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[31] **4567/1968**

[54] **METHOD OF SMOOTHING SURFACES OF BLANKS OF FIBER MASS AND A SMOOTHING MACHINE TO CARRY THE METHOD INTO EFFECT**
10 Claims, 4 Drawing Figs.

[52] **U.S. Cl.** **100/35,** 100/38, 100/74, 100/93, 100/153
[51] **Int. Cl.** **B30b 13/00,** B30b 15/34
[50] **Field of Search** ..... 100/35, 38, 153, 154, 74, 75, 93 RP, 92; 118/60, 101

[56] **References Cited**

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ABSTRACT: A method and a machine for smoothing surfaces of blanks of fiber mass by passing the blanks beneath a smoothing roller by means of a conveyor while keeping the smoothing roller at an elevated temperature and driving the roller with a peripheral speed which is different from the advancing speed of the conveyor.

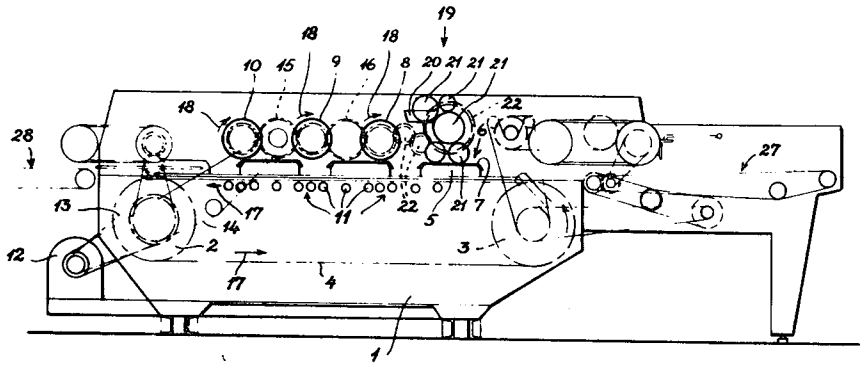
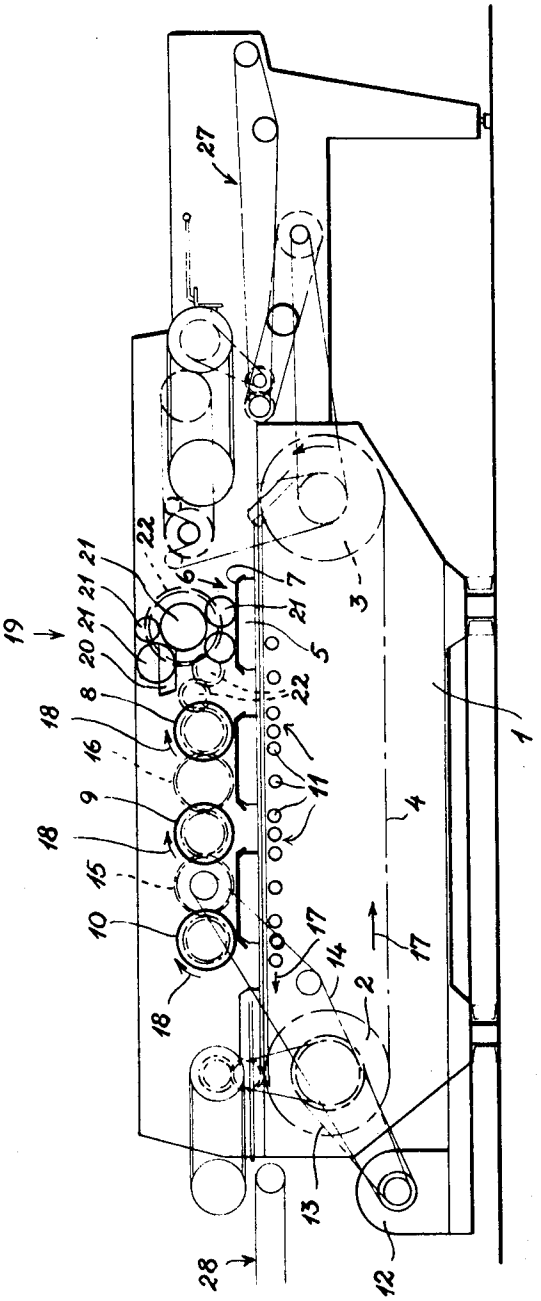


