United States Patent [19]

Roberson

[11] **3,881,222**

[45] **May 6, 1975**

[54] **METHOD AND APPARATUS FOR CONTROLLING THE MOISTURE CONTENT OF FIBROUS STOCK**

[75] Inventor: **James H. Roberson,** Greenville, S.C.

[73] Assignee: **Crompton & Knowles Corporation,** Worcester, Mass.

[22] Filed: **Nov. 19, 1973**

[21] Appl. No.: **417,013**

[52] **U.S. Cl.** ..... **19/66 R**

[51] **Int. Cl.** **D01b 3/04**

[58] **Field of Search** ..... 19/66 R, 105; 236/44 R

[56] **References Cited**

UNITED STATES PATENTS

2,079,407	5/1937	Hess	19/105
2,155,598	4/1939	Holt et al.	19/105 X
3,005,238	10/1961	Manning	19/66 R
3,821,833	7/1974	Wildbolz et al.	19/66 R

Primary Examiner—Dorsey Newton

[57] **ABSTRACT**

Moisture control method and apparatus for processing of textile fibrous stock whereby bales of stock are opened and formed into a uniform batt which is conveyed past a first point whereupon the moisture content of the batt is sensed and a signal is generated which varies with variations in the moisture content of the batt. Moisture is added to the fibrous stock at a second point located upstream of the first point. The amount of moisture which is added to the stock is in accordance with the signal generated at the first point and the fibrous stock is mixed after it has been conveyed past the first point.

