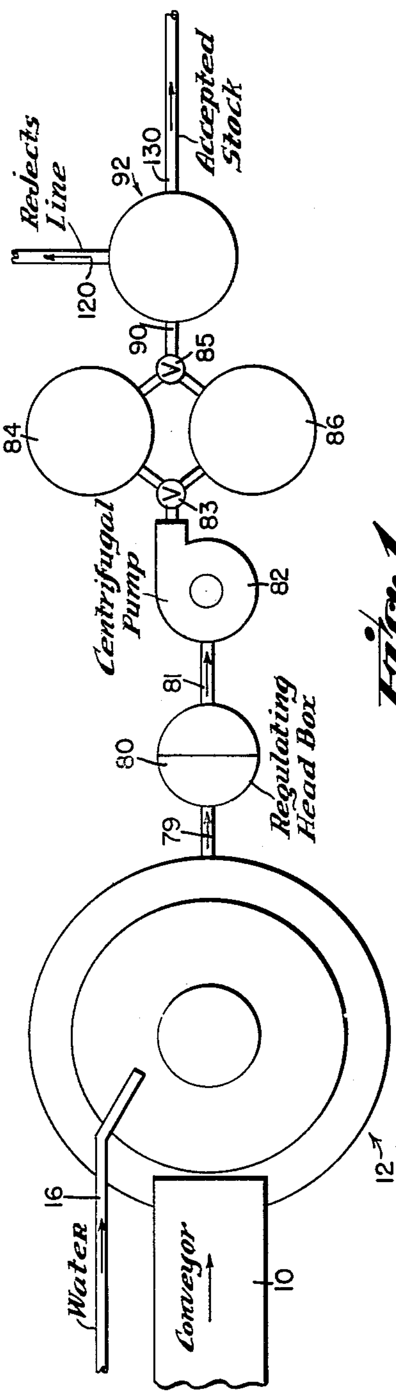

Fig. 1

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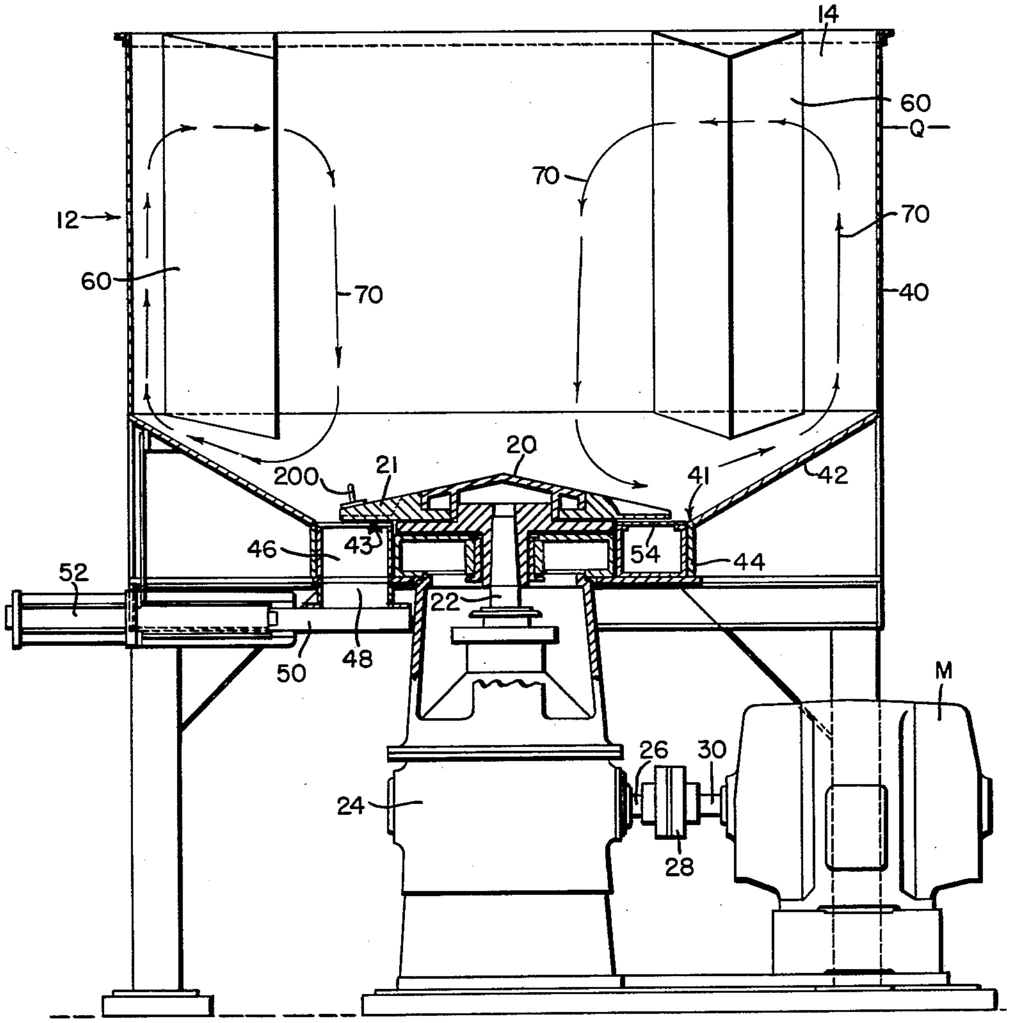

