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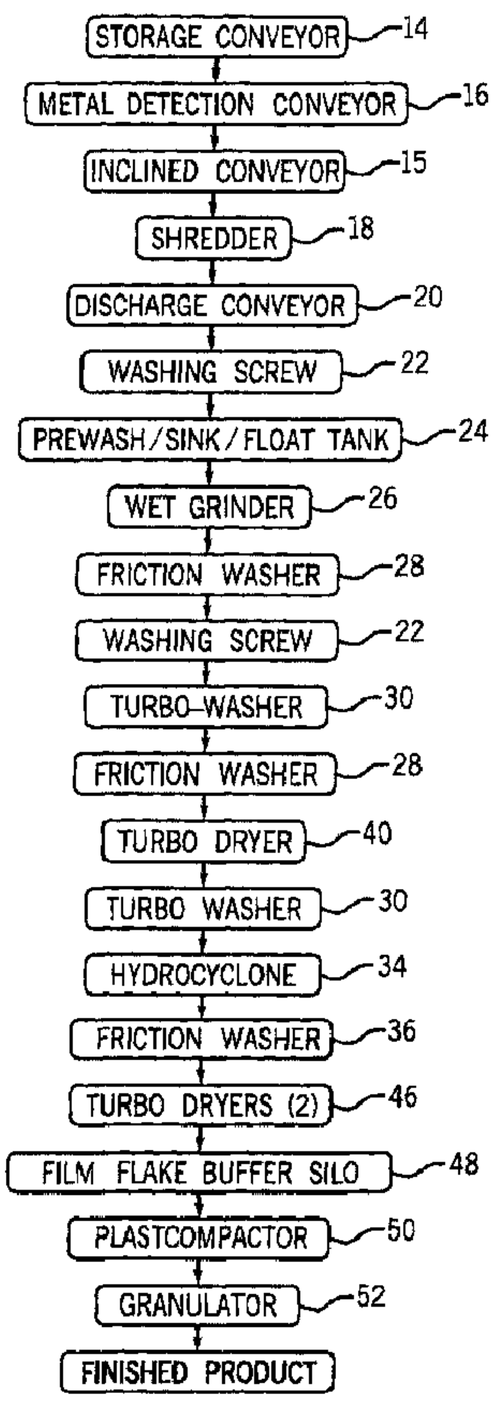
(54) **Titre : PROCEDE DE RECYCLAGE DE FILMS SANS VALEUR DE POST CONSOMMATION**
(54) **Title: POST CONSUMER SCRAP FILM RECYCLING PROCESS**



(57) **Abrégé/Abstract:**
A method for processing a supply of post consumer scrap linear low density or low density polyethylene film into near-virgin quality blown film product. The method includes tearing the supply of film in a shredder, wherein the surface area of the film is exposed,

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(57) **Abrégé(suite)/Abstract(continued):**
including delaminating the film. The torn supply of film is washed in a water bath including a surfactant. The film is agitated in the bath containing the surfactant wherein contaminants on the film are removed from the film. The washed film is ground into smaller pieces and additional washing of the ground film in a rotating friction washer occurs wherein additional contaminants are removed from the film. The ground film is then dried and compacted without addition of water into granulated objects of near-virgin quality blown film product.

ABSTRACT OF THE DISCLOSURE

A method for processing a supply of post consumer scrap linear low density or low density polyethylene film into near-virgin quality blown film product. The method includes tearing the supply of film in a shredder, wherein the surface area of the film is exposed, including delaminating the film. The torn supply of film is washed in a water bath including a surfactant. The film is agitated in the bath containing the surfactant wherein contaminants on the film are removed from the film. The washed film is ground into smaller pieces and additional washing of the ground film in a rotating friction washer occurs wherein additional contaminants are removed from the film. The ground film is then dried and compacted without addition of water into granulated objects of near-virgin quality blown film product.

POST CONSUMER SCRAP FILM RECYCLING PROCESS

BACKGROUND OF THE INVENTION

[0001] Field of the Invention -- The present invention relates to a process for recycling scrap, and more particularly to a process for recycling post-consumer scrap linear low density polyethylene film and post-consumer low density polyethylene film.

[0002] Recycling of post-consumer plastic waste has received considerable publicity as being environmentally correct and "green". It is known that the majority of municipal, mixed post-consumer plastic waste includes polyethylene perephthalathe (PET) materials, such as used in soda bottles and unpigmented high density polyethylene (HDPE) materials, such as milk bottles. In a typical recycling procedure, the containers composed of PET and HDPE are separated from other waste which are then shredded into smaller pieces, cleaned, heated and extruded or granulized for reuse as other products.

[0003] One type of post-consumer scrap (PC) that has been difficult to recycle is polyethylene film. Typically, the PC film material is a "stretch wrap" linear low density polyethylene (LLDPE). Because of the strength characteristics and the stretch characteristic of the LLDPE such film is used as a baling material and wrap material for palletized loads or baling processes. Another type of PC film is low density polyethylene (LDPE) used as a wrap and as a bag.

[0004] LLDPE film is used in wrapping and securing boxes, containers, or similar items on a pallet during shipping. Upon arrival at a given destination, such PC film is removed from the palletized materials and

scrapped. Such PC film typically has labels that are glued onto the outside of the film as well as various markings that are placed on the film during the shipping process. The PC film typically is wrapped around the materials on the pallets several times so that there are layers upon layers of the film.

[0005] PC film is also used to bale other scrap material. When PC film is removed from the pallets or other bales, because of the high level of contamination such as dirt, oil, biological material, layering, label adhesives, etc. the PC film is either tossed in a landfill or processed as a filler for other plastic products. Reuse of the PC film as a viable blown film product for use as industrial film or a bag product has generally not been instituted. Typically, such used film has limited use due to high level of contamination present which, in turn, causes severe processing issues as well as unpleasant properties in the finished product, for example, odor, discoloration and "pitted" appearance.

[0006] The apparatus implementing the present disclosure must also be of construction which is both durable and long lasting, and it should also require little or no maintenance to be provided by the user throughout its operating lifetime. In order to enhance the market appeal of the apparatus of the present disclosure, it should also be of inexpensive construction to thereby afford it the broadest possible market. Finally, it is believed that all of the aforesaid advantages and aspects are achieved without incurring any substantial relative disadvantage.

SUMMARY OF THE INVENTION

[0007] The disadvantages and limitations of the background art discussed above are believed to be overcome by the present disclosure.

[0008] There is provided a method for processing a supply of post consumer scrap linear low density polyethylene film or low density polyethylene film into near-virgin quality blown film product. The method includes tearing the supply of film in a shredder, wherein the surface area of the film is exposed, including delaminating the film. The torn supply of film is washed in a water bath including a detergent. The film is agitated in the bath containing the surfactant wherein contaminants on the film are removed from the film. The washed film is ground into smaller pieces and additional washing of the ground film in a rotating friction washer occurs wherein additional contaminants are removed from the film. The ground film is then dried and compacted without addition of water into granulated objects of near-virgin quality blown film product.

[0009] The method of processing the supply of film can include at least one of the washing processes in hot water having a temperature of at least 140° F. but not more than 190° F. During the process, metal is detected in the supply of film and removed from the supply prior to the grinding process.

[0010] There is also provided a method for processing post-consumer scrap film into a near-virgin quality blown film product. The method includes providing one of a supply of recyclable linear low density polyethylene plastic film and a supply of low density polyethylene plastic film and removing the

metal from the supply of plastic film. The plastic film is shredded after metal removal with the shredding process tearing the plastic film and exposing the surface area of the film. The shredded plastic film is discharged through a filter screen to a water bath wherein the shredded plastic film is agitated to wet all the surfaces of the shredded plastic film. The plastic film is then removed from the water bath and a wet grinding of the plastic film occurs.

[0011] The ground plastic film is washed again in a rotating friction washer wherein contaminants are removed from the plastic film. At least two different types of the washed ground plastic film is separated in a hydrocyclone wherein lighter plastic film is separated from heavier plastic film. The ground plastic film is dried and compacted without the addition of water into granulated objects of near-virgin quality linear low and low density polyethylene plastic. The granulated objects are then either stored or used as raw material in a blown film operation.

