Nov. 15, 1960 C. J. GREINER ET AL 2,960,023

PAPERMAKING MACHINE

Filed April 25, 1958 3 Sheets-Sheet 1

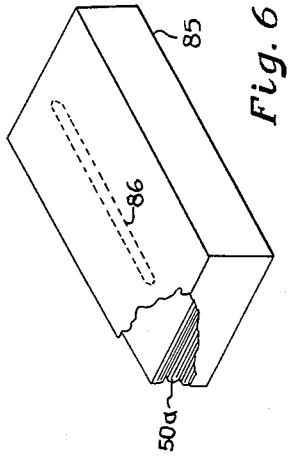


Fig. 6

Fig. 1

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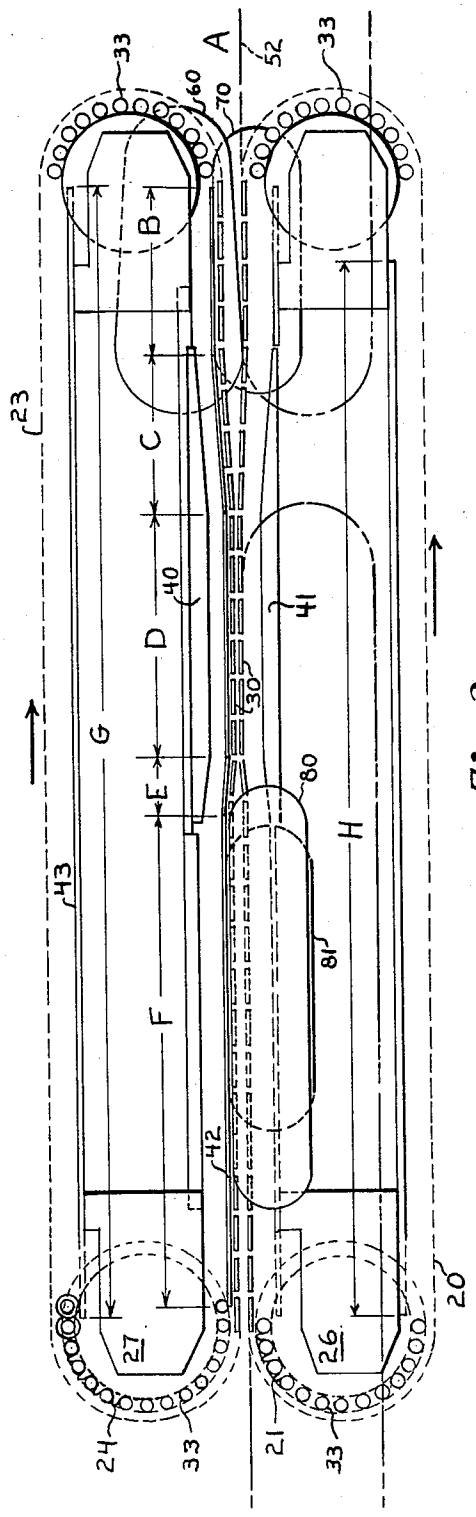


