June 15, 1948. P. H. SLAUGHTER 2,443,200

APPARATUS AND METHOD FOR MAKING ARTIFICIAL YARN AND SLIVER

Filed April 26, 1943

2 Sheets-Sheet 1

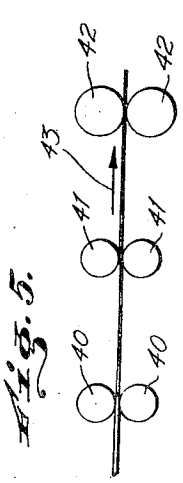


Fig. 5.

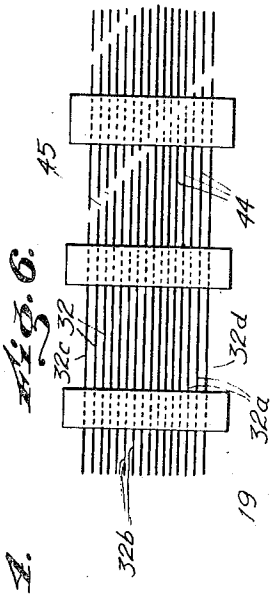


Fig. 6.

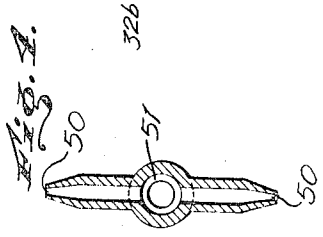


Fig. 4.

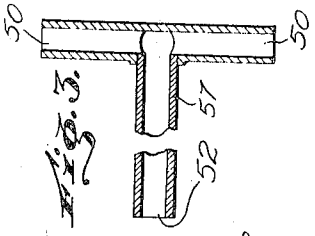


Fig. 3.

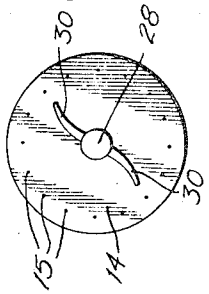


Fig. 2.

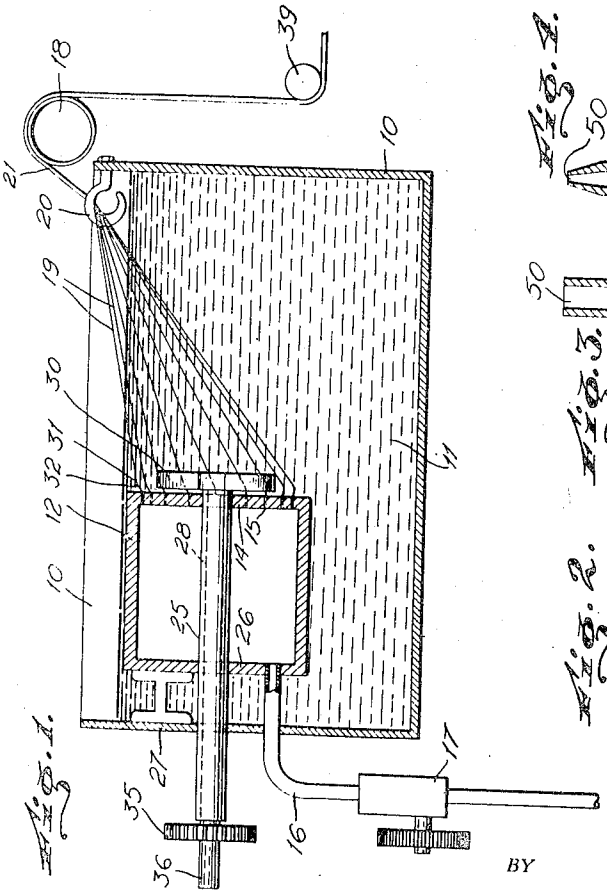


Fig. 1.