[0012] There is further provided a method for processing post-consumer scrap film into a near-virgin quality blown film product. The method includes providing one of a supply of recyclable linear low density polyethylene plastic film and a supply of low density polyethylene plastic film and removing the metal from the supply of plastic film. The plastic film is then shredded after metal removal wherein the plastic film is torn exposing the surface area of the film. The shredded plastic film is discharged through a filter screen to a water bath where the film is agitated to wet all the surfaces of the shredded plastic film. The water bath includes a surfactant,

for example, a detergent additive to assist in removal of contaminants. The washed plastic film is removed from the water bath and wet ground. The then ground plastic film is washed again in a rotating friction washer where additional contaminants are removed from the plastic film.

[0013] The plastic film is subjected to a hydrocyclone for separating at least two different types of the washed ground plastic film. The lighter plastic film is separated from heavier plastic film in the hydrocyclone. The ground plastic film is dried so that it contains not more than 10 percent, by weight, water content. The dried ground plastic film is compacted, without the addition of water, into granulated objects of near-virgin quality polyethylene plastic and is either stored or used as raw material in a blown film operation. The granulated plastic film can also be formed into pellets after the compacting step.

[0014] The apparatus to implement the present disclosure is of a construction which is both durable and long lasting, and which will require little or no maintenance to be provided by the user throughout its operating lifetime. The apparatus of the present disclosure is also of inexpensive construction to enhance its market appeal and to thereby afford it the broadest possible market. Finally, all of the aforesaid advantages and aspects are believed to be achieved without incurring any substantial relative disadvantage.

[0014a] A preferred aspect of the invention is a method for processing a supply of post consumer scrap linear low density polyethylene film or low density polyethylene film into near-virgin quality blown film

product. The method includes tearing the supply of multi-layer film in a shredder wherein a surface area of the film is exposed including delaminating the film, washing the torn film in a water bath including a surfactant and agitating the film in the bath wherein contaminates are removed from the delaminated film, grinding the film and washing the ground film in a plurality of rotating friction washers wherein additional contaminates are removed from the film, drying the ground film resulting in the ground film containing not more than 10% by weight of water content, and compacting the dry ground film without addition of water into granulated objects of near-virgin quality blown film product.

[0014b] Another aspect of the invention is a method for processing post consumer scrap film into a near-virgin quality blown film product wherein the method includes providing one of a supply of multi-layer recyclable linear low density polyethylene plastic film and a supply of recyclable multi-layer low density polyethylene plastic film, removing metal from the supply of plastic film, shredding the supply of multi-layer plastic film after metal removal wherein the plastic film is torn exposing delaminated surface area of film, discharging the shredded plastic film through a filter screen to a water bath, agitating the water in the water bath to further delaminate and wet all the surfaces of the shredded plastic film, removing the plastic film from the water bath, wet grinding the plastic film in a rotating friction washer wherein contaminates are removed from the plastic film, separating at least two different types of the washed ground plastic film in a hydrocyclone wherein lighter plastic film is separated from heavier plastic film, drying the washed ground plastic film so the film

contains not more than 10% by weight of water content, and compacting the dry ground plastic film without addition of water into granulated objects of near-virgin quality plastic film wherein the granulated objects are one of stored and used as raw material in a blown film operation.

[0014c] Yet another aspect of the invention is a method for processing post consumer scrap film into a near-virgin quality blown film product wherein the method includes providing one of a supply of multi-layer recyclable linear low density polyethylene plastic film and a supply of multi-layer recyclable low density polyethylene plastic film, removing metal from the supply of plastic film, shredding the supply of multi-layer plastic film after metal removal wherein the plastic film is torn exposing delaminated surface area of film; discharging the shredded plastic film through a filter screen to a water bath, agitating the water in the water bath to further delaminate and wet all the surfaces of the shredded plastic film wherein the water bath includes a surfactant additive including a detergent, an oxidizer and a bleaching agent, removing the plastic film from the water bath, wet grinding the plastic film, washing the ground plastic film in a rotating friction washer wherein contaminates are removed from the plastic film, separating at least two different types of the washed ground plastic film in a hydrocyclone wherein lighter plastic film is separated from heavier plastic film, drying the washed ground plastic film so the film contains not more than 10% by weight of water content, and compacting the dry ground plastic film without addition of water into granulated objects of near-virgin quality plastic film wherein the granulated objects are one of stored and used as raw material in a blown film operation.

[0014d] Still another aspect of the invention is a system for processing a supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film into near-virgin quality blown film product that includes a shredder configured to tear the supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film in the shredder wherein surface area of the film is exposed including delaminating the film, a water bath configured to wash the torn film in the water bath including a surfactant and agitating the film in the bath wherein contaminates are removed from the delaminated film, a grinder configured to grind the film, a plurality of rotating friction washers configured to wash the ground film wherein additional contaminates are removed from the film, a dryer configured to dry the ground film resulting in the ground film containing not more than 10% by weight of water content, a compactor configured to compact the dry ground film without addition of water into granulated objects of near-virgin quality blown film product, and a conveyor network interconnecting the various systems equipment with the conveyor network including one of a storage conveyor, incline conveyor, discharge belt, transport screw, and pneumatic transport tube.

[0014e] Yet still another aspect of the invention is a system for processing post-consumer scrap film into a near-virgin quality blown film product with the film including one of a supply of multi-layer recyclable linear low density polyethylene plastic film and a supply of multi-layer recyclable low density polyethylene plastic film that includes a detector configured to detect a non-film object in the supply of film, a machine configured to remove the non-film object detected in the film, a shredder configured to

shred the supply of multi-layer plastic film after removal of the non-film object and to tear the shredded film exposing a delaminated surface area of the film, a filter screen configured to receive and filter the shredded plastic film, a water bath apparatus configured to receive the filtered film from the filter screen, an agitator coupled to the water bath apparatus configured to agitate water in the water bath apparatus to further delaminate and wet all surfaces of the shredded plastic film, a wet grinder apparatus is configured to receive the shredded plastic film from the water bath with the wet grinder configured to grind the plastic film, a rotating friction washer configured to receive the wet ground plastic film with the rotating friction washer configured to wash the ground plastic film wherein contaminants are removed, a hydrocyclone configured to receive the ground plastic film from the rotating friction washer with the hydrocyclone configured to separate a light, by weight, plastic film from a heavy, by weight, plastic film, a pair of dryer apparatuses, with one dryer apparatus configured to receive the light plastic film and one dryer apparatus configured to receive the heavy plastic film with both dryer apparatuses configured to dry the plastic film so the film contains not more than 10% by weight of water content, a compactor apparatus configured to compact the dry plastic film received from the dryer apparatus without addition of water into granulated objects of near-virgin quality plastic film, and a storage apparatus configured to receive the compacted granulated objects of near-virgin quality plastic film.

[0014f] In one broad aspect, the invention pertains to a system for processing a supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film into near-virgin quality blown film product, comprising a shredder configured to tear the supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film in the shredder, wherein surface area of the film is exposed, including delaminating the film, a water bath configured to wet and agitate the torn film in the water bath to remove contaminates from the delaminated film, and a grinder configured to grind the wetted, delaminated film into ground film to reduce it in size. At least one washing device is configured to wash the ground film to remove additional contaminates from the ground film, wherein the at least one washing device contains hot water. One of the water bath or the at least one washing device includes a surfactant, at least one dryer is configured to dry the ground film into flakes of film containing not more than 10% by weight of water content, and there is additional processing apparatus configured to process the flakes of film into granulated objects of near-virgin quality blown film product.

[0014g] In a further aspect, the invention provides a system for processing a supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film into near-virgin quality blown film product, comprising a shredder configured to tear the supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film in the shredder, wherein surface area of the film is exposed, including delaminating the film, and a first washing screw that wets delaminated film received from the shredder. There is a prewash/sink/float tank apparatus that removes contaminates from the delaminated film received from the first washing screw, wherein the prewash/sink/float tank apparatus separates high density materials from the

delaminated film. A grinder is configured to grind the wetted, delaminated film into ground film to reduce it in size. A washing device is configured to wash the ground film to remove additional contaminates from the ground film, wherein the washing device containing hot water at a temperature of between about 140° F and about 190° F. The washing device comprises: a first friction washer that receives the ground film from the grinder; a second washing screw located subsequent to the first friction washer; and, a first turbo washer located subsequent to the second washing screw. A second friction washer is located subsequent to the first turbo washer and one of the first washing screw, the prewash/sink/float tank apparatus, and the washing device includes a surfactant. A second turbo washer is subsequent to the washing device, the second turbo washer being configured to rinse the ground film. A first turbo dryer is located intermediate the washing device and the second turbo washer, the first turbo dryer being configured to remove moisture from the ground film. A hydrocyclone is located subsequent to the first turbo dryer, the hydrocyclone being configured to further separate contaminates from the ground film and further separate layers of the ground film, and a third friction washer is located subsequent to the hydrocyclone. At least one additional turbo dryer is located subsequent to the third friction washer, at least one additional turbo dryer being configured to dry the ground film into flakes of film containing not more than 10% by weight of water content. A plastcompactor is located subsequent to the second and third turbo dryers, the plastcompactor being arranged to heat and further reduce moisture contained in the flakes of film, the plastcompactor fusing the flakes of film into formations of film. A second granulator is located subsequent to the plastcompactor, and the second granulator reduces the formations of film into the granulated objects of near-virgin quality blown film product.