9 Claims, 5 Drawing Figures

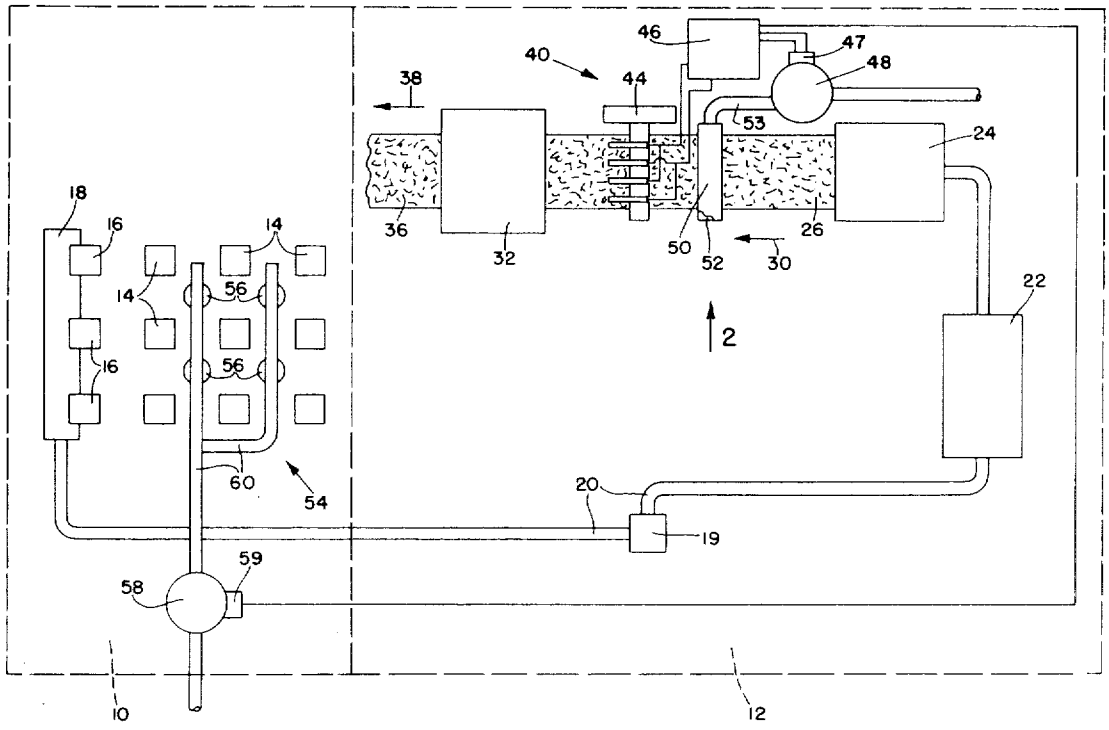


FIG. 1

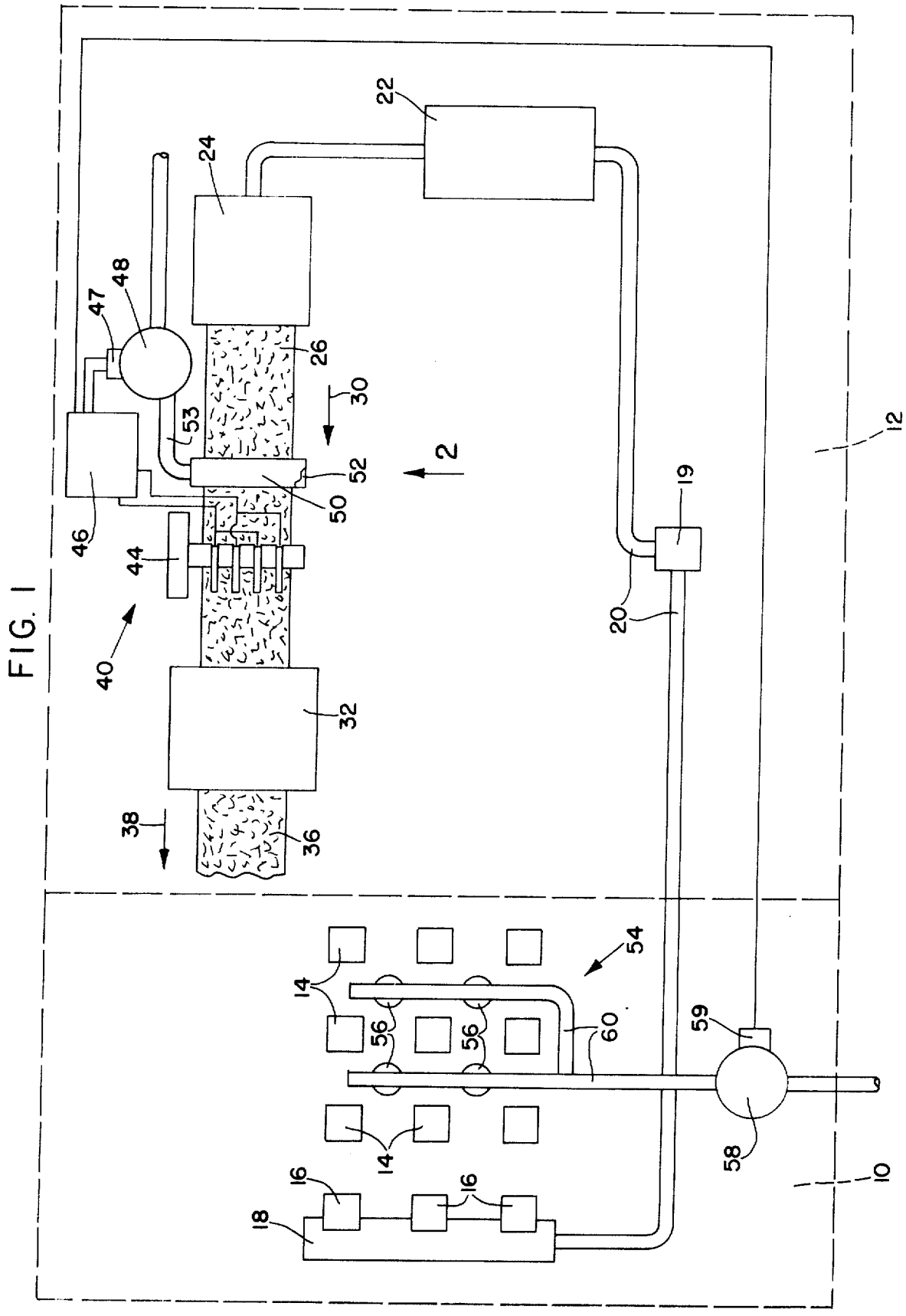

22
24
48
47
26
30
53
2
52
50
46
44
40
32
38
36
19
20
12
54
14
56
56
60
59
58
14
16
16
18
10