BY

INVENTOR
PHILIP H. SLAUGHTER
H. M. Kilpatrick
ATTORNEY

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APPARATUS AND METHOD FOR MAKING ARTIFICIAL YARN AND SLIVER

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2 Sheets-Sheet 2

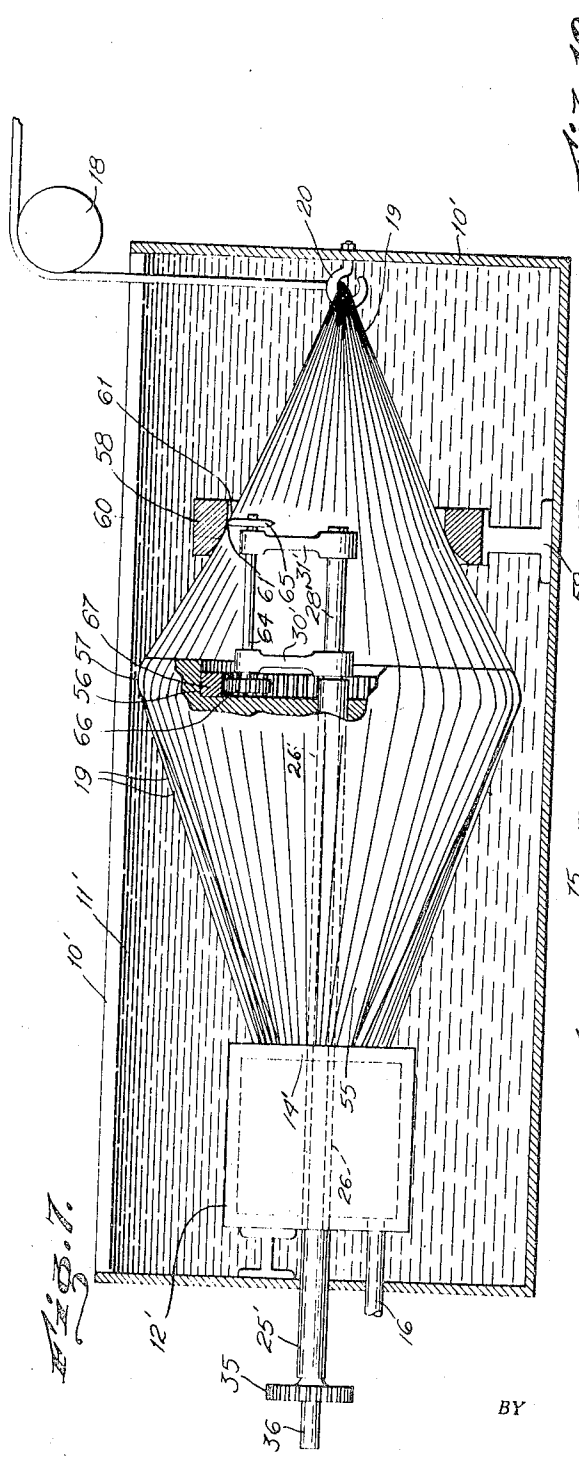


Fig. 1.

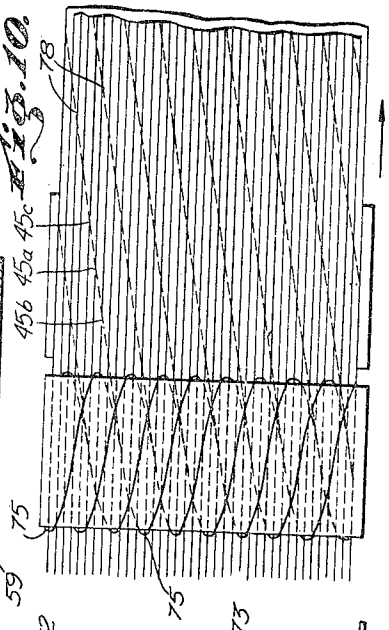


Fig. 10.

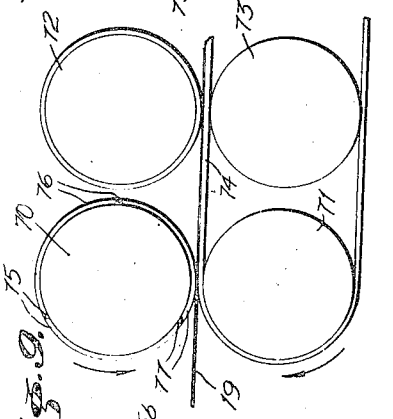


Fig. 9.

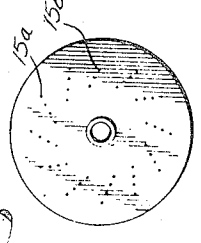


Fig. 8.

INVENTOR
PHILIP H. SLAUGHTER

BY

ATTORNEY

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2,443,200

APPARATUS AND METHOD FOR MAKING ARTIFICIAL YARN AND SLIVER

Philip H. Slaughter, Fayetteville, N. C.

Application April 26, 1943, Serial No. 484,597

11 Claims. (Cl. 18—8)

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This invention relates to apparatus and methods for producing a sliver of synthetic fibers.

One object of the invention is to provide improved apparatus and methods for arranging staple fibres to form sliver and resulting yarn or thread of uniform section and strength.

More particularly objects of the invention are to provide an improved apparatus and method of preparing a sliver of synthetic staple fibers, in which sliver fibres are of uniform length with ends of the fibres uniformly distributed throughout the length of the sliver.

Additional objects of the invention are to effect simplicity and efficiency in such sliver methods and apparatus and to provide an extremely simple apparatus of this kind which is economical, durable, and reliable in operation, and economical to manufacture and install.

