May 31, 1960 W. H. COCK 2,938,568

MACHINE FOR AND METHOD OF CORRUGATING PAPER

Filed Nov. 27, 1956 2 Sheets-Sheet 1

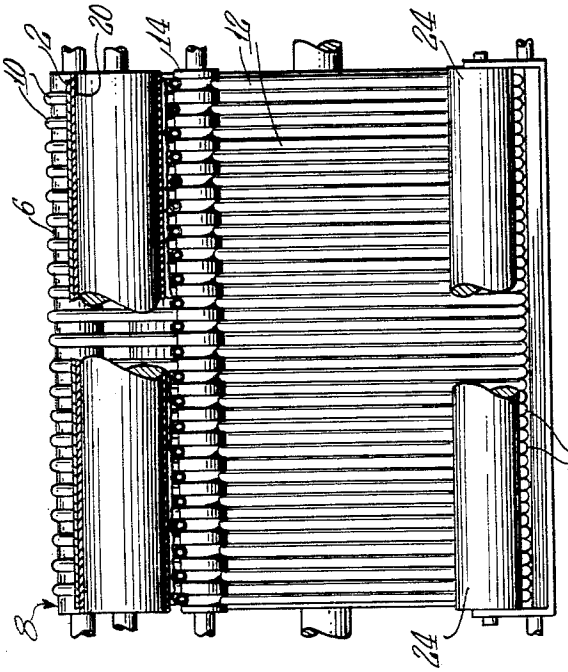

FIG. 2

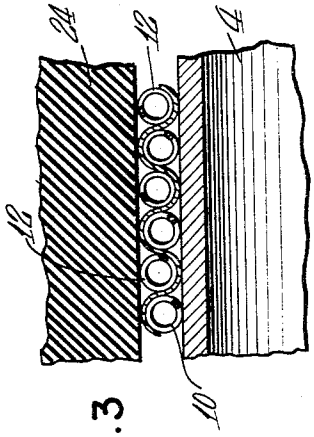

FIG. 3

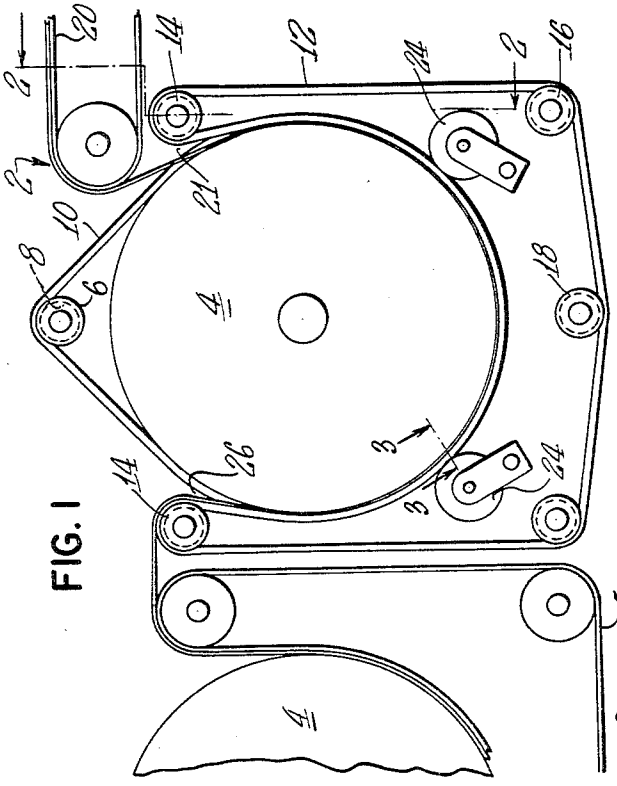

FIG. 1

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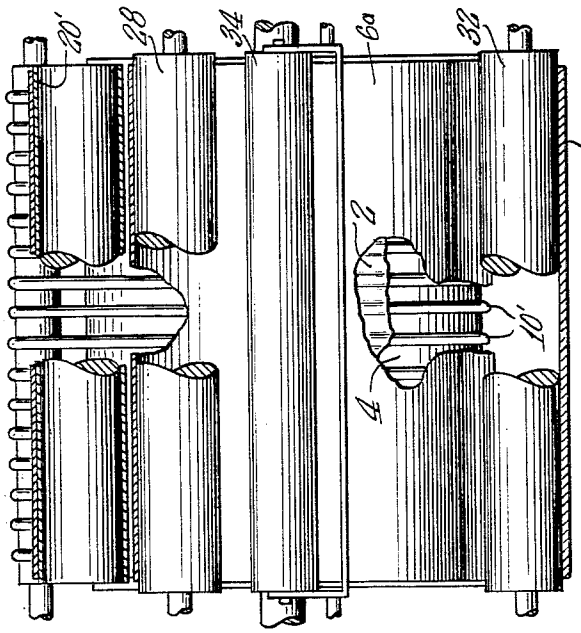

