Nov. 5, 1935. E. E. BERRY 2,019,649

VERTICAL DRIER FOR WEB MATERIAL

Filed June 9, 1933 3 Sheets-Sheet 1

Fig. 2.

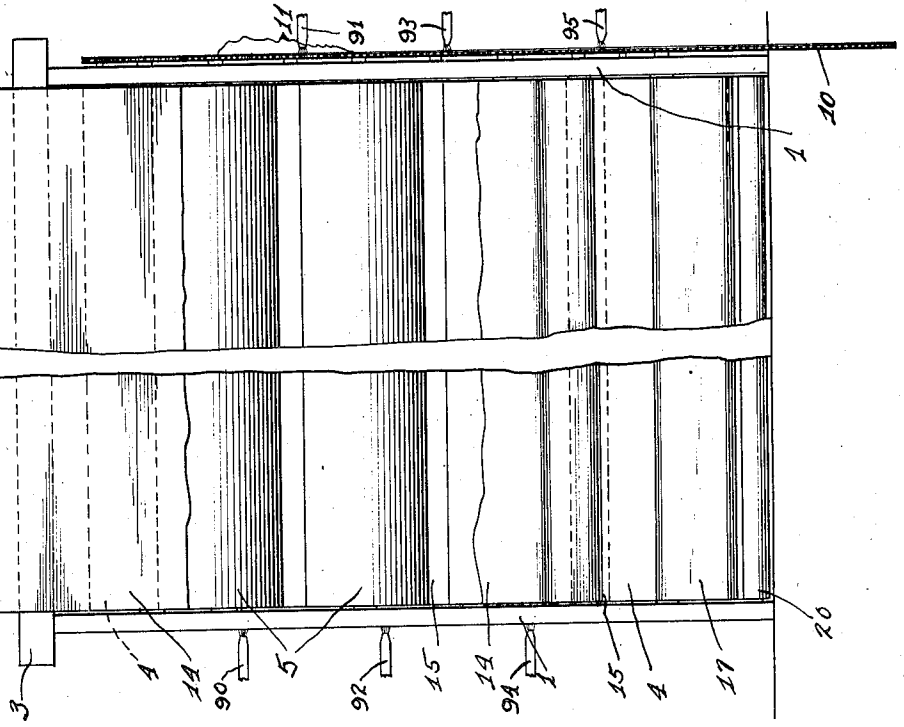

Fig. 1.

