

Jan. 26, 1960

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2,922,302

METHOD AND APPARATUS FOR DETERMINING OPENING FORCE
CHARACTERISTICS FOR FLAT-FOLDED CARTON BLANKS
Filed Jan. 17, 1956

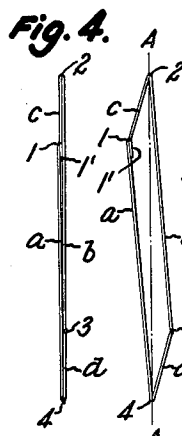
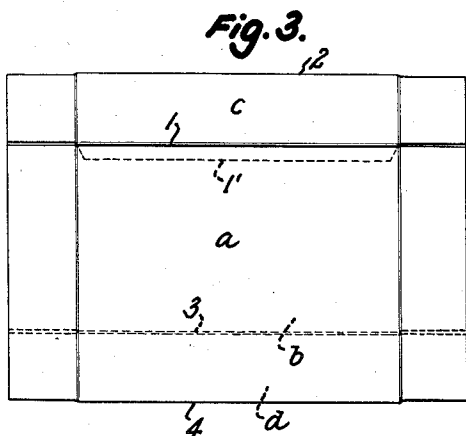
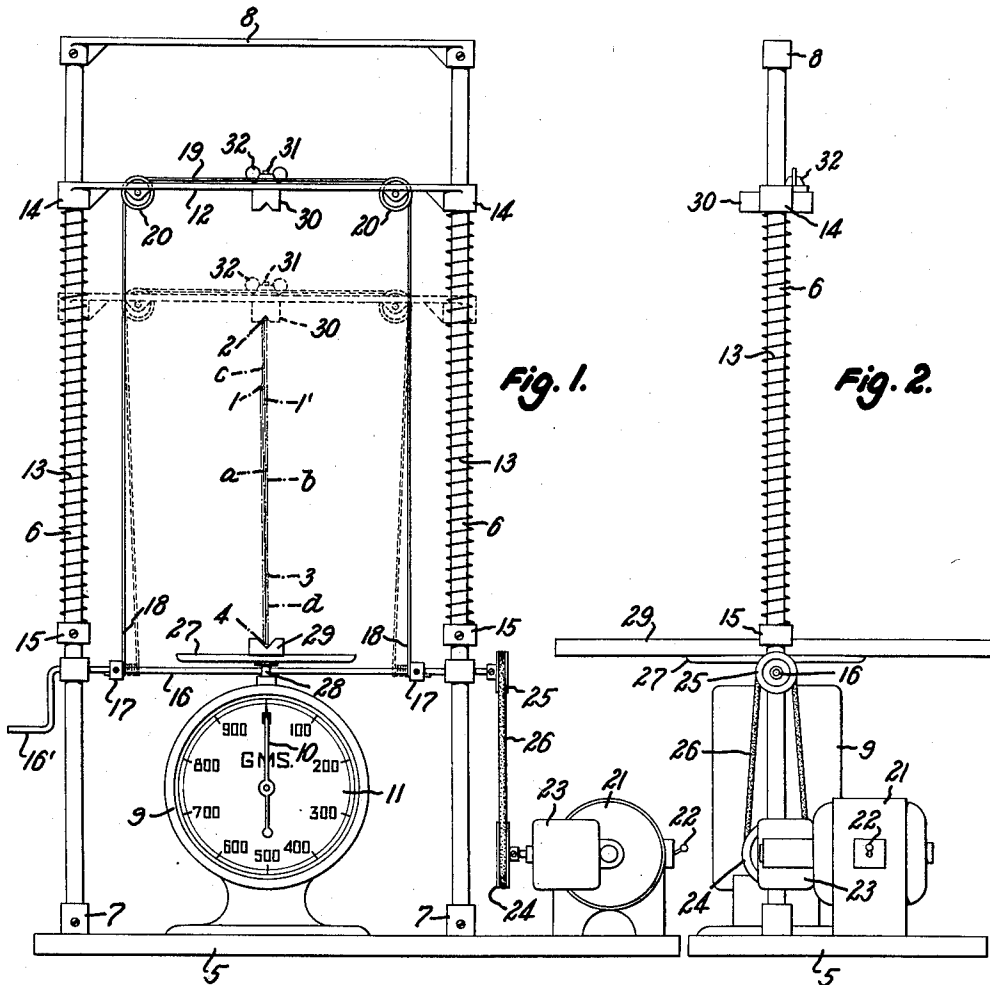


Fig. 5.

