Sept. 14, 1965 J. W. SMITH ETAL 3,206,021

TOW BALE

Filed July 1, 1963

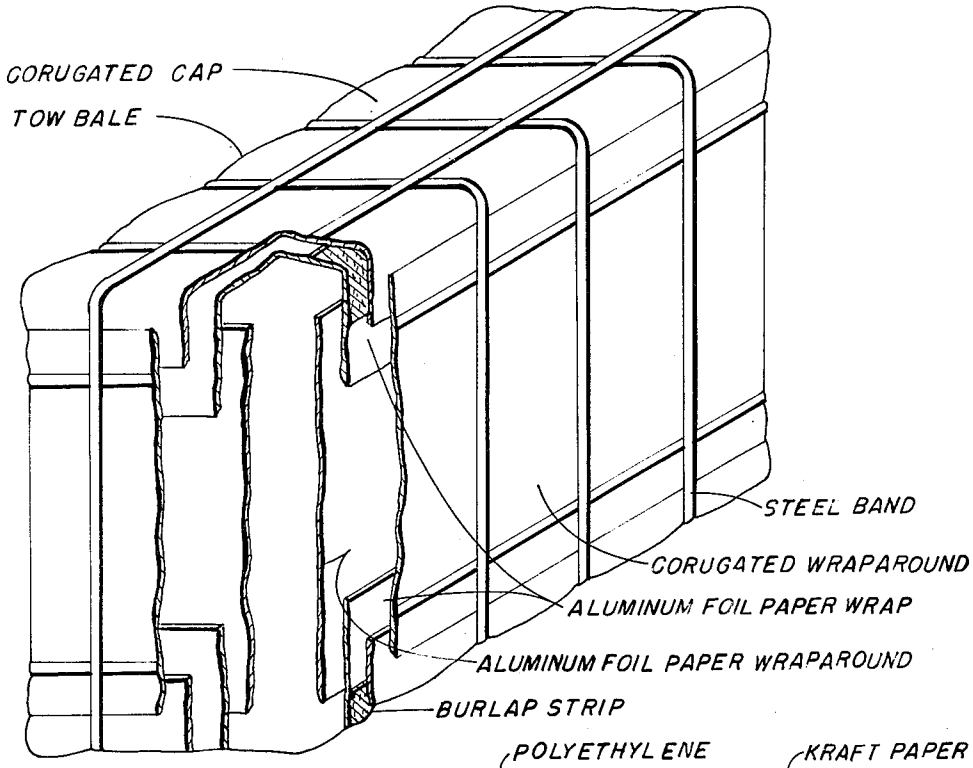

FIG. 1

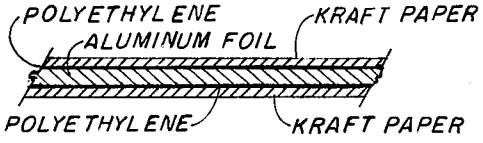

FIG. 2

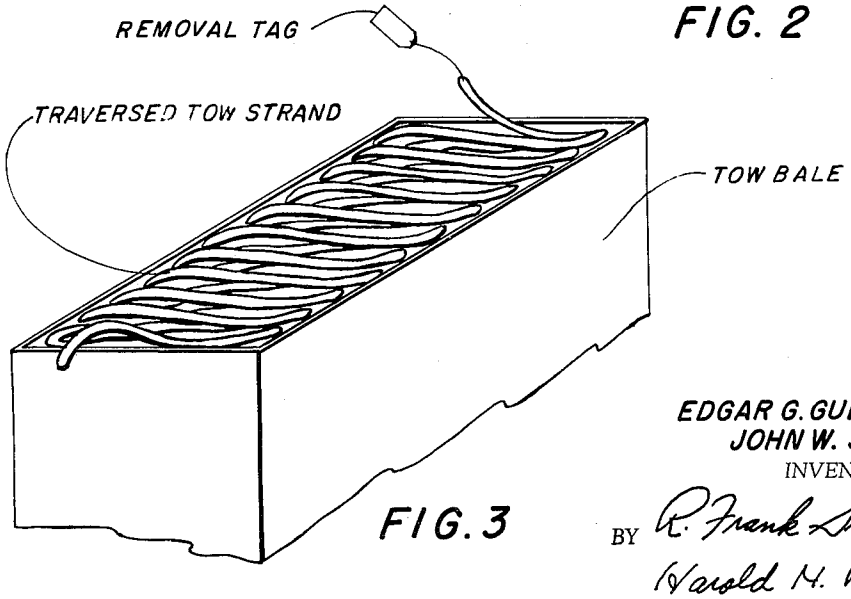

FIG. 3

EDGAR G. GUENTHER
JOHN W. SMITH
INVENTOR.

