Feb. 23, 1971 A. BATZDORFF ET AL 3,564,738

METHOD AND APPARATUS FOR ARRANGING AN ARTICLE OF LAUNDRY TO A PLANAR FORM

Filed March 6, 1969

FIG. 1

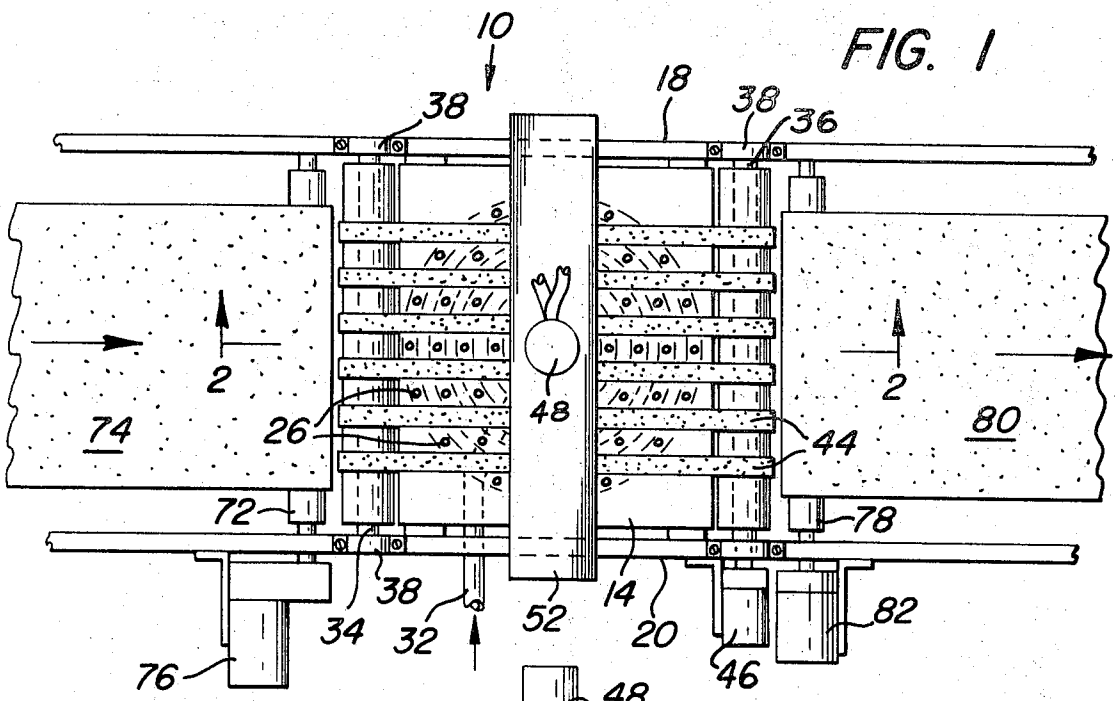



FIG. 2

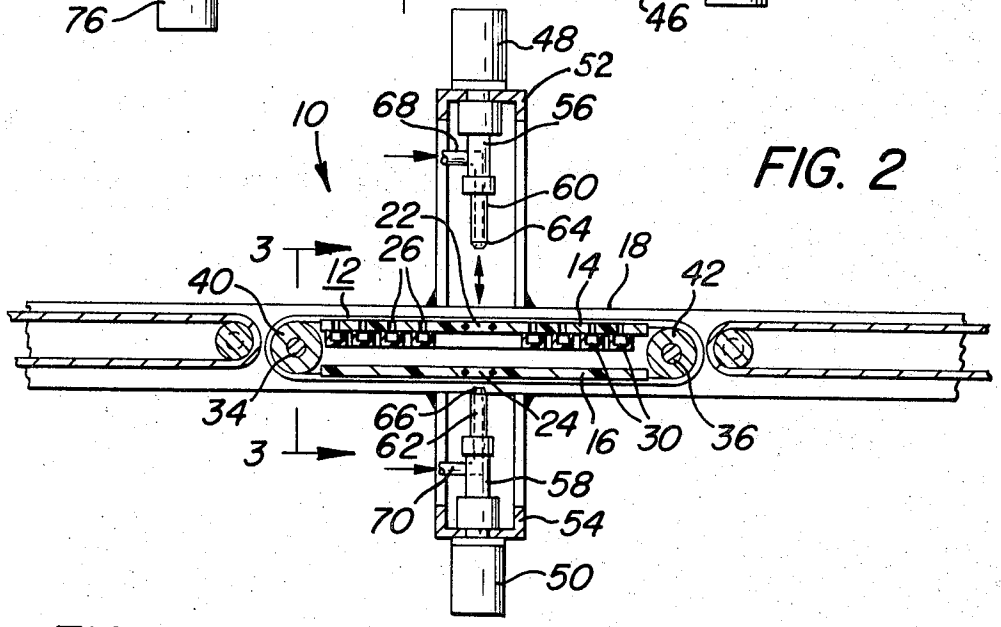
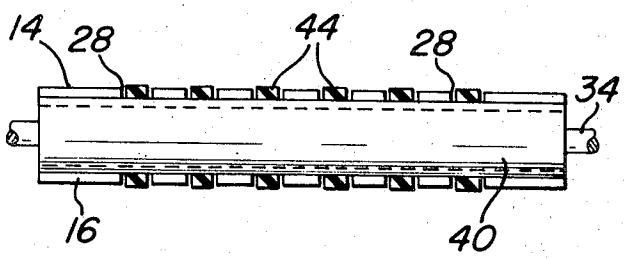



FIG. 3





INVENTORS.
ALFRED BATZDORFF
AMOTZ FRENKEL
BY Jacob Trachtman
ATTORNEY

United States Patent Office 3,564,738 Patented Feb. 23, 1971



3,564,738

# METHOD AND APPARATUS FOR ARRANGING AN ARTICLE OF LAUNDRY TO A PLANAR FORM

Alfred Batzdorff, Neshaminy Woods, Langhorne, and Amotz Frenkel, Lansdale, Pa., assignors to American Electronic Laboratories, Inc., Colmar, Pa., a corporation of Pennsylvania

Filed Mar. 6, 1969, Ser. No. 804,889
Int. Cl. D06c 3/00 D06f 67/04
U.S. Cl. 38—143 14 Claims

## ABSTRACT OF THE DISCLOSURE

A method and apparatus for arranging a flexible article, such as a towel, napkin, sheet or the like, which is heaped in random configuration, to a substantially planar form. The method and apparatus includes holding the article at a point of single thickness and applying a current of air across the surface of the article in all radial directions from the holding point. The flow of the current of air over the surface of the article completely unfolds the article until the article lies in substantially a single plane.

The present invention relates to a method and apparatus for arranging a flexible article, such as an article of laundry, which is heaped in random configuration, to a substantially planar form, and more particularly to a method and apparatus for automatically rearranging individual articles of laundry to planar form.

