

May 23, 1967

N. M. REITZEL
WEB DRYING APPARATUS

3,320,677

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2 Sheets-Sheet 1

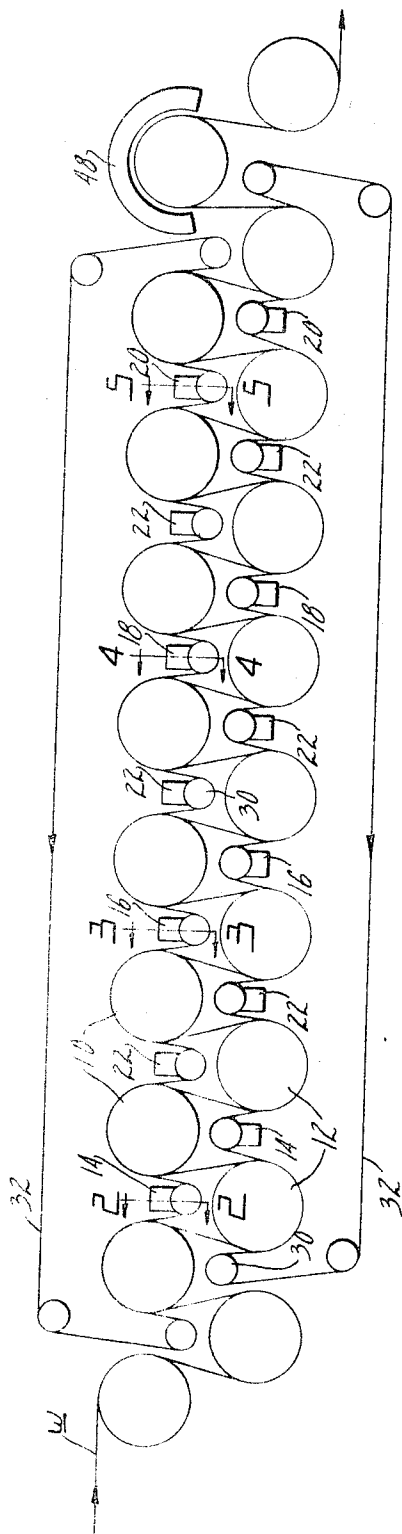


Fig. 1

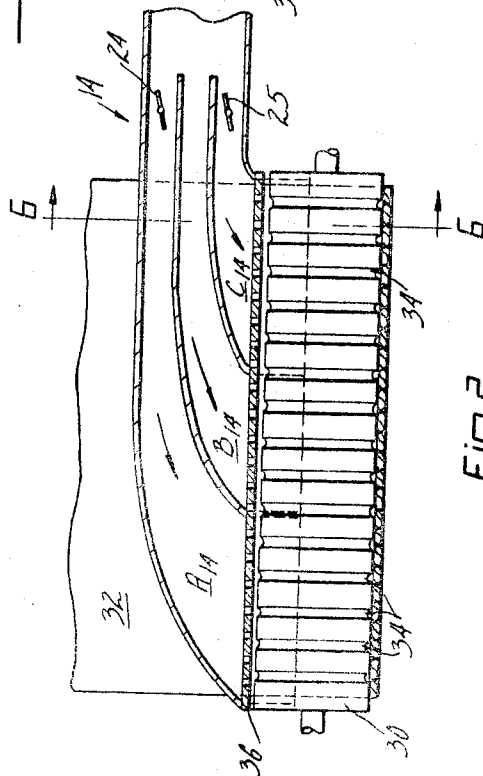


Fig. 2

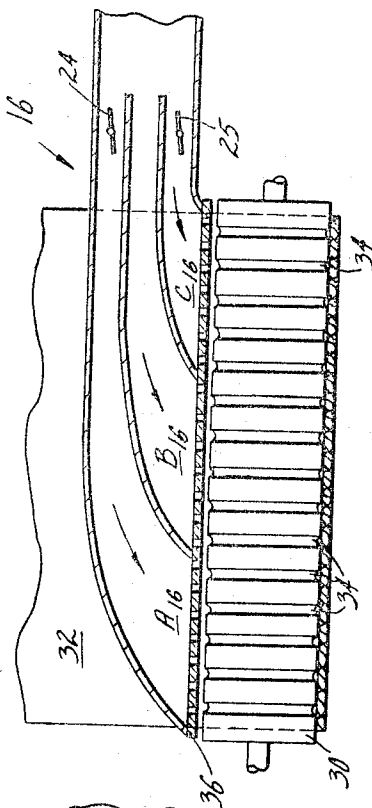


Fig. 3

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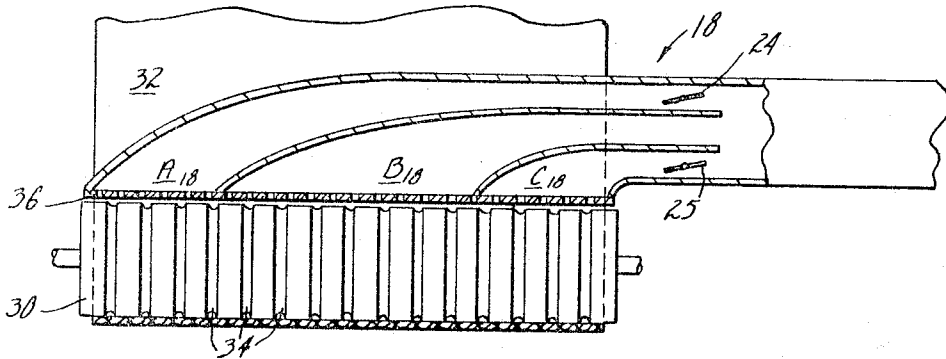