Fig. 2

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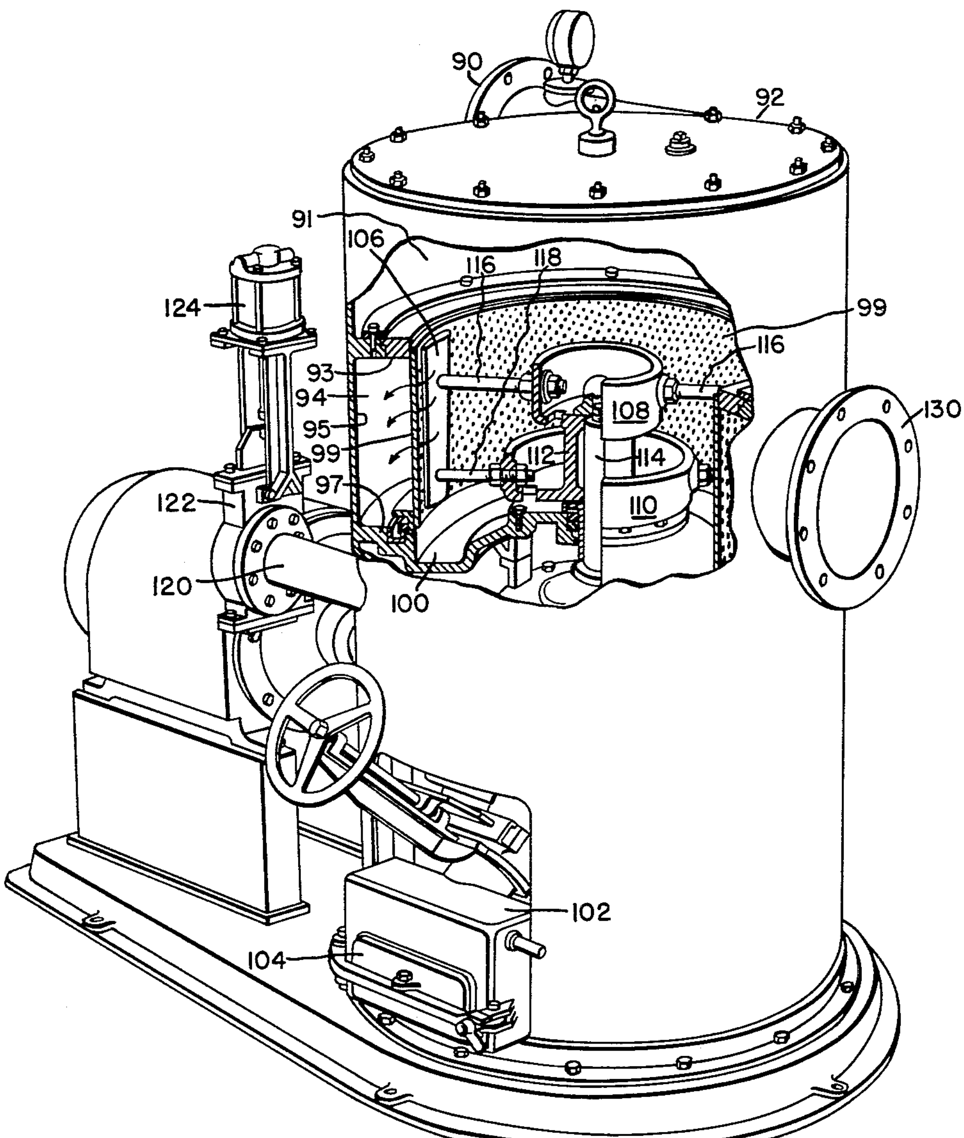