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1

2,922,302

METHOD AND APPARATUS FOR DETERMINING OPENING FORCE CHARACTERISTICS FOR FLAT-FOLDED CARTON BLANKS

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Application January 17, 1956, Serial No. 559,621

8 Claims. (Cl. 73—88)

In the use of packaging machines employing paperboard cartons which are fed to the machines in flat-folded condition and must be opened, or squared-up, prior to being filled and closed or sealed, it is important to the proper, continuing, faultless operation of such machines that the cartons supplied to them have substantially uniform characteristics of resistance or submission to breaking pressure applied to them to cause them to open or square-up upon their folding scores. In other words, if a packaging machine is adjusted to apply the opening force required by a given lot of cartons, and other cartons having different opening force requirements are inadvertently or accidentally included in the lot, inefficient functioning, or even stoppage, of the machine may result, thus not only causing loss of time and production but probable spoilage of cartons and waste of the material being packaged.

It will be apparent, therefore, that the opening force requirements of all flat-folded cartons in any lot or run be substantially the same and it is envisioned that if such requirements are indicated, say in grams of required pressure, upon the lots of cartons as furnished to the packager, much time and material will be saved and the packaging operation made easier to prepare for and control.

In order to accomplish this desired result I have found that with the requirements of the packager known, particularly the strength of the cartons required for the packaging of various commodities, the conditions under which they will be shipped and stored, and the opening force which will eventually be applied to them by any particular packaging machine or machines in order to erect them, or square them up, during the packaging operation, selection of paperboard material of the proper composition and caliper, determination of the proper depth and width of folding scores, and determination of gluing technique, may be made to provide carton blanks which will uniformly meet such requirements.

In other words, with the requirements of the packager known, the customer may be furnished with flat-folded, finished (glued or otherwise secured) carton blanks which will open to tube form under pressure applied by a packaging machine within prescribed limits of minimum and maximum force thus applied.

Thus, after determination of the requirements for a carton, and the production of carton blanks having paperboard characteristics, and provided with folding scores, which are preconceived as proper to embody the desired functional attributes, these blanks will be flat-folded and finished, as by gluing, and can thereafter be subjected, individually, to pressure applied to their opposite folded edges until such pressure is exerted as will cause them to initially open to tube form, that is to say to break upon their folding scores, and observation of the amount of pressure thus necessarily applied will give a reading of the opening force for the particular carton, and this opening force may be recognized an industry standard for this particular style and functional character of carton.

2

Obviously, if, upon opening force testing, a carton is found to fall outside of the requirements of a given packaging machine, changes in characteristics of the paperboard used, or in the formation of the folding scores, or in the gluing technique, and particularly in the latter two, will have to be made, and thus the proper combination of characteristics will be arrived at empirically in a manner well known to those skilled in the art of carton fabrication. However, once the proper characteristics have been determined, the opening force test accomplished by application of pressure, as hereinabove described, will serve as a standard for cartons of the type, and having the characteristics, desired.

Thus the opening force test provides a means for measuring the resistance of the carton to opening. It resolves into definite terms the cumulative result of the strength characteristics of the paperboard material, and the effect of the scoring, and the effect of the gluing machine prebreak functions and pressure.

Furthermore, if apparatus is provided for use throughout the carton manufacturing industry whereby certain standards may be set for the opening force required for various accepted types of cartons, say in grams of pressure, a marked advance will be made and now existing difficulties of packagers relieved.

The primary object of the present invention is, therefore, to provide the method, hereinbefore explained, and apparatus for carrying out the ultimate testing step, such apparatus being capable of determining with adequate accuracy the pressure which must be exerted upon a flat-folded and glued carton blank of more or less conventional tube form to cause it to break or open upon its folding scores; in other words to determine or test the so-called "opening force."