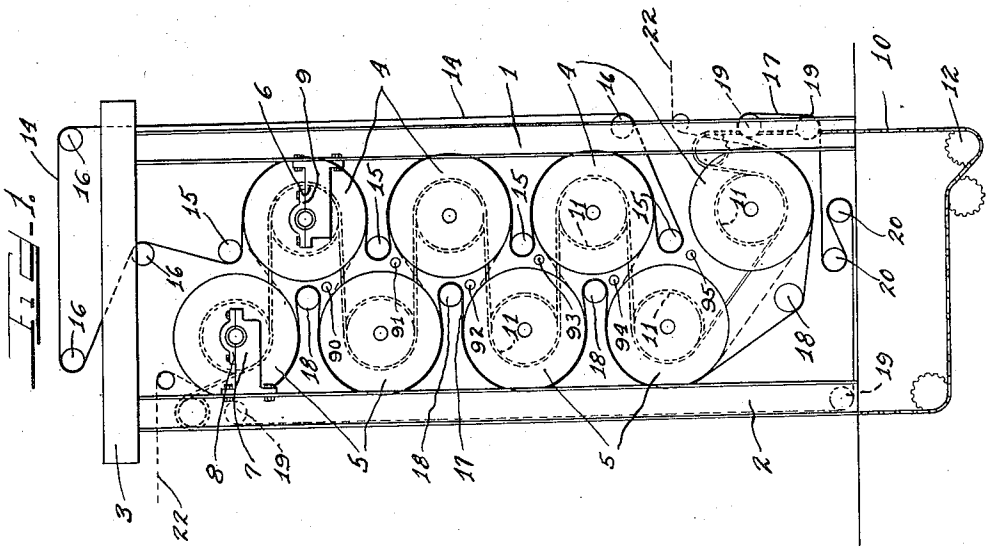

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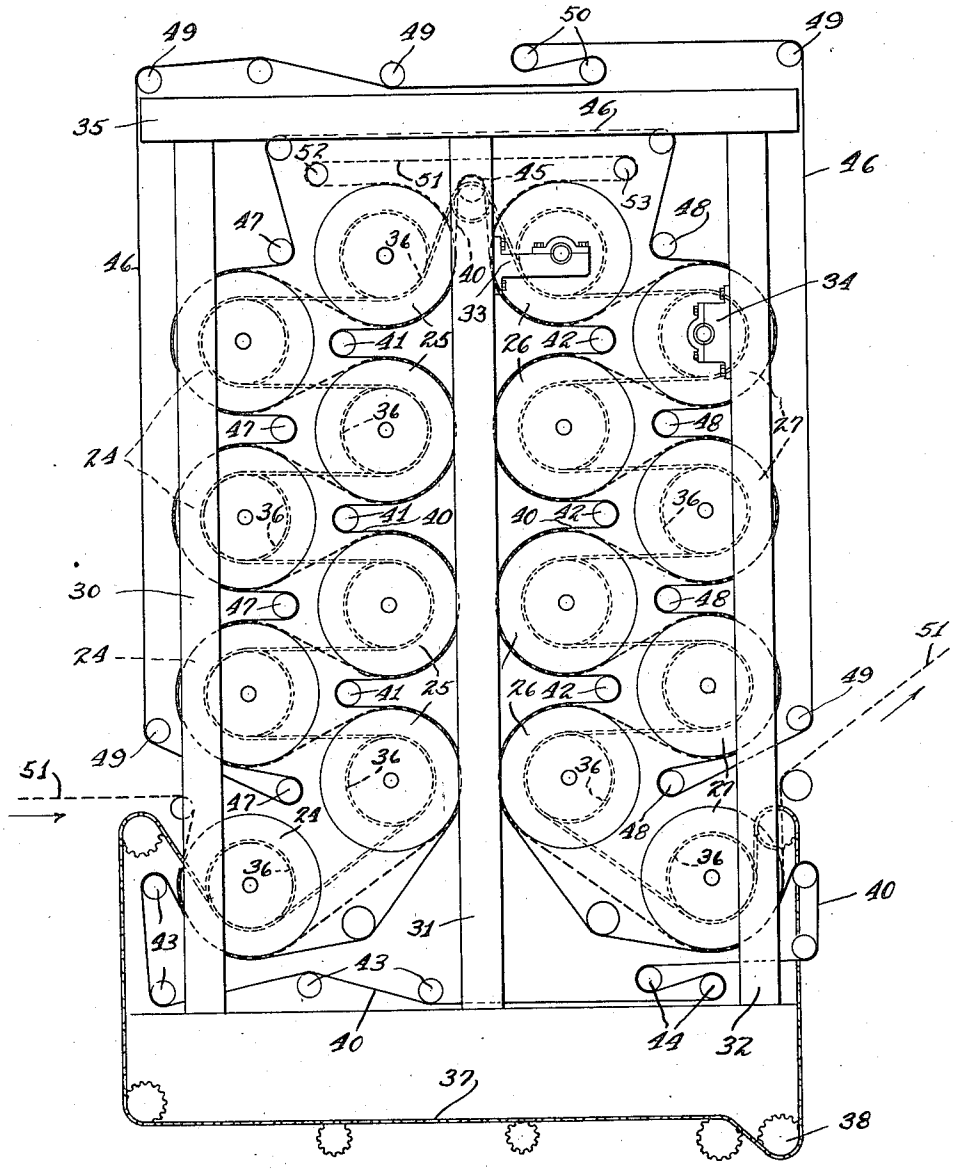
Fig. 3.