[0014h] In a still further aspect, the invention comprehends a method for processing a supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film into near-virgin quality blown film product, comprising tearing the supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film in a shredder, wherein surface area of the film is exposed, including delaminating the film, wetting and agitating the torn film in a water bath to remove contaminates from the delaminated film, grinding the wetted, delaminated film into ground film in a grinder to reduce the wetted, delaminated film in size, and washing the ground film in at least one washing device to remove additional contaminates from the ground film, wherein the at least one washing device contains hot water. One of the water bath or the at least one washing device includes a surfactant. The ground film is dried in at least one dryer into flakes of film containing not more than 10% by weight of water content, and the flakes of film are processed into granulated objects of near virgin quality blown film product in an additional processing apparatus.

[0014i] Yet further, the invention provides a method for processing a supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film into near-virgin quality blown film product, comprising tearing the supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film in a shredder, wherein surface area of the film is exposed, including delaminating the film, wetting delaminated film received from the shredder with a first washing screw, removing contaminates from the delaminated film received from the first washing screw with a prewash/sink/float tank apparatus that separates high density materials from the delaminated film, and grinding the wetted, delaminated film into ground film with a grinder to reduce the

wetted, delaminated film in size. A washing device is configured to wasing the ground film to remove additional contaminates from the ground film, wherein the washing device contains hot water at a temperature of between about 140° F and about 190° F. The washing device comprises: a first friction washer that receives the ground film from the grinder; a second washing screw located subsequent to the first friction washer; a first turbo washer located subsequent to the second washing screw; and a second friction washer located subsequent to the first turbo washer. One of the first washing screw, the prewash/sink/float tank apparatus, and the washing device includes a surfactant. The ground film is rinsed in a second turbo washer located subsequent to the washing device. Moisture is removed from the ground film in a first turbo dryer located intermediate the washing device and the second turbo washer. Contaminates are further separated from the ground film and layers of the ground film are further separated in a hydrocyclone located subsequent to the first turbo dryer. The ground film is washed in a third friction washer located subsequent to the hydrocyclone. The ground film is dried into flakes of film, containing not more than 10% by weight of water content, in at least one additional turbo dryer located subsequent to the third friction washer, which heats and further reduces moisture contained in the flakes of film in a plastcompactor located subsequent to the second and third turbo dryers. The plastcompactor fuses the flakes of film into formations of film, and reduces the formations of film into the granulated objects of near-virgin quality blown film product in a second granulator located subsequent to the plastcompactor.

DESCRIPTION OF THE DRAWINGS

[0015] These and other advantages of the present invention are best understood with reference to the drawings, in which:

[0016] FIG. 1 is a flow chart of an exemplary embodiment of a process for recycling post consumer scrap (PC) film.

[0017] FIG. 2 is a schematic top view of an apparatus configured to process PC film in accord with the flow chart illustrated in FIG. 1.

DETAILED DESCRIPTION OF THE EXEMPLARY EMBODIMENTS

[0018] There is provided a method and apparatus for recycling post-consumer scrap (PC) such as PC film which is difficult to recycle because of labels that are glued on the outside of the film as well as various markings that are placed on the film during the shipping process and other contaminates. In order to provide a viable blown film product that can be reused, the labeling, adhesives, other applied markings, and contaminates have to be removed from the PC film. It is the objective of the present disclosure to process the PC film (LLDPE and LDPE) into a near-virgin quality blown film product that can be used by itself or combined with virgin material.

[0019] For purposes of this application the term "near-virgin" shall mean a quality of the PC film compared to virgin material of blown film product. A test for such quality is a visual gel detection test. For purposes of this Application a "gel" is an unmelted portion of PC film or unmelted contaminate. In the test, the number of gels, independent of their size, are determined on a 12 inch by 12 inch square sample. Virgin material has a gel count of between 10 and 0 gels. Near-virgin material has a gel count of between 1,000 and 11 gels. The Applicants have compared a conventional PC product to a PC product produced with the method and apparatus of the present disclosure, resulting in the following:

Film Type	Gel Count
Conventional PC	52,740
Present Disclosure PC	720
Virgin Material	9

[0020] Referring to the Figures, FIG. 1 is a flow chart of an exemplary embodiment of a process for recycling post consumer scrap film into a near-virgin quality blown film product. FIG. 2 is a schematic top view of exemplary embodiments of an apparatus layout configured to process PC film in accord with the flow chart illustrated in FIG. 1. It should be understood that the physical layout of the equipment, as illustrated in FIG. 2, is exemplary and other configurations or equipment layouts are contemplated that can be arranged within the confines of the particular facility which utilizes the methods described herein.

[0021] A supply of post consumer scrap linear low density polyethylene film or low density polyethylene film or a combination of LLDPE and LDPE film 12 (hereinafter "PC film") is placed on a storage conveyor 14. Placement of the supply of PC film 12 on the conveyor 14 can be by any convenient and conventional method such as a forklift, crane, hoist, and in some instances manual disposition. The storage conveyor 14 moves the supply of PC film 12 to an incline conveyor 15.

[0022] The supply of PC film 12 typically is presented in bales held together by retainer bands. In a typical operation, the retainer bands are cut and the bale is pulled apart for initial visual inspection. Such process can be done manually or by a

machine as determined by the operator. If any non-film objects are initially seen in the supply of PC film 12, such objects are removed either manually or by machine.

[0023] The unbaled supply of PC film 12 is then moved by the storage conveyor 14 to a conveyor 15 through or near a metal detector 16 to facilitate removal of certain forms of metal. The metal detector 16 typically is an induction metal detector which has several forms of magnets, for example electromagnets, to detect and assist in removal of ferrous materials automatically. It is also contemplated that a series of permanent magnets within appropriate distances to the supply of PC film 12 can also be used to detect and/or remove ferrous metal objects. Other types of detectors, for example an x-ray machine, can also be used to detect non-film objects.

[0024] The incline conveyor 15 moves the supply of PC film 12 to a shredder 18, for example a Vecoplan or Wiema shredder that is configured to tear-shred the PC film into chunks and pieces and discharges the shredded film through a screen. The screen size and resultant film surface area may vary depending upon operational requirements. One example of a screen is one that has a plurality of 3-inch openings.

[0025] The shredder 18 is configured to tear the supply of PC film 12 wherein a surface area of the film is exposed. The shredder 18 also delaminates the film. Because of typical shipping wrap process, the PC film is layered one layer on top of another and the shredder 18 is configured to delaminate such layers, i.e. separate the film layers from one another. A shredder configured to cut the film, typically fuses

the film layers making cleaning the film difficult, if not impossible.

[0026] The shredded supply of PC film is moved by a discharge belt 20 to a wash and transport screw 22. The wash and transport screw 22 wets the shredded film and conveys the film to a prewash/sink/float tank apparatus 24. While in the float/sink 24 apparatus, further separation of high density materials not recognized by the metal detector 16, for example stone, glass, or sand, sink to the bottom of the apparatus 24 for later removal. While in the float/sink/float tank apparatus 24 the film is further made wet by agitation, performed, for example by a series of rotating paddles.

[0027] Additional cleaning of the PC film is accomplished, while in the wash tank 24, by surfactants, for example, detergents, and other compounds mixed in the tank to further clean the film of all contaminants, such as inks, adhesives, etc.

[0028] Surfactants are substances that are added to liquids to reduce the surface tension of the liquid thereby increasing the liquid's spreading and wetting properties. Surfactants are used to disperse aqueous suspensions of insoluble dyes, for example. Such additives also soften adhesives used to attach labels to the PC film. A preferred surfactant will include a detergent, an oxidizer, and a bleaching agent. It should be understood that the surfactant may include other chemicals or additives, including ionic and non-ionic agents. In addition to the cleaning of the PC film, while in the sink/float tank apparatus 24, the agitation also promotes delamination of the PC film which has a tendency to stick to itself.