Another object of the invention is to provide such an opening force testing apparatus which, although quite accurate in operation, may be manufactured and supplied to members of the industry at relatively low cost.

A further object is to provide an opening force testing apparatus which is simple in construction and operation and may be used repeatedly, as will normally be necessary to answer production requirements of the carton manufacturer, without danger of breakdown or failure to function properly.

Another object is to provide an opening force testing apparatus having such characteristics of semi-automatic operation that its employment by a shop foreman or inspector will not be avoided, thus tending to encourage its use and serving to advance the standardization of the carton characteristics that it is designed to establish.

Concretely considered, the opening force testing apparatus in which the invention is embodied will comprise pressure-responsive scale means, means for supporting and confining a flat-folded carton blank edgewise between such scale means and a pressure-applying member, and means for exerting pressure by such pressure-applying member through the thus supported and confined carton blank to said scale means so that when, as a result of such application of pressure, the carton blank opens or breaks upon its folding scores, the force of the applied pressure will be observable by the operator as registered by the scale means; and the apparatus comprises, more specifically, certain elements of construction and arrangements of parts, all as will be explained hereinafter more fully and finally claimed.

In the accompanying drawing illustrative of the invention, in the several figures of which like parts are similarly designated,

Fig. 1 is a front elevation of the testing apparatus of the invention,

Fig. 2 is a side elevation of the apparatus viewed from the right of Fig. 1,

3

Fig. 3 is a plan view of a flat-folded and glued carton blank of the general type to the production and testing of which the invention is directed,

Fig. 4 is an edge view of the blank shown in Fig. 3, and

Fig. 5 is an edge view of the blank in approximately the partially opened condition momentarily produced in the operation of testing.

Having reference to Figs. 3 and 4, for purposes of a full understanding of the testing technique, it will be seen that the conventional flat-folded carton blank or body shown comprises the usual broad side walls *a* and *b* and narrow side walls *c* and *d*, which are severally defined from each other by the first folding score 1 adjacent to the glue lap 1', the second folding score 2, the third folding score 3 and the fourth folding score 4, the usual broad and narrow end closure flaps being provided on the end edges of the broad and narrow side walls, respectively, to close and seal the erected and filled carton.

As shown, and in accordance with standard practice, the flat-folding is performed upon the second and fourth folding scores 2 and 4, respectively, to bring the glue lap 1' and the free side edge of the broad side wall *a* into gluing position, and when the opening force tester of the invention is employed it will give a reading or measurement of the amount of pressure applied at the edges formed at the second and fourth folding scores 2 and 4 necessary to open the folded blank upon these scores and upon the first and third folding scores 1 and 3, substantially as shown in Fig. 5.

Thus the apparatus of the invention will be employed to measure the amount of prebreak on the glue lap or first score 1 and third score 3, and the amount of ironing out on the second and fourth scores 2 and 4, respectively, thereby making it possible for the carton customer, or packager, to specify his needs more clearly so that the carton manufacturer may more consistently maintain the opening characteristics of his cartons, especially if there are slight variations in the caliper and other characteristics of, or inherent in, the paperboard from which they are manufactured.

As shown in Figs. 1 and 2, the apparatus of the invention preferably comprises a frame including base means 5 and a pair of similar, relatively laterally spaced, column members 6 connected at one end to the base means 5 as shown at 7 and having their other ends joined by a rigid spreader bar 3 so that they are fixed in desired parallelism.

Mounted upon the base means 5, and preferably fixedly attached thereto medially of the column members 6, are means 9 responsive to and for indicating applied pressure, such, for example, as spring scale means capable of registering from zero to one thousand grams by travel of a pointer 10 over the scale of a dial plate 11.

Slidably mounted upon the column members 6 is a travelling bridge member 12 normally urged away from the scale means 9 by column-encircling springs 13 which bear against the guide sockets 14 of the bridge member 12 and against stop collars 15 preferably made adjustable axially of the column members 6 so that the compression stress of the springs may be varied as desired.