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VERTICAL DRIER FOR WEB MATERIAL

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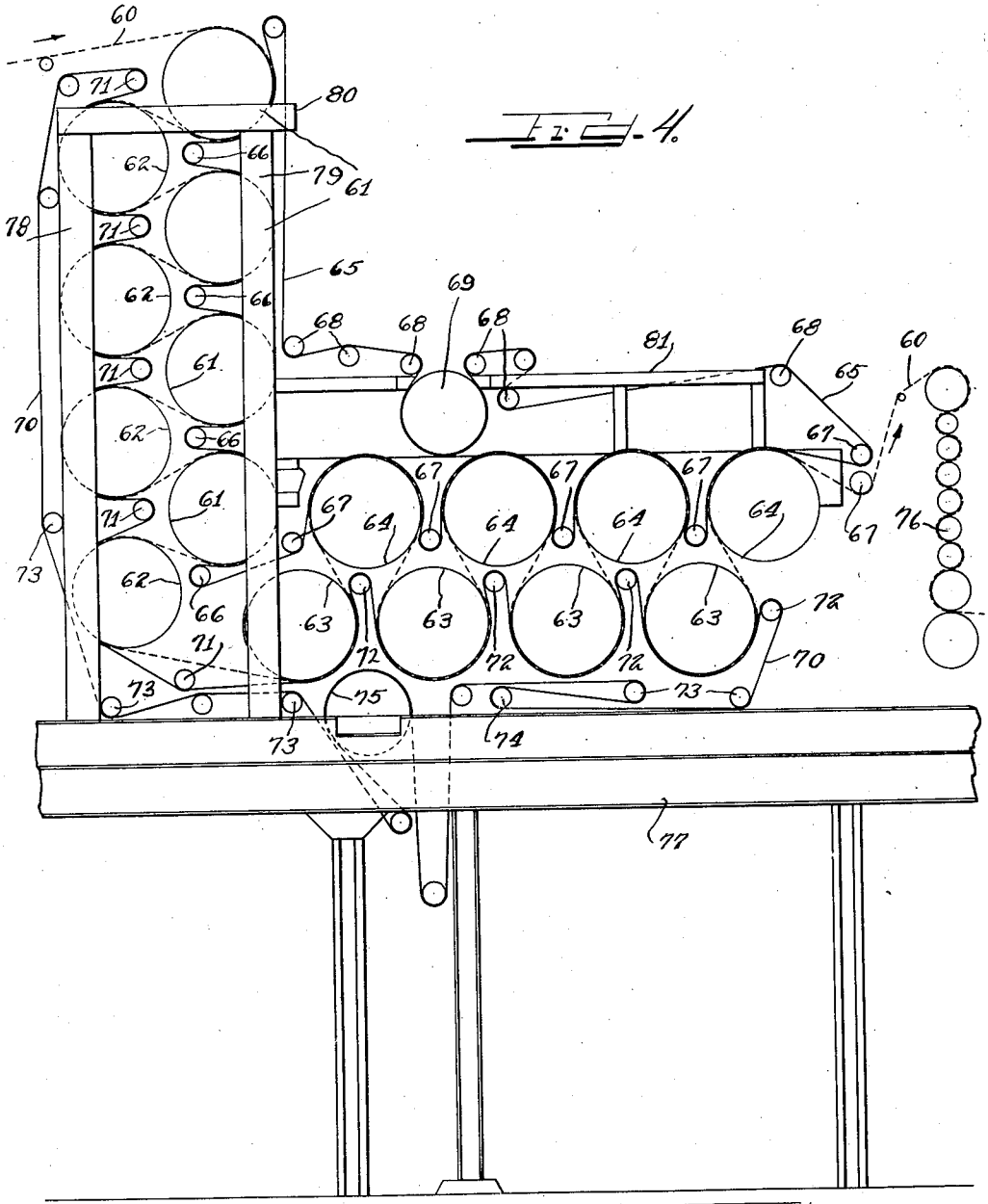

Fig. 4.