[0029] After a period of time as determined by the operator, the PC film fragments are conveyed to a first granular 26. The first granular 26 further reduces in size the PC film area received from the shredder and sink/float tank 24. A typical particle size after the first granulation process is approximately three-quarters of an inch. The granulation process in the first granulator 26 also promotes further separation of wet labels from the film substrate. From the first granulator 26, the PC film is conveyed to a friction washer 28.

[0030] The granulated PC film is washed in the friction washer 28 which is configured with an inclined cylindrical trough and an incline fast running paddle screw to dewater and clean ground material discharged from the first granulator 26. The screw is fixed in the housing by means of bearings and enclosed in a stainless steel screen. The shredded and granulated material and water are fed at the lower end of the trough with the screw transporting the material upward and spinning at a speed, for example 1,000 rpms.

[0031] The granulated PC film is washed in the friction washer 28 while it is being transported to the outlet at the top of the trough. The contaminates and the water are passed through the fine stainless steel screen to the trough wall while the friction of the high speed screw further cleans the PC film. It should be understood that the friction washer 28 can be positioned in front of or after washing tanks. As illustrated in FIG. 1, the friction washer 28 is positioned after a turbo washer 30. A friction washer 28 is also positioned after the wet grinder 26 as illustrated in FIG. 1. In FIG. 2, the turbo washer 30 is positioned after the friction washer 28.

[0032] The granulated supply of PC film 12 is moved by a pump 32 to a water cyclone, also referred to as a hydrocyclone 34, such as for example a hydrocyclone produced by Herbold Meckesheim. The hydrocyclone 34 operates under water pressure from the pump 32 which moves water in a spiral to further separate contaminates from the PC film and further separate layers of the PC film by rotational forces of the moving water within the hydrocyclone 34.

[0033] The PC film leaves the hydrocyclone 34 at its upper end with the main stream of water, with any sinking material (higher density material) at the lower end. The hydrocyclone 34 operates in conjunction with the pump 32 and the turbo washer 30 to provide additional cleansing of the PC film and separation of contaminants from the PC film. The water from the hydrocyclone 34 continues to transport the contaminates to a vibrating screening apparatus 38 and a second friction washer 36.

[0034] Operation of the turbo washer 30 can be either with cold water or hot water. In the case of a hot water bath, the temperature can be in the range of 120° F. to 170° F., with the preferred temperature being a water temperature of at least 140° F. but not more than about 190° F. The hot water is used to affect additional cleaning of the PC film in the washer in addition to the rotary motion imparted to the PC film. Temperatures over 190° F. tend to distort and/or melt the PC film.

[0035] Upon exiting the second friction washer 36, the PC film is deposited in a second turbo dryer 40. The turbo dryer 40 removes moisture from the PC film and through a pneumatic transport system 42 deposits

the PC film in a second turbo dryer 44. The second turbo dryer 44 removes additional moisture from the PC film. The PC film now is typically in the form of flakes and is then deposited in a film flake buffer silo 48.

[0036] Additional drying is performed in a thermal drying apparatus 46 which uses heat to remove additional moisture from the PC flakes. A series of pneumatic transport tubes and system 42 interconnect the first turbo dryer 40, the second turbo dryer 44, the thermal drying apparatus 46, and a film flake buffer silo 48. It should be understood that additional turbo dryer and thermal drying apparatuses can be installed in the system and coupled to pneumatic transport tubes.

[0037] From the film flake buffer silo 48, a pneumatic transport system tube 42 moves the PC film flakes to a plastcompactor apparatus 50, which may be any commercially available such device. In one such plastcompactor, the plastcompactor 50 operates with a rotating and a fixed compaction disk with both disks configured with a screw-fitted and replaceable kneading rails. The PC film is conveyed continuously from the feed silo 48 through the center of the fixed disk into the processing area of the plastcompactor 50 by means of a feed screw. The material is rapidly heated up by the friction against and between the compactor disks. During the operation in the plastcompactor apparatus, the PC material is warmed up because of friction and starts to soften. The PC surfaces start to fuse resulting in worm-shaped formations. The additional heating in the plastcompactor 50 further reduces moisture in the PC film. In a typical operation of the methods described

herein, the PC film has a moisture content of not more than 10% by weight.

[0038] From the plastcompactor apparatus 50 the worm-shaped formations are moved to a second granulator 52 which reduces the worm-shaped formations to the required agglomerated granulated object size. The specific size of the agglomerated PC film is selected by changing a screen inside the second granulator 52. The plastcompactor apparatus 50 further removes any additional moisture from the PC film and compacts the dry ground film, without addition of water, into the granulated objects of near-virgin quality blown film product.

[0039] In one embodiment of the method, a controller 54 is used to control the various functions of the apparatus including water temperatures, air pressures time periods, a specific machine granular size, and speed of operation.

[0040] The controller 54 may be a microprocessor coupled to the various apparatus of the system. The controller 54 may also be a server coupled to an array of peripherals or a desktop computer, or a laptop computer, or a smart-phone. It is also contemplated that the controller is configured to control each individual machine and may be remote from any of the apparatus. Communication between the controller 54 and the various apparatus may be either by hardwire or wireless devices. A memory/data base coupled to the controller may be remote from the controller 54. The controller 54 typically includes an input device, for example a mouse, or a keyboard, and a display device, for example a monitor screen or a smart phone. Such devices can be hardwired to the controller or connected wirelessly with appropriate software,

firmware, and hardware. The display device may also include a printer coupled to the controller 54. The display device may be configured to mail or fax reports as determined by a user. The controller 54 may be coupled to a network, for example, a local area network or a wide area network, which can be one of a hardwire network and a wireless network, for example a Bluetooth™ network or internet network, for example, by a WIFI connection or "cloud" connection.

[0041] In another embodiment a water treatment apparatus 60 is coupled to the various wash apparatus to recycle and filter the water used within the system for continued use. The quality of the water will vary at various stages of the process, with the recycling and filtering of the water controlled by the operator and/or in conjunction with the controller 54.

[0042] In a further embodiment, one or more testing stations are installed to test the quality of the PC film being processed. One such test is the "gel count" test described above, however, other appropriate tests can be implemented as determined by the operator. The test stations can be coupled to the controller 54 to automatically monitor, test and report results by configuring the controller 54. Testing is typically performed at various stages of the process as determined by the operator.

[0043] For purposes of this disclosure, the term "coupled" means the joining of two components (electrical or mechanical) directly or indirectly to one another. Such joining may be stationary in nature or moveable in nature. Such joining may be achieved with the two components (electrical or mechanical) and any additional intermediate members being integrally formed as a single unitary body with one another or

the two components and any additional member being attached to one another. Such adjoining may be permanent in nature or alternatively be removable or releasable in nature.

[0044] Although the foregoing description of the present process and apparatus has been shown and described with reference to particular embodiments and applications thereof, it has been presented for purposes of illustration and description and is not intended to be exhaustive or to limit the disclosure to the particular embodiments and applications disclosed. It will be apparent to those having ordinary skill in the art that a number of changes, modifications, variations, or alterations to the process and apparatus as described herein may be made.

The particular embodiments and applications were chosen and described to provide the best illustration of the principles of the process and its practical application to thereby enable one of ordinary skill in the art to utilize the process and apparatus in various embodiments and with various modifications as are suited to the particular use contemplated.

The scope of the claims should not be limited by the preferred embodiments set forth in the description, but should be given the broadest interpretation consistent with the description as a whole.

WHAT IS CLAIMED IS:

1. A method for processing a supply of post consumer scrap linear low density polyethylene film or low density polyethylene film into near-virgin quality blown film product, comprising:

tearing the supply of multi-layer film in a shredder, wherein surface area of the film is exposed, including delaminating the film;

washing the torn film in a water bath including a surfactant and agitating the film in the bath, wherein contaminates are removed from the delaminated film;

grinding the film and washing the ground film in a plurality of rotating friction washers, wherein additional contaminates are removed from the film;

drying the ground film resulting in the ground film containing not more than 10% by weight, water content; and

compacting the dry ground film, without addition of water, into granulated objects of near-virgin quality blown film product.