FIG. 2

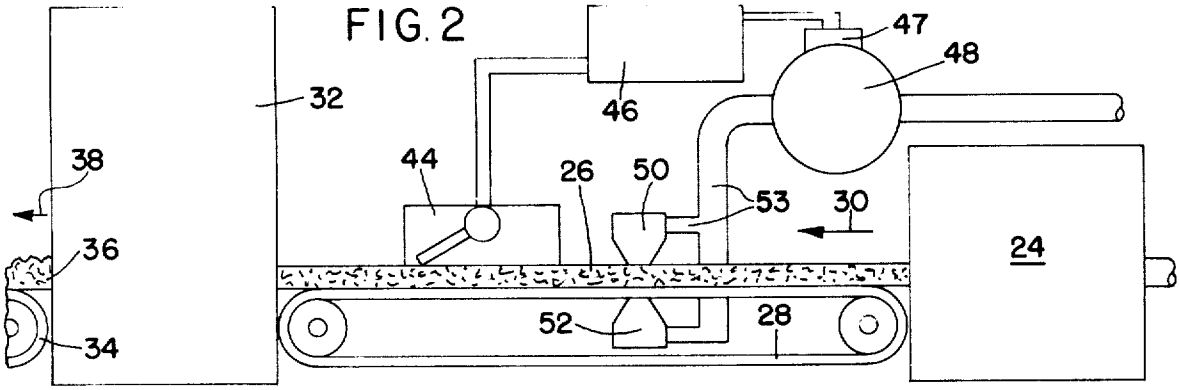


FIG. 3

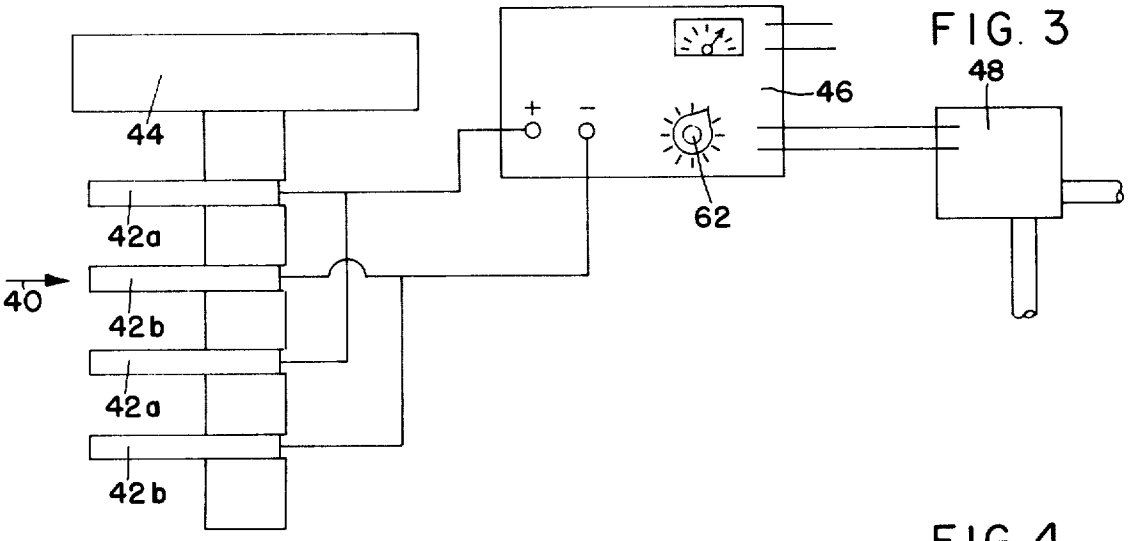


FIG. 4

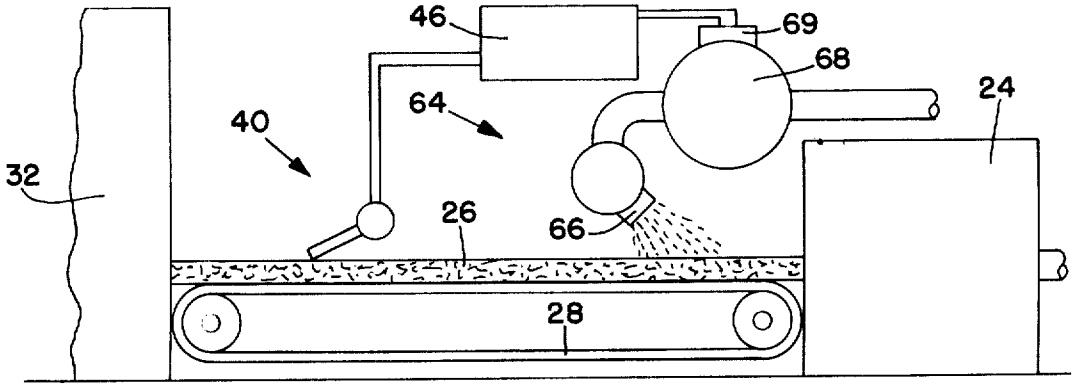
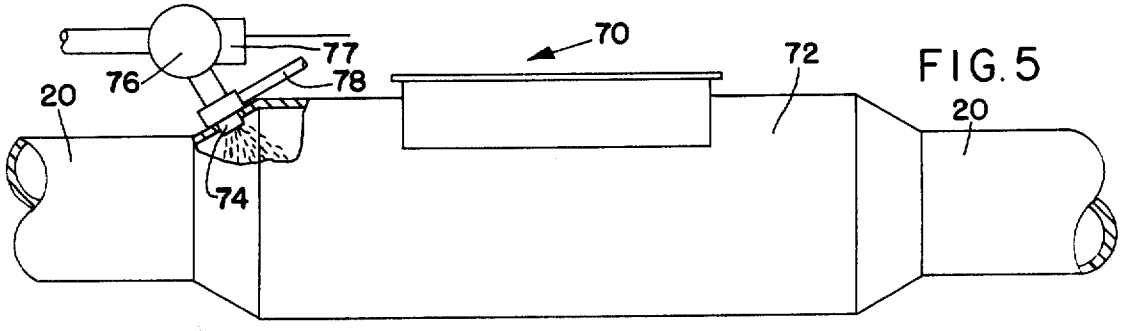


FIG. 5



METHOD AND APPARATUS FOR CONTROLLING THE MOISTURE CONTENT OF FIBROUS STOCK

BACKGROUND OF THE INVENTION

The present invention relates generally to moisture control for textile fibers and more specifically to moisture control during fiber processing.

It has long been recognized that the moisture content of fibers plays a very important role in the processing and handling characteristics of fibers. If the fibers are too dry, static electrical charges build up which causes the fibers to stick to the various mechanisms and cause jams. Dry fibers are also apt to be brittle and more likely to rupture during handling. If the fibers have too little moisture, the forces or power required to open, separate or otherwise handle the stock increases significantly.

There is some attempt to control the moisture content during ginning but precise control of the moisture content is not too important as long as it isn't too "wet."

The ultimate responsibility for correcting the moisture content of the fibrous stock to a desired value lies with the fiber processer who handles the stock after the ginning operation. During all subsequent processing stages, the machines must produce products of a given weight per unit length.

