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(54) Web alignment system and method

(57) A web alignment system (10) is provided which consists of at least one liner web roll (14) affixed to a first roll stand (12) and at least one medium web roll (18) affixed to a second roll stand (16). The web alignment system is characterized by further including control means (40) for pre-positioning the liner and medium web rolls prior to the commencement of unwinding of the liner web roll and the medium web roll.

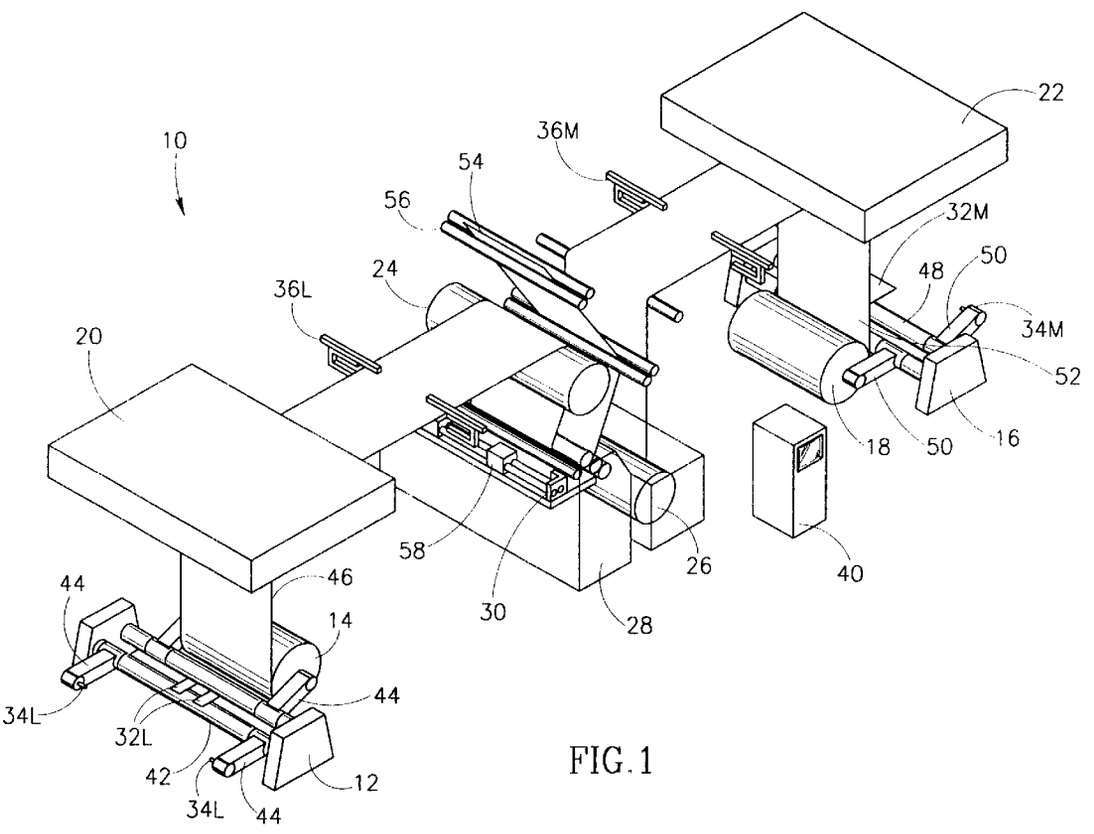

FIG. 1

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Description

The present invention relates to automated control systems generally and to web guiding equipment in particular.

Generally, materials which are guided in web form tend to be thin paper, film or fabric. Often, the material wanders from its correct alignment on the web due to various factors, such as material irregularity, web speed or faulty machinery.

Web guiding systems are commonly used in production processes to correctly guide and tension the material on the web. Generally, all automated control systems utilize actuators to correct web travel and sensors to detect the actual web position. The actual web position is continuously compared with a pre-determined value by a controller which ensures that the appropriate corrections are made.

Various types of actuators are known, the type of actuator used depending on the application and the type of fabric. Actuators include pivoting frames, steering and pivoting rollers and turning bars for example. When guided by pivoting frames, the web is subject to movement on both its longitudinal and transverse axes. Pivoting frames are commonly used where space is at a premium. Steering roller actuators are located in the infeed area of the positioning roller and simultaneously correct the web in two directions. Pivoting rollers are mostly used on continuously fed material webs, such as transport belts, where guiding accuracy tolerance of one centimeter is sufficient. Tune bars are used where it is necessary to change the web direction by 90 degrees and simultaneously make corrections.