2. The method for processing the supply of film of claim 1, wherein the water bath includes a plurality of washer.

3. The method for processing the supply of film of claim 2, wherein at least one of the washers contains hot water.

4. The method for processing the supply of film of claim 3, wherein the hot water is at least 140° F and not more than 190° F.

5. The method for processing the supply of film of claim 1, further comprising detecting metal from the supply of film and including subjecting the supply of film to a magnetic filed to identify ferrous metal.

6. The method for processing the supply of film of claim 5, further comprising removing detected metal including one of machine removal and manual removal.

7. The method for processing the supply of film of claim 1, further comprising forming the granulated objects into pellets after the compacting step.

8. A method for processing post consumer scrap film into a near-virgin quality blown film product, the method comprising:

providing one of a suply of multi-layer recyclable linear low density polyethylene plastic film and a supply of recyclable multi-layer low density polyethylene plastic film;

removing metal from the supply of plastic film;

shredding the supply of multi-layer plastic film after metal removal, wherein the plastic film is torn exposing delaminated surface area of film;

discharging the shredded plastic film through a filter screen to a water bath;

agitating the water in the water bath to further delaminate and wet all the surfaces of the shredded plastic film;

removing the plastic film from the water bath;

wet grinding the plastic film;

washing the ground plastic film in a rotating friction washer, wherein contaminates are removed from the plastic film;

separating at least two different types of the washed ground plastic film in a hydrocyclone, wherein lighter plastic film is separated from heavier plastic film;

drying the washed ground plastic film so the film contains not more that 10% by weight, water content; and

compacting the dry ground plastic film without addition of water into granulated objects of near-virgin quality plastic film, wherein the granulated objects are one of stored and used as raw material in a blown film operation.

9. The method for processing post consumer scrap film of claim 8, further comprising adding an additive to the water bath.

10. The method for processing post consumer scrap film of claim 9, wherein the additive is a detergent.

11. The method for processing post consumer scrap film of claim 8, wherein the water bath includes a plurality of washers.

12. The method for processing post consumer scrap film of claim 11, wherein at least one of the washers contains hot water.

13. The method for processing post consumer scrap film of claim 12, wherein the hot water is at least 140° F, but not more than 190° F.

14. The method for processing post consumer scrap film of claim 8, wherein the removing metal includes subjecting the supply of plastic film to a magnetic field to identify ferrous metal.

15. The method for processing post consumer scrap film of claim 8, wherein the removing metal includes one of machine removal and manual removal.

16. The method for processing post consumer scrap film of claim 8, further comprising forming the granulated objects into pellets after the compacting step.

17. A method for processing post consumer scrap film into a near-virgin quality blown film product, the method comprising:

proving one of a supply of multi-layer recyclable linear low density polyethylene plastic film and a supply of multi-layer recyclable low density polyethylene plastic film;

removing metal from the supply of plastic film;

shredding the supply of multi-layer plastic film after metal removal, wherein the plastic film is torn exposing delaminated surface area of film;

discharging the shredded plastic film through a filter screen to a water bath;

agitating the water in the water bath to further delaminate and wet all the surfaces of the shredded plastic film, the water bath including a surfactant additive including a detergent, an oxidizer, and a bleaching agent;

removing the plastic film from the water bath;

wet grinding the plastic film;

washing the ground plastic film in a rotating friction washer, wherein contaminates are removed from the plastic film;

separating at least two different types of the washed ground plastic film in a hydrocyclone, wherein lighter plastic film is separated from heavier plastic film;

drying the washed ground plastic film so the film contains not more than 10%, by weight, water content; and

compacting the dry ground plastic film without addition of water into granulated objects of near-virgin quality plastic film, wherein the granulated objects are one of stored and used as raw material in a blown film operation.

18. The method for processing post consumer scrap film of claim 17, further comprising forming the granulated objects into pellets after the compacting step.

19. A system for processing a supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film into near-virgin quality blown film product, comprising:

a shredder configured to tear the supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film in the shredder, wherein surface area of the film is exposed, including delaminating the film;

a water bath configured to wash the torn film in the water bath including a surfactant and agitating the film in the bath, wherein contaminates are removed from the delaminated film;

a grinder configured to grind the film;

a plurality of rotating friction washers configured to wash the ground film, wherein additional contaminates are removed from the film;

a dryer configured to dry the ground film resulting in the ground film containing not more than 10% by weight, water content;

a compactor configured to compact the dry, ground film, without addition of water, into granulated objects of near-virgin quality blown film product; and

a conveyor network interconnecting various systems equipment, with the conveyor network including one of a storage conveyor, incline conveyor, discharge belt, transport screw, and pneumatic transport tube.

20. The system for processing the supply of film of claim 19, wherein the water bath includes a plurality of washers.

21. The system for processing the supply of film of claim 20, wherein at least one of the washers contains hot water.

22. The system for processing the supply of film of claim 21, wherein the hot water is at least 140° F and not more than 190° F.

23. The system for processing the supply of film of claim 19, further comprising a detector configured to detect metal in the supply of film and including subjecting the supply of film to a magnetic field to identify ferrous metal.

24. The system for processing the supply of film of claim 23, further comprising a machine configured to remove detected ferrous metal.

25. The system for processing the supply of film of claim 23, further comprising a manual removal station configured to facilitate a manual removal of detected metal.

26. The system for processing the supply of film of claim 19, further comprising a granulator configured to form the granulated objects into pellets after the compacting step.

27. The system for processing the supply of film of claim 19, further comprising a detector configured as an X-ray machine to detect a non-film object.

28. A system for processing post-consumer scrap film into a near-virgin quality blown film product with the film including one of a supply of multi-layer recyclable linear low density polyethylene plastic film and a supply of multi-layer recyclable low density polyethylene plastic film, the system comprising:

a detector configured to detect a non-film object in the supply of film;

a machine configured to remove the non-film object detected in the film;

a shredder configured to shred the supply of multi-layer plastic film after removal of the non-film object and to tear the shredded film exposing a delaminated surface area of the film;

a filter screen configured to receive and filter the shredded plastic film;

a water bath apparatus configured to receive the filtered film from the filter screen;

an agitator coupled to the water bath apparatus configured to agitate water in the water bath apparatus to further delaminate and wet all surfaces of the shredded plastic film;

a wet grinder apparatus configured to receive the shredded plastic film from the water bath, with the wet grinder configured to grind the plastic film;

a rotating friction washer configured to receive the wet ground plastic film, with the rotating friction washer configured to wash the ground plastic film wherein contaminants are removed;

a hydrocyclone configured to receive the ground plastic film from the rotating friction washer, with the hydrocyclone configured to separate a light, by weight, plastic film from a heavy, by weight, plastic film;

a pair of dryer apparatus, with one dryer apparatus configured to receive the light plastic film and one dryer apparatus configured to receive the heavy plastic film, with both dryer apparatus configured to dry the plastic film so the film contains not more than 10%, by weight, water content;

a compactor apparatus configured to compact the dry plastic film received from the dryer apparatus, without addition of water, into granulated objects of near-virgin quality plastic film; and

a storage apparatus configured to receive the compacted granulated objects of near-virgin quality plastic film.

29. A system for processing post-consumer scrap film into a near-virgin quality blown film product of claim 28, wherein the non-film object is metal.

30. A system for processing post-consumer scrap film into a near-virgin quality blown film product of claim 28, wherein the detector is configured as one of an X-ray producing apparatus and a magnetic field producing apparatus.

31. The system for processing post-consumer scrap film into a near-virgin quality blown film product film of claim 28, wherein the water bath includes a plurality of washers.

32. The system for processing post-consumer scrap film into a near-virgin quality blown film product of film of claim 31, wherein at least one of the washers contains hot water.

33. The system for processing post-consumer scrap film into a near-virgin quality blwon film product of film of claim 32, wherein the hot water is at least 140° F and not more than 190° F.

34. A system for processing post-consumer scrap film into a near-virgin quality blown film product of claim 28, wherein the granulated objects are pellets.

35. A system for processing a supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film into near-virgin quality blown film product, comprising:

a shredder configured to tear the supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film in the shredder, wherein surface area of the film is exposed, including delaminating the film;

a water bath configured to wet and agitate the torn film in the water bath to remove contaminates from the delaminated film;

a grinder configured to grind the wetted, delaminated film into ground film to reduce it in size;

at least one washing device configured to wash the ground film to remove additional contaminates from the ground film, wherein the at least one washing device contains hot water;

wherein one of the water bath or the at least one washing device includes a surfactant;

at least one dryer configured to dry the ground film into flakes of film containing not more than 10% by weight of water content; and

additional processing apparatus configured to process the flakes of film into granulated objects of near-virgin quality blown film product.

