

wherein said conveyance belt includes said conveying nail formed as a protrusion protruded from said conveyance belt.

14. The system of claim 13,

wherein said conveying nail and said stopper member are positioned to a truing position at which said conveying nail and said stopper member are batt ed against said both side edge portions of said paper or said plurality of papers, or a standby position at which a gap between said conveying nail and said stopper member is wider than that at said truing position.

15. The system of claim 14,

wherein said driving section moves said conveying nail and/or said stopper member from said standby position to said truing position in order to conduct said width truing operation, and after said width truing operation is completed, said driving section again moves said conveying nail and/or said stopper member from said truing position to said standby position.

16. The system of claim 11,

wherein said finish processing section includes:

a folding device to fold said paper or said plurality of papers conveyed by said conveying mechanism and trued by said truing section.

17. The system of claim 16,

wherein said folding device applies a folding two processing or a folding three processing to said paper or said plurality of papers trued by said truing section.

18. An apparatus for conveying a paper while deflecting a long side and a short side of said paper at substantially 90 degree relative to a current conveyance direction of said paper, said apparatus comprising:

first conveying means for conveying said paper in a first conveyance direction;

second conveying means, including a conveyance belt to deflect said current conveying direction of said paper, for conveying said paper in a second conveyance direction, which is substantially orthogonal to a longitudinal direction of a leading edge of said paper conveyed in said first conveying means, wherein said conveyance belt includes a conveying nail formed as a protrusion protruded from said conveyance belt;

stopper means, being movable, for stopping and releasing a side edge portion of said paper, conveyed by said first conveying means, in a width direction of said paper; and

driving means for driving said conveyance belt and said stopper member;

wherein said driving means moves said conveying nail and/or said stopper means from an external area outside a paper conveying area, so that a width truing operation is achieved by bat ting said conveyance nail and said stopper means against both side edge portions of said paper.

19. A paper finishing apparatus for applying finish processing to a paper or a plurality of papers while conveying said paper or said plurality of papers, said paper finishing apparatus comprising:

conveying means for conveying and stacking said paper or said plurality of papers;

stopper means, being movable, for stopping a side edge portion of said paper or said plurality of papers conveyed and stacked by said conveying means so as to achieve a width truing operation;

truing means that includes a conveying nail, being movable and disposed in parallel with said stopper means in such a manner that said stopper means and said conveying nail oppose to each other;

driving means for driving both said stopper means and said conveying nail; and

finish processing means for applying said finish processing to said paper or said plurality of papers trued by said truing means;

wherein said driving means moves said stopper means and/or said conveying nail from an external area outside a paper conveying area, so that said width truing operation is achieved by bat ting said stopper means and/or said conveying nail against both side edge portions of said paper or said plurality of papers.

20. A paper conveying apparatus, wherein,

in the paper conveying apparatus that conveys a paper, to be conveyed, by deflecting a long side direction and a
short side direction of said paper at 90 degree in a conveyance direction of said paper, there is provided with:

first conveying means for conveying said paper in a first conveyance direction;

second conveying means that includes a conveyance belt for deflecting said conveying direction of said paper so as to convey said paper in a second conveyance direction, which is orthogonal to a leading edge of said paper conveyed in said first conveying section;

a conveying nail formed as a protrusion protruded from said conveyance belt;

a batting member, being movable, for contacting and releasing a side edge portion of said paper, conveyed by said first conveying means, in a width direction of said paper; and

a driving means for driving both said conveyance belt and said batting member; and

said driving means moves said conveying nail and/or said batting member from outside of a paper conveying area, and conducts a width truing operation by batting said conveying nail and said batting member against both side edge portions of said paper.

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