ABSTRACT OF THE DISCLOSURE

A method of folding foldable limp sheet material, for example laundry workpieces, which comprises supporting the sheet material in an open condition, restraining it along a fold line against upward movement, directing a curtain of air upwardly against the material from below along a line to one side of the fold line to raise the material at said one side of the fold line from its supported position and causing the raised material to swing across the fold line and then downwardly by constraining at least some of the air of the curtain to flow across the fold line.

In a preferred method two marginal portions of the material are folded inwardly towards one another about spaced parallel fold lines.

The disclosure includes apparatus for performing the method.

The present invention relates to folding of foldable limp sheet material and especially of laundry workpieces.

According to the present invention limp sheet material is folded by supporting it in an open condition, restraining it along a fold line against upward movement, directing a curtain of air upwardly against the material from below along a line to one side of the fold line to raise the material at said one side of the fold line from its supported position and causing the raised material to swing across the fold line and then downwardly by constraining at least some of the air of the curtain to flow across the fold line. Preferably at least some of the air curtain is constrained to flow across the fold line and then downwardly towards that part of the material at the other side of the fold line. The air curtain may be directed upwardly along a line immediately to one side of the fold line.

A further feature of the invention resides in folding limp sheet material on itself to a prescribed width by folding two marginal portions of the material inwardly towards one another in the manner set forth above about parallel fold lines which are spaced to correspond with said prescribed width. If said marginal portions are to overlap when folded then one curtain of air may be directed upwardly against one of said marginal portions before a second curtain of air is directed upwardly against the other.

The method of the present invention may be carried out while the material is stationarily supported for example on a platform or while supported on a travelling conveyor. The material may be restrained against upward movement along the fold line by a rod, rail or the like.

Apparatus for folding limp foldable sheet material according to the present invention comprises means for supporting the sheet material in an open condition, means for restraining the sheet material along a fold line against upward movement, a slot or gap in said supporting means to one side of the fold line, last means for directing a curtain of air upwardly from or through said slot or gap and guide means located above the fold line for constraining at least some of the air of the curtain to flow across the fold line. The said guide means may be arched transversely of the fold line in order to constrain at least some of the air of the curtain to flow across the fold line and then downwardly towards the supporting means at the other side of the fold line.

A folding device according to the invention may comprise means for restraining the sheet material along two spaced parallel fold lines (for example two parallel rods), a slot or gap in the supporting means to one side of each of the fold lines remote from the other, blast means for directing a curtain of air upwardly from or through each said slot or gap and guide means above each fold line.

The material to be folded may be conveyed to a folding location beneath said restraining means by a conveyor which comprises conveyor belts which provide therebetween a slot or gaps or slots or gaps through which an air curtain or curtains may be directed.

To enable the material to be folded whilst travelling on the conveyor the said constraining rods may be smoothly surfaced and conveyor tapes may be lightly spaced.

The invention is further described by way of example with reference to the accompanying drawings, in which:

FIGS.1 and 2 are a diagrammatic perspective and an end view illustrating the general principle of the invention;

FIG. 3 illustrates a sheet of material folded by means of the invention;

FIGS. 4 to 7 are diagrammatic side views illustrating one form of device according to the present invention at different stages of operation;

FIG. 8 is a diagrammatic end view illustrating a portion of the device of FIG. 4;

FIG. 9 is a plan view illustrating a modification of a part of the invention;

FIG. 10 is a perspective view illustrating a folding device according to the invention for folding sheet material whilst moving on a travelling conveyor; and

FIG. 11 is a perspective view illustrating a folding device, somewhat different from that of FIGS. 4 to 7, for folding sheet material whilst stationary.

In FIG. 1 a pair of parallel restraining rods 1 are connected by a yoke 2 and supported from above by an upward projection 3 extending from the middle of the yoke 2. The rods 1 are arranged above and extend longitudinally of a tape conveyor 4 supported by conveyor rollers 5, 6. Each of the rods 1 are arranged parallel to and inwardly of a gap 8 between two of the tapes of the conveyor. A transverse presser roller 10 is disposed just beyond the rods 1 in order to crease the folded material as it leaves the rods 1.