Fig. 4

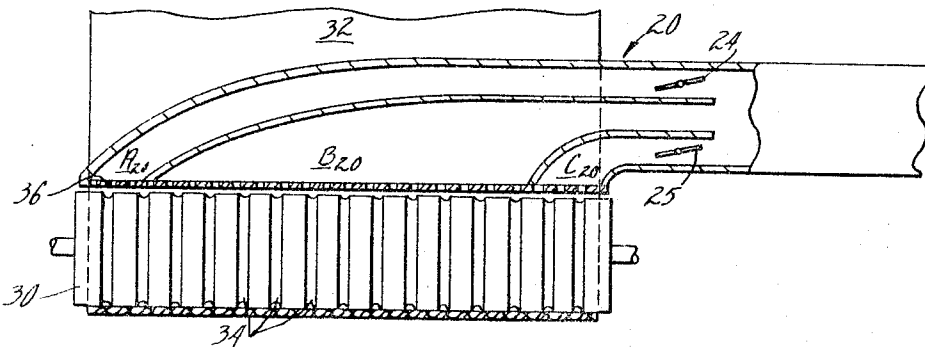


Fig. 5

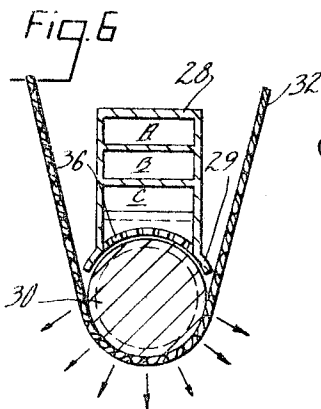


Fig. 6

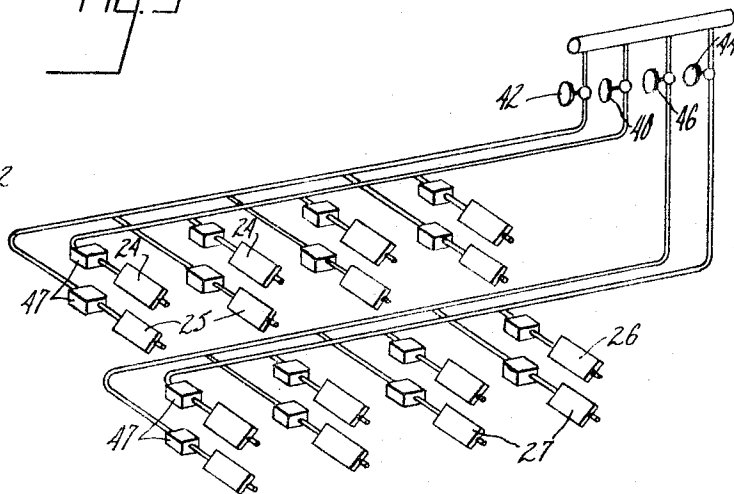


Fig. 7

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WEB DRYING APPARATUS

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12 Claims. (Cl. 34—54)

This invention relates to web drying apparatus.