Fig. 2

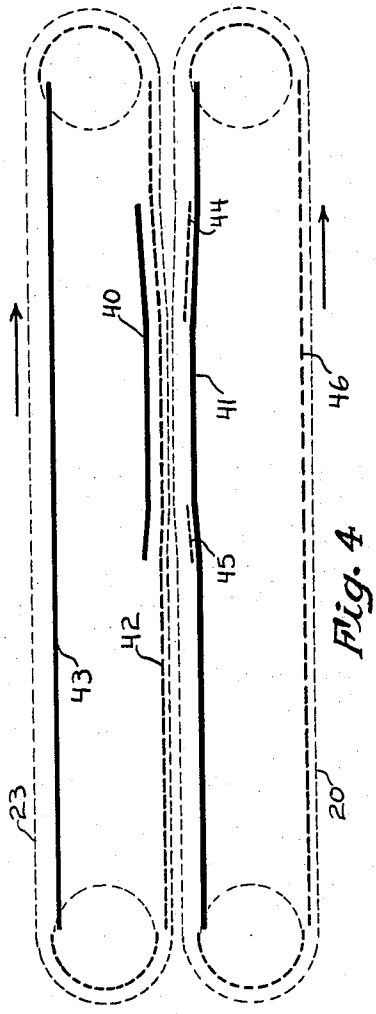


Fig. 4

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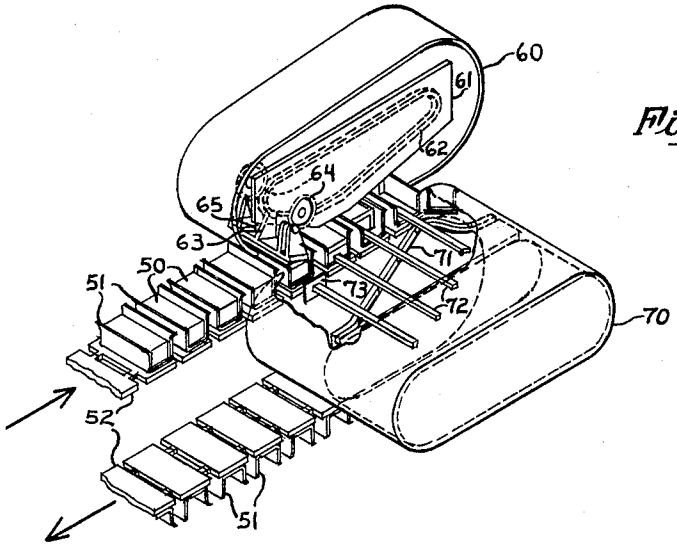


Fig. 5

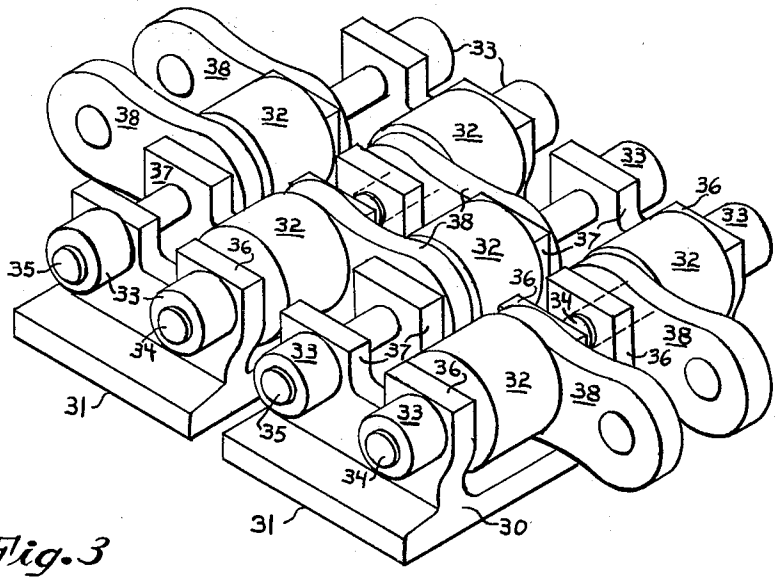


Fig. 3

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2,960,023

PAPERMAKING MACHINE

Charles J. Greiner and Anthony S. Hubin, Menasha, Wis., assignors to Kimberly-Clark Corporation, Neenah, Wis., a corporation of Delaware

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3 Claims. (Cl. 100—152)

This invention relates to apparatus for the forming of a compressed stack of tissue paper sheets and of a package of such sheets. In a particular application, the invention relates to apparatus for forming a compressed stack of paper facial tissue and a package thereof.

The well known product denominated as facial tissue has assumed a status of great commercial importance in recent years. These tissues are paper sheets, usually creped, of a basis weight (uncreped) of about seven to about ten pounds per ream (2880 square feet), the tissues ordinarily being of size about 9 x 10 inches, with the tissues frequently being of two-ply construction. The tissues are folded and arranged in a stack which is ordinarily placed in a paperboard carton for sale and dispensing therefrom by the consumer. In some cases, the individual tissues are interfolded, so that each tissue upon being dispensed from the carton brings the next succeeding tissue into dispensing position.

These relatively light and flimsy tissue sheets do not provide stacks of uniform height, assuming the same number of tissues are in the stacks, and this is particularly true upon comparison of stacks made from different runs of the papermaking machine. In fact, in commercial practice it is found that the untamped height of a stack of 400 two-ply tissues will vary from about two and one-half to four and one-half inches, where the tissues are arranged in the known interfolded manner. In order that the tissues, regardless of the height of the stack, will fit into the same size carton, it is obvious that the carton must have a height equal to the maximum height of the stack which it is expected will be encountered. While this very well takes care of the maximum height stacks, when a minimum height stack is put into the same carton a considerable and undesirable slack fill of the carton occurs. This looseness may be sufficient so that ordinary handling during shipment and sale will result in serious disarrangement of the tissues. It is obvious that in these cases of minimum height stacks, a large portion of the contents of the carton is air, and there is a resultant large cost for transportation and storage not based upon handling of useful materials.