In the production of corrugated board webs, the misalignment of the liner and medium roll edges necessitates the removal of overlapping edges and thus can lead to significant wastage and expense.

The known prior art web guiding systems require extra machinery and special installation and are not suited to optimal placing of the webs in corrugated boards. Furthermore, existing prior art systems are relatively slow and generally manually adjusted.

An object of the present invention is to provide a web guiding system for corrugated boards which overcomes the limitations and disadvantages of prior art units.

A further object of the present invention is to provide a web guiding system which is easily installed and does not require additional machinery or major modifications to the existing web.

A yet further object of the present invention is to provide a web guiding system for corrugated boards which prevents glue contamination of single facer rolls.

A yet further object of the present invention is to provide a web guiding system for corrugated boards which controllably adjusts the glue dam in accordance with the web width.

There is thus provided, in accordance with a preferred embodiment of the present invention, a web alignment system which includes at least one liner web roll affixed to a first roll stand and at least one medium web roll affixed to a second roll stand. The web alignment system is characterized by further including control means for pre-positioning the liner and medium web rolls prior to the commencement of unwinding of the liner web roll and the medium web roll.

Furthermore, in accordance with a preferred embodiment of the present invention, the web alignment system also includes a corrugator and a glue dam for gluing the liner web roll to the medium web roll.

Furthermore, in accordance with a preferred embodiment of the present invention, the control means positions the glue dam with reference to the corrugator.

Furthermore, in accordance with a preferred embodiment of the present invention, the positioning of the glue dam takes place prior to the commencement of unwinding of the medium web roll.

Furthermore, in accordance with a preferred embodiment of the present invention, the control means tracks and adjustably aligns the liner web roll and the medium web roll during operational movements to maintain the pre-positioning.

Furthermore, in accordance with a preferred embodiment of the present invention, the control means includes encoding position apparatus coupled to the liner roll stand and the medium roll stand.

Furthermore, in accordance with a preferred embodiment of the present invention, the control means further includes encoding position apparatus coupled to the glue dam.

Furthermore, in accordance with a preferred embodiment of the present invention, the encoding position apparatus includes at least one cable transducer.

Furthermore, in accordance with a preferred embodiment of the present invention, the encoding position apparatus includes at least one ultrasonic transducer.

Furthermore, in accordance with a preferred embodiment of the present invention, the control means further includes a plurality of laser sensors coupled to the web of the liner roll and the medium roll.

Furthermore, in accordance with a preferred embodiment of the present invention, the control means further comprises a database of dimensions of standard rolls.

Additionally, in accordance with a preferred embodiment of the present invention, there is provided a method for aligning a web having at least one liner web roll affixed to a first roll stand, at least one medium web roll affixed to a second roll stand, a corrugator and glue dam. The method includes the step of pre-positioning at least one of the medium and the liner web rolls.

Furthermore, in accordance with a preferred embodiment of the present invention, the step of pre-positioning is relative to the position of the corrugator.

Furthermore, in accordance with a preferred embodiment of the present invention, the step of pre-posi-

tioning the glue dam is relative to the position of the corrugator.

Furthermore, in accordance with a preferred embodiment of the present invention, the step of pre-positioning comprises the steps of:

a) placing the at least one of the medium and the liner web rolls on the corresponding roll stand;
b) determining the width of the at least one of the medium and the liner web rolls;
c) transferring the determined width to control apparatus;
d) by reference to the determined width, looking up the exact dimensions of the at least one of the medium and the liner web rolls from a database of roll dimensions; and
e) aligning the at least one of the medium and the liner web rolls in accordance with the database dimensions.

The present invention will be understood and appreciated more fully from the following detailed description taken in conjunction with the appended drawings in which:

Fig. 1 is a schematic isometric illustration of a web guiding system for corrugated boards, constructed and operative in accordance with a preferred embodiment of the present invention; and
Fig. 2 is a flow chart representation of the operation of web guiding system of Fig. 1.

Reference is now made to Fig. 1 which illustrates a web guiding system for corrugated boards, generally referenced 10, constructed and operative according to a preferred embodiment of the present invention.