In a commercial laundry when the pieces of laundry are taken from the washer or dryer, many such pieces, such as towels, napkins, sheets, tablecloths and the like, must be arranged in planar form in order to permit folding or ironing of the pieces. Heretofore, arranging the individual pieces of laundry in planar form has been carried out manually by either the operator who folds the piece or by the operator who irons the piece. Such manual handling of the individual pieces of laundry is both a time consuming and costly operation. In addition, it slows down any following operations which must be performed on the pieces of laundry. Therefore, it would be desirable to have a method and apparatus which automatically arranges the individual pieces of laundry into planar form so as to improve the operation of the laundry.

It is therefore an object of the present invention to provide a novel method for arranging articles of laundry into planar form.

It is another object of the present invention to provide a method for arranging articles of laundry which are heaped in individual piles of random configuration into planar form.

It is a further object of the present invention to provide an apparatus for automatically arranging heaped articles of laundry into planar form.

These objects are achieved by a method and apparatus in which articles of laundry which are heaped in random configuration in piles of single pieces are arranged into planar form. For this purpose each article is held at a point of single thickness, and a current of air is then applied across the surfaces of the article, which current of air emanates from the point that the article is held and which flows radially in all directions from the holding point. The air flowing over the surfaces of the article arranges the article into planar form. The flow of air is then stopped and the article released so that it is now in planar form and ready for further processing.