BY R. Frank Smith
Harold H. Powell
ATTORNEY

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TOW BALE

John Winston Smith and Edgar Gardner Guenther, Kingsport, Tenn., assignors to Eastman Kodak Company, Rochester, N.Y., a corporation of New Jersey

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This application is a continuation-in-part of Serial No. 120,461, filed June 19, 1961, now Patent No. 3,120,893, granted February 11, 1963.

The present invention relates to the packaging of man-made fibers and yarn. More particularly, this invention relates to a specially lined bale of highly compacted continuous filament crimped tow.

In said Serial No. 120,461 we disclose a readily opened high-density tow bale highly resistant to damage. Such tow bale features an inner plastic-lined protective cellulose cover. While said bale has proved highly acceptable to the fiber and fabric industry due to its ease of handling and transporting and its protection of the strands of filaments from damage, it is still susceptible to possible contamination by moisture, odors and the like particularly during long voyages while stored in the holds of ships, such as to overseas destinations. Such contamination may render the baled tow unsatisfactory for such usages as filter elements and the like. Therefore it is apparent that the development of a tow bale having a substantially moisture and odor proof barrier or lining represents a highly desirable object. After extended investigation we have found such a specially lined bale substantially resistant to undesirable attack of its tow contents of moisture, contaminating odors and the like.

One object of this invention is to provide a lined tow bale. Another object is to provide a bale of continuous filament tow the protective cover of which has an inner substantially moisture and odor-proof lining. A further object of this invention is to provide a protective cover for a package of compacted man-made fibers, preferably arranged in traversed layers of a continuous strand of fibers. Other objects will appear hereinafter.

In its broader aspects our invention involves wrapping a bale of filamentary tow susceptible to contamination with a contamination-preventing aluminum foil barrier. In one form the wrapper includes respective layers of (1) a cellulosic material such as paper, (2) polyolefin, (3) aluminum foil and (4) polyolefin, the preferred polyolefin in both instances being polyethylene. If desired, the layers may be prelaminated together by application of heat. The wrapper is adapted to form an inner wrap for lining at least a part of a tow bale, preferably a bale such as described in greater detail hereinafter. It is particularly useful when wrapped around the sides and ends next to the tow with the polyolefin layer on the side next to the tow. In some instances as an additional part of the wrapper a second layer of cellulosic material, preferably paper, may be placed next to the tow. According to our invention the bale may be further wrapped on the outside with a layer such as corrugated fiberboard. The wrap may be further reinforced with burlap strips, for example, at the edges and corners when the bale is of a generally rectangular configuration. The burlap strips may be arranged at intervals along a wrap comprised of an outer paper layer, a middle layer of aluminum foil lined on both sides with polyolefin, preferably polyethylene, and an inner paper layer. The burlap-stripped wrap may be effectively used as two sheets, one each at top and bottom of the bale next to the tow.

According to a preferred embodiment our lined tow bale includes the following wrapping.

(1) One each at top and bottom of the bale laminated sheeting comprising respectively from outside to inside layers of 2 thicknesses of extensible paper, the outer reinforced at intervals with burlap strips, polyethylene (preferably about 1 mil thick), aluminum foil (preferably about ½ mil thick), polyethylene (preferably about 1 mil thick), and extensible paper,

(2) corrugated fiberboard outer pads (which may be folded to give double thickness and have flaps to form caps) at both top and bottom, said pads preferably having two or three kraft paper liners, and optionally a section of double-wall corrugated fiberboard at the bottom next to the tow,

(3) an inner wrap around side and ends of the bale of laminated sheeting comprising extensible paper, polyethylene (preferably about 1 mil thick), aluminum foil (preferably about ½ mil thick) and polyethylene (preferably about 1 mil thick), with inner layer of polyethylene next to the tow and

(4) outer wraps around sides and ends of the bale comprising double wall corrugated fiberboard.