Still other objects of the invention will appear as the description proceeds; and while herein details of the invention are described in the specification and some of the claims, the invention as described in some of the broader claims is not limited to these, and many and various changes may be made without departing from the scope of the invention as claimed in the broader claims.

Previously, baled staple fibres of a variety of materials have been opened in a tangled or disarranged mass and run through one of the several multi-process systems of arranging the fibres into a suitable sliver for twisting into yarn in yarn manufacturing, the principal object in arranging this distorted mass being to get the fibres as parallel as practice demands and in as uniform a sliver as to cross sectional area and as to the staggering of the fibres with relation to each other as possible or practicable.

Subsequently a different process was developed wherein a continuous filament sliver was drafted beyond the breaking point of the component filaments prior to being twisted, the sliver being subsequently twisted, thus producing a staple fibre yarn from a continuous filament sliver. This latter mentioned method has a serious fault in that there is no accurate or approximately accurate control or predetermination of the spacing of the breaking points along the sliver. This results in a non-uniform yarn and consequently excessive breaks and other troubles in manufacturning processes, resultant in inferior yarn or fabrics made from yarn so produced. Obviously, without control, breaks in the filaments too often occur too near each other, and in too non-uniform order as to staggering with relation to each other, thereby failing to accomplish the desired

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results. It is customary practice in spinning synthetic fibres (as acetate compounded with cellulose, or regenerated cellulose, other rayons and the like) to form filaments by extruding viscous material through apertures by means of pressure, the resultant extrusions emerging in the presence of a gaseous or liquid solidifying agent, the filament or filaments thus formed being drawn away from the spinneret by means of the frictional contact of the filaments with a revolving pulley, or "Godet" wheel, or by other suitable external means, which external means also serves the purpose of stretching the newly formed filament or filaments by pulling it or them at a rate of linear speed greater than the speed of the filament or filaments at the point of extrusion. Sometimes the coagulating bath is intentionally kept flowing or circulating for the purpose of keeping that part which contacts the filament at a substantially constant or uniform concentration or temperature. It is also desirable to have some of the fibres stretched while solidifying for increased tensile strength, for appearance and for other reasons.

Objects of the present invention are to overcome the objections of the heretofore multi-process system of arranging the staple fibres, and also to overcome objections to the drafting and spinning of ordinary multi-filament yarn. My invention accomplishes this by providing a process or method of making a special sliver of suitable material, which sliver contains a plurality of continuous filaments with spaced weak points along the component filaments of the sliver, the spacing of these weak points being predetermined and so spaced with relation to each other on different component filaments so that the sliver is adapted for drafting and whereby, in the drafting process the filaments break at the weak points, and the yarn may subsequently be twisted, either as a continuous or a discontinuous process, the resulting product being a staple fibre yarn instead of a continuous filament yarn. Thus the multi-process system of arranging a distorted mass of staple fibres is avoided, as the filaments remain substantially parallel from the time they are extruded until the time they are twisted. Also the objections of the system of drafting and spinning plain or ordinary continuous filaments are overcome by controlling the breaking points of the filaments.

The drafting method herein described is applicable to any filaments having properly spaced weak points; and the method of preparing the filaments is generally applicable to any method

of manufacturing fibres, or fibrous materials wherein a filament is formed by extruding a liquid or viscous substance through one or more apertures into a liquid or gaseous solidifying or coagulating bath, regardless of chemical process used, some of the better known fibres to which it is adaptable being viscose process rayon, cellulose acetate process rayon, cupramonium process rayon, "Vinyon," "nylon," "Lanital," and others, also to glass, etc., or even to chemical processes not yet developed or discovered which may employ similar methods of handling the chemicals to bring about the desired results. After the filaments are formed and partially or completely solidified any subsequent chemical treatment (for example, bleaching, desulphurizing, etc.) may be employed without departing from the scope of this invention if the preweakened points have been established, since it is an object of this invention to establish the weak points in desirable order.

The inventive features for the accomplishment of these and other objects are shown herein by way of example in connection with apparatus which briefly stated, includes a metering pump taking the filament forming substance from a suitable source and forcing it through apertures of a spinneret; and an impeller so fixed in relation to the extrusion apertures of the spinneret that as the impeller blade moves it impacts the coagulating and solidifying bath material surrounding the exterior of the spinneret against the filaments being extruded with sufficient force to stretch or elongate the filaments in successive order. Means are provided for removing the silver from the spinneret at a proper rate. The coagulating bath is suitably replenished, circulated and controlled in order to maintain a substantially constant concentration or temperature.

In the drawing is shown conventional means for breaking the filaments along said weak points while maintaining the filaments in sliver form, successive filaments having breaks disposed successive substantially equal distances along the sliver.