36. The system of claim 35, additionally comprising:

a metal detector configured to detect metal in post-consumer scrap linear low density polyethylene film or low density polyethylene film prior to providing it to the shredder.

37. The system of claim 36, wherein the metal detector subjects the post-consumer scrap linear low density polyethylene film or low density polyethylene film to a magnetic field to identify ferrous metal, wherein the system additionally comprises:

a machine configured to remove detected ferrous metal.

38. The system of claim 36, additionally comprising:

a manual removal station configured to facilitate a manual removal of detected metal.

39. The system of claim 35, additionally comprising:

a detector configured as an X-ray machine to detect a non-film object in the post-consumer scrap linear low density polyethylene film or low density polyethylene film.

40. The system of claim 35, wherein the water bath comprises:

a prewash/sink/float tank apparatus that separates high density materials from the delaminated film.

41. The system of claim 40, wherein the water bath additionally comprises:

a first washing screw that initially wets the delaminated film received from the shredder and then conveys the wetted, delaminated film to the prewash/sink/float tank apparatus.

42. The system of claim 35, wherein the at least one washing device comprises:

a first friction washer; and

a first turbo washer.

43. The system of claim 42, wherein the at least one washing device additionally comprises:

a second washing screw located intermediate the first friction washer and the first turbo washer; and

a second friction washer located subsequent to the first turbo washer.

44. The system of claim 35, wherein the hot water is at least about 140° F, but not more than about 190° F.

45. The system of claim 35, wherein the surfactant is taken from the group comprising:

a detergent;

a detergent and an oxidizer, a detergent and a bleaching agent, and a combination of a detergent, oxidizer and bleaching agent.

46. The system of claim 35, additionally comprising:

a second turbo washer subsequent to the at least one washing device, the second turbo washer being configured to rinse the ground film.

47. The system of claim 46, additionally comprising:

a first turbo dryer located intermediate the at least one washing device and the second turbo washer, the first turbo dryer being configured to remove moisture from the ground film.

48. The system of claim 35, additionally comprising:

a hydrocyclone located subsequent to the at least one washing device, the hydrocyclone being configured to further separate contaminates from the ground film and further separate layers of the ground film.

49. The system of claim 48, additionally comprising:

a third friction washer located intermediate the hydrocyclone and the at least one dryer.

50. The system of claim 35, wherein the at least one dryer comprises:

a second turbo dryer; and

a third turbo dryer.

51. The system of claim 35, additionally comprising:

a film flake buffer silo located intermediate the at least one dryer and the additional processing apparatus, the flakes of film being temporarily deposited into the film flake buffer silo.

52. The system of claim 35, wherein the additional processing apparatus comprises;

a plastcompactor arranged to heat and further reduce moisture contained in the flakes of film, the plastcompactor fusing the flakes of film into formations of film; and

a second granulator located subsequent to the plastcompactor, the second granulator reducing the formations of film into the granulated objects of near-virgin quality blown film product.

53. The system of claim 35, wherein elements of the system as set forth in claim 35 are arranged and configured to produce granulated objects of blown film product having a gel count that does not exceed approximately 10.

54. The system of claim 35, additionally comprising:

a conveyor network configured to interconnect various elements of the systems for the processing as set forth in claim 35, wherein the conveyor network comprises at least one of a storage conveyor, an inclines conveyor, a discharge belt, a transport screw, and a pneumatic transport tube.

55. A system for processing a supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film into near-virgin quality blown film product, comprising:

a shredder configured to tear the supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film in the shredder, wherein surface area of the film is exposed, including delaminating the film;

a first washing screw that wets delaminated film received from the shredder;

a prewash/sink/float tank apparatus that removes contaminates from the delaminated film received from the first washing screw, the prewash/sink/float tank apparatus separating high density materials from the delaminated film;

a grinder configured to grind the wetted, delaminated film into ground film to reduce it in size;

a washing device configured to wash the ground film to remove additional contaminates from the ground film, wherein the washing device contains hot water at a temperature of between about 140° F and about 190° F, and wherein the washing device comprises:

a first friction washer that receives the ground film from the grinder;

a second washing screw located subsequent to the first friction washer;

a first turbo washer located subsequent to the second washing screw; and

a second friction washer located subsequent to the first turbo washer;

wherein one of the first washing screw, the prewash/sink/float tank apparatus, and the washing device includes a surfactant;

a second turbo washer subsequent to the washing device, the second turbo washer being configured to rinse the ground film;

a first turbo dryer located intermediate the washing device and the second turbo washer, the first turbo dryer being configured to remove moisture from the ground film;

a hydrocyclone located subsequent to the first turbo dryer, the hydrocyclone being configured to further separate contaminates from the ground film and further separate layers of the ground film;

a third friction washer located subsequent to the hydrocyclone;

at least one additional turbo dryer located subsequent to the third friction washer, at least one additional turbo dryer being configured to dry the ground film into flakes of film containing not more than 10% by weight of water content;

a plastcompactor located subsequent to the second and third turbo dryers, the plastcompactor being arranged to heat and further reduce moisture contained in the flakes of film, the plastcompactor fusing the flakes of film into formations of film; and

a second granulator located subsequent to the plastcompactor, the second granulator reducing the formations of film into the granulated objects of near-virgin quality blown film product.

56. A method for processing a supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film into near-virgin quality blown film product, comprising:

tearing the supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film in a shredder, wherein surface area of the film is exposed, including delaminating the film;

wetting and agitating the torn film in a water bath to remove contaminates from the delaminated film;

grinding the wetted, delaminated film into ground film in a grinder to reduce the wetted, delaminated film in size;

washing the ground film in at least one washing device to remove additional contaminates from the ground film, wherein the at least one washing device contains hot water;

wherein one of the water bath or the at least one washing device includes a surfactant;

drying the ground film in at least one dryer into flakes of film containing not more than 10% by weight of water content; and

processing the flakes of film into granulated objects of near-virgin quality blown film product in an additional processing apparatus.

57. The method of claim 56, additionally comprising:

detecting metal in post-consumer scrap linear low density polyethylene film or low density polyethylene film with a metal detector prior to providing the post-consumer scrap linear low density polyethylene film or low density polyethylene film to the shredder.

58. The method of claim 57, wherein the metal detector subjects the post-consumer scrap linear low density polyethylene film or low density polyethylene film to a magnetic field to identify ferrous metal, wherein the method additionally comprises:

removing detected ferrous metal.

59. The method of claim 57, additionally comprising:

manually removing detected metal at a manual removal station.

60. The method of claim 56, additionally comprising:

detecting a non-film object in the post-consumer scrap linear low density polyethylene film or low density polyethylene film with a detector configured as an X-ray machine.

61. The method of claim 56, wherein the wetting and agitating step comprises:

separating high density materials from the delaminated film in a prewash/sink/float tank apparatus.

62. The method of claim 61, wherein the wetting and agitating step additionally comprises:

initially wetting the delaminated film received from the shredder with a first washing screw and then conveying the wetted, delaminated film to the prewash/sink/float tank apparatus.

63. The method of claim 56, wherein the washing step comprises:
washing the ground film in a first friction washer; and
washing the ground film in a first turbo washer.

64. The method of claim 63, wherein the washing step additionally comprises:
washing the ground film in a second washing screw located intermediate the first friction washer and the first turbo washer; and
washing the ground film in a second friction washer located subsequent to the first turbo washer.

65. The method of claim 56, wherein the hot water is at least about 140° F, but not more than about 190° F.

66. The method of claim 56, wherein the surfactant is taken from a group comprising:
a detergent;
a detergent and an oxidizer, a detergent and a bleaching agent, and a combination of a detergent, an oxidizer and bleaching agent.

67. The method of claim 56, additionally comprising:
rinsing the ground film in a second turbo washer subsequent to the at least one washing device.

68. The method of claim 67, additionally comprising:
drying the ground film in a first turbo dryer located intermediate the at least one washing device and the second turbo washer to remove moisture from the ground film.

69. The method of claim 56, additionally comprising:
further separating contaminates from the ground film and further separating layers of the ground film in a hydrocyclone located subsequent to the at least one washing device.