The basic object of the invention is to provide apparatus, simple and practical both to manufacture and to use, for controlling the profile (i.e., liquid content plotted against width) of webs being dried.

In one important aspect, the invention features provision, between a multiplicity of pair of dryer rolls, of a corresponding multiplicity of transversely extending plenums each providing at least three transversely consecutive outlet areas through which drying gas may be blown out under different pressures in central and side areas through a felt, moving over the dryer rolls and felt rolls, into the open-sided pocket defined by the felt, the web, and a dryer roll, some of the areas being of different (transverse) widths, in different plenums and otherwise. In another important aspect, the invention features providing plenums with compartments in which transversely consecutive outlet end zones are in communication with vertically consecutive zones extending transversely to a side of the dryer, in which at the side are placed at least in the two outermost compartments flow controllers for varying pressure at the outlet ends. Other important novel features of preferred embodiments are grooved felt rolls cooperatively associated with the plenums, provision in each plenum of three compartments, master controls permitting simultaneous varying of a multiplicity of the flow controllers, and in association with at least one dryer, a high velocity drying hood.

Other objects, features and advantages will appear from the following description of a preferred embodiment of the invention, taken with the attached drawings thereof, in which:

FIG. 1 is a diagrammatic view of the dry end of a paper machine;

FIG. 2 is a sectional view at 2—2 of FIG. 1;

FIG. 3 is a sectional view at 3—3 of FIG. 1;

FIG. 4 is a sectional view at 4—4 of FIG. 1;

FIG. 5 is a sectional view at 5—5 of FIG. 1;

FIG. 6 is a sectional view at 6—6 of FIG. 2; and

FIG. 7 is an isometric diagram of the flow controls.

Referring now more particularly to the drawings, there is shown in FIG. 1 an upper row of dryer rolls 10 and a lower row of dryer rolls 12. Although only ten dryer rolls are shown in each row, a typical actual installation would have thirty dryers in each row. Although only fourteen plenums (14, 16, 18, 20, and 22) are shown, said typical installation would have forty-eight.

Each plenum is divided into three compartments A, B, and C, and each compartment extends horizontally from its inlet end and then downwardly at its outlet end, the compartments being vertically consecutive toward their inlet ends, and transversely consecutive at their outlet ends. Each compartment A and C includes a damper 24, 25 toward its inlet end for varying rate of flow therethrough and pressure therein at the outlet end.

The plenums 14 (of which six, three up and three down, would be present in said actual installation) have side compartments A₁₄ and C₁₄ each of which at its outlet end is three-eighths of the width of the plenum, leaving a center compartment B₁₄ one quarter of said width. The plenums 16 (of which six, three up and three down, would also be present in said actual installation) have side compartments A₁₆ and C₁₆ and a center compartment B₁₆, all at their outlet ends one-third the width of the plenum 16.

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The plenums 18 (of which also six would be present in the actual installation mentioned, three up and three down), have side compartments A₁₈ and C₁₈ each one-quarter, at their outlet ends, the width of plenum 18, the center compartment B₁₈ being half said width. The plenums 20 (of which again six, three up and three down, would be found in said actual installation) have side compartments A₂₀ and C₂₀ that at their outlet ends are one-eighth said width, the center compartment B₂₀ being three-quarters of said width. At their inlet ends, all said compartments A, B, and C extend fully across the plenum, and dampers 24, 25, 26, and 27 are mounted in the uppermost and lowermost compartments A and C toward said inlet ends to vary flow rate therethrough; all the compartments A, B, and C are supplied from a common source of hot air.

