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DEVICE FOR DETECTING THE LINEAR SPEED OF A MOVING WEB OF SINGLE-FACE CORRUGATED PAPER

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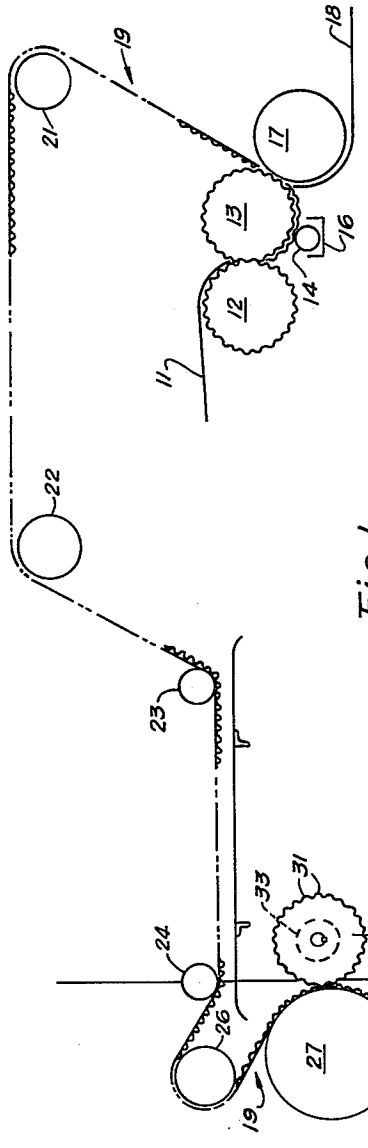

Fig. 1

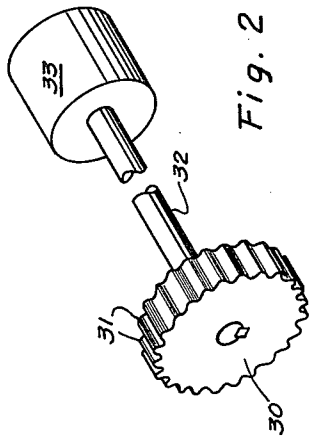

Fig. 2

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DEVICE FOR DETECTING THE LINEAR SPEED OF A MOVING WEB OF SINGLE-FACE CORRUGATED PAPER

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This invention relates to the manufacture of corrugated paper board, either of the angle-face type or of the double-face type commonly used in cartons and, more particularly, to a device for accurately detecting the speed of the moving web of paper board during the manufacturing sequence.

In the manufacture of corrugated board the corrugated center element is first prepared, and then attached to the liner in a gluing operation to produce the single-face, heated and later combined with the second liner in the double backing operation after a second gluing step, carried through a curing operation and finally slit into strips of the desired width and cut to the desired length in a cut-off mechanism.

Knowledge of the speed of the moving web can prove useful in the automatic control of various segments of the apparatus performing in the sequence of operations, for example, controlling the temperature and quantity of steam admitted to condition the center element for the corrugating step, controlling the temperature of the heater rolls about which the single-face is passed prior to the double-facing operation, controlling the supply and viscosity of adhesive to the dauber unit for application to the web and controlling the length of board severed by the cut-off mechanism. Of these above-mentioned operations, the one requiring the most accurate information reflecting the speed of the moving web is that operation in which the cut-off knife separates the web into lengths for later conversion into box blanks in the slitting and scoring operations.

When it is considered that the web is traveling at upwards of 700 ft./minute past the cut-off knife, it may be readily seen that in order to produce a box blank cut to within reasonable tolerances and with its edges free of crimping or bending, the speed of the web must be detected with great accuracy in order that the operation of the cut-off knife can be appropriately timed.

In the past, emphasis has been on determining the speed of the completed web either by determining the speed of some element driving the double backer or by directly measuring the speed of the completed web with a friction-driven roller resting on the surface of the web at some point between the double backer and the cut-off knife.

Both of these methods of measurement leave much to be desired with respect to the accuracy of the measurement. In measuring the speed of a driving member for the double backer, appreciable inaccuracies occur because of the fact that the double backer is a friction device employing belts in contact with each of the two flat surfaces of the double-lined web in order to grip and draw this web over a series of steam heated plates to cure the glue previously applied at the glue station and to pass the completed web forward into the slitting and cut-off operations. Since the grip between the belts of the double backer and the completed web is dependent only upon friction, two types of slip occur to decrease the accuracy of the measurement of the speed of the moving board. The first of these is the slip which occurs between each belt and its driving drum. The second type of slip occurs between each belt and the board itself during the pull through the double backer.

This latter slip is much greater than the former but both types of slip do occur. Further, experience has shown that the amount of slip varies with the conditions of board speed, temperature and differences in the liner material making it too difficult to compensate in any way for the error.

In the case of measurement with a friction-driven roller placed in contact with a surface of the completed board, appreciable error results from the lack of positive drive of the roller by the board. While the roller and the board surface remain firmly in contact the measurement is reliable, but in the event of separation between the roller and the board surface as the result of jerking or flapping of the board, the detected board speed is in error.

It is, therefore, an object of the present invention to provide a device always positively driven by the moving web thereby eliminating slip error in the detection of the speed of the moving web.

It is a further object of the present invention to provide simple, inexpensive mechanical means advantageously located in positive driving relationship with the single facer whereby the speed of the moving web may be very accurately determined.