Web guiding system 10 comprises a first roll stand 12 having at least one liner roll 14 affixed thereto, a second roll stand 16 having at least one medium (or fluting) roll 18 affixed thereto, a liner splicer 20 and a medium splicer 22, first and second pre-heaters 24 and 26, respectively a single facer 28 and a glue dam 30. All of the above referenced components of web guiding system 10 are standard, known in the art, components used for the production of single-faced corrugated cardboard sheet.

In a preferred embodiment, web guiding system 10 comprises a pair of liner rolls 14 and a pair of medium rolls 18. In operation, one of each of the pair of liner and medium rolls 14 and 18, respectively is in use at any one time. The second of the pair of liner and medium rolls 14 and 18, respectively are on standby and are placed in operation when the first pair of rolls are exhausted. For the purposes of clarity, only one liner roll 14 and medium roll 18 is illustrated in Fig. 1.

Web guiding system 10 further comprises a pair of liner cable transducers, referenced 32L and 32M, respectively, a pair of ultrasonic transducers, generally referenced 34L and 34M, respectively, a plurality of laser sensors, generally referenced 36L and 36M, respectively, and control means, generally designated 40. Since cable transducers 32, ultrasonic transducers 34 and laser sensors 36 generally perform the same function for both liner rolls 14 and medium rolls 18, they have been referenced with the same numerals with the addition of suffixes "L" and "M", respectively, to distinguish which of the various components are attached to liner roll 14 and medium roll 18.

Control means 40 accurately pre-positions liner roll 14 and medium roll 18 and then constantly tracks both liner and medium rolls, 14 and 18, respectively, effecting any adjustments and alignment to the web edges which may be needed.

First roll stand 12 comprises at least one longitudinal element 42 to which are attached a pair of arms 44. Liner roll 14 is retained by pair of arms 44 and is freely rotatable about a longitudinal axis defined by a line connecting pair of arms 44. The liner roll web 46 is fed, via liner splicer 20 and first pre-heater 24, to the single-facer 28. Each of cable transducers 32L and each of the ultrasonic transducers 34L are suitably coupled to the corresponding arm 44. The plurality of laser sensors 36L are located either side of web 46, preferably between liner splicer 20 and first pre-heater 24.

Similarly, second roll stand 16 comprises at least one longitudinal element 48 to which are attached a pair of arms 50. Medium roll 18 is retained by arms 50 and is freely rotatable about a longitudinal axis defined by a line connecting arms 50. The medium roll web 52 is fed via medium splicer 22 to second pre-heater 26 and thence to single-facer 28. Each of cable transducers 32M and each of the ultrasonic transducers 34M are suitably coupled to the corresponding arm 50 of longitudinal element 48. The plurality of laser sensors 36M are located either side of medium roll web 52, preferably between medium splicer 22 and second pre-heater 26.

Liner roll 14 and medium roll 18 are glued together in single-facer 28 to produce the corrugated board 54 which then exits via a plurality of rollers 56.

Cable transducers 32, ultrasonic transducers 34 and laser sensors 36 are standard known in the art components and are not further described. It will be appreciated by persons knowledgeable in the art that any suitable type of encoder for locating the position of apparatus may be used and that the present invention is not restricted to the use of cable and ultrasonic transducers 32 and 34, respectively which are described by way of example only. Furthermore, cable and ultrasonic transducers 32 and 34, respectively, may be interchangeably used. In an alternative embodiment, laser sensors may be used instead of ultrasonic sensors.

Glue dam 30 is a typical known in the art glue dam suitable for single spacer or double backer use. In the preferred embodiment, for the purposes of example only, a single spacer system is referred to. A cable transducer 58 is attached to glue dam 30 for positioning the

glue dam 30.

Control means 40, which is suitably coupled to transducers 32, ultrasonic transducers 34 and laser sensors 36, processes data received from these components and regulates the positioning of first and second roll-stands 12 and 16, respectively and glue dam 30 accordingly. Control means 40 comprises, inter alia, a database containing data (such as exact dimensions) of standard rolls.

Reference is now also made to Fig. 2, which is a flow chart representation of the operation of web guiding system 10.

A standard medium roll 18 is placed on arms 50 of first roll stand 16 (step 202) and the operator closes arms 50 onto the medium roll 18 (step 204). Cable and ultrasonic transducers 32M and 34M, respectively, (located on each arm 50) determine the width of the medium roll 18 and transmit this data to control means 40 (step 206). Control means 40 refers to its database to lookup the exact dimensions of the medium roll 18 placed on arms 50 (step 208). The medium roll 18 is then accurately positioned by means of the pair of ultrasonic transducers 34M which receive instructions from control means 40. (step 210).