A modified form of filament weakening means is shown whereby a revolving jet of air is impacted against the filaments to elongate or heat and weaken them, or whereby some chemical substance is successively injected on the filaments to weaken them.

In other embodiments of the invention, suitable for either dry or wet spinning, the filaments may be staggeredly weakened by squeezing and/or crimping successive filaments to form weakened points of reduced cross-sectional area or kinks therein. For accomplishing the squeezing or kinking action the filaments, in sliver, band or spread-apart form, may be pressed by a rolling disk against a backing means, or by a smooth roller against a substantially helical rib on a cooperating roller.

In another form of the invention said rib may be a cutting knife, to cut the spread apart filaments, instead of the weakening and breaking operations.

In the accompanying drawing showing by way of example several of many possible embodiments of the invention,

Fig. 1 is a diagrammatic longitudinal vertical sectional view, partly in elevation, showing the extruding means, impacting means and means for gathering and drawing off the filaments;

Fig. 2 is an elevation showing the spinneret and impeller;

Figs. 3 and 4 are respectively longitudinal sectional views taken at right angles to each other and showing the jet impacting means;

Fig. 5 is a diagrammatic side elevation showing the means for drafting the weakened filaments to cause the breaks;

Fig. 6 is a fragmental diagrammatic plan showing the filaments of the sliver conventionally developed or separated laterally to show the offset relation of the weak points and breaks;

Fig. 7 is a diagrammatic longitudinal vertical sectional view, partly in elevation, showing the extruding means, means for gathering and drawing off the filaments and an intermediate disk pressing the filaments against a backing ring;

Fig. 8 is an end elevation showing the orifices of the spinneret;

Fig. 9 is a diagrammatic side elevation showing the pairs of rollers for drafting and weakening or cutting the filaments;

Fig. 10 is a fragmental diagrammatic plan showing the filaments separated laterally to show the offset relation of the weak points or cuts.

The embodiment of Figs. 1 and 2 is shown in combination with a tank 10 containing coagulating bath material 11 in which is disposed a spinneret 12 provided with an end wall 14 provided with an annular series of extrusion orifices 15 (Figs. 1 and 2), the spinneret being fed by conduit means 16 having a usual pump 17 interposed therein for forcing filament-forming material into the spinneret. A Godet wheel 18 above the bath pulls the extended filaments 19 simultaneously from the spinneret; and a hook or guide 20 between the Godet wheel and spinneret gathers or combines the filaments into a band or sliver 21 and guides it to the Godet wheel.

The holes in spinneret in Fig. 2 may vary widely from the illustration shown, as additional concentric rings of holes may be employed, or holes may extend radially from sides of cylindrical (or other shaped) spinneret near the top, or other suitable arrangements of holes may be employed, either in regular or irregular order, and the size and shape of the holes may vary, without departing from the scope of this invention.

A tubular bearing 25 passes rearwardly through and from said wall 14 at the center of said annular series of orifices 15 through the opposite wall 26 of the spinneret and the adjacent wall 27 of the tank to the exterior of the tank, and receives and rotatably supports a shaft 28 passing through said bearing 25 and provided on its front end with one or more radial impeller blades 30 extending to near said orifices to force and impact surges of the bath centrifugally against successive extruding filaments to force the filaments laterally from the orifices, as at 31, thereby to elongate a short portion of each filament as it is extruded, thereby to decrease its cross-section and form in it a weak place, as at 32, in the filament, the earlier produced weak places 32*a*, as shown in the developed view of Fig. 6, being progressively more advanced from the spinneret than later produced weak places 32*b* as the filaments are simultaneously drawn off.

A suitably driven gear 35 or other drive means on the projecting exterior end 36 of the shaft serves for driving the impeller blades in substantially timed relation with the pump 17, the number of blades and speeds of the impeller being so related to the speed of extrusion, that the weak places of the filaments in the series are spaced or offset in the direction of travel of the filament

substantially equal distances from the weak space of the adjacent filament at the extrusion orifices, thereby to provide a band or sliver of filaments, in which the filaments have successive weak places disposed substantially equal distance along the filament. As shown in Fig. 6 the weak places **32** in the filaments are preferably disposed progressively along the band or sliver relative to weak places of other filaments substantially equal or proper distances with a substantially equal number of breaks in the sliver in each unit of distance.

As stated the impeller blade in revolving forces a stronger current of the solidifying bath against the successive filaments in successive order, which surges of bath material tend to force the extruding filaments away from the apertures with such force that the filament is drawn out or elongated to the extent that its cross sectional area at **32** is smaller where it is elongated most.