Fig. 3

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METHOD OF RECLAIMING CELLULOSE FIBERS FROM THERMOPLASTIC COATED CELLULOSIC WEBS

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This invention relates to a method of reclaiming cellulose fibers from thermoplastic coated cellulosic webs.

It is generally known in the art that thermoplastic coated cellulosic webs are not easily or readily reclaimable by conventional pulping methods, and prior to my invention it has not been economically feasible to utilize special processes and/or equipment to produce a thermoplastic free pulp from thermoplastic coated broke, that is, from thermoplastic coated waste, trim or scrap paper.

An object of the present invention is to teach a simple, inexpensive, highly efficient method of separating cellulose fibers from a thermoplastic film or coating, wherein the term "thermoplastic" includes:

(*a*) Polyolefins, such as, by way of example, polyethylene, polypropylene, polyisobutylene, polypentene, and the like;

(*b*) Polyvinyls, such as, by way of example, polyvinylchloride, polyvinylacetate, copolymers of polyvinylchloride, copolymers of polyvinylacetate, polystyrene, ABS resins, polyacrylic acid resins, etc.;

(*c*) Thermoplastic polyesters; and

(*d*) Polycarbonates.

Another object of the invention is to teach a method of effectively separating cellulose fibers from a thermoplastic film without requiring the use of chemicals and/or hot water.

A further object of the invention is to teach a method of reclaiming cellulose fibers which are entirely free of the thermoplastic film from which the fibers were removed, and wherein the defibered thermoplastic remains intact for recovery and reuse without further processing.

These and other objects are attained by the means described herein and as illustrated in the attached drawings, in which:

FIG. 1 is a flow chart of the subject process.

FIG. 2 is a sectional view of a device which comprises part of apparatus which may be used in practicing the teachings of the present invention.

FIG. 3 is a perspective view, with portions thereof broken away, of a device which constitutes part of apparatus which may be used in practicing the invention.

At the outset it should be noted that the teachings of the present invention enable cellulose fibers to be effectively stripped from thermoplastic film at but a fraction of the initial and operating cost of other systems of which we are presently aware. By way of example, in our system the use of apparatus costing but $20,000.00 will produce results far superior to, at a lesser cost and at a higher throughput than competitive systems costing in excess of $300,000.00.

With particular reference now to FIG. 1, the numeral 10 denotes a conveyor upon which a quantity of thermoplastic coated scrap may be delivered to and dumped into tub 12 of the pulping unit of FIG. 2. The tub is defined by upstanding side walls 40 the lower ends of which slope inwardly as at 42 and thence downwardly as at 44 in circumscribing relationship with a circular manifold 46.

The lower edge 41 of the upper face of the inclined bottom wall 42 of the tub terminates at the plane of the upper surface of a perforated bed plate 54 which spans and comprises an upper foraminous wall of manifold 46 which includes a discharge or outlet port 48 having associated therewith means, such as, by way of example, a slide valve 50 for controlling the flow of material from the manifold. The numeral 52 denotes generally the cylinder of a power actuator for slide valve 50.