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UNITED STATES PATENT OFFICE

2,019,649

VERTICAL DRIER FOR WEB MATERIAL

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Application June 9, 1933, Serial No. 674,975

2 Claims. (Cl. 34—48)

This invention relates to improvements in vertical driers for web material such as paper and the like.

More specifically this invention relates to vertically mounted cylindrical drier drums for web material equipped with directing felts or canvas to press the web being dried against the cylinders and to prevent curling of the web without destroying circulation of drying gases through the drier stack. The invention includes a novel supporting structure for the drier drums whereby the serpentine course of the web through the driers is viewed unobstructedly from the side of the apparatus.

It is sometimes desirable, because of lack of floor space, to mount the drier drums for paper and the like web material in a vertical stack positioned immediately after the wet end of the paper or web machine. Since the usual type of horizontal driers requires an enormous amount of floor space it is obvious that a stack arrangement, vertical or inclined, of the drier drums will effect considerable saving in floor space.

Heretofore vertical driers have been, when used, almost always confined to drying heavy papers because it has been considered impossible to equip the vertical driers with directing felts or canvas to hold the sheet against the drier drums and thereby obtain a good heat transfer. When heavy sheets are dried, however, the normal shrinkage of the sheets causes a tight contact with the drier drum and a good heat transfer is thereby obtained. The tendency for heavy papers to shrivel or cockle during the drying operation, furthermore, is relatively slight, whereas when lighter papers are dried, and especially those papers made from pulps that are highly hydrated, there is a very great tendency for the sheet to shrivel and cockle. As a result it is necessary to use felts to hold the lightweight sheets very tightly to the drier surfaces. In the usual horizontal type of driers, the heat transfer has been obtained by the use of felts or canvas partially wrapped around each drier drum and operated under considerable tension. The lightweight sheet is then passed between the canvas and the drier drum and an efficient heat transfer obtained.

It has been proposed to equip the vertically mounted driers with directing felts or canvas so that this type of drier might be used for lightweight papers. However the proposed arrangements of felt or canvas webs in vertical driers have completely destroyed the circulation of air or drying gases through the drier stack and have thereby greatly reduced the efficiency of the drying operation. It is well recognized that a good air circulation should be maintained through the driers so that the moisture-laden air surrounding the web being dried is rapidly removed from the web region. In some installations it has been proposed to blow a blast of air through the drier stacks. With the known manners of threading the directing felts for the lightweight papers this air circulation has been cut off by the felt or canvas passing across the stack and thus destroyed.

I have now provided an arrangement of directing felts or canvas for vertical driers whereby the air or drying gas circulation through the stack is capable of being operated with the same efficiency as the horizontal type of apparatus.

I have also provided a novel arrangement for mounting the drier drums between vertical supports which do not obstruct the view and make it possible for the operator to follow the entire serpentine course or path of travel of the web through the drier stack without difficulty. This is a very important feature since when breaks occur in the web they can be immediately detected and the broken web may be readily threaded through the stack without hindrance because of supporting structure.

A preferred form of my invention includes a silent chain drive for the drier drums.

It is therefore an object of this invention to provide a vertical type of drier for web material which is equipped with directing felts or canvas which do not cut off the air circulation through the stack.

It is another object of this invention to provide a vertical type of drier for paper and the like in which the paper web is directed through the drier by means of directing felts or canvas partly entrained around the drier drums without destroying air circulation through the apparatus.

It is a specific object of this invention to provide a vertical type of drier for web material in which the drier drums are mounted between two vertical supports, the drier drums being in cooperating sets, driven by a single endless chain and equipped with directing felts for pressing the web against the drier drum surface to obtain a good heat transfer.

Another object of this invention is to provide a vertical type of drier for web material composed of a plurality of drier drums mounted between vertical supports so that the travel of the web through the drier may be viewed without obstruction.