Most mills begin the moisture "conditioning" process in the opening room by "laying down" fibrous stock and controlling the relative humidity to a desired value. A major weakness of this conditioning procedure is that it is too slow. At high production rates there is insufficient time for the stock to reach true equilibrium since it is difficult to exchange moisture between the atmosphere and the bales. A longer exposure period could be obtained by increasing the floor space available for an increase in the amount of laydown. This is, of course, not very economical and also increases the plant's air conditioning load.

A recent attempt to overcome this difficulty has been the provision of a continuous moisture detecting apparatus for the fibrous stock in the opened state. This is accomplished by passing a batt of opened fibers or lap between a pair of electrical contacts which measures the resistance or impedance therebetween and generating a signal which varies with the resistance. This signal is then utilized to operate a moisturizing system which controls the relative humidity in the entire room in which the batt or lap forming machinery is located. An example of such a system is illustrated in U.S. Pat. No. 3,005,238 to C. R. Manning, dated Oct. 24, 1961. This system is still time dependent. The opened fibers will absorb moisture from the atmosphere at a greater rate than fibers in the baled state but not at a rate sufficient for present day rates of production. There is a considerable time lag between the detection of a moisture content below a set value and the raising of the moisture content to that value by the moisturizing system. This results in fluctuations of the moisture content of the batt of fibers as it is processed.

SUMMARY OF THE INVENTION

It is a principle object of the invention to overcome the disadvantages and problems encountered in present day moisture control systems for fibrous stock.

The object of the invention is accomplished by providing means for and method of forming the fibrous stock into a batt, measuring the moisture content of the batt, adding moisture directly to the opened stock at a point directly upstream of the point of measurement in accordance with the measured moisture content and opening, mixing and blending the fibrous stock after the addition of moisture. In this way the desired amount of moisture is added directly to the fibrous stock and is absorbed during the subsequent processing stages. A gradient in moisture content may exist from one side of the batt to the other. This is overcome by mixing and blending the moisturized stock, which achieves a uniformity of moisture content for additional fiber processing stages.

It is a further object of the invention to also provide means, responsive to the sensing means, for moisturizing the fibrous stock while it is still in the baled state. The opened stock is then mixed prior to being formed into a batt. This raises the moisture content of the fibrous stock to an intermediate level before it is formed into a batt. The additional moisturizing stage serves to "top off" the addition of moisture at a controlled value. This minimizes the moisture gradient through the batt at the point that it is sensed. This approach is most desirable with types of fibrous stock which are highly variable in initial moisture content and with stock to which it may be necessary to add a relatively large amount of moisture.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a diagramatic plan view of the preferred embodiment of the invention;

FIG. **2** is a diagramatic side elevation, looking in the direction of arrow **2** in FIG. **1**;

FIG. **3** is a plan view of the moisture detecting means on an enlarged scale;

FIG. **4** is a fragmentary view of first modification; and

FIG. **5** is a fragmentary view of a second modification.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

Referring to FIGS. **1** and **2**, a conventional fiber processing mill is schematically illustrated and is divided into an opening room **10** and a fiber processing room **12.**

The fibrous stock to be processed is derived from bales **14** arranged in rows on the floor of the opening room. The bales **14** are fed into hoppers **16** of a typical opening, blending and mixing mechanism **18.** Mechanism **18** may be any of the many types which are available, an example of which is shown in U.S. Pat. No. 2,885,741 to Leineweber, Jr. dated May 12, 1959. The stock emerges from mechanism **18** as a loose substantially fluffy fibrous mass. This mass is drawn through a conveyor duct **20** by a fan **19** to a cleaning apparatus **22** which cleans and mixes the stock. An example of such an apparatus is shown in U.S. Pat. No. 3,046,612 to Kyame et al dated July 31, 1962. The stock is then conveyed from the cleaning apparatus **22** to batt forming machine **24** such as a picker which converts the stock into a batt or lap **26.** Batt forming machine **24** may also comprise apparatus as shown in my U.S. Pat. No. 3,562,866 dated Feb. 16, 1971. Only one batt forming machine **24** is shown but it is to be understood that a plurality of such machines would normally be employed.