Fig. 1



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Fig. 2

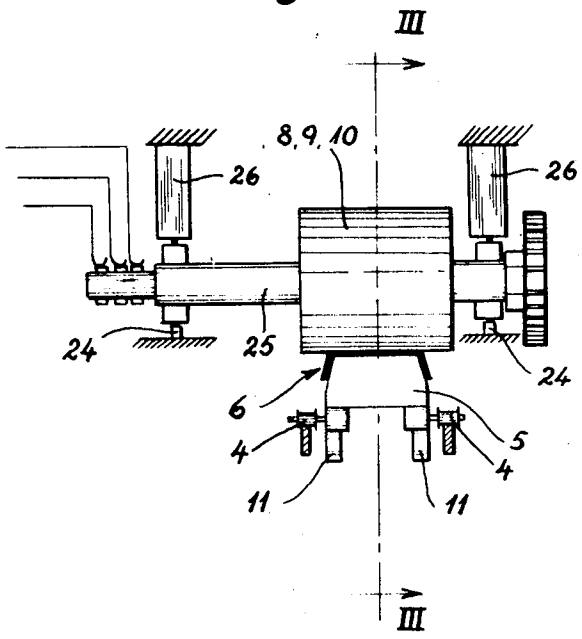
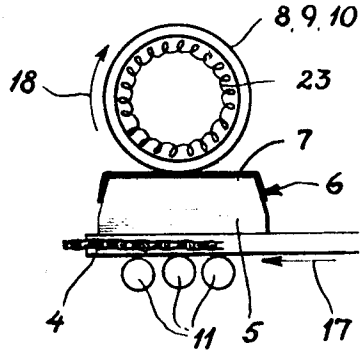


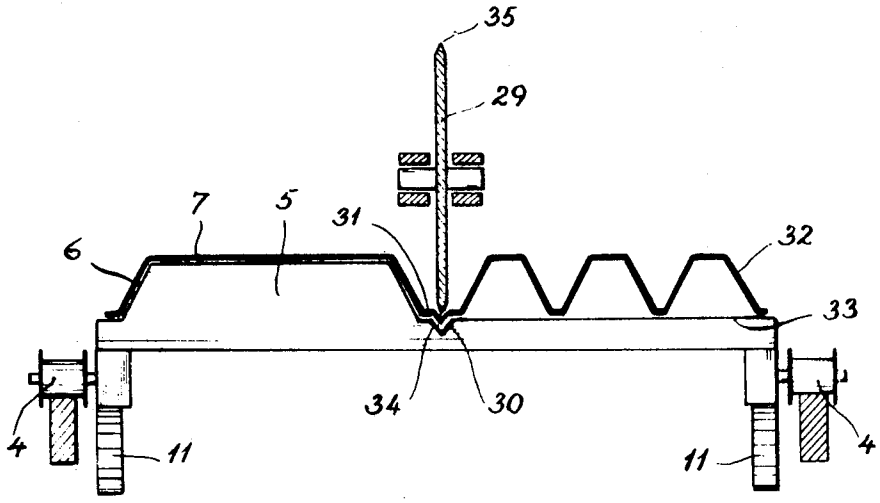
Fig. 3



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Fig. 4



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METHOD OF SMOOTHING SURFACES OF BLANKS OF FIBER MASS AND A SMOOTHING MACHINE TO CARRY THE METHOD INTO EFFECT

The present invention relates to a method of smoothing surfaces of blanks of fiber mass, according to which the blanks are kept on a conveyor and individually advanced under a smoothing roller for smoothing said surfaces.