The invention is further illustrated on the ac-

companying sheets of drawings which form a part of this specification and show preferred forms of my invention.

On the drawings:

Figure 1 is a side elevational view of a vertical drier stack showing a single set of drier drums equipped with two endless directing felts and driven by a single endless chain.

Figure 2 is a broken front elevational view of the vertical drier shown in Figure 1 with part of the outside felt broken away to show the drier drums.

Figure 3 is another form of vertical drier showing two sets of drier drums mounted on three sets of vertical supports, driven by a single endless chain and equipped with directing felts for holding the web of paper against the drum surfaces.

Figure 4 is a combined form of vertical and horizontal drier drums so arranged that a single endless felt is entrained around the top set of horizontal driers and the right hand set of vertical driers while another directing felt is entrained around the bottom set of horizontal drums and the left hand set of vertical drums.

As shown on the drawings:

In Figures 1 and 2 the reference numerals 1 and 2 indicate vertical beams or supporting structure for a plurality of drier drums arranged in two vertical stacks, comprising the drying rolls 4 and 5, respectively. A top beam or support 3 may be fastened to the beams 1 and 2 at the top ends thereof to impart rigidity to the supporting structure. The drying rolls or drums 4 and 5 are mounted in bearings such as 6 and 7 which are bolted respectively to the vertical beams 1 and 2. The bearing 7 for the top drum 5 is preferably of the horizontal supporting type with a strap 8 across the top, which is removable, to permit removal upwardly of the top drying drum 5. Similar bearings, such as 6 may be provided with straps 9 to support and hold the drums 4 in fixed rotatable relation.

The drier drums 4 and 5 are driven by a silent chain 10 which meshes with a gear 11 on each drier drum. The chain 10 is driven by means of a driving gear 12 or other suitable driving mechanism.

A felt 14 is guided around all of the drier drums 4, with the exception of the lowermost roll, by means of guide rolls 15 positioned above and below said drums. Said rolls 15 are positioned with their lateral faces lying back from the inner crowns of the drier drums 4 so as not to obstruct the free upward passage of air by the felts. Guide rolls 16 are also provided to direct the felt 14 around the outside of the drier drum frame or supporting structure so as not to interfere with the web passing through the drier unit.

A second felt 17 is partly entrained around all of the drier drums 5 and the bottom drier drum 4 by means of guide rolls 18 positioned below the drums 5 in the vertical stack. Said rolls 18 are positioned in a manner similar to that described for the rolls 15 so as not to interfere with the circulation of air between the drums 4 and 5. Additional guide rolls 19 are provided to direct the outside run of the felt 17 so as not to interfere with the web passing through the drier. Tension rolls 20 may be provided to keep the felt 17 in a stretched condition.

It will thus be seen that a web of paper such as the web 22 may enter the drier stack from the top and travel downward in a serpentine path around the drier rolls 4 and 5 and emerge from the bottom of the stack as shown. The felts 14 and 17 maintain a tight contact of the web with the drier drums 4 and 5 and prevent cockling or crinkling of the web. At the same time, the sheet is exposed to the natural draft of drying air, or to mechanically produced vertical air blasts that may be circulated through the drier stack and the air circulation is not materially interfered with or cut off by the felts 14 and 17.

In Figure 3 two sets of drier drums 24 and 25 and of drums 26 and 27, respectively, are mounted on vertical supporting beams 30, 31 and 32 by means of bearings such as 33 and 34 which, as shown, are bolted to the supports 31 and 32. A top support 35 is provided to impart rigidity to the framework. It is thus seen that four vertical columns of drier drums are supported by means of three pairs of vertical beams. It is understood, of course, that two sets of beams 30 and 31 and 32 are provided, one on each end of the drums 24, 25, 26, and 27. The construction in this respect is similar to that shown in Figure 2.