Batt **26** is deposited on a foraminous conveyor **28** which conveys the batt in the direction of arrow **30** toward a mixing apparatus **32**, an example of which is shown in U.S. Pat No. 3,051,998 to Rust, Jr., et al., dated Sept. 4, 1962. Apparatus **32** breaks the batt into loose fibers, mixes the fibers and deposits them onto a second conveyor **34** as a mass of fluffy fibers indicated at **36**. This mass of fibers is conveyed in the direction of arrow **38** to subsequent fiber processing apparatus.

Means for sensing the moisture content of the batt **26** are generally indicated at **40**, see also FIG. **3**. Sensing means **40** includes a plurality of sensing fingers **42***a* and **42***b* alternately mounted on an insulated support **44** in contact with batt **26**. Fingers **42***a* and **42***b* are connected to terminals of opposite polarity in a control unit **46** and function as contacts for the small current flow between the fingers **42***a* and **42***b*. Variations in fiber moisture causes changes in the electrical resistance between sensing fingers which is reflected by changes in current flow. The greater the moisture content, the greater the current flow. Fingers **42***a* and **42***b* are arranged across the width of the batt so that the total current flow between each finger and its adjacent finger or fingers is indicative of the average moisture content across the width of the batt. This total current flow represents a signal which is amplified by control unit **46** to an output signal for controlling an electro-mechanical actuator **47** for a proportional valve **48** which controls steam flow from a source of steam, not shown, to upper and lower multi-ported steam nozzles **50** and **52**, respectively via pipes **53**. Nozzle **52** is located just beneath the upper run of conveyor **28** and directs steam through the foraminous conveyor to the lower face of the batt **26**. Nozzle **50** directs steam to the upper face of the batt. Valve **48** is controlled by unit **46** so that as the total current flow between sensing fingers **42***a* and **42***b* decreases the amount of steam to nozzles **50** and **52** increases.

Under certain conditions where a higher moisture level is desired or extra dry fibers are being processed, a preliminary moisturizing system is employed to add moisture to the fibers while they are in the baled state. The preliminary moisturizing system is indicated generally at **54** and comprises spray nozzles **56** located just over the bales **14** which are arranged in rows on the floor of the opening room **10**. Spray nozzles **56** are located over the bales **14** so that they will spray moisture in the form of water directly onto the bales. Moisture is supplied to nozzles **56** from a valve **58** through pipes **60**. Moisture is supplied to valve **58** from a supply source, not shown. Valve **58** may be a proportional valve such as **48** and controlled by unit **46** which acts through an electro-mechanical actuator **59** or simply an "open-shut" valve which is opened when the measured moisture content of the batt falls below a predetermined value. Regardless of what type of valve is used, the amount of moisture which is added to the bales is less than required to bring the moisture content of the fibers to the desired value. The moisture which is added to the bales is not absorbed uniformly throughout the bales but by the time the bales are opened and the fibers mixed, cleaned and formed into a batt **26**, the moisture content of the fibrous stock is substantially uniform. The addition of moisture by the steam nozzles **50** and **52** represents a "topping off" stage to bring the moisture content to a predetermined value. Control unit **46** may be adjusted by a rheostat **62** so that more or less moisture will be added for a given total measured current between the fingers **42***a* and **42***b*.

Referring to FIG. **4**, there is shown a modified apparatus for adding moisture to the batt **26** between the sensing means **40** and picker **24**. This apparatus is indicated generally at **64** and includes a multi-ported spray head **66** which is located above and extends across the upper face of the batt **26**. The flow of moisture to spray head **66** is regulated by a proportional valve **68** which is controlled by unit **46** through an electro-mechanical actuator **69** in the same manner as valve **48** and actuator **47**.