For the sake of simplicity of description a sheet of material 12 is shown in FIG. 2 supported on a platform 13 instead of on a belt. Parallel linear slots 14 run lengthwise of the platform 13 and rods 15 extend along and above the inner margins of the slots 14. A blast pipe 16 is disposed beneath each of the slots 14.

Above each blast pipe 16 and rod 15 there is a transversely arched guide sheet 17 which extends inwardly and upwardly to a locality beyond rod 15 and then descends towards the platform 13. Margins of the material to be folded are shown in a flat condition at 20, in a fully folded condition at 21 and in an intermediate condition at 22. From this it will be appreciated that the folding is achieved by constraining the air curtain to blow firstly inwardly and upwardly and then inwardly and downwardly.

FIG. 3 illustrates the sheet 12 when folded.

The device illustrated in FIGS. 4 to 7 incorporates the
tape conveyor 4 of FIG. 1 supported by conveyor rolls 5, 6, a pair of parallel rods 1 supported from an upward projection 3 and a presser roller 10. A feeder device for sensing the arrival at the folding position of a piece of material 20 to be folded is diagrammatically illustrated at 26. A platform 27 disposed between the upper and lower runs of the conveyor 4 is supported by two transversely spaced ramps 28 which are capable of raising the platform as illustrated in FIG. 5 and of lowering it again as illustrated in FIG. 7. The appearance of the platform in end view is illustrated in FIG. 8 from which the ramps 28 are omitted. The platform has narrower parallel channels 30 in its upper surface each capable of receiving one of the tapes of the conveyor 4 and it also has wider parallel channels 31 each capable of receiving a tape of the conveyor and one of the blast pipes 16 of FIG. 2. Arched guide sheets 32 (not shown in FIGS. 4 to 7) substantially similar to the guide sheets 17 of FIG. 2 are arranged respectively above the blast pipes 16.

When the forward end of a workpiece 25 reaches the feeder device 26 a timing mechanism is set in operation which first of all causes the conveyor 4 to stop. The platform 27 is then automatically caused to rise as indicated by the arrow 33 to the position shown in FIG. 5 so as to bring the surface of the platform into abutment with the rods 1 whereby to clamp the piece 25 therebetween. An air curtain is then caused to issue upwardly from blast pipes 16 (not shown in FIGS. 4 to 7). The material is then caused to move as indicated by the broken lines in FIG. 8 to reach a folded condition as illustrated in FIG. 6. The timing mechanism then causes the platform 27 to descend as illustrated by the arrow 34 to its original position and re-starts the conveyor 4 to pass the folded piece 25 between a presser platform 35 and presser roller 10.

FIG. 9 diagrammatically illustrates part of an alternative form of device in which the restraining rods 1 are provided with slightly divergent extensions 40 to enhance the neatness of the fold prior to the arrival of the folded material beneath the presser roller 10. FIG. 9 illustrates a case where the folded margins 41, 42 overlap. When the margins of the folded material are to overlap the issue of the air curtains from the blast pipes 16 should be separately timed to enable the folding of one margin of the material to begin before the other.

In FIG. 10 the restraining means comprises a pair of parallel rods 1 supported from a yoke 2 and supported from above by a projection 3 from the middle of the yoke 2. The rods 1 are arranged above and extend longitudinally of a tape conveyor 4 supported by conveyor rolls 5, 6. Each of the rods 1 is arranged parallel to and at the inner edge of a gap 8 between two of the tapes of the conveyor.

A blast pipe 16 is arranged in each of the gaps 8. Guide means 17 are arched transversely over each of the rods 1. The supply of air to the blast pipes 16 is controlled by a sensing device 26 which is capable of detecting the arrival beneath the restraining rods 1 of a piece of material to be fed.