It has long been considered desirable to find some solution to the above shortcomings, but until the present invention no apparatus which would in any way eliminate these shortcomings has been available. It is therefore the principal object of this invention to provide apparatus whereby stacks of creped tissue of widely varying uncompressed height may be formed into stacks of substantially lesser and uniform height, and for packaging the stacks in a single size carton of dimensions only slightly greater than those of the compressed stacks after limited re-expansion, so that slack fill of the carton is substantially eliminated. Details of this and other important objects and advantages of the invention will be made clear from the following description of the attached drawings, in which:

Figure 1 is a perspective view, largely schematic and partially cut away, of apparatus according to this invention,

Figure 2 is a side view, partially schematic and cut away, of the apparatus taken from the foreground of Figure 1,

Figure 3 is a perspective view of certain parts of the apparatus of Figure 1,

Figure 4 is a schematic side elevation of certain basic parts of the apparatus of Figure 1,

Figure 5 is a perspective view, partly schematic and cut away, of certain details of the apparatus, and

Figure 6 is a perspective view, partially cut away, of a packaged compressed stack of tissue made in accordance with the invention.

Referring first to Figures 1 and 2, the apparatus includes a lower continuous compression or bearing track 20 mounted for travel about driving sprockets 21 and idlers 22, and an upper continuous compression or bearing track 23 mounted for travel about driving sprockets 24 and idlers 25. Sprockets and idlers 21, 22, 24 and 25 are rotatably mounted on lower and upper frame members 26 and 27 respectively, sprockets 21 and 24 being conventionally driven to cause travel of upper and lower tracks 20 and 23 as indicated by the directional arrows. These elements are shown primarily in schematic form, since the sprockets and idlers are conventional and the tracks are later shown in more detail and fully described.

Each of tracks 20 and 23 comprises a continuous chain or linkage of pressure platens 30, adjacent platens being connected together in a manner to be described later herein. Portions of the platens engage the teeth 28 and 29 of driving sprockets 21 and 24 respectively to produce travel of the tracks or chains of platens. The driving mechanisms for the two tracks are geared or otherwise associated together so that the upper and lower tracks travel at precisely the same speed and in timed relationship.

At the infeed end A of the compression apparatus the space between the upper and lower platens is sufficient to accommodate stacks of substantially uncompressed tissue of the size which it is desired to compress. In order to provide a distance of travel of the tracks whereat stacks of uncompressed tissue may automatically be positioned between the tracks, the infeed station where the stacks may be inserted as above noted is of material length and constant spacing between upper and lower tracks, such as indicated at station B in Figure 2. Beyond station B the tracks equally converge together throughout the length of station C, during travel through which the stacks of tissue are actually undergoing a compressing action. Throughout the next station, D, the tracks are maintained at that reduced spacing which provides the necessary degree of compression of the stacks, and through the succeeding station E the tracks are equally led apart and disengaged from compressing action on the stacks. At the final station F the tracks are spaced apart a distance somewhat in excess of the re-expanded height of the stacks of tissue, so that the stacks may be automatically removed from between the platens of the upper and lower tracks or chains 23 and 20.

Referring next to Figure 3, it is seen that each platen 30 comprises a main compression surface portion 31 against the exterior face of which a surface of the stack is compressed, three main bearings 32, and four auxiliary supporting bearings 33. It will be noted that two of the main bearings 32 are axially aligned, one each being commonly mounted on a shaft 34 with one of bearings 33. The other main bearing 32 is mounted on a shaft 35 in common with the other two auxiliary bearings 33. Shafts 34 are journaled in stanchions 36 and shaft 35 is journaled in stanchions 37. Shaft 35 on one platen 30 is linked to shafts 34 on the next adjacent platen by a pair of connecting links 38. The compression surface of por-

tion 31 is of course somewhat larger than the corresponding size of the materials against which it is to bear.

Figure 4 shows schematically the bearing surfaces against which bearings 32 and 33 ride during the travel of the tracks as the compression part of the apparatus operates. Referring also to Figures 1 and 2, during travel of tracks 23 and 20 through stations C, D and E, upper 40 and lower 41 main compression bearing surfaces are provided on the upper and lower frames 27 and 26, against which the main bearings 32 of the upper and lower tracks respectively may bear during the time when the stacks of sheet material therebetween are under compression. Throughout stations B, C, D, E and F, there is provided an auxiliary supporting surface 42 against which auxiliary bearings 33 may bear. Surface 42 serves to carry the very considerable weight of the lower course of the platens 30 of the upper track 23, especially in the situation where no stacks are being compressed, and in stations C and E also serves to make certain that the platens precisely follow the prescribed line of travel. During the travel of the upper track 23 through its upper course, station G, the track is supported by an auxiliary bearing surface 43 upon which ride main bearings 32. This latter support is provided to avoid the large strain upon the apparatus which would be imposed by the natural attempt of the upper course of the track to assume catenary form.