FIG. 5

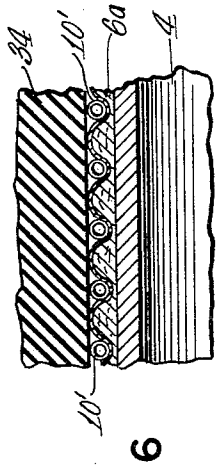

FIG. 6

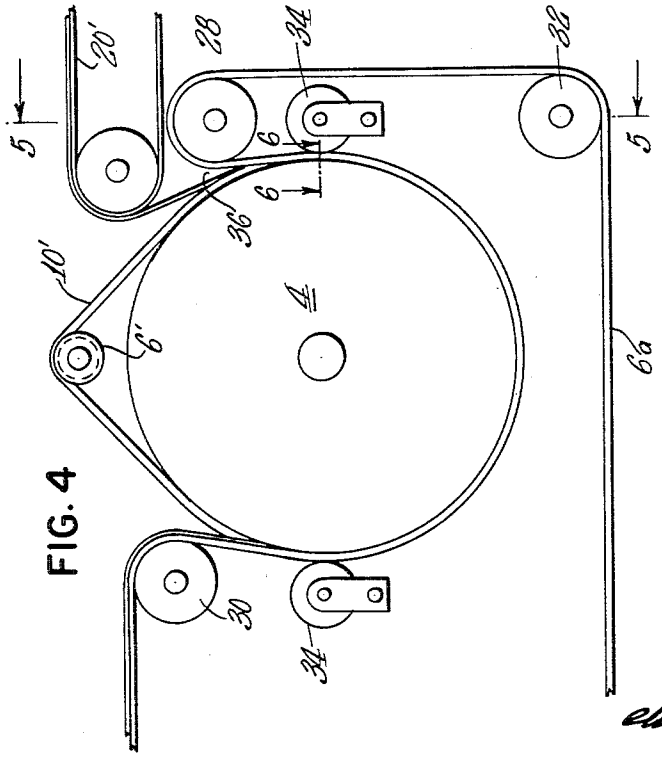

FIG. 4

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MACHINE FOR AND METHOD OF CORRUGATING PAPER

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5 Claims. (Cl. 154—30)

The present invention relates to machines for and methods of corrugating paper webs.

One of the objects of the invention is to provide a machine of this character which is simple in construction and efficient in operation.

Another of the objects of the invention is to provide a novel and improved method of the character indicated.

The several features of the invention, whereby these and other objects may be attained, will be readily understood from the following description and accompanying drawings, in which:

Figure 1 is a side view, partly diagrammatical of a machine embodying features of the invention in their preferred form;

Fig. 2 is a sectional elevation taken on the line 2—2 of Fig. 1 with parts broken away;

Fig. 3 is a sectional view, on an enlarged scale, taken on the line 3—3 of Fig. 1;

Figs. 4 and 5 are views corresponding respectively to Figs. 1 and 2 of a modified machine, the sectional elevation Fig. 5 taken on the line 5—5 of Fig. 4; and

Fig. 6 is a detailed sectional view, partly in elevation, taken substantially on the line 6—6 of Fig. 4.

The machine illustrated in the drawings is particularly adapted for corrugating a paper web 2 as the web leaves a crinkling machine which forms transversely extending crinkles in the web.

Paper webs are usually crinkled when in a moistened condition, and a drum dryer may be employed to dry the web after it leaves the crinkling machine. The drum dryer may consist of a series of rotating steam-heated drums 4 over which an endless blanket 5 of canvas successively passes which conveys the web from one drum to the other until the web is dried to the desired degree of moisture content which may be about six percent by weight.

My corrugating machine, as shown in the drawings, may utilize the first drum 4 of the drum dryer, which may be steam-heated at a temperature of 190° F., and may be driven at a speed of 200–500 feet per minute, but it will be apparent that the temperature and speed may be varied to meet different conditions. In the form of machine shown in Fig. 1, the canvas blanket 5 is omitted from this drum, the blanket starting with the second drum. A roller 6 is mounted a distance above the first drum 4 and parallel therewith. This roller is substantially the same length as the drum and is provided with grooves 8 that may be spaced apart one-half inch from their centers. Endless belts 10, which may be in the form of coiled springs pass in the grooves 8 and over the drum. These springs may be one-quarter inch in diameter and made of round wire with their coils normally closed. The springs should be placed under sufficient tension to cause them to be carried by the drum. The tension of the springs may be varied by vertically adjusting the position of the grooved roller 6 with relation to the drum.