70. The method of claim 69, additionally comprising:

washing the ground film in a third friction washer located intermediate the hydrocyclone and the at least one dryer.

71. The method of claim 56, wherein the drying step comprises:

drying the ground film in a second turbo dryer; and

drying the ground film in a third turbo dryer.

72. The method of claim 56, additionally comprising:

temporarily depositing the flakes of film in film flake butter silo after the drying step and the processing step.

73. The method of claim 56, wherein the processing step comprises:

heating and further reducing moisture contained in the flakes of film in a plastcompactor that fuses the flakes of film into formations of film; and

reducing the formations of film into the granulated objects of near-virgin quality blown film product in a second granulator located subsequent to the plastcompactor.

74. The method of claim 56, wherein the method is performed in a manner to produce granulated objects of blown film product having a gel count that does not exceed approximately 10.

75. The method of claim 56, additionally comprising:

interconnecting various elements carrying out the processing defined in claim 56, with a conveyor network comprising at least one of a storage conveyor, an inclines conveyor, a discharge belt, a transport screw, and a pneumatic transport tube.

76. A method for processing a supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film into near-virgin quality blown film product, comprising:

tearing the supply of post-consumer scrap linear low density polyethylene film or low density polyethylene film in a shredder, wherein surface area of the film is exposed, including delaminating the film;

wetting delaminated film received from the shredder with a first washing screw;

removing contaminates from the delaminated film received from the first washing screw with a prewash/sink/float tank apparatus that separates high density materials from the delaminated film;

grinding the wetted, delaminated film into ground film with a grinder to reduce the wetted, delaminated film in size;

configured to washing the ground film with a washing device to remove additional contaminates from the ground film, wherein the washing device contains hot water at a temperature of between about 140° F and about 190° F, and wherein the washing device comprises:

a first friction washer that receives the ground film from the grinder;

a second washing screw located subsequent to the first friction washer;

a first turbo washer located subsequent to the second washing screw; and

a second friction washer located subsequent to the first turbo washer;

wherein one of the first washing screw, the prewash/sink/float tank apparatus, and the washing device includes a surfactant;

rinsing the ground film in a second turbo washer located subsequent to the washing device;

removing moisture from the ground film in a first turbo dryer located intermediate the washing device and the second turbo washer;

further separating contaminates from the ground film and further separating layers of the ground film in a hydrocyclone located subsequent to the first turbo dryer;

washing the ground film in a third friction washer located subsequent to the hydrocyclone;

dry the ground film into flakes of film containing not more than 10% by weight of water content in at least one additional turbo dryer located subsequent to the third friction washer;

heating and further reducing moisture contained in the flakes of film in a plastcompactor located subsequent to the second and third turbo dryers, the plastcompactor that fuses the flakes of film into formations of film; and

reducing the formations of film into the granulated objects of near-virgin quality blown film product in a second granulator located subsequent to the plastcompactor.

77. A system for processing a supply of post-consumer scrap polyethylene film into near-virgin quality blown film product, comprising:

a shredder configured to tear and delaminate the supply of post-consumer scrap polyethylene film, wherein surface area of the film is exposed;

a water bath configured to wet and agitate the torn and delaminated film in the water bath to remove contaminates therefrom, wherein the water bath includes a surfactant;

a grinder configured to grind the wetted, delaminated film into ground film;

at least one friction washer configured to wash the ground film to remove additional contaminates from the ground film;

wherein at least one of the water bath or the at least one friction washer contains hot water;

at least one dryer configured to dry the ground film into flakes of film containing not more than 10% by weight of water content; and

a compactor configured to process the flakes of film into granulated objects of near-virgin quality blown film product.

78. The system of claim 77, wherein the water bath comprises:

a prewash/sink/float tank apparatus that separates high density materials from the delaminated film.

79 The system of claim 78, wherein the water bath additionally comprises:

a first washing screw that initially wets the delaminated film received from the shredder and then conveys the wetted, delaminated film to the prewash/sink/float tank apparatus.

80. The system of claim 77, additionally comprising:

a first turbo washer;

a second washing screw located intermediate the at least one first friction washer and the first turbo washer; and

a second friction washer located subsequent to the first turbo washer.

81. The system of claim 77, wherein the hot water is at least about 140 degrees Fahrenheit, but not more than about 190 degrees Fahrenheit.

82. The system of claim 77, wherein the surfactant comprises:

a detergent; and

wherein the surfactant optionally comprises at least one of an oxidizer and a bleaching agent.

83. The system of claim 77, additionally comprising:

a second turbo washer subsequent to the at least one friction washer, the second turbo washer being configured to rinse the ground film.

84. The system of claim 83, additionally comprising:

a first turbo dryer located intermediate the at least one friction washer and the second turbo washer, the first turbo dryer being configured to remove moisture from the ground film.

85. The system of claim 77, additionally comprising:

a hydrocyclone located subsequent to the at least one friction washer, the hydrocyclone being configured to further separate contaminates from the ground film and further separate layers of the ground film.

86. The system of claim 77, wherein the elements of the system are arranged and configured to produce granulated objects of blown film product having a gel count that does not exceed approximately 10.

87. A method for processing a supply of post-consumer scrap polyethylene film into near-virgin quality blown film product, comprising:

tearing and delaminating the supply of post-consumer scrap polyethylene film in a shredder, wherein surface area of the film is exposed;

wetting and agitating the torn and delaminated film in a water bath to remove contaminates therefrom,

wherein one of the water bath or the at least one washing device includes a surfactant;

grinding the wetted, delaminated film into ground film in a grinder;

washing the ground film in at least one friction washer to remove additional contaminates from the ground film;

wherein at least one of the water bath or the at least one friction washer contains hot water;

drying the ground film in at least one dryer into flakes of film containing not more than 10% by weight of water content; and

compacting the flakes of film into granulated objects of near-virgin quality blown film product.

88. The method of claim 87, wherein the wetting and agitating step comprises:

separating high density materials from the delaminated film in a prewash/sink/float tank apparatus.

89. The method of claim 88, wherein the wetting and agitating step additionally comprises:

initially wetting the delaminated film received from the shredder with a first washing screw and then conveying the wetted, delaminated film to the prewash/sink/float tank apparatus.

90. The method of claim 87, additionally comprising:

washing the ground film in a first turbo washer;

washing the ground film in a second washing screw located intermediate the at least one friction washer and the first turbo washer; and

washing the ground film in a second friction washer located subsequent to the first turbo washer.

91. The method of claim 87, wherein the hot water is at least about 140 degrees Fahrenheit, but not more than about 190 degrees Fahrenheit.

92. The method of claim 87, wherein the surfactant comprises:

a detergent; and

wherein the surfactant optionally comprises at least one of an oxidizer and a bleaching agent.

93. The method of claim 87, additionally comprising:

rinsing the ground film in a second turbo washer subsequent to the at least one friction washer.

94. The method of claim 93, additionally comprising:

drying the ground film in a first turbo dryer located intermediate the at least one friction washer and the second turbo washer to remove moisture from the ground film.

95. The method of claim 87, additionally comprising:

further separating contaminates from the ground film and further separating layers of the ground film in a hydrocyclone located subsequent to the at least one friction washer.

96. The method of claim 87, wherein the method is performed in a manner to produce granulated objects of blown film product having a gel count that does not exceed approximately 10.