For the lower track 20, at the infeed end of station C and the outfeed end of station E there are provided auxiliary bearing surfaces 44 and 45 respectively against the bottom surface of which auxiliary bearings 33 may ride to assure that the lower track 20 precisely follows the prescribed line of travel. Throughout the entire lower course, station H, of lower track 20 there is an auxiliary supporting surface 46 against the upper surface of which auxiliary bearings 33 may ride for support of this lower course of the track.

Referring particularly to Figure 1, it is seen that stacks 50 of material such as creped tissue paper are carried into position for feeding into the compressing apparatus described by buckets 51 mounted on a conveyor 52. The conveyor is of conventional type, and hence not disclosed in detail. This conveyor travels along the far side of the compressing apparatus, as seen in Figure 1, throughout substantially the length of station B (see Figure 2), carrying stacks 50 with their bottoms only very slightly above the upper bearing surface 31 of lower platens 30 in the region of station B. Conveyor 52 and platens 30 laterally are in immediate proximity to each other, so that the stacks 50 may be conveniently slidingly transferred from buckets 51 to lower platens 30.

Referring also to Figure 5, positioned above the terminal end of conveyor 52 and in the region of station B, is a stack tamper 60. Tamper 60 includes a main track member 61 having a cam surface 62 about which a series of tamping members 63 are carried in a predetermined course for tamping of the stacks 50 just before and during their transfer from buckets 51 to the lower platens 30. Tamping members 63, only one of which is shown in Figure 5, comprise a cam follower 64 and a tamping foot 65 mounted thereto. As is seen, cam surface 62 is of predetermined form, so that tamper feet 65 are inserted into successive buckets 51 for tamping of the stacks of sheet material. This tamping action is to ensure that regardless of differences in heights of stacks 50, the stacks will if necessary be slightly compressed sufficient to permit their placement between upper and lower stacks 23 and 20 at station B.

Positioned alongside conveyor 52 at the infeed end of the compressing apparatus is a transfer apparatus 70 of the type known as a barrel loader, by means of which successive stacks of material 50 are slidingly transferred from buckets 51 onto the upper surface 31 of lower platens 30 in the region of station B. Barrel loader 70 includes a cam surface 71 by which are guided a succession of transfer plungers 72 having pusher pads 73 mounted on their inner ends adjacent conveyor 52. Cam followers (not shown) fixed on transfer plungers 72 follow cam surface 71, causing entry of transfer plungers 72 into successive buckets 51 sufficiently to push stacks 50 onto lower platens 30, and thereafter withdrawal of plungers 72 from the buckets.

Of course, conveyor 52, tamper 60 and barrel loader 70 operate in timed relationship with tracks 20 and 23 so that each successive pair of opposed upper and lower platens 30 in their travel through station B is provided with a stack 50 of material therebetween, if each bucket 51 carries a stack.

Referring particularly to Figure 1, at the near side of the compression apparatus there is only schematically illustrated the location of a second barrel loader of the type previously described, by which the compressed stacks of tissue may be slidingly pushed out from between upper and lower tracks 23 and 20 in the region of station F (Figure 2). On the far side of the compressing apparatus, opposite barrel loader 80, there is schematically located a receiving apparatus 81, which may be of any conventional sort, for example, similar to conveyor 52, for receiving of the compressed stacks and/or for packaging thereof. Receiving apparatus 81 preferably includes a conventional packaging machine by means of which the reexpanded compressed stacks are packaged in a carton or other package, for example, to form a completed package as shown in Figure 6. This completed package in the preferred form comprises a carton 85 having a weakness line 86 therein to define a dispensing opening, and containing therein the reexpanded compressed stack 50*a* of sheet material such as creped paper facial tissue.

By conventional means, the actions of conveyor 52, tamper 60, barrel loaders 70 and 80, and conveyor and receving apparatus 81 are timed with the travel of tracks 20 and 23 caused by driving engagement of bearings 33 with sprockets 21 and 24, so that under normal operating conditions a stack of material is fed between each successive pair of opposed platens 30. The spacing between upper frame 27 and lower frame 26, and consequently between upper track 23 and lower track 20, may be made adjustable, so that the average size stack of material to be compressed may be varied, for example, 400 sheet stacks of facial tissue or 200 sheet stacks. It is desirable that safety means be incorporated into the compressing apparatus, to prevent damage to the apparatus in the event substantially incompressible material should inadvertently be inserted between the tracks.