A second set of endless belts 12 which, like the belts 10, may be in the form of coiled springs, engage between the belts 10. This set passes over grooved rollers

14 at opposite sides of the upper portion of the drum, guide rollers 16, and a grooved roller 18 positioned between the guide rollers. These belts are placed under sufficient tension to tend to cause them to firmly engage the drum.

The paper web may be conveyed from the crinkling machine by means of an endless conveyor 20. This crinkled web may have a moisture content of about twenty-five–seventy-five percent by weight. As the web leaves the conveyor, it passes downwardly between the forward converging portion 21 of the two sets of belts 10 and 12. As the web is carried about the drum by the belts the outer belts 12 force it over and between the inner belts 10. The converging portions 21 of the belts gradually and uniformly work the web between the two sets of belts, and between the belts of the inner set. The smooth round wire cylindrical springs allowing easy slipping of the web to permit this to be accomplished without injuring the paper. This results in uniform rounded corrugations being formed in the web which become set as the web passes from the drum and over the rear grooved roller 14.

To provide maximum depth with relation to width of the corrugations, the outer set of belts 12 should force the web against the drum and against the sides of the inner belts 14.

Such pressure of the outer belts 12 on the web may be varied by means of rubber rollers 24 located adjacent the lower portion of the drum. These rollers are adjustable to force the outer belts 12 toward the drum in varying degrees. Thus as the web enters between the belts, it is gradually forced by the outer belts 12 between the inner belts 10 and toward the drum until it reaches the front pressure roller 24 which places the maximum pressure on the outer set of belts.

By suitably spacing the belts of the two sets, and with the belts of suitable diameter, the paper is firmly pressed between the belts of the two sets, and over the individual belts thereof. This materially contributes to the uniform setting of the corrugations. With the belts spaced one-half inch between centers, it has been found that substantially one-quarter inch belts may be employed with the coils closed and about 24 coils to the inch. These coiled springs yield enough to allow the outer belts and web to be forced between the inner belts and substantially against the drum. This ensures maximum depth and uniform setting of the corrugations.

The rear pressure roller 24 ensures the two sets of belts remaining in corrugating position from the front roller 24 for a substantial portion of the tavel of the web so as to ensure effective setting of the corrugations.

As the web approaches the diverging portions 26 of the belts, it is gradually and uniformly separated from the inner belts and drum.

After passing from the rear grooved roller 14, the web is carried by the blanket 5 over the next drum 4, and successively over the other drums of the dryer to complete the drying of the web, usually to a normal moisture content of about six percent.

The form of machine shown in Figs. 4 and 5, like the other form, utilizes the first drum 4 of the drum drier, and also a set of belts 10′ that correspond to the belts 10. The belts 10′ pass over a grooved roller 6′ and about the drum in the same manner as the belts 10.

The belts 10′ also consist of coiled springs but they may be of somewhat smaller diameter, such as one-eighth inch, when spaced apart approximately one-half inch between centers. It will be apparent, however, that the diameter of the belts and their spacing may be varied depending on the width and depth of the corrugations to be formed, the thickness and nature of the web, etc.

In this form, the usual canvas blanket 6a passes over

the lower portion of the first drum 4 and the belts 10'. The blanket may be guided by a guide roller 28 spaced in front of the upper portion of the drum, and a guide roller 30 spaced at the rear of the upper portion of the drum. A roller 32 guides the blanket 6a to the front guide roller 28.

Adjustable pressure rubber rollers 34, corresponding to the rollers 24, are provided for pressing the blanket against the belts 10' and drum 4. The web to be corrugated may be delivered to the machine on a conveyor 20', corresponding to the conveyor 20.

With this machine, as the web leaves the conveyor 20' it is carried downwardly between the converging portions 36 of the blanket 6a and belts 10', in a direction substantially tangent to the drum 4.

As the web approaches the front pressure roller 34, the web is pressed over the belts 10', and this pressure causes the belts to be embedded in the blanket to form the corrugations (Fig. 6), the degree of pressure of the roller on the blanket determining the depth of the corrugations. The canvas blanket may be one-eighth inch in thickness and sufficiently soft to permit such embedding of the belts and web therein.

After the web and blanket pass the rear pressure roller 34, they pass between the diverging portions of the blanket and belts which causes them to gradually separate from the belts 10'. The blanket and corrugated web then pass over the rear guide roller 30 from which they pass over the other drums of the dryer.

Thus with both forms of the machine the corrugations are gradually and uniformly made without subjecting the paper web to undue strain either longitudinally or laterally, and the operation may be performed at high speed. Also as the web leaves the first drum, the corrugations are effectively set and partially dried, and remain set as the web passes over the other drums of the dryer.