In fixed relation to the scale means 9, and having rotative bearings on the column members 6, is a winding shaft 16 to which are attached by collars or the like 17, in spaced relation axially of the shaft, the two ends 18 of a flexible cable or cord having its mid portion or loop 19 adaptably bearing upon and partially spanning the bridge member 12 longitudinally thereof. This adaptability of the loop 19 may be accomplished by running it over pulleys 20, or it may have plain bearings through the bridge member 12, and thus upon winding and unwinding of the cable ends by the winding shaft 16 the cable may travel longitudinally of the bridge member and adjust itself with respect thereto. Thus, possible uneven movement or yawing of the bridge member and binding of its guides 14 upon the column members 6 will be avoided.

Rotation of the winding shaft 16 is preferably derived from a reversible electric motor 21 controlled by a switch

4

22 within easy reach of an operator, and power is transmitted from this motor to the winding shaft 16 through a speed-reducing gearing 23 which drives a pulley 24 from which rotation is imparted to a pulley 25 on one end of the winding shaft in relation to the speed of the motor 21 by an appropriate change in pulley ratio. Alternatively, the winding shaft may be rotated manually by its crank-shaped opposite end 16'.

The platform 27, or pillar 28, of the scale means 9, and the bridge member 12 are provided with complementally aligned V-notched bearing elements 29 and 30, respectively, between which will be supported, edgewise upon their folded folding scores 2 and 4, the carton blanks to be tested, as indicated in dot-and-dash lines, Fig. 1. In order that desired alignment of the V-notches of the bearing elements 29 and 30 may be insured, the bearing element 30 carried by the bridge member 12 may be adjustably attached thereto by a bolt 31 and wing nut 32, and the bridge member may be provided with an elongated opening or slot (not shown) through which the bolt 31 passes.

It is thought that the operation of the device will be apparent from the foregoing description, but for clarity it will be stated that in its use an operator will select, at appropriate intervals during a run of carton blanks through a folding and gluing machine, individual finished carton blanks or bodies to be tested upon the apparatus of the invention, thus to obtain a comprehensive check upon the opening force characteristics of carton blanks of the entire run.

The ends 18 of the cable having been unwound from the winding shaft 16 and the travelling bridge 12 having at the same time been moved by its springs 13 to its retracted position, as shown in full lines, Fig. 1, and the cable meanwhile having thus been maintained taut, a flat-folded carton blank or body of those selected will be positioned with either of its fold edges 2 or 4 resting in the V-notch of the bearing element 29 carried by the scale means 9 and the motor 21 will be operated to wind the cable ends 18 upon the winding shaft 16 until the bridge member 12 travels to the position where the opposite fold edge of the carton blank or body is met by the V-notch of the bearing element 30 carried by the bridge member, as shown in broken lines, Fig. 1.

When thus arranged, the pressure-receiving axis A—A, Fig. 5, of the carton blank or body will extend through the bases of the V-notches of the bearing elements 29 and 30 and the blank or body will be properly supported and confined for testing.

Thereafter, with his attention centered upon the pointer 10 and the scale of the dial plate 11, the operator will continue winding of the cable ends upon the winding shaft 16 until the carton blank or body breaks upon its first and third folding scores 1 and 3, as indicated in Fig. 5, at which instant he will take a reading, upon the scale of the dial plate 11, of the applied pressure, in grams, at which the break occurred.

Obviously, a carton manufacturer may establish a pressure chart having an opening force testing value for each of the appropriate types of cartons in his line, and these values may be made to accord with the requirements of his customers. Also, throughout the carton industry somewhat similar charts could be recognized as proper for setting standards to be complied with in the manufacture of cartons, and especially for cartons to be used with any one of the many packaging machines having recognized operating characteristics or requirements with which the cartons must be made to conform.

Various changes and modifications are considered to be within the principle of the invention and the scope of the following claims.

What I claim is:

1. A method for determining the opening force characteristics of a flat-folded carton body formed from a paperboard blank having the selected attributes of its

paperboard material, the folding scores defining its wall panels, and its manufacturers seam preconceived as appropriate for a predetermined packaging operation, which comprises the steps of confiningly supporting the opposite folded edges of the flat-folded carton body, subjecting the body at said edges to the application of pressure sufficient to cause said body to initially open and its wall panels to separate upon its several folding scores, and noting the amount of pressure thus applied as representing the opening force characteristic of said body to provide a standard for carton bodies having comparable attributes of composition and formation.