A rotor 20 is suitably journaled for rotation with shaft 22 of transmission 24 whose in-put shaft 26 is coupled as at 28 to the drive shaft 30 of an electric motor M. In the preferred embodiment of the invention rotor 20 may comprise a six bladed propeller having zero pitch, wherein each blade includes a flat lower face 43 which is in spaced parallelism with the upper surface of the perforated bed plate 54. Uniformly satisfactory results have been obtained in those instances wherein the clearance between the bed plate and blades is from .050″ to .075″.

The thermoplastic coated scrap, or poly coated broke, as it is known in the trade, is charged into tub 12 with ambient temperature water, from conduit 16, to a concentration of up to 8% by weight, 5% by weight being preferred.

High speed rotation of rotor 20 will subject the contents of tub 12 to centrifugal forces which will cause the mixture therein to circulate in a manner as indicated by the headed arrows 70 of FIG. 2, relative to and about a plurality of vertical, open-ended baffles 60 which are secured to and carried by walls 40 of tub 12.

In a comparatively short period of time the action imparted to the contents of the tub will break the bond between the cellulose fibers and the thermoplastic; and simultaneously therewith the intense hydraulic shear which is developed by the rotating blades of the rotor strips the cellulose fibers from the thermoplastic, the fibers mixing with the water to provide a pulp.

In those instances wherein 1500 pounds of thermoplastic-coated scrap are charged with 28,000 pounds of water into a tub 12 eleven feet in diameter, operation of rotor 20 for six or seven minutes will result in the complete defibering of from 95% to 98% of the thermoplastic film, at which time valve 50 may be opened for discharging the pulp mixture to a regulating head box denoted generally by the numeral 80, FIG. 1.

When valve 50 is opened, "make up" water is continuously added to tub 12 via conduit 16 whereby to maintain the fluid volume within the tub substantially constant, such as, by way of example, at a level indicated by the headed arrow Q, FIG. 2. The pulp mixture from outlet 48 is discharged by gravity flow via conduit 79 to a regulating head box 80, FIG. 1, from whence it is pumped via conduit 81 by pump 82 to a distributor valve 83 and thence to one or the other of stock tanks 84 or 86, each of which is provided with suitable agitators, not illustrated, for maintaining a uniform pulp suspension within said tanks.

The amount of "make up" water which is added is such as to provide a 0.6% to 1.0 mixture of pulp in the stock tanks.

Rotor 20 is operated continuously during the entire period of time when valve 50 is open incident to the addition of "make up" water and the simultaneous discharge of pulp from tub 12. As individual blades 21 of the rotor sweep over the perforated bed plate, the resultant Bernoulli Effect will literally lift and positively dislodge any thermoplastic film from the surface of the bed plate, and the centrifugal force induced by the rotor will divert said film outwardly toward walls 40 of the tub in such a manner as to bodily remove the de-fibered film from the upper surface and immediate area of the perforated bed plate 54, whereby the cellulose fibers and water in the form of pulp will be free to pass into manifold 46 through the openings in the bed plate.

In those instances in which the perforations or openings in the bed plate consist of .125″ holes, the screening effect of the bed plate in conjunction with the action of the rotor is about 99% efficient. That is, 99% pulp and but 1% loose, de-fibered film will pass through the bed plate.

At this point it should be understood that if an 0.8% mixture of pulp is desired in the stock tank, 160,000 pounds of "make up" water would be used, which added to the 28,000 pounds, originally in the tub, would result in 186,000 pounds of water being delivered to the stock tank for each batch, run, or de-fibering cycle of the device of FIG. 2.

The "make up" water also provides a continuous washing of the de-fibered thermoplastic film within the tub.