Sprocket gears 36 are provided on each drum 24, 25, 26 and 27 for meshing with an endless driving chain 37 which is suitably driven by driving gears such as 38.

An endless felt 40 is guided around the drums 25 and 26 by means of rollers 41 and 42 respectively which are positioned between the drums 25 and 26. Said rollers 41 and 42 are positioned with their lateral faces lying back from the inner crowns of the drier drums so that the web being dried will be unobstructed as it passes from drier to drier. The felt 40 is guided across the bottom of the drier by means of guide rollers 43 so as not to interfere with the web entering into and emerging from the drier. Tensioning rolls 44 may be provided to maintain the felt in a stretched condition. A top roll 45 is provided between the two top drier drums 25 and 26 for guiding the felt around the top of the vertical stack. It is thus seen that the single felt 40 is utilized to guide the web being dried around the two inner vertical columns of drier drums 25 and 26.

Another endless felt 46 is provided to guide the web being dried around the outside drier rolls 24 and 27. Guide rolls 47 and 48 are positioned between the drier drums 24 and 27 respectively to direct the felt 46 around the outside periphery of these drums. Additional guide rolls 49 may be provided alongside the outer run of the felt to prevent interference with the web being dried. Tensioning rolls 50 may also be used to maintain the web 46 in a stretched condition.

By this arrangement the web or felt 46 holds the paper or web being dried tightly against the top 3 drier drums 24 and 27, as the web passes over these drums. The inside felt or felt 40 holds the web against the four inside drier drums 25 and 26 and also the bottom outside drier drums 24 and 27. A web of material such as the paper web 51 enters the drier as shown in the dotted lines at the left hand bottom side and travels around the bottom drier drum 24 and then in a serpentine path upward between the drums 25 and 24 until it reaches the top drum 25 where its upward direction is reversed over a set of guide rolls 52 and 53. The web then descends in a serpentine path between the drums 26 and 27 and emerges from the bottom drum 27 as shown. The felt arrangement whereby a single felt takes care of the two bottom drums 24 and 27 and the inside stack of drums 25 and 26 while another single felt takes care of the remaining outside

drums 24 and 27 permits a very efficient drying operation since air blasts may be circulated through the stack in the same manner as if the felt were not provided since the felts do not cross over and cut off the air current. The only hindrance in the path of the air currents through the stack is the paper web itself which is, of course, being dried and is intended to be acted upon by the air currents.

In the modification shown in Figure 4 a web of material to be dried such as a web of paper 60 enters into the vertical column of drier drums at the top thereof around the top drum 61 and descends in a serpentine path to the bottom drum 62 from which it is transferred into the horizontal section of the drier and travels in a serpentine path over horizontal drums 63 and 64. The web 60 is directed around the drum 61 and drum 64 by means of an endless felt or canvas 65 which is held tightly against the drums 61 and 64 respectively by guide rolls 66 and 67 respectively located between the drier drums. The back run of the felt 65 is guided around guide rolls 68 so as not to interfere with the run of the paper through the drier. The felt may be dried by passage over a heated drum 69 before returning to the top drier drum 61 where it again contacts the paper web. It is thus seen that the web 65 serves the vertical drier drums 61 and the top set of horizontal driers 64.

An additional felt 70 is provided for pressing the web against the drums 62 and 63 and is guided around these drums by means of guide rolls 71 and 72 respectively. The back run of the felt 70 is guided around guide rolls 73 so as not to interfere with the travel of the paper through the drier. A tension roll 74 may be provided to maintain the felt in a stretched condition. Likewise a drier drum 75 may be provided to dry the felt before it is returned to contact with the incoming web of paper 60 at the top drier drum 62. It is thus seen that the felt 70 serves the vertical stack of drier drums 62 and the lower horizontal row of drier drums 63 without in any way interfering with a vertical blast of air through the vertical drier stack or a horizontal blast of air through the horizontal drier section. The paper web upon emerging from the horizontal section around the last guide roll 67 may be passed through the conventional cylinder stack 76.