2. A method for determining the opening force characteristics of a flat-folded carton body for use, for example, in a predetermined packaging operation as performed upon a machine having known characteristics of carton opening force application, said carton body being formed from a blank having the selected attributes of its paperboard material, the folding scores defining its wall panels, and its manufacturers seam preconceived as appropriate for such packaging operation, which comprises the steps of confiningly supporting the opposite folded edges of the flat-folded carton body, subjecting the body at said edges to the application of pressure sufficient to cause said body to initially open and its wall panels to separate upon its several folding scores, and noting the amount of pressure thus applied as representing the opening force characteristic of said body to provide a standard for carton bodies having comparable attributes as suitable for use upon such machine.

3. In an opening force testing apparatus for flat-folded carton blanks or bodies which have folding scores upon which they may be opened to erected condition, base means, means supported by said base means and responsive to and for indicating pressure, a traveller bridge member and means for supporting it for movement toward and away from said pressure responsive and indicating means, means for imparting controlled movement of said bridge member toward said pressure responsive and indicating means, resilient means for normally urging said bridge member away from said pressure responsive means, and means carried by said bridge member and by said pressure responsive and indicating means, respectively, for supporting and confining a flat-folded carton blank or body in edge-wise relation therebetween, whereby, upon the imparting of relative movement between said bridge member and pressure responsive and indicating means to cause them to approach each other, pressure thus exerted upon said carton blank or body will be reflected on said pressure responsive and indicating means and the amount of the thus applied pressure necessary to break said carton blank or body from its flat-folded condition upon its folding scores may be observed.

4. In an opening force testing apparatus for flat-folded carton blanks or bodies which have folding scores upon which they may be opened to erected condition, a frame structure including base means, a pair of laterally spaced

column members, means for maintaining said column members in parallelism, pressure responsive scale means supported by said base means between said column members, a traveller bridge member supported on said column members and movable longitudinally thereof, means for imparting controlled movement of said bridge member toward and away from said scale means, and means carried by said bridge member and scale means, respectively, for supporting and confining a flat-folded carton blank or body in edge-wise relation therebetween, whereby, upon the imparting of relative movement between said bridge member and scale means to cause them to approach each other, pressure thus exerted upon said carton blank or body will be reflected on said scale means and the amount of the thus applied pressure necessary to break said carton blank or body upon its folding scores may be observed.

5. Apparatus as claimed in claim 3, in which the means for imparting movement to said bridge member toward said pressure responsive means include a winding device having an axis of rotation fixed in relation to said pressure responsive and indicating means, and cable means bearing upon said bridge member and capable of being wound upon and unwound from said winding means.

6. Apparatus as claimed in claim 3, in which the means for imparting movement to said bridge member toward said pressure responsive means include a winding device having an axis of rotation fixed in relation to said pressure responsive and indicating means, and cable means bearing upon said bridge member and capable of being wound upon and unwound from said winding means, the unwinding of said cable means being accomplished in response to movement of said bridge member under the influence of said resilient means.

7. Apparatus as claimed in claim 5, in which said cable means have two ends both affixed to and windable on and unwindable from said winding means in laterally spaced relation and its mid portion adaptably bears upon and is capable of travelling longitudinally of said bridge member so that its pull thereon may be equalized.

8. Apparatus as claimed in claim 5, in which power actuated means are provided for imparting cable-winding and unwinding motion of said winding means.

References Cited in the file of this patent

UNITED STATES PATENTS

232,123	Hartsook	Sept. 14, 1880
833,753	Shand et al.	Oct. 23, 1906
2,224,218	Blum et al.	Dec. 10, 1940
2,280,966	Nadai et al.	Apr. 28, 1942
2,325,026	Anway	July 27, 1943
2,687,070	Gastright	Aug. 24, 1954
2,760,370	Linhorst	Aug. 28, 1956

OTHER REFERENCES

Publication: "A.S.T.M. Standards for Paper and Paper Products," October 1946, page 78, TS 1109 A5 (1946).