The capacity of each stock tank is such as to receive the entire charge of pulp mixture from the pulping unit of FIG. 2; and after a stock tank has been so charged with pulp mixture, valve 83 may be closed and valve 85 opened for discharging the contents of said tank into means wherein it is subjected to a second screening operation for removing any loose particles of de-fibered film therefrom.

Uniformly satisfactory results have been attained in those instances in which the dilute pulp mixture from the stock tank is pumped into intake 90 of a screening device denoted generally by the numeral 92, which, as illustrated in FIG. 3, comprises a closed central chamber 91 which includes a circular manifold 94 defined by imperforate upper, outer and lower walls 93, 95, 97 and an inner perforate wall or screen 99 having .060" openings therethrough.

The bottom of chamber 91 is defined by imperforate lower wall 97 which may be formed whereby to include an annular depressed tray portion 100, below screen 99, upon which foreign objects such as metallic particles will be deposited for discharge through a suitable hatch, not illustrated, to a refuse box 102 having an access door 104.

Diametrically opposed airfoil shaped bars or blades 106 are secured to upstanding collars 108 and 110 of a centrally disposed member 112 which is secured to and carried by rotatable shaft 114 by means of support elements 116 and 118, respectively.

The numeral 120 denotes the rejects line or pipe having a valving device 122 therein under the control of an actuator denoted generally by the numeral 124. A passageway, not illustrated, places the interior of collars 108 and 110 in open communication with rejects line 120.

Outlet port 130 is in open communication with the interior of manifold 94.

The contents of the stock tank is pumped into chamber 91 via port 90 while a pressure differential of 5–7 p.s.i. is maintained across perforate wall or screen 99. Rotation of blades 106 in a clockwise direction produces a Bernoulli Effect which lifts and removes any particles of de-fibered thermoplastic film which is deposited on the chamber side or inner face of screen 99.

Valve 122 is normally cracked or opened slightly to permit a small flow or trickle of fluid from chamber 91, with the result that the fiber-free thermoplastic film particles within the pulp mixture in the chamber will pass into collars 108 and/or 110, thence to the rejects line 120 while the cellulose pulp and water will pass through screen 99, into manifold 94 and out port 130 from which it may be pumped to any suitable pulp refiner, to a cylinder or a Fourdrinier machine, or any other suitable means for extracting the water from the cellulose fibers of the pulp mixture leaving port 130.

The pulp mixture from port 130 is entirely free of film.

From the foregoing, it will be noted that we have provided a simple yet highly effective process of reclaiming cellulose pulp from thermoplastic coated cellulosic webs, wherein the reclaimed pulp is entirely free of any traces of film.

In the first step of the process we effect separation of the callulose substrata from the thermoplastic film, after which the substrata is removed as a dilute pulp mixture from the de-fibered film. The de-fibered film remains in

tub 12 after the cellulose substrata has been discharged through manifold 46. The de-fibered film may be easily lifted or otherwise removed from tub 12, after which it may be dried, compacted and sold as plastic scrap.

In the second step of the process we effect separation of any particles of de-fibered film which may have passed through the perforated bed plate 54 with the pulp and water, from the pulp and water whereby to provide a high quality cellulose pulp which is entirely free of thermoplastic.

It will be observed that the first step is conducted as a batch process wherein a given amount of dry poly coated broke is processed whereby to provide a cellulosic pulp which is substantially free of de-fibered film, and a quantity of de-fibered film. Make-up water is added to the pulp to provide a predictable quantity of 0.6% to 1.0% pulp mixture which is pumped into a stock tank. After the first step has been completed, the de-fibered film is removed from tub 12, after which it may be recharged with more dry broke and water and the process repeated, with the pulp mixture being delivered to stock tank 86.

The second step of our process may be continuous for screening first the contents of stock tank 84 and then the contents of tank 86, then 84, etc.

With reference to FIG. 2, the numeral 200 indicates a short, upstanding, vertical knife secured to and carried by one or more of the ends of the individual blades of rotor 20. Knife 200 effectively cuts the scrap or broke into smaller pieces for easier and more rapid pulping; it also serves to prevent the de-fibered film from "balling up" during those periods of time when the pulp is being separated from the de-fibered film in the device of FIG. 2.