Each plenum includes a housing 28 the lower ends 29 of which extend for short distances in directions generally tangential to felt rolls 30 about which felts 32 are trained. The felt rolls include annular grooves 34 through which air blown through the plenums is blown through the felts all around the rolls 30, as indicated by the arrows in FIG. 6. Extending over the outlet ends of compartments A, B, and C of each plenum is curved perforated distributor plate 36, for distribution of air blown through each compartment.

Dampers 24, which regulate flow through the front side compartments A of the top row plenums 14, 16, 18, and 20, are regulated for simultaneous movement as a group by control knob 40. Dampers 25, which regulate flow through the back side compartments C of the top row plenums 14, 16, 18, and 20, are regulated for joint movement as a group by control knob 42. Dampers 26, in front side compartments A of the bottom row plenums 14, 16, 18, and 20, are similarly regulated by knob 44. Dampers 27, in back side compartments C of said bottom row plenums are thus regulated by knob 46. Each damper suitably has associated with it, an air actuator 47 of character well known in the art, all the air actuators for each group of dampers being controlled by the group's respective knob.

The plenums 22 are constructed identically as are the plenums 16. However, the dampers in the side compartments of the plenums 22 are manually operable only, for normally setting only on initial machine setup, operating adjustments in normal use being made through the knobs controlling the dampers of plenums 14, 16, 18, and 20.

High velocity hood 48 of character well known in the art, has a multiplicity of transverse compartments through which air may be blown at selectively different rates to eliminate small moisture variations, which usually show up as streaks, across the width of the web w.

In operation, despite great simplicity (thus, each plenum in the preferred embodiment has only three compartments and two dampers, and the dampers are not only easily accessible for manual control variation but may be regulated through only four control knobs), great profile control may be maintained. Moisture content in each side of each row of plenums is separately controllable, for gross moisture variation prevention, and hood 48 cooperatively smooths out small moisture variation. Because the widths of the side compartments of different plenums varies, sharp boundaries are eliminated, and a graduated, shaded effect is achieved. At the same time, number of compartments and dampers for each plenum may be minimized, for great simplicity.

What is claimed is:

1. Web drying apparatus for profile control of a web by blowing air through a felt into a plurality of longitudinally successive pockets defined by said felt, one row of dryer rolls, and said web running between dryer rolls

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of said one row of dryer rolls and dryer rolls of another row of dryer rolls, said apparatus comprising in combination with said felt a plurality of longitudinally successive plenums, each of said plenums including at least three compartments with transversely consecutive outlet portions adjacent said felt having widths in a transverse direction, certain of said widths being different from certain others thereof, and flow control elements in both those compartments transversely extreme at their outlet portions at least one of said plenums including a said width different from a correspondingly positioned said width in another said plenum.

2. The apparatus of claim 1 in which each of said plenums includes two side compartments and a center compartment.

3. The apparatus of claim 2 in which said two side compartments include outlet portions of the same said width.

4. The apparatus of claim 3 which includes a multiplicity of different side outlet compartment widths.

5. The apparatus of claim 4 which includes plenums with four different arrangements of said widths, one of said arrangements having side outlet compartment widths of $\frac{1}{8}$ total outlet width, another having side outlet compartment widths of $\frac{1}{4}$ total outlet width, another having side outlet compartment widths of $\frac{1}{3}$ total outlet width, and another having side outlet compartment widths of $\frac{3}{8}$ total outlet width.

6. The apparatus of claim 1 in which said compartments are vertically consecutive toward their inlet portions, and said flow control elements are disposed in said compartments where they are vertically consecutive.

7. The apparatus of claim 1 in which at least one of said compartments intermediate of said compartments

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transversely extreme at their outlet portions is free of a flow controller.

8. The apparatus of claim 1 in which outlet portions of at least one of said plenums are positioned adjacent a circumferentially grooved felt roll to blow through the grooves and said felt therearound.

9. The apparatus of claim 1 which includes a high velocity dryer hood.

10. The apparatus of claim 1 in which a plurality of said flow control elements are jointly controlled by a single control element.

11. The apparatus of claim 4 in which a multiplicity of said flow control elements for compartments of plenums in one row and with outlet portions on one side of said apparatus are jointly controlled by a single control element.

12. The apparatus of claim 5 in which certain of said flow control elements of said side are not jointly controlled with the others.

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