The speed or rate of flow of the filament forming material at the pump may be varied; the size and number of the extrusion holes may be varied; the rate of speed of the impeller blade (or the number or arrangement of blades) may be varied; and the speed of the means for drawing the sliver away from the spinneret may be varied, all independently of each other, or fixed in any desired relation to each other in order to accomplish a desired result, without departing from the scope of this invention. It can readily be seen that the rate of flow of the metering pump and its relation to the rate of linear speed of the formed sliver as it is pulled away from the spinneret will be an important factor in determining the size or denier of the filaments thus formed. Also it can readily be seen that the change in frequency of the surges of bath material (as can be changed directly with the speed of the impeller means) against the emerging filaments at any constant rate of flow of the filament material through the sliver forming process (linear rate of flow or rate of "removal") will change the spacings, or distances between successive weak points of any particular filament involved, the faster the frequency of the blade, the closer together will be the weak points.

For producing "novelty" yarns, the elements (rate of flow of metering pump, size of extrusion holes, rate of speed of weakening means blade or jet, speed of means for drawing the sliver from the spinneret) may vary independently and the moving elements pulsatingly, or irregularly, if desired or together in any desired combination without departing from the scope of this invention. Obviously, if the metering pump operates pulsatingly, a sliver of varying cross sectional area will be formed, sometimes called "slubby" yarn, or "thick and thin" yarn, suitable for weaving "Shantung" or other suitable fabrics.

If the process employed is a dry process, the impacting fluid thrown by the propeller blades **30** may be air or other gas.

When the band or sliver leaves the Godet wheel **18** or other guide means **39**, it may be led directly to the drafting means (Figs. 5 and 6) for breaking the weak places, or it may be wound or coiled or otherwise stored until ready for transportation to the drafting means.

Fig. 5 is a diagrammatic conventional view of the drafting means which comprises a plurality of pairs **40**, **41**, **42** of positively rotated opposed drafting rolls or rollers between which the band or sliver of filaments may be successively passed and drafted, which rollers are positively rotated in the feeding direction of the arrow **43**. Each successive pair of rolls, or the last pair only, along

the path of travel of the sliver may rotate at slightly faster peripheral speed, whereby the filaments are stretched sufficiently to cause them to break at the weak points. In Fig. 5 the last pair of rollers **42** is shown larger to show that that pair has a greater peripheral speed. If the rollers are of the same size, the last pair or last two pairs may be rotated at successively greater speeds, in the usual manner, to cause the filaments to break at the weak points.

Fig. 6 is a plan of the assembly shown in Fig. 5, but showing the filaments much separated laterally. The sliver that passes between the rollers is, in practice, not much laterally separated as in Fig. 6, the filaments of Fig. 6 being shown much laterally separated to show more clearly the weak points **32** and the breaks **45**. The production of a sliver at the spinneret, and the drafting means are not necessarily a continuous or uninterrupted process, and in practice this might be two separate stages because of the high or fast rate of speed in making or forming the sliver as compared with the much slower relative speed of the drafting means, which must, even with the best present day equipment, necessarily be slow enough for the twisting means to put the desired number of turns of twist into the drafted sliver as the drafting means delivers it to the twist-imparting spindle. In practice, there is no special arrangement of the weak points and breaks except longitudinally, as shown in Fig. 6.

When the drafting action of the rolls breaks the filaments at the weak points **32**, this provides a sliver composed of short pieces **44** of filament of substantially equal length disposed progressively substantially equal distances along the sliver with a substantially equal number of breaks at each of said distances.

It is noted that the last weak point **32*c*** of a series is advanced the same distance relative to the weak point **32*d*** of the succeeding series as are the various adjacent points **32** relative to each other, and in the practical sliver, the weak point **32*d*** might be laterally as close to the weak point **32*c*** as other adjacent weak points **32** are to each other. Therefore, the breaks are consequently all similarly spaced and arranged like the weak points, so that the breaks are regularly successively distributed along the sliver and resulting yarn or thread.

While herein the weak points and breaks are respectively shown at very regular longitudinal distances apart, it is understood that these distances may, if desired, be somewhat irregular and still be more evenly distributed than heretofore and still be within the scope of the invention and the broader claims herein.

Instead of bath material being thrown against the filaments by the impeller as in Figs. 1 and 2, it may be directed or impacted against the filament by being projected from jet nozzles **50** as in Figs. 3 and 4, carried by a hollow shaft **51** rotatable in and passing through said tubular bearing **25** and provided on its rear end with an inlet portion **52** (similar to the end **36**) and on its front end with the one or more radial nozzles **50** haing passages communicating with the hollow of the shaft and extending to near the orifices **15**, whereby fluid introduced under pressure by any suitable means forced into the projecting end **52** of the shaft may be impacted against successive extruding filament portions **31** to force them laterally from the orifices thereby to weaken a short portion of each filament as it is extruded

and form a weak place therein, the earlier produced weak places being progressively more advanced from the spinneret as explained of the form of invention of Figs. 1 and 2.