Blanks of this nature, e.g. egg cartons, are usually produced by precipitation of fiber mass on a suction mould of fine wire netting. As a rule the surfaces of the blanks are rather soft. Furthermore, as the blanks are often produced in such a way that the sides of the blanks, abutting the suction mould constitute the outer sides of the blanks when these are put to use, the outer sides will as a rule be covered with net marks corresponding to the reticular design of the suction mould.

This may have the effect that the appearance of the blanks becomes unattractive, and the two phenomena will be particularly annoying when the said surfaces of the blanks are to be provided with an imprint, because usually the imprints will not be neat, sharply defined and uniform. In order to improve the imprint it has already been suggested to smooth the printing surface of the blank before advancing the blank to the printing apparatus, the blank being advanced under a freely rotatable smoothing roller which together with countermembers defines a slit which is smaller than the original wall thickness of the part of the blank which is to receive the imprint. Thus, the said part of the blank is compressed with the result that a surface is produced which is firmer and smoother than the original surface and therefore better suited for receiving imprints than an untreated surface of the blank.

It is the object of the present invention to indicate how to obtain a further improvement in the surface treatment in order to produce a firm and smooth surface, thus not only improving the appearance of the surface but also making it better suited for receiving imprints.

According toe invention the object is achieved by keeping the smoothing roller at an elevated temperature, preferably between 100° and 300° C., at the same time driving the roller at a peripheral speed differing from the speed with which the blanks are advanced under the roller.

In this way a distinct ironing effect is obtained, the treated surface becoming particularly firm and smooth. The effect is substantial because as a rule the blanks conveyed to the machine contain a certain residual content of moisture, so that on account of the heat treatment also the moisture content contributes toward producing a firm and smooth surface. If necessary, the moisture content of the blanks may be regulated before the blanks are delivered to the smoothing roller. According to the invention a particularly effective ironing effect is obtained by selecting a peripheral speed of the smoothing roller approximately twice the speed of the advancing blanks.

Furthermore, according to the invention it may be particularly appropriate to carry out the smoothing stepwise, the blanks being advanced successively under several smoothing rollers positioned one after the other, said rollers being driven as explained in the foregoing and producing a contact pressure increasing from roller to roller in the travelling direction. Thus it becomes possible to work with optimal ironing effects from roller to roller, the total smoothing work leading to a particularly good final result.

If the blanks to be treated consist of at least two parts interconnected by means of a grooved hinge flap, e.g. egg cartons consisting of a bottom portion and a lid, the blanks may according to the invention be passed through the smoothing machine with their hinge groove or grooves extending in the travelling direction, an after-grooving of the groove or grooves being performed during the passage of the blanks through the machine. In this way the force keeping the blanks on the conveyor and being necessary to carry through an effective smoothing of the surface to be treated is also utilized to carry out an effective after-grooving of the hinge groove, so that the density of the material in the area of the hinge is increased. By means of such an after-treatment a strengthening of the hinge area and an improvement of the movability of the hinge will be obtained. The vibrations which may occur owing to the after-grooving operation will not be detrimental to the smoothing work, but the vibrations may be troublesome if the after-grooving is e.g. performed in a subsequent printing machine where they may lead to blurred imprints.

The invention also relates to a smoothing machine to carry the method into effect, said machine comprising a conveyor for the blanks and a superjacent smoothing roller, and according to the invention the machine is characteristic in that the smoothing roller is provided with a heating device and connected to a driving motor. According to the invention a moistening device may be provided before the smoothing roller as seen in the travelling direction in order to regulate the moisture content of the blanks. If, as mentioned in the foregoing, the smoothing is to be carried out in steps a plurality of smoothing rollers may according to the invention be positioned in succession above the conveyor, said rollers being shaped as described in the foregoing and arranged in the travelling direction at a distance from the conveyor decreasing from roller to roller.

In order to carry out the after-grooving the smoothing machine may according to the invention have at least one rotatable after-grooving roller or disc arranged in a plane extending parallel to the traveling direction of the conveyor and transversely of the axial direction of the smoothing roller, said roller or disc being adapted so as to engage said hinge groove or grooves.