The rods 1 are smoothly surfaced and the conveyor tapes more roughly surfaced. Transverse press roller 10 extends across the conveyor 4 at the downstream side of the rods 1 and guides 17. The device of FIG. 10 folds the workpiece while traversing the conveyor 4.

The folding device illustrated in FIG. 11 is largely similar to that of FIG. 10 but is adapted for folding a workpiece when stationary and it differs from that of FIGS. 4 to 7 in that the platform 27 of FIGS. 4 to 7 is replaced by a set of interconnected spaced parallel lifter bars 45 located in gaps between the tapes of the conveyor 4. The set of lifter bars 45 are raised and lowered by a set of four pneumatic jacks 46 (of which only three can be seen in FIG. 11). The sensing device 26 is capable of detecting the arrival beneath the rods 1 of a sheet of material to be folded and with the aid of a timing device controls first of all the raising of the jacks 46 to raise the lifter bars 45, then the supply of air to the blast pipes 16, then the discontinuance of the air supply to the blast pipes and the lowering of the jacks 46.

1 claim:
1. A method of folding limp sheet material, for example laundry workpieces wherein the sheet material is supported in an open condition and is folded across a fold line along which it is restrained against upward movement characterized by directing a curtain of air upwardly against the material from below along a line to one side of the fold line to raise the material at said one side of the fold line from its supported position and at some distance above the fold line to the air curtain to change direction to constrain at least some of the air of the curtain to flow across the fold line and thus to cause the raised material to swing across the fold line.
2. A method according to claim 6 in which at least some of the air of the curtain is constrained to flow across the fold line and then to fold the raised part of the material at the other side of the fold line.
3. A method according to claim 6 in which the material is folded while supported on a travelling conveyor.
4. A method according to claim 6 in which two marginal portions of the material are folded inwardly towards one another about spaced parallel fold lines.
5. A method according to claim 4 in which said marginal portions are folded by two air curtains, one of which is directed upwardly against one of said marginal portions and the other directed upwardly against the other of said marginal portions.
6. Apparatus for folding limp sheet material, for example laundry workpieces comprising means for supporting the sheet material in a flat open condition, means for restraining the sheet material along a fold line against upward movement, a slot in said supporting means to one side of the fold line, blast means for directing a curtain of air upwardly through said slot, and air guide means located above the fold line for constraining at least some of the air of the curtain to flow across the fold line for folding a portion of the sheet material inwardly about the fold line.
7. Apparatus according to claim 6 in which said guide means is arched transversely of the fold line in order to constrain at least some of the air of the curtain to flow across the fold line and then to cause the raised material to swing across the fold line.
8. Apparatus according to claim 6 comprising means for restraining the sheet material along two spaced parallel fold lines, a gap in said supporting means to one side of each of the fold lines remote from the other, an air curtain for causing a curtain of air to flow upwardly from each of said gaps and guide means above each fold line.
9. Apparatus according to claim 6 in which said restraining means comprises a rod.
10. Apparatus according to claim 6 in which the material to be folded is conveyed towards a folding location beneath said restraining means by means of a conveyor which comprises conveyor tapes which provide therebetween a gap through which an air curtain may be directed.
11. Apparatus according to claim 10 comprising a tape conveyor, a platform located beneath said restraining means and between the upper and lower runs of the conveyor and capable of being raised into abutment with the restraining means and of being lowered therefrom and formed with channels to accommodate the tapes of the conveyor and to accommodate at least one blast air supply pipe running parallel with said restraining means and with the spaced parallel lifter bars located beneath said restraining means and between the upper and lower runs of the conveyor and capable of being raised into abutment with the restraining means and
of being lowered therefrom, each of said lifter bars being located between two adjacent tapes of the conveyor, and a blast air supply pipe or pipes running parallel with said restraining means and with the tapes of the conveyor.

13. Apparatus according to claim 6 comprising a sensing means controlling the supply of air to said blast means and capable of detecting the arrival beneath said restraining means of material to be folded.

14. Apparatus according to claim 6 comprising a presser roll extending across the supporting means beyond the restraining means.

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