To assist in holding the compact tow in place in a form easy to remove upon opening, the bale may be surrounded in all three directions with bands or straps placed at intervals which may be of metal or an alloy such as steel, leather, plastic or the like.

The tow may be compacted into the bale by the method and apparatus described in our U.S. Patents 2,947,241 and 2,947,242, for example. Accordingly, further description of this operation appears unnecessary herein.

In order to prepare the tow prior to compacting in our novel bale we may proceed as follows. A spinning composition, e.g., of cellulose acetate having a 38–41% acetyl content, in acetone or other suitable solvent, is made up. If round or clover-leaf shaped filaments are desired, the spinning solution is spun in accordance with the methods described in H. G. Stone U.S. Patents Nos. 2,000,047 and 2,000,048. If on the other hand filaments of a special cross section such as a Y cross section are desired, the solution may be spun in accordance with the method described in Raynolds et al. U.S. Patent No. 2,839,027.

The filaments may be dry spun from high viscosity cellulose acetate through orifices of .030–.045 mm. diameter at low draft. For example, using acetone solvent, the high viscosity ester is spun at about 55° C. at a draft of less than 1.8.

The filaments of whatever configuration, produced as aforesaid after removal of solvent and setting up in a spinning cabinet, may be conducted out of the cabinet around a godet roll. Prior to or beyond the godet roll the filaments may be treated with an appropriate lubricant such as a sorbitan compound. After this 5,000 to 40,000 of the filaments are formed into a tow and have imparted thereto a uniform and regular crimp. This may be accomplished as follows:

Generally the number of filaments and the size tow are that it is not convenient to produce the tow from a single large spinnerette and our preferred practice is to combine the threads from a number of spinning cabinets. 1000 to 5000 denier is an advantageous size to produce from a single cabinet, so 15 to 70 cabinets are combined to form a composite tow of, for example, 20,000 to 70,000 denier. The spinning capacity of the cabinet and the arrangement of the cabinets will together determine the number which can readily be combined to form the desired tow. Since the linear speed of all cabinet threads should be the same, the godet rolls may be driven from a common power source. So that each cabinet will produce its proportionate share of the total denier, each spinnerette may be supplied spinning solution from its own metering pump,

and these may also be driven from a common power unit. The godet rolls and metering pumps may both be driven by the same motor, or separate power units may be used, in which case they should be inter-connected electrically, hydraulicially, or mechanically.

The threads from the required number of cabinets are drawn together to form the tow which is fed to a stuffing box type crimper. To secure uniform crimp, it is important that the tow be presented to the crimper as a flat band of uniform width and thickness. Variations cannot be tolerated, and it is equally important that the band width as the tow enters the crimper be properly correlated to the width of the rolls. Too narrow a band causes low crimp on the edges. Too wide a band results in what is termed "crimper harsh." This occurs when a few filaments are trapped between the sides of the rolls and the side plates which form the stuffing-box, the filaments thereby being chewed up and pressed into small, flat flakes of the material from which the filaments were spun.

Following the crimping operation the tow is compacted into the novel bales of the instant invention.

For assistance in the further understanding of our invention reference is made to the attached drawing forming a part of the present application.

FIG. 1 is a perspective view of the finished tow bale of this invention, with a cutaway portion depicting an illustrative part of the inside of said bale showing our novel aluminum foil moisture and odor-proofing liner.

FIG. 2 is a cross section showing the respective layers of our aluminum foil-containing laminar sheeting tow bale wrap.

FIG. 3 is another perspective view of the bale with top open to indicate zig-zag layers of traversed tow.

A still further understanding of our invention will be had from a consideration of the following illustrative examples.