For the purpose of illustrating the invention there is shown in the drawing a form which is presently preferred; it being understood, however, that this invention is not limited to the precise arrangements and instrumentalities shown.



FIG. 1 is a top plan view of the apparatus of the present invention.

FIG. 2 is a sectional view of the apparatus taken along line 2—2 of FIG. 1.

FIG. 3 is a sectional view taken along line 3—3 of FIG. 2.

The method of the present invention in general comprises holding an article of laundry which is heaped in a pile of random configuration at an area of single thickness, and passing a current of air over the surfaces of the article radially in all directions from the point at which the article is held until the article is unraveled into planar form. More particularly, the article is held between a pair of vertically aligned nozzles from which the air emanates in all directions from the ends of the nozzles. Also, conveyor means are provided to carry the individual piles of the articles to the nozzles and to carry the articles in a planar form from the nozzles. In addition, a thin cushion of air may be provided on which the article rests during the arrangement of the article.

Refer to the drawing which illustrates an apparatus **10** for carrying out the method of the present invention and which apparatus is referred to as a "planing apparatus" since it arranges the articles of laundry to a planar form.

Planing apparatus **10** comprises a horizontal table **12** having a pair of horizontally extending rectangular plates **14** and **16** secured in vertically spaced, parallel relation between a pair of horizontally extending, parallel side rails **18** and **20**. The side rails **18** and **20** are supported above the floor on suitable legs or a frame, not shown. The plates **14** and **16** have vertically aligned openings **22** and **24** respectively through the centers thereof (see FIG. 2). Top plate **14** has a plurality of small holes **26** therethrough. As shown in FIG. 1, the holes **26** are arranged in a plurality of concentric circles around the opening **22**. The top plate **14** may also have a plurality of narrow, shallow grooves **28** in its top surface for guiding endless conveyor belts described below. The grooves **28** are arranged in spaced, parallel arrangement across the width of the top plate and extend from one end of the top plate to its other end between the holes **26**.

A plurality of circular manifold tubes **30** are secured to the bottom surface of the top plate **14**. Each of the manifold tubes **30** is positioned in alignment with a separate set of the circularly arranged holes **26**, and is open to its respective set of holes **26**. An air feeder pipe **32** extends through the side rail **20** and is connected to each of the manifold tubes **30**. The feeder pipe **32** is connected to a suitable means for providing air under pressure, such as a fan or pump not shown, so as to feed the air through the manifold tubes **30** to the holes **26**. However, instead of the manifold tubes **30**, the plates **14** and **16** may be connected together to form a sealed chamber therebetween with the feeder pipe **32** supplying the air to the chamber.

A pair of parallel shafts **34** and **36** extend between the plates **14** and **16** at the ends of the plates, and are rotatably supported in bearings **38** on the side rails **18** and **20** (see FIG. 1). A plurality of pulleys **40** are mounted in spaced relation on the shaft **34**, and a plurality of pulleys **42** are mounted in spaced relation on the shaft **36**. The number of pulleys **40** and **42** on the shafts **34** and **36** is equal to the number of grooves **28** in the top plate **14**, and the pulleys **40** and **42** are positioned in alignment with the grooves **28**. A plurality of narrow endless belts **44** extend around the table **12** and extend from one end of the table to its other end. Each of the belts **44** rides in a separate one of the grooves **28** in the top plate **14** and extends around a separate set of aligned pulleys **40** and **42**. A clutched motor **46** is connected to the shaft **36** to rotate the shaft **36** and thereby move the belts **44** across the top plate **14**.