This impacting fluid may be drawn from the tank 10 or from a suitable exterior source.

If the process is a dry process this impacting fluid may be air or other gas mixture or gas impacted against the filaments; or the fluid passing from the jets may be heated liquid, gas or air having a physical weakening effect, or liquid or gas having a chemical weakening action on the filament, in which case, the jet from nozzle 50 need have no appreciable mechanical impact. The fluid could be selected to give a softening weakening action or could be selected to effect a brittleness that would cause the filament to break more easily at the point of application of the fluid.

The chemical reaction on the filaments to physically alter the tensile strength at different points may also be due to the filament contacting a more concentrated or more saturated (or less concentrated or less saturated) portion of the bath, which bath is directed onto the emerging filaments, either by a blade, or by a tube, as described above, or by otherwise directing the bath onto the emerging filaments in desired successive order.

The weakening of the filaments may be accomplished by chemical action in order to reduce their tensile strength at the desired points. For chemical treatment the nozzle of Figs. 3 and 4 are particularly useful in that the chemical may be taken from an external source and suitably directed on the filaments.

The chemical action on the filaments is not completely understood. If oxidizing agents are used part of the filament may be oxidized or eaten away to cause actual reduction in cross sectional area. Reducing agents may cause a different compound of low tensile strength to be formed. Coagulation retardents may allow a soft or weak point to remain in the filament. Coagulation accelerators may cause a hard skin to form on the outside of the filament which the coagulating bath does not sufficiently penetrate to harden and strengthen the interior.

Because of the variety of the processes used in preparation of the extrudable cellulose material all chemical treatments may not be equally applicable for weakening all types of filaments. However oxidizing and reducing agents may be used, though with differing degrees of effectiveness, on filaments from all known cellulose processes. Suitable oxidizing agents include gaseous or liquid chlorine, nitrogen-trioxide, sodium hypochlorite solution and the solutions of soluble chlorates. Reducing agents include oxalic acid, formaldehyde, formic acid, carbon monoxide, etc.

Coagulation retardents for the viscose and cuprammonium processes may include strong alkalis such as sodium hydroxide, trisoduim phosphate, ammonia solution and hydroxides or salts forming solutions having a pH value substantially greater than seven, while the acids such as sulphuric, hydrochloric and salts hydrolyzable to form strong acids such as aluminum sulfate may act as accelerators.

For acetate and regenerated cellulose or dry spun filaments, alcohols, mineral and vegetable oils, and water retard coagulation.

When an accelerator is obtained from an external source and is also used in the coagulating bath, the feed of the accelerator may be at such a rate so as to obtain the proper concentration of the bath.

In Figs. 7 and 8 is shown another form of the invention comprising a tank 10' of coagulating bath material 11 and a spinneret 12' therein provided with a flat wall 14' provided with a plurality of concentric closely adjacent annular series of extrusion orifices 15a, 15b (Fig. 8). The hook 20 below the Godet wheel 18 is spaced a distance from the spinneret at the axis thereof for combining the filaments for the Godet wheel as will be explained.

A fixed tubular bearing 25' projects frontwardly of said wall 14' as at 26' and passes rearwardly through and from said wall at the center of said annular series 15a, 15b and through the opposite wall of the spinneret and the adjacent wall of the tank to the exterior as described of Fig. 1. A smooth truncated fixed spreading cone 55 is mounted coaxially on the projecting front part 26' of the tubular bearing 25' and has a shallow circular recess 56 in the outer end face and has a rounded periphery 57 at its large end, larger in diameter than said series 15a, 15b, whereby filaments 19 drawn from the orifices may be spread out over the smooth cone and rounded periphery and converged to the hook 20.

A backing ring 58 mounted on a bracket 59 mounted on the bottom wall of the tank has a smooth rounded inner face 60 pressing against and bending slightly inward the filaments as at 61, between said periphery 57 and the hook 20.

A shaft 28' rotatable in and passing through said bearing 25' is rotated by suitable drive means 35 and provided fast on its front end part with one or more radial arms 30', 31' extending to near said periphery and ring and carrying a planetary spindle 64 rotatably mounted in the ends of the arms and having fast on its front end a small planetary pressing wheel or disk 65, the wheel having a blunt or rounded non-cutting periphery adapted to press against successive extruding filaments, as the shaft 28' rotates, to force the filaments laterally against the ring, thereby to flatten a short portion of each filament to decrease its cross-section and form a weak place therein, the earlier produced weak places being progressively more advanced from the spinneret as the filaments are simultaneously drawn off.