In place of the drum drying means shown, it will be understood that any suitable drying means may be employed for drying the web after it leaves the ribbing or corrugating cylinder or drum.

In the case of webs of crinkled paper, the corrugating is performed without materially stretching the paper longitudinally. The material is of cloth-like pliability. The corrugations may provide for eight to ten percent stretch or even more, and the elasticity thereof is effectively retained when the web is dried, and is particularly adapted for use for wrapping paper, and for the plies of bags where strength, stretchability and pliability thereof are desired.

In addition to paper webs both crinkled and flat, of single or a plurality of plies, my improved machine and method may be employed to corrugate various other sheet material such as cloth and plastics, and combinations thereof.

What I claim is:

1. In a machine for corrugating a web of the class described, a rotating dryer drum, a roller arranged axially parallel to and spaced from the outer periphery of the drum, a set of belts passing over said roller and the drum, said belts being spaced apart, two rollers arranged at opposite sides of the drum and spaced a distance therefrom, a second set of belts looped over said rollers with the inner length of the individual belts of said second set passing in coextending relationship over the drum and the belts of the first set, the belts of the second set being spaced apart and adapted to enter the spaces between the belts of the first set and being driven by the drum, and the portions of said inner lengths of the second set of belts adjacent said rollers associated with the belts being inclined outwardly with relation to the belts of the first set, means for delivering a web between said inclined portions of the two sets of belts whereby the web is carried by the belts about the drum, said belts being coiled springs of smooth round wire, said second set of belts being under tension so as to cause them to be progressively pressed with the web into the spaces between the belts

of the first set, said web being able to slip easily as it contracts laterally between the progressively engaging belts during formation of the longitudinal corrugations, the belts being held in substantially parallel spaced relationship while being carried about said drum.

2. In a machine for corrugating a web of the class described, a rotating dryer drum having a realtively smooth outer periphery, a roller arranged axially parallel to and spaced from the outer periphery of the drum, said roller having a plurality of annular grooves in its peripheral surface that are spaced apart, a set of belts with the belts in the set respectively arranged in the grooves and extending from the roller about the drum in substantially spaced parallel relationship, a second set of belts, a plurality of rollers over which the second set of belts pass for guiding individual belts of said second set in substantially spaced parallel and coextending relationship over the drum, each of said plurality of rollers having circumferential grooves for respectively receiving the belts of the second set, the grooves in the latter rollers being spaced apart so as to cause the belts to enter the spaces between the belts of the first set, the two sets of belts being endless coiled springs of smooth round wire carried by the drum, means for feeding a web between the two sets of belts to corrugate the web longitudinally, and means acting upon the belts of the second set wherein individual ones of such belts and the web are co-instantaneously and progressively urged into interdigitating relationship with the spaced belts of said first set against the outer peripheral surface of said drum, said web being able to slip as it contracts laterally between the progressively engaging belts during formation of the corrugations.

3. In a machine for corrugating a web of the class described, a rotating dryer drum having a relatively smooth outer periphery, a set of belts of endless coiled springs of smooth round wire passing over said drum and carried thereby in parallel spaced relationship, means for passing a web over said belts and drum whereby the web is carried thereby, and movable outer means engaging the web for progressively pressing the web over said belts and into the spaces between them to form longitudinal corrugations in the web, said web being caused to slip over said belts and laterally contract as it is being progressively pressed into the belt spaces, said means and web being substantially coinstantaneously urged into the spaces between said belts wherein the web is thus urged against the smooth peripheral drum surface as the web is carried around the drum.

4. A structure according to claim 1 further including means comprising rollers for engaging the belts of the second set at spaced points to press them towards the drum.

5. The method of corrugating a web of the class described comprising placing the web longitudinally between two sets of belts of coiled springs of smooth round wire carried by a rotating dryer drum having a smooth outer periphery, the individual belts of the two sets being spaced apart and in parallel relationship, and applying tension to the outer set of belts to cause the individual belts thereof in coextending lateral relationship to progressively enter the spaces between the belts of the inner set and carry the web therewith to form longitudinal corrugations in the web as it passes about the drum, wherein the web is caused to slip upon lateral contraction between the progressively engaging belts during formation of the corrugations.

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UNITED STATES PATENT OFFICE

CERTIFICATE OF CORRECTION

Patent No. 2,938,568 May 31, 1960

William H. Cock

It is hereby certified that error appears in the printed specification of the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 1, line 56, after "this" insert -- first --; column 2, line 50, for "tavel" read -- travel --.

Signed and sealed this 22nd day of November 1960.

(SEAL)

Attest:

KARL H. AXLINE
Attesting Officer

ROBERT C. WATSON
Commissioner of Patents