Referring to FIG. **5**, there is shown a still further modification. In this modification moisture is added to the fibrous stock as it is being conveyed in the duct **20** by moisturizing apparatus generally indicated by the reference numeral **70**. This apparatus comprises a housing **72** which forms part of the conveyor duct **20** and an atomizing spray head **74** which extends through the wall of the housing. Moisture is supplied to the spray head **74** from a source of supply, not shown, through a proportional valve **76**. Pressurized air is supplied to spray head **74** from a hose **78**. Valve **76** is automatically adjusted by an electro-mechanical actuator **77** which is controlled by unit **46** in the same manner as valves **48** and actuator **47**. Moisturizing apparatus **70** may be used as the primary moisturizing apparatus in place of nozzles **50** and **52** and used in combination with these nozzles as a preliminary moisturizing system in which case it can be used instead of spray nozzles **56** or in addition to these nozzles.

Having now described my invention, I claim:

1. A process for controlling the moisture content of fibrous stock processed from bales which comprises:

a. opening said bales of fibrous stock;

b. forming said opened stock into a substantially uniform batt;

c. sensing the moisture content of said batt at a first point; and

d. applying moisture directly to said batt at a second point located upstream of said first point in accordance with the sensed moisture content at said first point.

2. The process as set forth in claim **1**, which further comprises:

a. adding moisture to said bales when the moisture content sensed at said first point is below a designated value; and

b. mixing said opened stock before it is formed into said batt.

3. The process as set forth in claim **1** wherein said moisture is added to said batt and said process further comprises:

a. adding moisture to said opened fibrous stock before it is formed into said batt when the moisture content sensed at said first point is below a designated value; and

b. mixing said opened stock before it is formed into said batt.

4. Moisture control apparatus for processing of fibrous stock from bales, comprising:

a. means for continuously opening said bales of fibrous stock;

b. means for forming a substantially uniform batt from said opened stock;

c. means for conveying said batt;

d. means for sensing the moisture content of said batt as it is conveyed past a first point and for generating a signal which varies with variations in the moisture content of said batt;

e. means for applying moisture directly to said batt at a second point located upstream of said first point;

f. control means connected to said means for applying moisture and to said sensing means for applying moisture to said batt in accordance with the signal generated by said sensing means; and

g. means for disintegrating and mixing said fibrous batt after it has been conveyed past said first point.

5. The moisture control apparatus as set forth in claim **4**, wherein the means for applying moisture to said batt comprises:

a. a source of steam;

b. a plurality of steam nozzles located at said second point for directing steam into said batt; and

c. a proportional valve located between said source of steam and said nozzles under control of said control means.

6. The moisture control apparatus as set forth in claim **5**, wherein there are a plurality of said steam nozzles for directing steam into opposite faces of said batt.

7. The moisture control apparatus as set forth in claim **4**, comprising:

a. an opening room for containing said bales of fibrous stock;

b. means connected to said control means for adding moisture to said bales; and

c. means for mixing said opened stock before it is formed into said batt.

8. A process for controlling the moisture content of fibrous stock processed from bales which comprises:

a. opening said bales of fibrous stock;

b. forming said opened stock into a substantially uniform batt;

c. sensing the moisture content of said batt at a first point;

d. applying steam directly to said batt at a second point located upstream of said first point in accordance with the sensed moisture content at said first point; and

e. disintegrating said batt and mixing said fibrous stock obtained therefrom.

9. A process for controlling the moisture content of fibrous stock processed from bales which comprises:

a. opening said bales of fibrous stock;

b. forming said opened stock into a substantially uniform batt;

c. sensing the moisture content of said batt at a first point;

d. applying steam to opposite faces of said batt upstream of said first point; and

e. disintegrating said batt and mixing said fibrous stock obtained therefrom.

* * * * *