The foregoing description of a new and novel process for separating thermoplastic film from cellulosic substrata discloses the use of water of ambient temperature, with no chemical additions being required to effect this separation. If a faster defibering of the thermoplastic film is desired, however, two-tenths of one percent calculated on the weight of the dry scrap charge, of a cationic surface active agent can be added to the ambient temperature in the tub. This surface tension lowering agent will decrease the defibering time by as much as one-third. In any case, however, the need for elevated temperatures in the water supply is eliminated.

It should be understood that various changes and modifications may be made, within the scope of the appended claims, without departing from the spirit of the invention.

What is claimed is:

1. In the process of separating thermoplastic film from the cellulose substrata of thermoplastic coated broke, the steps of mixing in a suitable receptacle, dry broke and water, continuously and violently subjecting the broke in said receptacle to hydraulic shear by violently and continuously agitating the water and the broke therein to break the bond between the substrata and the film and to strip the cellulose fibers from the film and mix said fibers with said water to form a pulp therewith, continuously adding water to the pulp and stripped film mixture while subjecting said mixture to a screening action for passing the pulp from the mixture while retaining all of the unstripped broke and substantially all of the stripped film from the pulp, and then subjecting said initially screened pulp to a centrifugal screening action for removing therefrom any remaining film which may have passed in the first screening.

2. In the process of separating thermoplastic film from the cellulose substrata of thermoplastic coated broke, the steps of mixing in a suitable receptacle, dry broke and water, continuously and violently subjecting the broke in said receptacle to hydraulic shear by violently and continuously agitating the water and the broke therein and to centrifugal forces to break the bond between the substrata and the film and to strip the cellulose fibers from the film and mix said fibers with said water to form a pulp therewith, continuously adding water to the pulp and stripped film mixture while subjecting said mixture to a

screening action for passing the pulp from the mixture while retaining all of the unstripped broke and substantially all of the stripped film separate from the pulp.

3. The process of separating and reclaiming cellulose fiber from thermoplastic coated broke, which comprises charging the broke in a dry condition into a treatment receptacle together with water at ambient temperature, violently agitating and subjecting the mixture to centrifugal forces to break the physical bonds securing the film to the body of cellulose material and simultaneously effecting parting of the film from the cellulose body and reducing the latter to a cellulose fiber pulp, then withdrawing pulp laden water while continuously adding "make-up" water and continuing the stated agitation and effecting movement of the water in a manner to lift and remove the separated film from the area of withdrawal of the cellulose fiber pulp to thereby avoid interference by the parted film of passage of the fiber laden water from the receptacle and retaining substantially all of the film therein for separate recovery.

4. The process according to claim 3, wherein the concentration of the dry broke in the charge is preferably about 5% to 8% by weight.

5. The process according to claim 3, wherein is included the step of subjecting the broke to a cutting operation simultaneously with the execution of the said violent agitation.

6. The process according to claim 3, wherein the quantity of said "make-up" water is such as to provide a 0.6% to 1.0% mixture of pulp in the total fiber laden water withdrawn from the receptacle and wherein the process comprises the further steps, for effecting removal of any film particles which may have escaped separation from the cellulose fiber laden water, of centrifuging the fiber laden water and fibers carried thereby through a multiplicity of foramina and simultaneously effecting the lifting away from the foramina of film particles in the water to thereby prevent such particles from blocking passage of cellulose particles through the foramina.

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Disclaimer

3,154,255.—*David L. Schulman*, Cincinnati, and *George E. Brown, Jr.*, Glendale, Ohio. METHOD OF RECLAIMING CELLULOSE FIBERS FROM THERMOPLASTIC COATED CELLULOSIC WEBS. Patent dated Oct. 27, 1964. Disclaimer filed Feb. 3, 1969, by the inventors, the assignee, *The Amberley Company*, consenting.

Hereby enter this disclaimer to claim 5 of said patent.

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