Example I

A continuous filament cellulose acetate tow of about 2 denier per filament (D/F), 37,000 total denier (TD) and 16 crimps per inch (c.p.i.) was compacted into bales of a density of about 24 pounds per cubic foot wrapped with an aluminum foil liner having polyethylene on both surfaces thereof and reinforced with burlap and corrugated fiberboard as depicted in FIG. 1 and described hereinabove. The bales were stored for two weeks in a humid odoriferous atmosphere and the tow then removed therefrom and processed into filter elements. The moisture content of several samples of tow removed from the bales was measured as substantially the same as prior to baling, and the tow was still substantially odor-free after removal from the bales.

Example II

A continuous filament cellulose acetate tow (acetyl content about 39%) was compacted into two bales of 1.67 D/F, 37,000 TD and 15 c.p.i. tow. The first bale was of a density of 23.4 pounds per cubic foot, the former weighing 636 pounds, and the latter weighing 784 pounds. The volume of each of the bales was approximately 27.2 cubic feet. After aging for one week, tow from the bales was withdrawn through an 8" banding jet, over a fixed drum guide, through a pair of feed rolls, and then to an air doffer. Withdrawal speed of the tow was 300 feet per minute. One ten minute run was made from each bale. Observations were made of differences in withdrawal characteristics and appearance of the bale surface. Filament pull-ups were more frequent for the lower density bale, and occasionally the filaments would be pulled up to the banding jet. Upon completion of the ten-minute run, the number of plucks on the surface of the bale was determined. The "pluck count" was as follows:

Bale density	No. of plucks
28.8 lbs./cu. ft.	12
23.4 lbs./cu. ft.	30

From the above description and examples it should be apparent that by our invention we have provided a novel tow bale rendered substantially moisture and odor proof by an aluminum foil lining.

Although the invention has been described in considerable detail with reference to certain preferred embodiments thereof, it will be understood that variations and modifications can be effected without departing from the spirit and scope of the invention as defined in the appended claims.

We claim:

1. A substantially rectangular tow bale which comprises
(1) laid in separate layersof zig-zag pattern extending the width and length of the bale a continuous strand of crimped tow,
(2) at top and bottom of said bale laminar sheeting comprising respective layers from outside to inside of extensible paper reinforced at intervals with burlap strips, polyethylene, aluminum foil and polyethylene, the latter layer of polyethylene being next to the tow,
(3) at top and bottom of said bale outer-capping corrugated fiberboard pads,
(4) around sides and ends of said bale an inner wrap comprising from outside to inside respective layers of extensible paper, polyethylene, aluminum foil and polyethylene, the latter layer of polyethylene being next to the tow,
(5) around sides and ends of said bale an outer wrap comprising corrugated fiberboard and
(6) encircling said bale leading continuously respectively
(a) over top, one side, bottom and opposite side,
(b) over top, one end, bottom and opposite end and
(c) around the sides and ends
reinforcing bands.

2. A substantially rectangular tow bale which comprises a plurality of layers of a continuous strand of crimped tow compressed in bale form and extending from end to end and side to side of the bale lined with a substantially moisture-proof and odor-proof tow bale lining consisting of:
(1) two sheets of extensible paper with burlap strips, one each at top and bottom of the bale next to the tow, each of said two sheets being laminated from outside to inside in the following layers:
(a) at least one outside extensible paper sheet reinforced at intervals with burlap strips
(b) polyolefin film
(c) aluminum foil
(d) polyolefin film and
(e) an inside extensible paper sheet next to the tow,
said polyolefin film being extrusion coated on each side of said aluminum foil thereby protecting said foil from breaking when folded,
(2) two corrugated fiberboard outer pads with flaps to form caps and with kraft liners, one each at top and bottom of the bale,
(3) a piece of combination sheeting forming an inner wrap around the sides and ends of the bale next to the tow, having the following layers from outside to inside:
(a) on the outside an extensible paper sheet
(b) polyolefin film
(c) aluminum foil and
(d) polyolefin film next to the tow and
said polyolefin film also being extrusion coated on each side of said aluminum foil,
(4) at least two pieces of double wall corrugated fiberboard with kraft liners forming an outer wrap around the sides and ends of the bale,
said lining being held in place tightly around the com-

pacted tow in the bale by straps extending around the bale in at least two of the three directions, said three directions comprising (1) around the sides and ends, (2) over the top and bottom by way of the ends and (3) over the top and bottom by way of the sides.

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THERON E. CONDON, *Primary Examiner.*