The invention will now be explained in more detail, reference being had to the drawings wherein

FIG. 1 is a side view of an embodiment of a smoothing machine according to the invention,

FIG. 2 is a longitudinal section on an increased scale through one of the smoothing rollers of the machine with appurtenant bearings and driving means,

FIG. 3 is a cross section through the roller along the line III—III in FIG. 2,

FIG. 4 shows on an increased scale and partly in section a mechanism for after-grooving the hinge groove in the hinge flap between two portions together constituting a blank to be treated.

Revolving rollers **2** and **3** are mounted in bearings on a frame **1** and constitute parts of a conveyor comprising endless conveyor chains **4** carrying counterblocks **5** for the blanks **6**, the surfaces **7** of which are to be smoothed. Three smoothing rollers **8**, **9** and **10** are positioned in succession, one after the other, above the uppermost forward-moving part of the chains **4**, and counterpressure rollers **11** are positioned below the same part in order to prevent depression of the chains.

An electric motor **12** is connected to the revolving roller **2** by means of the chain drive **13** and is also by means of an additional chain drive **14** connected to a gear wheel **15** placed between the smoothing rollers **9** and **10** and engaging said rollers. An additional gear wheel **16** is arranged between the smoothing rollers **9** and **8** and engages same.

When the motor **12** rotates anticlockwise the chains **4** will move in the direction of the arrows **17**, and at the same time all smoothing rollers will rotate in the direction of the arrows **18**, i.e. in flow with the forward movement of the uppermost part of the chains **4**. In principle, the rollers may also rotate in the opposite direction. The gear rations are so chosen that the peripheral speed of the smoothing rollers when moved in the first-mentioned direction is higher than the advancing speed of the chains **4**.

A moistening apparatus **19** is positioned before the smoothing rollers **8–10** as seen in the travelling direction, said apparatus comprising a liquid container **20** and a number of moistening rollers **21** which are in surface contact with each other. The rollers **21** are driven by the smoothing roller **8** by means of intermediate gear wheels **22**.

The smoothing rollers 8–10 are heatable. FIG. 3 shows a smoothing roller with a built-in electric heating element 23, its thermal effect being adjustable. However, the rollers may also be heated in other ways, e.g. by means of heating means such as oil and steam. The distance of the rollers from the conveyor chains 4 is adjustable by means of set screws 24, confer FIG. 2, or similar means acting on the shaft 25 of the smoothing rollers and cooperating with suitable countermembers 26.

The blanks 6 are delivered to the blocks 5 of the smoothing machine by means of a conveyor 27 and they are removed from the smoothing machine by means of a further conveyor 28 which e.g. takes the treated blanks to a printing apparatus. The conveyors 27 and 28 act independent of the chain conveyor 4.

Each of the blanks 6 delivered to the smoothing machine is by means of the conveyor 27 placed on a block 5 and subsequently advanced below the moistening rollers 21 moistening the blank surfaces 7 which are to be smoothed. Thereupon the blanks are taken successively to the smoothing rollers 8, 9 and 10 which press against the surfaces 7 in step with the advance of the blanks. The pressure exerted by the smoothing rollers is counteracted by the countermembers 11.

In the present case the smoothing rollers are so adjusted by means of the set screws 24 that the size of the slit between the blocks 5 and the smoothing rollers decreases from roller 8 to roller 10 from approximately 1.2 mm. to approximately 0.6 mm. The surface temperature of the smoothing rollers is maintained at approximately 250° C., and the peripheral speed of the rollers is about twice the rate of advance of the chain conveyor 4. Experiments have shown that also other speed ratios and other degrees of heating will lead to ironing effects resulting in the desired smoothing of the surfaces 7. However, the same experiments have also shown that in the case of fibrous pulp as normally used for the production of e.g. egg cartons no ironing effect of any value is obtained when the temperature sinks below approximately 100° C. and the speed ration is substantially below 1.5:1, whilst the temperatures approaching or exceeding 300° C. lead to a discoloration of the material.