The entire drier may be mounted on a support such as is shown at 77 while the vertically mounted drier drums are supported by means of the vertical beams 78 and 79. A top supporting beam 80 is provided to impart rigidity to the supporting structure. The guide rolls 68 and the drier drum 69 for the felt 65 may be supported by any suitable means such as a beam 81.

The drier drums may be driven by a silent chain drive such as is shown in Figures 1 and 3 or by any other suitable means.

While the naturally occurring or forced air currents through the drier are not interfered with by the directing felt and thus aid in making the vertical drier of this invention just as efficient as a horizontal type of drier, in some instances, it may be desirable to create horizontal air currents through the vertical drier. These horizontal air currents can act directly on the web being dried as it passes between the rolls in the drier. They may be formed by ejecting air from nozzles located along the sides of the driers and supplied with air at sufficient pressure to travel across the width of the machine.

As shown in Figures 1 and 2 nozzles 90 to 95 inclusive are provided for directing horizontal air currents across the drier unit to carry the moisture away from the web being dried. The air supplied may be either at room temperature or slightly heated to increase its moisture absorption capacity. The moisture vapors coming from the lower drier rolls rise and pass alongside of the higher drier rolls with the result that the surrounding atmosphere at the top of the drier section is highly saturated with moisture. The formation of the horizontal air currents prevents the saturation of the upper section of the drier with moisture.

Since the placing of all of the air nozzles on one side of the machine would cause the atmosphere surrounding the sheet to be highly saturated with moisture on the side of the machine opposite the nozzles I propose to alternate the positioning of the nozzles on each side of the machine. Thus nozzles 91, 93, and 95 are placed on one side of the machine while the cooperating nozzles 90, 92, and 94 at different levels are placed on the other side of the machine.

While the nozzles for producing horizontal air currents are only shown in Figures 1 and 2 it is obvious that they may be added to the structure shown in Figures 3 and 4 without departing from this invention.

It is to be understood that any desired number of drier drums may be mounted in the vertical or horizontal sections of my improved drying apparatus. From the above description it is evident that I have provided a drier for a web material which may be readily driven by a single endless chain silent drive and which is equipped with directing or press felts for holding the web tightly against the drum to insure a good heat transfer without in any way interfering with air currents through the drier. I have also provided a simplified structure whereby vertical supporting beams are used to mount the drier drums without obstructing the operator's view of the course of travel of the web through the drier. The entire structure makes possible an efficient drying operation at low power operating cost and with a great conservation of floor space.

By the terms "endless belt" and "endless felt" as used in the above specification and in the following claims I mean to include any type of directing web such as felt or canvas whether initially formed into an endless loop or sewed together at the ends after being threaded into position in the drier.

I am aware that many changes may be made and numerous details of construction may be varied through a wide range without departing from the principles of this invention, and I therefore do not purpose limiting the patent granted hereon otherwise than necessitated by the prior art.

I claim as my invention:

1. In a vertical type paper drier, four vertical stacks of drier drums arranged in spaced relation in each stack and in staggered relation in adjoining stacks, an endless felt trained to wrap around part of the peripheries of successive drums in the two inside stacks, and the lowermost drums in the outside stacks, a second endless felt trained to wrap around part of the peripheries of the drums in the outside stacks, said felts cooperating to guide a paper web through the drier in a serpentine path without cutting off vertical air currents through the drier.

2. A vertical drier unit for web material comprising vertical standards, four vertical stacks of

drier drums supported from said standards in parallel relation and with the drums of the two inner stacks in staggered relation with the drums of the two outer stacks, a felt for guiding paper through the drier and rollers around which said felt is trained so arranged between said drums as to lap said felt about the outer surfaces of the drums in the outer stack, a second felt trained over rollers and over the outer surfaces of the drums in the two middle stacks to thereby define a serpentine path for the web material extending back and forth between the successive drums in said stack without being obstructed by the felt as it passes from one drum stack to another.

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