A pneumatic cylinder **48** is mounted above the table **12**, and a pneumatic cylinder **50** is mounted below the table **12**. The pneumatic cylinders **48** and **50** are mounted with their axes in vertical alignment with each other and with the openings **22** and **24** in the table plates **14** and **16**. The pneumatic cylinder **48** is supported on a bracket **52** which extends across the width of the top plate **14** and is mounted on the side rails **18** and **20**. The pneumatic cylinder **50** is supported on a bracket **54** which extends across the width of the bottom plate **16** and is mounted on the side rails **18** and **20**. The piston rods **56** and **58** of the pneumatic cylinders **48** and **50** respectively extend toward the table **12**. Tubular nozzles **60** and **62** are secured to the ends of the piston rods **56** and **58** respectively in vertical alignment therewith. The ends of the nozzles **60** and **62** are frusto-conical and have a plurality of circumferentially spaced holes **64** and **66** respectively in the conical surfaces thereof. Tubes **68** and **70** extend into the nozzles **60** and **62** respectively and are connected to a suitable source of air under pressure so as to feed the air to and through the nozzles. The pneumatic cylinders **48** and **50** are so positioned and the strokes of the piston rods **56** and **58** are such that upon being extended the end of the nozzle **60** extends to the upper surface of the top plate **14** and the end of the nozzle **62** extends through the openings **24** and **22** in the table plates **16** and **14** to the upper surface of the top plate **14**.

A shaft **72** is rotatably supported between the side rails **18** and **20** adjacent the shaft **34**. A wide conveyor belt **74** extends around and is driven by the shaft **72**. The conveyor belt **74** extends to the location in the laundry where the articles of laundry are singled out from piles of washed and dried laundry for delivery to the planing apparatus. Thus, the conveyor belt **74** serves to deliver the articles of laundry to the table **12**. A motor **76** is connected to the shaft **72** to drive the conveyor belt **74**. A shaft **78** is also rotatably supported between the side rails **18** and **20** adjacent the shaft **36**. A wide conveyor belt **80** extends around and is driven by the shaft **78**. The conveyor belt **80** extends to a place in the laundry where further operations are performed on the articles of laundry, such as where the ironing machines or the place for folding the articles are located. Thus, the conveyor belt **80** serves to carry the articles of laundry from the table **12** to the next operation. A motor **82** is connected to the shaft **78** to drive the conveyor belt **80**.

In the operation of the planing apparatus **10**, the individual articles of laundry, either damp dry as they come from the washer or completely dry as they come from the dryer, are individually positioned in piles of random configuration on the center of the conveyor belt **74** with the articles being spaced from each other along the conveyor belt. The conveyor belt **74** carries the first article to the table **12**. At the table **12** the article of laundry is transferred to the belts **44** by the conveyor belt **74** which is positioned proximate to and moves the article onto the belts **44** of the table **12**. The belts **44** carry the article over the top plate **14** and between the nozzles **60** and **62**. When an area of the article of single thickness comes between the nozzles **60** and **62** the movement of the belts **44** is stopped. Conveyor belt **74** may also be stopped until the next article is to be delivered to the table **12**.

At this time the following operations occur in rapid succession. Air is admitted into the pneumatic cylinders **48** and **50** so as to move the nozzles **60** and **62** together until they clamp the article of laundry therebetween. Air is admitted through the feeder pipe **32**, manifold tubes **30** and holes **26** in the top plate **14** so as to form a thin cushion of air on the top plate **14**. Air is then passed through the tubes **68** and **70**, nozzles **60** and **62** and out through the holes **64** and **66** in the ends of the nozzles. This provides a flow of air over the surfaces of the article of laundry which flow extends radially in all directions from the nozzles **60** and **62**. This flow of air causes the



article of laundry to unravel and arranges the article into planar form.

When the article of laundry is in planar form, the following operations occur. The flow of air through the holes **26** in the top plate **14** is stopped to discontinue the air cushion and cause the article of laundry to rest on the top plate **14**. The flow of air through the nozzles **60** and **62** is discontinued and the pneumatic cylinders **48** and **50** are actuated to move the nozzles **60** and **62** away from each other. The drive to the belts **44** is engaged and the article of laundry in planar form is carried from the table **12** to the conveyor belt **80** which carries the article to the next operation. The next article of laundry is then delivered to the table **12** and the planing operation is repeated.