In summary, the present invention in its more specific aspects employs a gear type wheel having teeth formed thereon for cooperatively meshing with the flutes of the single face at a point at which the single face is under tension and is also supported on the liner side thereof thereby insuring that the single face will positively drive the gear wheel as the single face is pulled through the double-backer and the angular velocity of the gear wheel will thereby accurately reflect the board speed.

The exact nature of this invention as well as other objects and advantages thereof will be readily apparent from consideration of the following specification relating to the annexed drawing in which:

FIG. 1 is a schematic representation of the present invention embodied in the equipment for performing the sequence of operations including the corrugating step, the formation of the single face and the heating of the single face preparatory to the double-backing operation, and

FIG. 2 is an isometric view showing the configuration of the preferred embodiment of the present invention.

In FIG. 1 at the right hand end thereof is illustrated the operatioin of forming the single face. Stock strip 11 having been previously treated with steam is passed between toothed corrugator roll 12 and toothed corrugator roll 13 complementary therewith whereby corrugations or flutes are impressed in strip 11. As fluted strip 11 passes around the underside of roll 13, adhesive is applied to the outer tips of the flutes by doctor roll 14 which, as it rotates, picks up adhesive from pot 16.

As fluted strip 11 with the adhesive applied thereto passes between roll 13 and presser roller 17, the outer tips of the flutes in strip 11 are brought into positive contact with liner 18 which is advanced around roller 17 and these two components of the single face are firmly joined to produce single-face web 19.

Single-face web 19 advances over idler rolls 21 and 22, under guide rolls 23 and 24 and around idler 26 for proper orientation of the web for passage around first heater drum 27 with the flutes of single-face web 19 projecting outwardly away from the surface of heater drum 27 and with the liner thereof in contact with the surface of heater drum 27.

The flutes formed in stock strip 11 retain a form closely approximating the shape of the teeth of cooperating corrugating rolls 12 and 13 because almost immediately after impression of the flutes in strip 11, the fluted strip

11 is glued to liner 18 under the influence of heat and pressure.

After passage around a series of heater drums similar to heater drum 27, single-face 19 enters an adhesive-applying mechanism (not shown) preparatory to being introduced to the double backing operation. Since single-face 19 is pulled through glue machine 28 and through the double backer 29 by belts 29*a*, the web is under tension as it passes around heater drum 27 and is supported along the liner side thereof by heater drum 27.

With single-face 19 being under tension and well-supported along its liner side, this point in the sequence of manufacturing operations is ideally suited for locating web-speed detecting gear wheel 30 for positive, continuous drive thereof by single-face 19. The positive driving action desired is provided in this preferred embodiment by mounting gear wheel 30 with its axis in a fixed position relative to single-face 19 and with its teeth 31 in meshing engagement with the flutes of single-face 19.

Gear wheel 30 is substantially identical in cross-section with the cross-section of both corrugator roll 12 and cooperating roll 13 in order that accurate meshing is achieved between the flutes of single-face 19 and teeth 31. Gear wheel 30 is mounted on shaft 32 projecting from tachometer 33 which is suitably mounted against movement relative to the axis of rotation of heater drum 27. In this manner, a uniform positive and continuous meshing action between the flutes of single-face 19 and gear teeth 31 is insured.

As gear wheel 30 is rotated under the driving action of single-face 19, a voltage is generated by tachometer 33. The magnitude of this generated voltage provides a very accurate measure of the angular velocity of gear 30 and thereby provides a direct measure of the speed of single-face 19. Since the speed at which the completed board leaves the double backer 29 and is fed to the cut-off mechanism (not shown) is the same as the speed at which single-face 19 is pulled through the glue machine 28 and double backer 29, this measurement of the speed of single-face 19 also represents the speed of the finished board.

It, therefore, becomes readily apparent that in contrast to the methods previously employed for the measurement of board speed wherein dependence was placed upon friction engagement between the detecting means and the moving web, the present invention provides a simple, inexpensive mechanical device employing the positive driving action of the web material itself at a well-chosen location in the sequence of operations to produce a direct measurement of web speed devoid of slip error.

It should be understood, of course, that the foregoing disclosure relates to only a preferred embodiment of the invention and that modifications or alterations may be made therein without departing from the spirit and the scope of the invention as set forth in the appended claims.

What is claimed:

1. In processing equipment for the manufacture of corrugated board the combination of a rotatable drum, a moving continuous web of single-face wrapped about a portion of said drum with the liner side of the single-face in contact with the surface of said drum, means for continuously applying tension to the single-face whereby the single-face is drawn through said processing equipment, a rotatably-mounted wheel having teeth formed on the outer periphery thereof, said teeth successively meshing with the flutes of the single-face, a voltage generating device and means for transmitting the angular velocity of said wheel to said voltage generating device.

2. In processing equipment for the manufacture of corrugated board the combination of a rotatable drum, a moving continuous web of single-face wrapped about a portion of said drum with the liner side of the single-face in contact with the surface of said drum, means for continuously applying tension to the single-face whereby the single-face is drawn through said processing equipment, a rotatably-mounted wheel having teeth formed on the outer periphery thereof substantially identical in shape and spacing to the teeth of the corrugating equipment employed to form the flutes in the fluted portion of the single-face, said teeth successively meshing with the flutes, a voltage generating device and means for transmitting the angular velocity of said wheel to said voltage generating device.

3. The combination for use in the processing equipment for the manufacture of corrugated board as set forth in claim 1 wherein the rotatable drum is the first heater drum contacted by the single-face as it enters the glue machine.

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