An example of preferred operation of the apparatus is the compression and packaging of the conventional 400 sheet (200 tissue) stack of facial tissue. The sheets of paper, two plies of which commonly make up each tissue, are creped tissue paper with a crepe ratio of about 105 percent to 130 percent, and having a basis weight of about six to ten pounds per ream of 2880 square feet. The two-ply tissues commonly are about 9 x 10 inches, being folded in half for packaging, and in some instances the tissues are interfolded to provide a convenient dispensing action. A stack of 200 such tissues originally will have a height varying from about two and one-half to four and one-half inches. Under normal conditions of temperature and moisture content, and with a standard type of paper, application of a pressure of about 750 pounds per square inch to such a stack in the direction essentially perpendicular to the tissues, and maintenance of such pressure for a distinct interval of time, such as, for example, at least about one second, will result in reduction in the dimensions of such stacks to a substantially uniform height, regardless of the aforementioned variations in original height. In the example under consideration, the reduction will be to a height slightly under two inches, or in the order of 50

percent of original height. The application of this pressure will during the time of application reduce the height of the stack to about 5/8 inch, and accordingly, it is possible to achieve the desired degree of height reduction even upon resulting re-expansion, by compressing the stack to a height which is about 10 to 22 percent of uncompressed height of the stack. This controlled and permanent reduction in stack height apparently is due to elimination of entrapped air, smoothing of crepe of the paper, ironing of fibers, and/or pressing of the folds in the tissue. Not only does such compression uniformly reduce stack height, but remarkably it is found that this action, under controlled conditions in accordance with those described, results in tissue sheets of greater softness, generally better "hand," stronger bond between adjacent sheets of individual two-ply tissues, and stronger interfacial bond between adjacent interfolded tissues for assurance of dispensing action.

A preferred operation of the apparatus involves lineal travel of tracks 20 and 23 at a speed of about 100 feet per minute, with about 160 stacks per minute being compressed. Obviously, this speed will be adjustable to meet actual conditions and needs.

A number of modifications of the described apparatus, not involving the exercise of inventive faculty, will occur to those skilled in this art. Accordingly, the invention is to be considered as limited only as specifically set forth in the appended claims.

What is claimed is:

1. In apparatus for compressing stacks of tissue paper, a pair of endless movable tracks, a plurality of platens carried by each of said tracks, means for driving said tracks in timed relationship to each other so that pairs of platens of said two tracks travel opposite each other, track guiding mechanism having an inclined portion for at least one of said tracks causing one platen of each of said pair of platens to move toward the other as said tracks are driven for compressing stacks of paper between said pairs of platens, a conveyer for said stacks of paper adjacent to said tracks and driven in timed relationship thereto, means for tamping each of the stacks of paper as it moves along said conveyer so as to smooth out the upper surface of the stack, and means for transferring said stacks of paper from said conveyer on to individual ones of the lowermost of said platens as said conveyer and tracks move for subsequent compression between the platens.

2. In apparatus for compressing stacks of tissue paper, a pair of endless movable tracks, a plurality of substantially flat platens carried by each of said tracks, means for driving said tracks in timed relationship to each other so that pairs of platens of said two tracks travel opposite each other, guiding mechanism for said tracks having an inclined portion for at least one of said tracks for causing the platens on said one track to move toward the platens on the other track as the tracks are driven for compressing stacks of paper between pairs of platens on the two tracks, a conveyer travelling adjacent said two tracks and including a plurality of buckets each of which is adapted to receive a stack of paper for holding the stack substantially vertical, means for driving said conveyer in timed relationship to said tracks so that said buckets travel substantially alongside of said platens, and means for transferring stacks of paper within said buckets on to said platens as said tracks and conveyer move.

3. In apparatus for compressing stacks of tissue paper, a pair of endless movable tracks, a plurality of substantially flat platens carried by each of said tracks, means for driving said tracks in timed relationship to each other so that pairs of platens of said two tracks travel opposite each other, guiding mechanism for said tracks having an inclined portion for at least one of said tracks for causing the platens on said one track to move toward the platens on the other track as the tracks are driven for compressing stacks of paper between pairs of platens on the two tracks, a conveyer travelling adjacent said two tracks and including a plurality of buckets each of which has vertical sides and is adapted to receive one of the stacks of paper for holding the stack substantially vertical, means for driving said conveyor in timed relationship to said tracks so that said buckets travel substantially along side of said platens, means for tamping the stacks of paper in said buckets as they move along said conveyor so as to smooth out the upper surfaces of the stacks and including a plurality of tamping members bearing on the stacks of paper, and means for transferring the stacks of paper within said buckets on to said platens as said tracks and conveyor move.

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