It should be understood that the controls for controlling the flow of air to the pneumatic cylinders **48** and **50**, the nozzles **60** and **62** and the holes **26** in the top plate **14**, and for controlling the drive of the belts **44**, **74** and **80** can be connected to a timing and sequencing mechanism for actuating the various controls at the proper time and sequence to automatically perform the various operations described above once the planing apparatus is actuated. Also, the planing apparatus **10** can be provided with a sensing device which senses when an area of the article of laundry of single thickness comes between the nozzles **60** and **62** and which then stops the drive of the belts **44** to start the cycle of the operation of the apparatus. Thus, there is provided by the present invention a method and apparatus for automatically arranging an article of laundry which is in a pile of random configuration to a planar form.

The present invention may be embodied in other specific forms without departing from the spirit or essential attributes thereof and, accordingly, reference should be made to the appended claims, rather than to the foregoing specification as indicating the scope of the invention.

What is claimed is:

**1.** A method of straightening an article of laundry which is arranged in random nonplanar configuration to a planar form comprising the steps of holding the article by clamping at a point of single thickness and passing a current of air across a surface of the article from the point that the article is held until the article is unraveled to substantially planar form.

**2.** The method of claim **1** in which the current of air is passed across the surface of the article directed radially from the point that the article is held.

**3.** The method of claim **2** including passing currents of air over both surfaces of the article from the point that the article is held.

**4.** The method of claim **3** including providing a cushion of air on which the article rests while the currents of air are passed over the surfaces of the article.

**5.** Apparatus for straightening individual articles of laundry which are arranged individually in random nonplanar configuration to a planar form comprising a horizontal table, means for holding by clamping an article of laundry which rests on said table in a random nonplanar configuration, and means for providing a current of air over a surface of the article directed radially from said holding means.

**6.** Apparatus in accordance with claim **5** including means for carrying and periodically delivering an article of laundry over said table to said holding means for straightening to planar form and periodically away from said holding means.

**7.** Apparatus in accordance with claim **5** including means for providing a cushion of air over the surface of said table.

**8.** Apparatus in accordance with claim **5** in which the means for holding the article and providing the current of air over the surface of the article comprises a tubular nozzle vertically mounted over the table, said nozzle having a plurality of circumferentially spaced openings there-

through at its lower end, means for providing a flow of air through the nozzle, and means for moving the nozzle to and away from the top surface of the table.

**9.** Apparatus in accordance with claim **8** including means for providing a cushion of air over the surface of said table.

**10.** Apparatus in accordance with claim **8** including a second tubular nozzle mounted below the table in vertical alignment with said first nozzle, said second nozzle having a plurality of circumferentially spaced openings therethrough at its upper end, means for providing a flow of air through said second nozzle, the table having an opening therethrough in alignment with said nozzles, and means for moving said second nozzle to and away from the top surface of said table.

**11.** Apparatus in accordance with claim **10** including means for providing a cushion of air over the surface of said table.

**12.** Apparatus in accordance with claim **11** including means for carrying the article of laundry over the table comprising a plurality of narrow endless belts extending around the table in spaced parallel relation and means for driving said belts.

**13.** Apparatus in accordance with claim **12** in which



the means for providing the cushion of air comprises a plurality of spaced holes in the table extending to the top surface of the table, said holes being positioned between the belts, and means for providing a flow of air through said holes.

**14.** Apparatus in accordance with claim **13** including a conveyor for carrying the articles of laundry arranged in random nonplanar configuration for periodic delivery to the table for straightening to planar form, and another conveyor for periodically receiving and carrying the articles of laundry in planar form away from the table.

**References Cited**

UNITED STATES PATENTS

| | | | |
|---|---|---|---|
| 1,912,724 | 6/1933 | Remington | 38—143X |
| 3,168,307 | 2/1965 | Walton et al. | 38—143X |
| 3,386,192 | 6/1968 | Fornaciari | 38—143 |
| 3,436,853 | 4/1969 | Buss | 38—143 |


PATRICK D. LAWSON, Primary Examiner

G. V. LARKIN, Assistant Examiner

U.S. Cl. X.R.

271—26