The above operations (steps 202 - 210) are then carried out for liner roll 14 (step 212).

The glue dam 30 is then accurately positioned, by means of cable transducers 58 (step 214), according to the position set for medium roll 18.

It is a feature of the invention that, the liner and medium rolls 14 and 18, respectively are independently pre-positioned prior to the unwinding of the rolls and that the position of the medium roll 18 is not determined by the common "master/slave" arrangement. Thus, the positioning of the liner roll 14 is not dependent on the positioning of the medium roll 18, or vice versa.

It is a further feature of the invention that, during pre-positioning, control means 40 takes into account the offset between the material and the facer 28 to achieve accurate pre-positioning within a tolerance of +/- 3mm. Generally, prior art web systems do not allow for the offset between paper and machine and if any adjustment is made, only adjust the rolls relative to each other at the gluing stage. Since approximately 15 to 20 m of paper travels from each roll to the glue dam 30 before gluing begins, pre-positioning and accurate adjustment of the glue dam 30 saves this normally wasted roll material.

Commonly, a single facer has a vacuum or pressure slot to ensure that the fluting roll retains its gluing capabilities while being affixed to the liner roll 14. The positioning of the web within the single facer takes into account the vacuum or pressure slots, thereby optimizing the web position within the facer.

During corrugation, as the liner and medium rolls 14 and 18, respectively are unwinding and traveling towards the glue dam 30, on-line positioning takes place (step 216). On-line positioning is controlled by laser sensors 36 in conjunction with control means 40. Laser sensors 36, which generally only have a 30 mm range, sense the position of the liner and medium rolls 14 and 18, respectively and continuously transfer the data to control means 40. Control means 40 adjusts liner and medium rolls 14 and 18, respectively via instructions to ultrasonic sensors 34.

It will be appreciated by persons skilled in the art that the invention is applicable to double backer as well as single facer corrugators and is also applicable to any other type of web. A feature of the invention is the accurate alignment of a web without the need for changes to standard web guiding equipment or the addition of cross machine rollers for example.

It will be further appreciated that the present invention is not limited by what has been described hereinabove and that numerous modifications, all of which fall within the scope of the present invention, exist. For example, while the present invention has been described with respect to a web guiding system comprising a single liner roll and medium roll, a pair of liner rolls and a pair of medium rolls may be used, each of the pair of liner rolls and medium rolls to be used alternatively.

It will be appreciated by persons skilled in the art that the present invention is not limited by what has been particularly shown and described herein above. Rather the scope of the invention is defined by the claims which follow:

Claims

1. A web alignment system comprising at least one liner web roll affixed to a first roll stand, at least one medium web roll affixed to a second roll stand said web alignment system characterized by further comprising control means for pre-positioning said liner web roll and said medium web roll prior to the commencement of unwinding of said liner web roll and said medium web roll.

2. A web alignment system according to claim 1 and further comprising a corrugator and a glue dam for gluing said at least one liner web roll to said at least one medium web roll.

3. A web alignment system according to claim 2 and wherein said control means positions said glue dam with reference to said corrugator.

4. A web alignment system according to claim 3 and wherein said positioning of said glue dam takes place prior to the commencement of unwinding of said medium web roll.

5. A web alignment system according to any of the preceding claims and wherein said control means tracks and adjustably aligns said liner web roll and said medium web roll during operational move-

ments to maintain said pre-positioning.

6. A web alignment system according to any of the preceding claims and wherein said control means comprises encoding position apparatus coupled to said liner roll stand and said medium roll stand.

7. A web alignment system according to any of claims 2 to 6 and wherein said control means further comprises encoding position apparatus coupled to said glue dam.

8. A web alignment system according to any of claims 6 and 7 and wherein said encoding position apparatus comprises any of a group including at least one cable transducer, and at least one ultrasonic transducer.

9. A web alignment system according to any of the preceding claims and wherein said control means further comprises a plurality of laser sensors coupled to the web of said liner roll and said medium roll.

10. A web alignment system according to any of the preceding claims and wherein said control means further comprises a database of dimensions of standard rolls.

11. A method for aligning a web comprising at least one liner web roll affixed to a first roll stand, at least one medium web roll affixed to a second roll stand and a corrugator and glue dam, said method comprising the step of pre-positioning at least one of said medium and said liner web rolls.

12. A method according to claim 11 and wherein said step of pre-positioning is relative to the position of said corrugator.