In order to constrain the wheel to roll on said ring without any sliding, thereby to avoid tearing or breaking the filaments at the ring, there is provided on the inner end of the spindle a pinion 66 of the same effective pitch diameter as said wheel and meshing with an internal ring gear 67 fixed in said recess 56 coaxially of the shaft 28'.

After the weakened filaments pass the Godet wheel, they are drafted and broken at the weak places, to form staple lengths, in any suitable manner or as described above in connection with Figs. 5 and 6.

In the form of the invention as in Figs. 9 and 10, either pressing or weakening or cutting means are provided, as will be explained.

If pressing means are provided, the mechanism of Figs. 9 and 10 may receive the filaments directly from the spinneret, in spread out condition, as in Figs. 6 or 10, before the filaments harden; and the mechanism of Figs. 9 and 10 may be in the coagulating bath if desired.

Said mechanism comprises a horizontal series of pairs of successive cooperating drafting rollers 70, 71 and 72, 73 for drawing the spread out filaments 19 therebetween. If desired an apron 74 may be provided to be drawn between the rolls

on which spread-out filaments may be supported between the pairs. A plurality of helical pressers or knives 75, 76, 77 are mounted spirally at a small pitch or otherwise offset around the upper roll 70 of the succeeding pair against which pressers the filaments are pressed by the roller 71 below and thereby flatten and weaken points in the filaments staple lengths apart, depending upon the distance apart of the pressers, the circumference of the roll 70 and the number of knives or pressers determining the staple length. The filaments may be broken to form interruptions at the weak points, as explained in connection with Fig. 6.

If the knives 75, 76, 77 are cutting knives, they cut the filaments instead of merely weakening them, and the drafting-breaking operation above described is not necessary for forming the interruptions, though it may be desirable to employ drafting means to elongate the sliver by further offsetting the cut fibres thus formed.

The rolls rotate in the direction of the arrows of Fig. 9; and the filaments or sliver, and the filament supporting apron if any, moves in the direction of the arrow of Fig. 10. This causes the path of contact of the ribs or knives on the sliver or filaments to assume the position of the dotted lines 78 to form at the intersections 45*a*, 45*b*, 45*c*, when these paths cross the filaments, breaks like those indicated at 32 in Fig. 6 or interruptions like those indicated at 45, in Fig. 6.

As arbitrarily chosen for illustration in Fig. 10, the pitch is small enough for each knife to pass around the roller three times, the angle of cuts relative to the sliver or filaments as a whole is nearly longitudinal to the path of the filaments, and any weakening cut or interruption 45*a* (Fig. 10) is quite distant longitudinally from adjacent weaknesses, cuts or interruptions 45*b* and 45*c*.

The smallness of the pitch of the spiral determines the lateral distance apart of the cuts and the number of cuts at any right angularly transverse cross-section of the sliver and the relative longitudinal distance along the sliver of adjacent cuts of adjacent filaments. The smaller the pitch, the more are adjacent cuts longitudinally offset from each other, whereby filaments at the cuts are held in line and carried along by adhesion and friction of adjacent uncut parts of neighboring filaments thereby to maintain the integrity of the sliver, making the apron beneath not necessary.

The apron 74 or lower roller 71 beneath the cutting roller may be yieldable or the roll 71 may be grooved beneath the cutting knife to allow the knives to move into the filaments. Or the roller 71 may be hard and press the filament directly against the cutting knife.

When the knives 75, 76, 77 are cutting knives, they may be any desired distance from the spinneret, and may receive the filaments in the spread out condition in which they are extruded without being combined into usual sliver form. If desired, however, usual sliver may be formed and again spread out as in Fig. 10, before introducing to the rollers 70, 71. If this is done the sliver may be stored and/or shipped or transported after it is formed and before it is introduced to the rolls 70, 71.

The number of cutting or pressing knives and the diameter of the rolls determine the circumferential distance apart of the cutters at any right angularly transverse section of the roll, and thus determine the length of the staple.

The parts of the mechanism herein described are made of suitable materials resistant to the chemicals used. The cutting knives do not need a very sharp edge, and they and the pressing disk or ribs may be made of any suitable metal, plastic or other suitable material and need not be very hard. The machine for producing the sliver may consist of a plurality of spinneret units, and one or more or all of them may be operated by several or a single motion imparting means.

The invention claimed is:

1. A method for forming weak points in filaments comprising simultaneously extruding a plurality of filaments; simultaneously drawing the filaments from the extruding means and combining them to form a sliver; and successively oxidizing successive filaments near the extruding means to form specific weakened points in the filaments.

2. In combination, a spinneret provided with a rear wall, and with a flat front wall provided with an annular series of extrusion orifices; axially alined bearings in said walls coaxial with said annular series; a shaft rotatable in and passing through said bearings and provided on its end at said front wall with one or more radial members for radially directing fluid and extending to near said orifices; and drive means for rotating the shaft and members; whereby fluid may be impacted against successive extruding filaments to force them laterally away from the orifices thereby to weaken a short portion of each filament.