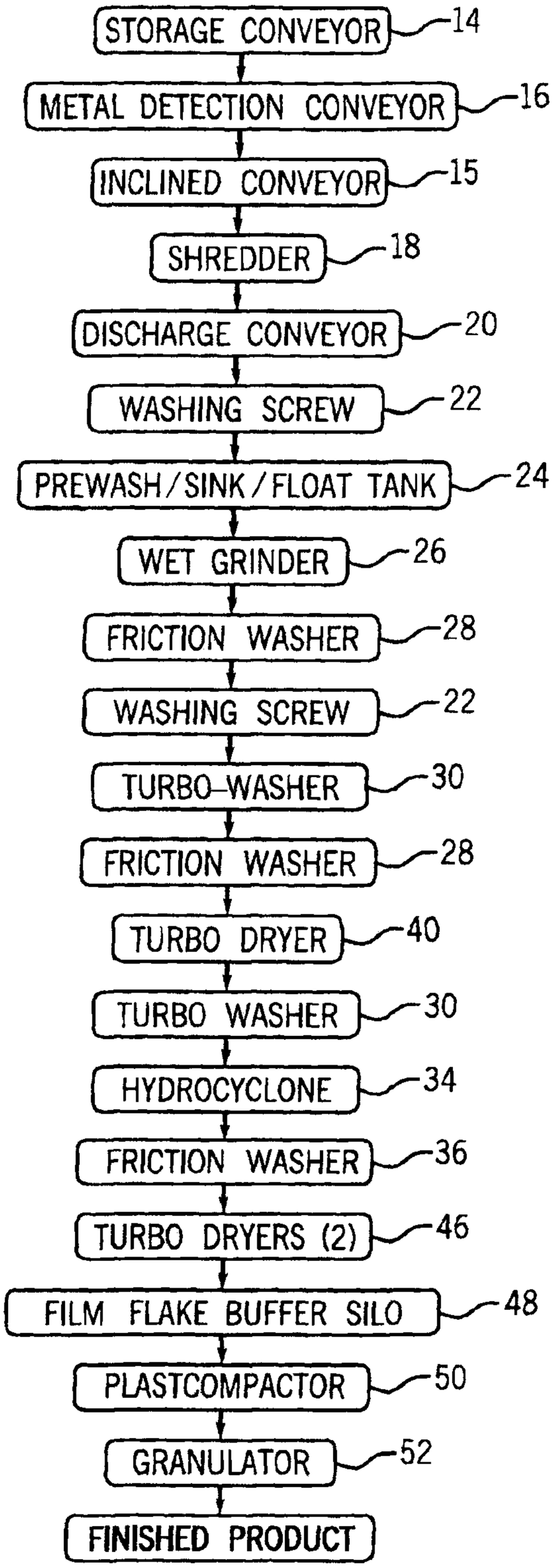
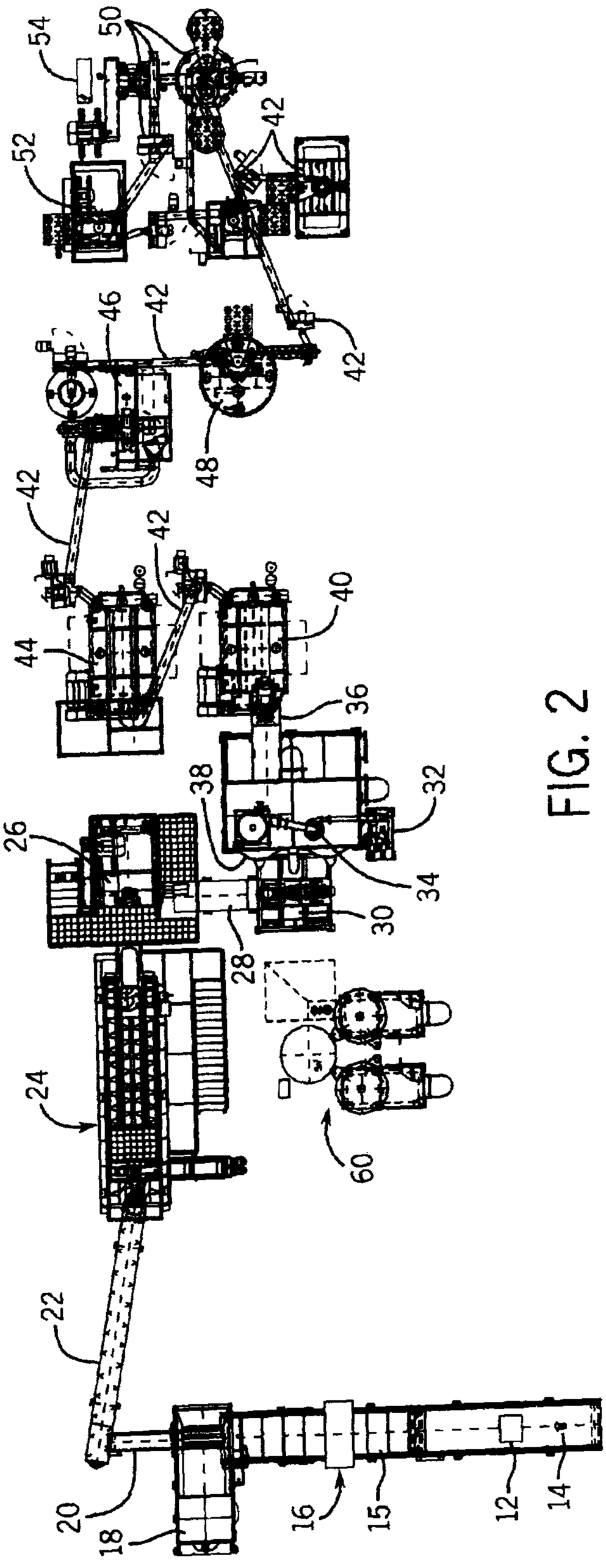

STORAGE CONVEYOR
14
METAL DETECTION CONVEYOR
16
INCLINED CONVEYOR
15
SHREDDER
18
DISCHARGE CONVEYOR
20
WASHING SCREW
22
PREWASH/SINK/FLOAT TANK
24
WET GRINDER
26
FRICTION WASHER
28
WASHING SCREW
22
TURBO-WASHER
30
FRICTION WASHER
28
TURBO DRYER
40
TURBO WASHER
30
HYDROCYCLONE
34
FRICTION WASHER
36
TURBO DRYERS (2)
46
FILM FLAKE BUFFER SILO
48
PLASTCOMPACTOR
50
GRANULATOR
52
FINISHED PRODUCT

FIG. 1


54
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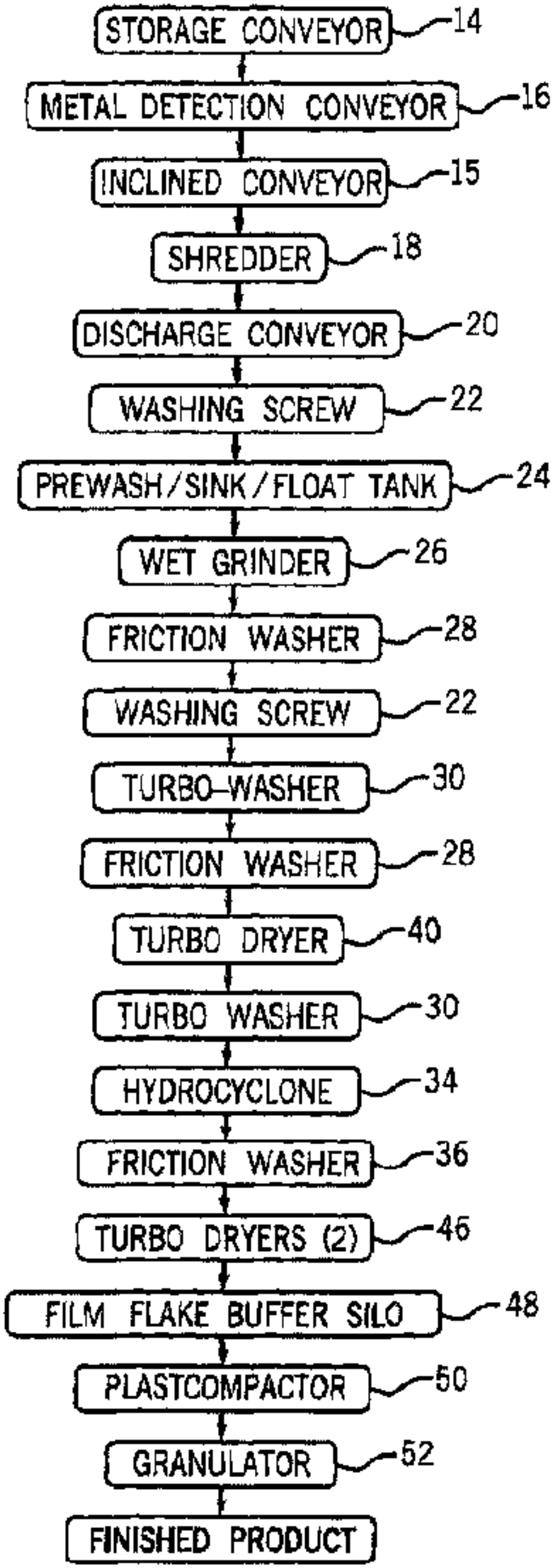
12
14

FIG. 2


STORAGE CONVEYOR
14
METAL DETECTION CONVEYOR
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INCLINED CONVEYOR
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