13. A method according to claim 11 or 12 and further comprising the step of pre-positioning said glue dam relative to the position of said corrugator.

14. A method according to any of claims 11, 12, or 13 and wherein said step of pre-positioning comprises the steps of:

placing said at least one of said medium and said liner web rolls on said corresponding roll stand;
determining the width of said at least one of said medium and said liner web rolls;
transferring said determined width to control apparatus;
by reference to said determined width, looking up the exact dimensions of said at least one of said medium and said liner web rolls from a database of roll dimensions; and
aligning said at least one of said medium and said liner web rolls in accordance with said database dimensions.

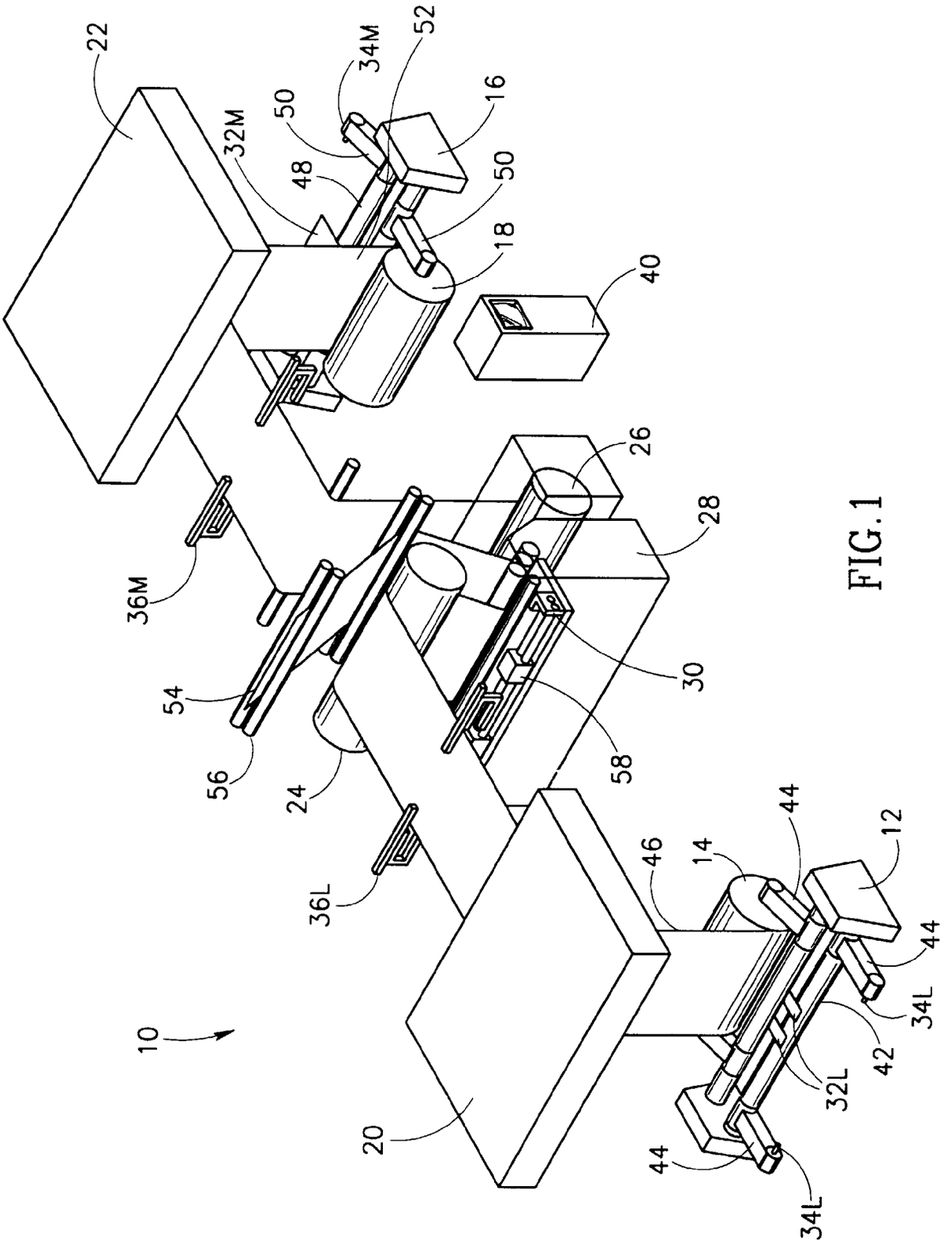
22
32M
50
34M
52
16
48
50
18
40
26
28
36M
30
54
56
58
24
36L
44
46
14
12
44
34L
42
32L
44
34L
20
10