3. In combination, a spinneret provided with a rear wall, and with a flat front wall provided with an annular series of extrusion orifices; a tubular bearing passing rearwardly through and from said walls coaxial with said annular series; a hollow shaft rotatable in and passing through said bearing and having a rear end provided with an inlet portion and a front end provided with one or more radial jets or nozzles having passages communicating with the hollow of the shaft and extending to near said orifices; and drive means for rotating the shaft.

4. In combination, a spinneret provided with a rear wall, and with a flat front wall provided with an annular series of extrusion orifices; means having a pump interposed therein for forcing filament forming material into the spinneret; a tubular bearing passing rearwardly through and from said walls coaxial with said annular series; a shaft rotatable in and passing through said bearing and provided on its front end with one or more radial impeller blades extending to near said orifices to force surges centrifugally against successive extruding filaments to force them laterally away from the orifices thereby to elongate a short portion of each filament, thereby to decrease its cross-section and form a weak place therein, the earlier produced weak places being progressively more advanced from the spinneret as the filaments are simultaneously drawn off; and drive means on the projecting exterior end of the shaft for driving the impeller blades in substantially timed relation with the pump.

5. In combination a spinneret; metering pump means for forcing a viscous filament forming substance or ingredient through apertures of the spinneret to form a plurality of filaments; a solidifying fluid bath material into which the filaments are extruded; means for forcing the bath material against the not-yet-solidified filaments intermittently and successively with enough force to weaken the filaments at suc-

cessively spaced points on each filament; means for gathering the continuous filaments into a sliver, and means for drawing the sliver away from the spinneret.

6. A method which comprises simultaneously extruding a plurality of filament-forming liquid jets directly into a liquid hardening agent to form filaments; drawing the filaments through the agent from the points of extrusion in a single plane; successively weakening successive filaments at predetermined short successive portions of the filament in the agent at a predetermined distance from the point of extrusion as the filaments are being drawn through the agent, thereby to provide short weakened places in each filament longitudinally offset from the weak places in other filaments; and collecting the filaments in a sliver after they have passed substantially through the agent.

7. A method which comprises simultaneously extruding a plurality of filament-forming liquid jets directly into a hardening agent to form filaments; drawing the filaments from the points of extrusion through the agent; successively applying force laterally of successive not-yet-hardened filaments at definite points in the agent at a definite distance from point of extrusion as the filaments are being drawn through the agent thereby to elongate and weaken the filaments adjacent said points to provide weakened places in each filament longitudinally offset from the weak places in other filaments; and collecting the filaments into a sliver after they have passed substantially through the agent.

8. A method which comprises simultaneously extruding a plurality of filaments directly into a liquid hardening agent; drawing the filaments from the points of extrusion through the agent; successively weakening successive individual filaments one at time at definite points in the agent at a definite distance from point of extrusion as the filaments are being drawn through the agent, thereby to provide weakened places in each filament longitudinally offset from the weak places in other filaments; and collecting the filaments into a sliver.

9. Method which comprises simultaneously extruding a plurality of filament-forming liquid jets directly into a liquid hardening-agent at a plurality of points to form filaments; drawing the filaments from the points of extrusion through the agent whereby the filaments are progressively hardened; successively weakening, while maintaining the filament continuous, short portions of the somewhat hardened successive filaments one after another at points in the agent at practically the same short distance from the points of extrusion as the filaments are being drawn through the agent and then cyclically repeatedly repeating the weakening stress before the first mentioned weakened portions leave the agent; thereby to provide while the filaments are in the agent longitudinally closely spaced short weakened places in each continuous filament longitudinally offset from the weak places in other filaments; and collecting the filaments in a sliver after they with the weak places thereon have passed substantially through the agent thereby to form a sliver having spaced short weak places in each filament progressively longitudinally offset from the other weak places.

10. Apparatus for the production of artificial filaments having sections of reduced strength at spaced points along the length thereof, which comprises means for extruding a plurality of filaments in the form of a bundle, fluid delivery means for directing a stream of fluid against the filaments comprising the bundle, and means for moving said fluid delivery means relatively of said bundle to direct said fluid stream against a portion only of the length of the filaments at any given moment.

11. In a process for the production of artificial staple fibers, the method of providing continuous filaments with points of reduced strength spaced along the length thereof, comprising extruding a fiber-forming material into a setting medium and subjecting the filaments being extruded, and while the same are in plastic condition, to the force of a stream of fluid moved relatively, including transversely, of the filaments and directed, against spaced-apart portions only of the length of the filaments.

PHILIP H. SLAUGHTER.

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