In the embodiment shown in FIG. 4 the smoothing machine is supplemented with an after-grooving member in the form of a rotatable after-grooving disc 2. The said disc extends parallel to the travelling direction 17 of the conveyor 4 and transversely of the axial direction of the smoothing rollers 8, 9 and 10. In the shown example the disc 29 serves to after-groove a hinge groove 30 in a hinge flap 31 connecting the blank 6 constituting the lid of an egg carton with a blank 32 constituting the bottom portion of the egg carton. The blank 32 rests on a surface 33 which is contiguous with the counterblock 5, and aligned with the hinge groove 30 a groove 34 is formed in the surface. The configuration of the periphery 35 of the disc 29 is adapted to the cross-sectional shape of the hinge groove 30.

The after-grooving disc 29 is so positioned and if desired adjustable in such a way that it performs an after-grooving of the hinge groove 30 when the blank 6,32 is advanced below the disc in position by the counterpressure block 5. During this after-grooving process the material of the flap 31 may be pressed into the groove 34.

Having now fully described my invention I claim as new and desire to protect by Letters Patent:

1. A method of smoothing surfaces of blanks of fiber mass, comprising keeping the blanks on a conveyor, advancing the blanks by means of said conveyor towards a smoothing roller and passing the blanks beneath said roller in such a way that a pressure contact is maintained between the peripheral surface of the roller and the surface of the blank being smoothed while keeping the smoothing roller at an elevated temperature, preferably between 100° C. and 300° C. and driving the smoothing roller at a peripheral speed which is different from the advancing speed of the conveyor.

2. A method according to claim 1, characterized in that the blanks are conveyed to the smoothing roller with a predetermined minimum moisture content.

3. A method according to claim 1, characterized in that the peripheral speed of the smoothing roller is approximately twice the rate of advance of the blanks.

4. A method according to claim 1, characterized in that the blanks are advanced successively under several smoothing rollers positioned one after the other, the contact pressure of the rollers increasing from roller to roller as seen in the travelling direction.

5. A method according to claim 1, wherein the blanks comprise at least two parts interconnected by means of a grooved hinge flap, e.g. egg cartons consisting of a bottom portion and a lid, characterized in that the hinged blanks are passed through the smoothing machine with their hinge grooves extending in the travelling direction, an after-grooving being performed in the grooves during the passage of the blanks through the machine.

6. A method of smoothing surfaces of blanks of fiber mass according to claim 1, wherein the smoothing roller is a heated pressure roller, advancing the blanks having a predetermined minimum moisture content by means of said conveyor towards said heated pressure roller, the blanks being held by the conveyor during their advance and passage beneath the pressure roller and their surfaces while being smoothed being supported by the conveyor, and subjecting the surface portions of the blanks being smoothed respectively to a pressure resulting in only a partial compression of the fiber mass thereof.

7. A smoothing machine for smoothing surfaces of blanks of fiber mass, comprising a conveyor adapted to individual advancement of the blanks, a smoothing roller arranged in a superjacent position relative to the conveyor, a heating device for heating the roller and a driving motor for rotating the roller at a peripheral speed which is different from the advancing speed of the conveyor.

8. A smoothing machine according to claim 7, characterized in that a moistening device is provided before the smoothing roller as seen in the travelling direction.

9. A smoothing machine according to claim 7, characterized in that a plurality of rollers is positioned in succession above the conveyor, one after another, all the rollers being arranged in the travelling direction of the conveyor at a distance therefrom decreasing from roller to roller.

10. A smoothing machine according to claim 7, for carrying out the method according to claim 5, characterized in that at least one rotatable after-grooving roller or disc is arranged in a plane parallel to the travelling direction of the conveyor and transversely of the axial direction of the smoothing roller, said after-grooving roller or disc being adapted to engage said hinge grooves.