FIG. 1

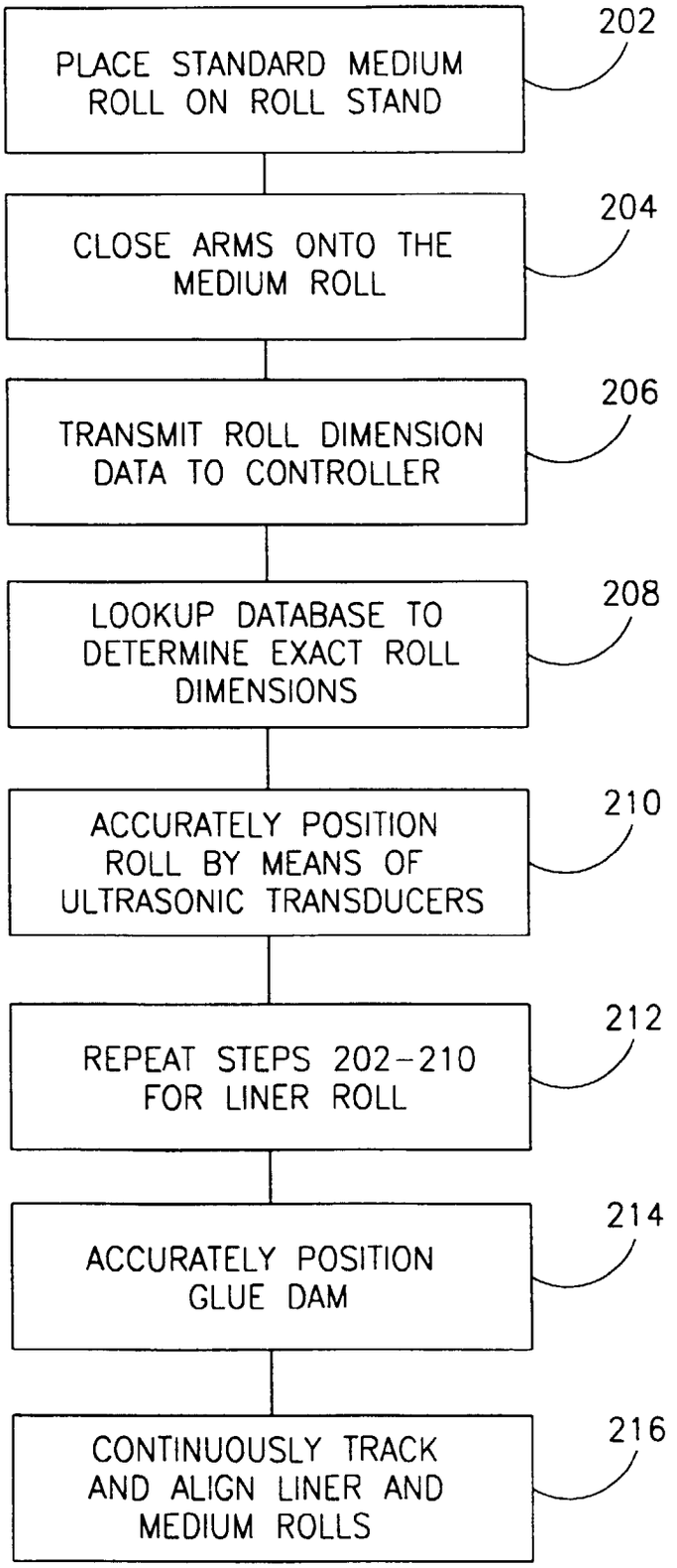
PLACE STANDARD MEDIUM ROLL ON ROLL STAND
202
CLOSE ARMS ONTO THE MEDIUM ROLL
204
TRANSMIT ROLL DIMENSION DATA TO CONTROLLER
206
LOOKUP DATABASE TO DETERMINE EXACT ROLL DIMENSIONS
208
ACCURATELY POSITION ROLL BY MEANS OF ULTRASONIC TRANSDUCERS
210
REPEAT STEPS 202-210 FOR LINER ROLL
212
ACCURATELY POSITION GLUE DAM
214
CONTINUOUSLY TRACK AND ALIGN LINER AND MEDIUM ROLLS
216

FIG.2